# Learning Outcomes and Their Effects

## Useful Categories of Human Performance

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*ABSTRACT: The outcomes of learning are persistent states that make possible a variety of human performances. While learning results are specific to the task undertaken, learning investigators have sought to identify broader categories of learning outcomes in order to foresee to what extent their findings can be generalized. Five varieties of learning outcomes have been distinguished and appear to be widely accepted. The categories are (a) intellectual skills (procedural knowledge), (b) verbal information (declarative knowledge), (c) cognitive strategies (executive control processes), (d) motor skills, and (e) attitudes. Each of these categories may be seen to encompass a broad variety of human activities. It is held that results indicating the effects on learning of most principal independent variables can be generalized within these categories but not between them. This article identifies additional effects of each type of learning outcome and discusses the current state of knowledge about them.*

The question of understanding how human beings learn has been a central theme of psychological research since the time of the English associationist philosophers Hobbes, Locke, and Mill, and the experimental work of Ebbinghaus (1913) in 1885. From that time until the present day, learning has been understood as a change of state of the human being that is remembered and that makes possible a corresponding change in the individual's behavior in a given type of situation. This change of state must, of course, be distinguished from others that may be effected by innate forces, by maturation, or by other physiological influences. Instead, learning is brought about by one or more experiences that are either the same as or that somehow represent the situation in which the newly acquired behavior is exhibited.

Psychologists who have studied the phenomenon of learning have sometimes confined their observations to human learning. Such learning was studied by the followers of the Ebbinghaus tradition and was usually referred to as *verbal learning*. Verbal learning was studied by such investigators as Robinson (1932), McGeoch (1932), Melton (1963), Postman (1961), and Underwood (1957), among others. Many students

of learning, however, did not hesitate to study the behavior of animals as well as humans nor to relate the phenomena observed across the species gap. Pioneers in this tradition include Thorndike (1898), Guthrie (1935), Tolman (1932), and Hull (1943). Other differences in fundamental approaches to the study of human learning arose from points of view noted by Bower and Hilgard (1981) as empiricism versus rationalism, contiguity versus reinforcement, and gradual increments versus all-or-none spurts. These issues persist down to the present day and cannot be said to have been resolved in the sense of having attained a consensus of scientists.

Perhaps, though, the most distinctive differences among studies of learning, as reported to us by various investigators, are differences in the *behavior-in-situation* that identifies the new learning. This is often referred to as the *learning task,* a phrase that implies that its specification includes both the external situation and the behavior that interacts with it. This tendency to identify learning with the situation is reflected in texts having learning as a subject, such as Hulse, Deese, and Egeth (1975), or Hill (1981). When Melton (1964) assembled chapters in *Categories of Human Learning,* they dealt with such familiar situations as the classically conditioned eye blink, operant conditioning of pigeons, rote learning of verbal associates, incidental learning of word pairs, and perceptual-motor skills learning. Even when theories of learning are addressed directly, as by Bower and Hilgard (1981), we find the theoretical ideas tied to situations such as dogs salivating to the sight of food, pigeons pecking at circular spots, rats running to food boxes, or people learning paired associates.

The advent of the cognitive psychology of learning, as represented in books done by Klatzky (1980), Bransford (1979), and Anderson (1980), among others, has broadened the situations employed for the study of learning. Thus, we now have insightful studies of the learning of elementary arithmetic (Resnick & Ford, 1981), of constructing geometric proofs (Greeno, 1978b), of story comprehension (Stein & Trabasso, 1982), and of the prediction of rainfall (Stevens & Collins, 1982). Most surely, it is a welcome change to find investigators of human learning choosing schoolroom situations for learning or at least sit-

uations that have what might be called "face validity" with tasks encountered by students. The greater diversity of such situations, as contrasted with the narrowly defined learning of paired associates on a memory drum, is a welcome change. If there are cautions to be noted, they may be expressed in the hope that these new school-learning tasks will not themselves become frozen into narrow channels of study, so that we end up with the "psychology of arithmetic learning," the "psychology of reading learning," the "psychology of geometry learning," and the like. I do not think this will necessarily happen. Nevertheless, in our enthusiasm for a newly found freedom from a set of traditional learning tasks, we should, I think, keep firmly in mind that a psychology of learning seeks generalizations that are not tied to particular learning situations. The history of paired-associate learning should help us remember this lesson. For many years, studies of paired associates sought to discover *general* principles about the learning of associations. As understanding increased, however, such studies came to be seen as dealing with a very particular kind of learning task called "paired-associate learning." Many, perhaps most, of the results obtained apply only to that specific learning task.

Should the study of learning continue to be situation bound? Of course, the conceptions of Skinner (1969) offer a way out. Those who view learning as a matter of arranging contingencies of reinforcement can demonstrate how that principle applies to virtually every situation. The case for application of reinforcement techniques as a way of arranging situations for learning is entirely convincing; it is indeed difficult to find contrary evidence. Yet the tendency of learning investigators to seek more detailed specifications for learning situations, from mazes to geometry, implies that reinforcement contingencies are not enough. Greater specificity continues to be sought in the description of the interaction between learner and environment—in the *task*, in other words. Students of learning phenomena continue to find dimensions of the learning situation that do not contradict the operation of reinforcement but that must be described in greater detail.

How can we achieve a psychology of learning that is not tied to specific situations or tasks and that at the same time has the potential for generalization that we value as a scientific goal? My suggestion is that now is a good time to look closely and intensively at the question, what do people learn? This question must be examined as broadly as possible. By this I mean, we need to gain an idea of what all kinds of people learn—not only school children or laboratory subjects but masons, carpenters, astronauts, politicians, housewives, and word-processing operators. Most of the overt behavior people engage in during each day, of course, is what they have learned to do. As observers of behavior, we know what has been learned by perceiving what people can do. In other words, we know that learning has occurred when we observe its outcomes or effects.

How can we find principles of learning that can be generalized and that are not tied to specific subject matter? Actually, it seems to me that learning psychologists, particularly those in the information-processing tradition, are coming close to a satisfactory answer to this question. I trust they will continue to keep the appropriate goal in mind and will not be too seriously distracted by trendy issues suggested by neighboring disciplines. The question continues to be, how do people learn what they learn? That is not the same question, obviously, as how does a person become an expert? Certainly, expertness is learned, but many people learn many things without ever becoming experts.

## Categories of Learning Outcomes

A number of years ago (Gagné, 1972), I proposed a set of categories of learning outcomes that seemed to me to possess certain desirable distinctive properties. While I do not intend here simply to cover the same ground, it is worthwhile to state what the characteristics of such categories should be:

1. Each category of learning outcomes should be distinguishable in terms of a formal definition of the class of human performance made possible by the learning.

2. Each category should include a broad variety of human activities that are independent (excluding the extremes) of intelligence, age, race, economic status, and so on. The possibility of special categories (e.g., musical virtuosity, expert wine tasting) is acknowledged but is not relevant to the main point. In order not to be narrow, each category must apply to a widely diverse set of human activities.

3. Each category should be seen to differ in the nature of information-processing demands for its learning. Specifically, each kind of outcome should require different (a) substantive type of relevant prior learning, (b) manner of encoding for long-term stor-

age, and (c) requirements for retrieval and transfer to new situations.

4. It should be possible to generalize the principles concerning factors affecting the learning of each category to a variety of specific tasks *within* the category but not to learning tasks in other categories. Excluded here is the factor of reinforcement, assumed to apply to all categories.

With such characteristics in mind for the principles of learning that can be generalized, I identified five categories of learning outcomes: (a) intellectual skills, (b) verbal information, (c) cognitive strategies, (d) attitudes, and (e) motor skills. I will discuss each of these categories again from the viewpoint of contemporary learning psychology and from the standpoint of learning effects. Where possible, I will mention a few of the things I think we still need to discover about the effects of learning.

### Intellectual Skills

As a category of learning outcome, intellectual skills have in recent times appeared to find their proper place in the scheme of things. Intellectual skills include concepts, rules, and procedures. Perhaps the best-known synonym is *procedural knowledge* (Anderson, 1976, 1980). Some investigators prefer the computer-derived language of Newell and Simon (1972), who call this category *production systems.* Some would prefer to distinguish procedures, conceived as having a number of sequential steps, from rules, which may have only two or three. Since I view them as the same category, I have used the phrase "procedural rules" (Gagné, 1977) for the former.

Does procedural knowledge show itself as a learning outcome in a great diversity of human activity? Of course it does. Consider all the rules that govern the use of language both in speaking and writing. This complex set of rules applies to reading in the sense of the phonological and semantic processing of printed discourse. Intellectual skills are easiest to exemplify in the field of mathematics, where there are rules for computation, for interpretation of word problems, and for verifying mathematical solutions (Resnick & Ford, 1981). Procedural rules are involved in the application of scientific principles to real-world problems (Larkin, 1980). But beyond the various subjects of school learning, procedural rules govern a great many common activities of our daily lives— driving an automobile, using a lawnmower, making a telephone call, or shopping in a supermarket. Think of what kinds of knowledge are possessed by a technician in a nuclear power plant or by an aircraft mechanic. Obviously the knowledge most highly relevant to jobs like these, or to a whole host of other jobs, involves items of procedural knowledge, ranging from the simple to the highly complex. There should

be little doubt, then, that intellectual skills of this sort occur in an enormous variety of essential human activities.

As described by Anderson (1980), the representation in memory of procedural knowledge is production systems. Each production has a *condition* and an *action.* For example, "IF the goal is to generate a plural of a noun and the noun ends in a hard consonant THEN generate the noun + s" (Anderson, 1980, p. 239). What is apparent about this representation is that it includes a number of concepts that have previously been learned, such as *noun, plural, end* (of word), *hard consonant, add* (a letter to a word), and *s.* Intellectual skills, then, must typically be composed of concepts. An individual who possesses such a rule is able to apply it to *any* noun ending in a hard consonant, even one that may not have been previously encountered (such as *nib*). The other characteristic of procedural knowledge is also made apparent by this example. A procedure involves a *sequence*—first an individual takes one action, then another, followed by another. In the case of this example, the steps might be described as follows: (a) identify the word as a noun; (b) identify an ending consonant; (c) identify the ending consonant as a hard sound; (d) recall *s;* (e) add *s* to the word; and (f) give the plural.

In summary, the possession of an intellectual skill (an item of procedural knowledge) is shown when a person is able to apply a sequence of concepts representing condition and action to a general class of situations.

What do we know, or need to know, about the learning effects of this kind of learning outcome? First, it would seem likely that very simple rules, involving only a small number of steps, are acquired abruptly. For instance, determining the sign of a product of two positive and negative numbers involves two fairly simple rules that would seem to be learned in an all-or-none fashion. What could possibly be gradual about such learning? It would appear, then, that there must be a phase of learning that ought to be identifiable as *initial acquisition.* If learning has occurred, the rule or procedure can be applied to any instance; if the application cannot be made, learning in this initial sense has not yet happened. But in the sense I am using it here, learning *cannot* have occurred partially. The evidence for these ideas is currently weak; yet they appear to be of some importance for the understanding of this kind of learning outcome.

There is more to this story, however, particularly when we consider procedures that are complicated and have many steps. Learning must somehow be devoted to acquiring the sequence of the procedure in such a way that it can be retrieved readily. Neves and Anderson (1981) discuss a possible way of processing for what they call *proceduralization.* Going

beyond that stage, they point out that continued practice may lead to composition, which involves combining production systems, to speeding up of the action of the procedure, and ultimately to *automatization*. These, then, are some of the additional possibilities for learning effects when we are dealing with the type of outcome called procedural knowledge. It is notable that these effects of practice do not involve a change in the nature of the outcome itself; being able to add two-digit numbers is still the same outcome. But the procedure may be accomplished by a somewhat different process and more rapidly. It may come to demand a smaller amount of the attentional resource, as Shiffrin and Schneider (1977) suggest. Yet the essential outcome remains the same. The effects of learning, beyond the stage of initial acquisition, must be looked for in processing changes, not in changes in the nature of the outcome itself.

## Verbal Information

A second category of learning outcome is what I have called *verbal information. Declarative knowledge* is probably a better name, implying that its presence is shown by the ability of a person to "declare" or "state" something. Yet I do not necessarily retreat from the supposition that such knowledge, when it is displayed, typically takes the form of verbal statements.

As a learning outcome, is declarative knowledge a widespread and diverse occurrence? It is curious that when attempting to address this question, it is necessary to take account of the fact that there are different kinds of packages for this information. There are "facts" that may be more or less isolated from other knowledge, such as the names of particular persons, the names of the months of the year, or the names of metric measures of length. Another kind of "package," however, is meaningfully connected prose or poetry that is learned and recalled in verbatim form. We recall the "Salute to the Flag" and the words of the "Star Spangled Banner." Some of us may recall Hamlet's soliloquy and the "seven ages of man" and the words to Cole Porter's song, "You're the Top," in both the square and profane versions.

Still another kind of package for declarative knowledge is composed of organized, meaningful domains to be identified and recalled in a great variety of ways. We realize that the name for a common class of objects, an era of history, or one of the nations of the world can call up for us a complex of interconnected knowledge. A number of different suggestions have been made by various theorists regarding the nature of organization attained by such knowledge in its stored form. One suggestion is that knowledge is organized as networks of units connected to properties (Collins & Loftus, 1975). Another is that concepts form a semantic space and are related to each

other in terms of their attributes (Smith, Shoben, & Rips, 1974).

But of greater immediate relevance is the idea that knowledge is stored in networks of propositions. Each proposition is complete with its syntactic structure—at least a subject and predicate and probably a good deal more than that. Many investigators hold the view that the organization of each such network forms a *schema.* A schema is a representation of a situation or an event. It may be viewed as a prototype that indicates the usual sequence of events to be expected. Events (such as those of a story) may be stored as a *script,* according to Schank and Abelson (1977), who also describe other forms of organized knowledge called *goals, plans,* and *themes,* from which scripts can be constructed. While it is not yet clear that the concept of schema has been well defined in a general sense, it surely represents a widely accepted way of describing organized knowledge.

What, then, is the nature of the learning outcome for this category of declarative knowledge? This question must be answered differently for the different "packages" in which such knowledge comes. On the one hand, the investigator seeks the exact reinstatement of a word, phrase, or sequence of words in sentence form. If an individual has learned the names of persons, objects, or foreign-language words, exact reproduction of these entities is expected. If someone has committed Lincoln's Gettysburg address to memory, that person is expected to be able to repeat the address word for word without paraphrase or omission. On the other hand, what will convince someone that a student "comprehends" or "understands" a chapter in a textbook such as that dealing with the history of disarmament in the 1920s? Obviously, no one expects such knowledge to be displayed by a verbatim recitation of the chapter's text, word by word. A recognition of the "main ideas" may be expected or perhaps a description of the learner's schema.

It should be possible now for me to propose a definition that runs as follows: The learning of verbal information (declarative knowledge) may be confirmed when the learner is able either to: (a) reinstate in speech or writing the word or sequence of words in the same order as presented; or (b) reconstruct an organized representation of a verbal passage, containing identifiable main and subordinate ideas arranged in a meaningful schema.

One of the most interesting facts about such knowledge, which we do not yet fully understand, is the following. Despite the fact that both of these packages are varieties of declarative knowledge, they are intuitively very different. Most teachers would strongly aver, for example, that being able to recite Lincoln's Gettysburg address is very different from displaying "understanding" of President Lincoln's message. It

is conceivable that a learner might be able to recite the speech without being able to recount any of its meaning. Nevertheless, knowing the address in verbatim form may well contribute to a performance that intends to produce only a paraphrase of its main ideas. There are puzzles here about memory that have not yet been explained. It is clear that knowing the sequence of main ideas in a long passage of prose or poetry is helpful in remembering that passage in a verbatim sense. Is the reverse true? Is the retention of a passage in the sense of a schema influenced by certain partial features, words, or phrases that are remembered in their precise form? It may be helpful to think about this question in terms of "levels of processing" (Craik & Lockhart, 1972).

As for the question of learning effects, this also must deal with the distinction between verbatim reinstatement and the recounting of main ideas or themes. As we know from the work of Gates (1917) and other studies of more recent vintage, added practice in the form of recitation increases the quality of verbatim recall. Errors and hesitations are reduced, and the performance becomes more sure. But additional learning experience with passages of meaningful prose has quite a different effect. As learning proceeds, additional links with other concepts and other networks of concepts are formed. What is learned is elaborated (Anderson, 1980) or processed more deeply (Craik & Tulving, 1975). The schema as originally acquired becomes more elaborate as the empty slots in its outline are filled in. It seems clear, then, that the effects of continued learning of this second kind of package are very different from such effects on verbatim learning. In this case, there is a definite qualitative change in the performance of the learner. New elements, additional ideas, are added to the main themes with which the learning began.

Notable, too, are the differences in learning effects for declarative knowledge from those I previously described as applicable to procedural knowledge. For verbatim reinstatement, it is not at all evident that the learner goes through any phases comparable to what Neves and Anderson (1981) called composition, speed-up, or automaticity. While a familiar word may be more rapidly responded to than an unfamiliar one, it is not evident that the other criteria of automatism, such as the allocation of attentional resources, are applicable to verbatim recall of verbal material in quite the same manner as to an intellectual skill. Of course, when we consider the other package, the reconstruction of meaningful discourse, the effects are very different indeed. Rather than a condensation of procedural steps, as in what is called *composition*, we see the effect of greater and greater elaboration. These are some of the reasons for believing that procedural knowledge and declarative knowledge are highly distinctive kinds of learning outcomes.

## Cognitive Strategies

Most cognitive learning theorists distinguish another type of cognitive skill besides the procedural knowledge previously mentioned. Most speak of these learned entities as *executive control processes* (Atkinson & Shiffrin, 1968) or more generally as *strategic knowledge* (Greeno, 1978a). In many studies of learning and of human problem solving, it has been repeatedly shown that learners bring to new tasks not only previously learned declarative knowledge and procedural knowledge but also some skills of when and how to use this knowledge. Cognitive strategies for recalling word pairs may consist of constructing images and sentences, and such techniques have been taught to both children and adults (Rohwer, 1970). Strategies for encoding and for cueing retrieval are suggested by research from many sources (Anderson, 1980; Brown, 1978). Strategies of problem solving have been the subject of a good deal of research (Wickelgren, 1974). Greeno (1978b) has written an excellent article on geometric problem solving.

Cognitive strategies vary considerably in the degree of specificity or generality they possess. Some appear to be highly specific to the task being undertaken or to the problem being solved. A strategy of checking subtraction by converting numbers to multiples of ten is surely a useful strategy of limited generality. Strategies such as constructive search, limiting the problem space (Greeno, 1978a), and dividing the problem into parts have been suggested as having general applicability. The strategy called *means-end analysis* is very general in its applicability, according to Newell and Simon (1972). Correlated with the specificity of cognitive strategies may be their ease of learning and recall. Some strategies seem very easy to communicate to learners faced with a particular learning or problem-solving situation ("put the two words into a sentence" is an example). Usually, though, these are the strategies that are very specific to the task. More general strategies, such as "breaking the problem into its parts," although clear to the learner in relation to one task, may not be readily transferable to other novel problem-solving situations.

The definition I suggest for this kind of learning outcome is as follows. A cognitive strategy enables a learner to exercise some degree of control over the processes involved in attending, perceiving, encoding, remembering, and thinking. Strategies enable learners to choose at appropriate times the intellectual skills and declarative knowledge they will bring to bear on learning, remembering, and problem solving. Differences in strategies are usually inferred from differences in efficient processing (as it occurs in learning, thinking, etc.). Evidence of strategies and their use comes from learner's reports, or protocols, of their own processing methods.

Despite the inferential nature of the evidence for one cognitive strategy or another, it is difficult to deny their existence or their role as executive processes that influence other forms of information processing. If we admit that cognitive strategies apply not just to problem solving but to all of the kinds of processing involved in cognition—perceiving, learning, remembering, thinking—then there must be many kinds of strategies for almost any conceivable kind of task. Greeno (1978a) has written about the ways strategies enter into problem solving, as has Newell (1980). Learning-to-learn strategies have recently been critically discussed by Langley and Simon (1981).

The effects of continued learning, or continued practice, on cognitive strategies are not well known. Presumably, though, they behave somewhat like intellectual skills. For one thing, cognitive strategies are often learned abruptly. When children are told to remember a set of pictures by putting them in categories, they do it right away and are not particularly better at it after five trials than after one. If a learner discovers a "working backwards" strategy for solving a Tower of Hanoi problem, he or she puts it into effect abruptly and continues to use it thereafter. Whether or not strategies exhibit practice changes, such as composition and automatization, has not been shown. It seems reasonable to suppose, though, that these executive skills may behave similarly to their more pedestrian cousins, the procedural skills, which have external rather than internal targets for their effects. The problem of how to make cognitive strategies generalizable to new learning and problem-solving situations is also a feature shared with procedural knowledge. The question of transfer of training for both these categories of intellectual skill continues to be a problem not yet well understood.

### Motor Skills

We're all familiar with the motor skills we use in writing, using tools, skating, riding bicycles, and performing various athletic activities. These performances are based on the possession of learned skills. Should we bother to distinguish them from intellectual skills, or should we simply call them all *skills* and let it go at that? I think the distinction is an important one. Of course, all performances are in some sense "motor," or we would be unable to observe them at all. Stating something, pointing at something, or pushing a button are all motor responses. In fact, they are motor skills that we have learned in the early years of life and have practiced ever since. But if we are attempting to identify a category of learning outcome that reflects new learning, we must have in mind activities such as fly casting, top spinning, lariat twirling, or others that have not previously been done. A skill is identified as a *motor skill* when gradual improvements in the quality of its movement

(smoothness, timing) can be attained only by repetition of that movement. That is to say, learning consists of practice of the movement itself, under conditions in which reinforcement occurs, resulting in gradual improvement in the skill (Singer, 1980).

Surely it is evident that procedural knowledge (intellectual skill) does not have these characteristics. Intellectual skills frequently seem to be acquired abruptly, and this is never the case with motor skills. Practice of intellectual skills means applying a general rule to varied examples. It is not apparent that the practice of a motor skill can be described in such terms since it requires repetition of the particular muscular movements involved. Finally, there seems nothing comparable in the area of intellectual skills to the increase in smoothness and timing of movement that is observed in motor skills. I would emphasize, then, that although both deserve to be called skills, the intellectual type and the motor type should not on that account be considered a single category.

Fitts and Posner (1967) provided a description of three phases in the learning of a motor skill. The earliest they called a *cognitive* phase, and this was devoted primarily to the learning of the procedure that underlies the skill, the *executive subroutine*. For example, in making a tennis serve, the movements required involve shifting body weight to one foot, tossing the ball in the air, bringing the racquet up, and striking the ball with the racquet while aiming in a particular direction. All of these movements must be learned as a procedure during the early phase of skill learning, even though at that time the motor skill itself may be of minimal quality. A next phase, according to Fitts and Posner, is an *associative* phase, during which all the parts of the skill come to be fitted together. This phase, of course, establishes the smoothness and timing we recognize as characteristic of a motor skill. A third phase they called *autonomous*, in which the skill can be exercised without the need for much attention. Presumably, this is the same as what is meant by automatization.

Fitts and Posner, then, have provided us with a basic account of learning effects, so far as this category of learning outcome is concerned. Motor skills begin with the learning of the sequence of muscular movements, the executive subroutine. Continued practice, (successive repetitions of this same set of movements) brings about increased quality of skilled performance, observable as improved timing and smoothness. Continued practice, sometimes over long periods of time, results in automatization of the skill, evidenced by the ability to carry on the skill in the presence of potentially interfering activities.

If the effects of continued practice of motor skills are similar to those of intellectual skills, this similarity may be structurally true, or it may be a kind of coincidence. Is the improvement in smoothness and

timing of a motor skill comparable to what is meant by composition and speed-up of procedural knowledge? As a general description, these terms sound right. Yet it is not easy to accept the idea that a well-practiced intellectual skill (such as mentally adding positive and negative numbers) exhibits a phase that can be characterized as smooth or well-timed. One other learning effect that should be mentioned for this category of motor skill is the fact that improvement in performance continues for very long periods of time (Fitts & Posner, 1967). Any particular level of performance at which the skill is treated as fully learned is presumably an arbitrary limit. However, this does not seem a proper way to describe the effects of long-continued practice of an intellectual skill. Whatever comparison is made, motor skills are different.

### Attitudes

The fifth kind of learning outcome to be considered is an attitude. There can be little doubt about the pervasiveness of efforts to establish and modify our attitudes. The medium that is most heavily devoted to such aims is television. The commercial messages of television are textbook examples of how attitudes are affected. Not only that, it seems likely that the remaining television fare, including soap operas, continues to produce and reinforce attitudes toward the various problems of everyday living. Whether these attitudes are beneficial in the long run is a matter of opinion, but their existence is surely apparent. Of course, there are other sources that attempt to modify our attitudes, and these include all other communication media with which we are surrounded. Even schools do a great deal to establish attitudes. Schools are fairly successful in establishing socially beneficial attitudes (such as fairness or thoughtfulness of others) in the primary grades but are apparently much less successful in getting across attitudes such as avoidance of smoking or of harmful drugs in later years. At any rate, we can readily realize that many forces are at work in our society to determine our attitudes.

Attitudes are inferred internal states. We cannot observe them directly, but must make inferences from one or another kind of observable behavior. Furthermore, as many investigators have pointed out (Rokeach, 1969; Triandis, 1971), the relation between reported attitudes and overt behavior is seldom found to be a close one. Attitudes are sometimes described as having both cognitive and emotional components. These ideas surely have an intuitive appeal, but they do little to provide a scientific explanation of attitudes. All we are able to say is that attitudes *influence* behavior. They do not determine human performance in the sense that both procedural and declarative knowledge do; they appear instead to modulate behavior. Thus, when performance itself is considered,

the distinctive qualities of attitudes can readily be seen.

I find my definition of attitude to be remarkably similar to Allport's (1935), or at least it seems to be highly compatible with it. An attitude is an internal state that influences the choice of personal action. As an example, a positive attitude toward listening to classical music influences the behavior of an individual to choose such listening when a choice is provided. An attitude of rejection toward using harmful drugs influences the behavior of rejection when the individual is confronted with choices of this nature.

What about learning effects of this category of learning outcome? The contrast with other kinds of outcome is marked. Whereas we expect declarative knowledge, procedural knowledge, and cognitive strategies to be acquired in some circumstances when learners are told what we want them to learn, it appears extremely unlikely that attitudes are ever acquired this way. Communications that attempt to establish attitudes directly, whether by persuasive logic, emotional appeal, or otherwise, have consistently been found to be ineffective (McGuire, 1969). Whatever conditions must be arranged for the learning of attitudes, they must apparently be different from directly telling learners what we want them to learn.

Are there, then, distinctive conditions for attitude learning? This would appear to be the case, although it can't be said that the precise nature of these conditions is well understood. Some investigators see conflicts in beliefs or between beliefs and other information as origins of attitudes; others give emphasis to contingencies of reinforcement. I am impressed with the evidence found by Bandura (1969) and his associates, which assigns a critical function to the *human model*. It seems to me that at least one highly common way in which attitudes are acquired or changed is through the mediation of a human model. Bandura has described the typical procedure by which such learning occurs; it involves a statement or demonstration of the choice of personal action by the model, followed by learner observation of reinforcement to the model, which is called *vicarious reinforcement*. My view is that this is more than simply observational learning, although I have no doubt of the reality of such learning. However, I tend to think that for attitude learning, the human model is an essential component. What is encoded, I suggest, is a representation of the human model making the choice of action, which is compared with the planned behavior of the learner himself or herself.

Other differences in learning effects serve to distinguish attitudes from other learning outcomes. It is a common observation that particular attitudes may persist for many years and be highly resistant to change. Such persistence may take place regardless of the frequency with which the action choice takes

place. Reinforcement of action choices seems to have its expected effect. However, we do not appear to know with any degree of assurance what happens to an attitude when it is "practiced," or when it is displayed in many different circumstances over a period of time. The way attitudes are represented in memory may turn out to be a matter of considerable complexity.

## Why Five Kinds of Learning Outcomes?

Now I have described five kinds of learning outcomes, stated why they appear to be different from each other, and suggested some areas in which the effects of learning are still not well understood.

It seems to me that the recognition of distinctive characteristics for these five learning outcomes has gained increasingly wide acceptance among learning psychologists in recent years. The distinction of motor skills from verbal learning has a long history in psychology. Attitudes have usually been assumed to occupy a special place as learned entities. Developments in the psychology of information processing have led to an emphasis on the distinction between verbal information and intellectual skills (or declarative and procedural knowledge). Investigation of artificial intelligence and human problem solving has given renewed evidence of the need to infer executive control processes, or cognitive strategies, in human thinking. Accordingly, it seems that students of learning and its processes have come to accept and to depend upon these five distinctions.

No particular reason exists to think of these five different learning outcomes as constituting a taxonomy or as having been derived for that reason. As I have tried to show, the five learning outcomes exist because they differ, first, as human performances; second, because the requirements for their learning are different despite the pervasiveness of such general conditions as contiguity and reinforcement; and third, because the effects of learning, and of continued learning, appear also to differ from each other.

There are good reasons why we should not be content with the idea that learning is learning is learning. Of course, learning has some common conditions for its occurrence that are quite general. Those of us who have tried to apply principles of learning in practical situations, whether in connection with school learning, military training, or adult professional development, have become keenly aware that greater detail in specification of learning conditions is required than is provided by the general "laws of learning" (cf. Gagné, 1962, 1977). The contrasting viewpoint about types of learning is equally unacceptable. This is the view that we must discover and formulate principles of mathematics learning, science learning, automobile repair learning, and so on. We overlook truly important generalities, for example, when we

refuse to look at the resemblances in learning outcomes between, say, arithmetic and reading, geometry and composition, or between the procedures of office management and the procedures of aircraft maintenance.

These five outcomes of learning represent a middle ground but not because a compromise has been sought. Instead, they are categories within which generalizations can legitimately be drawn, according to both reason and empirical evidence. They are also categories between which generalizations about learning are either impossible or very risky. Within these categories of declarative knowledge, procedural knowledge, cognitive strategies, motor skills, and attitudes, we have a continually increasing store of knowledge of when and how learning occurs. The effects of learning on these outcomes are better known for some than for others. For each of these categories, there are questions to be explored about the effects of continued or repeated learning experiences.

It appears to me that psychological research has been well served by these five categories. I believe they are widely accepted as distinctions and that the results of research are made more readily interpretable when the learning effects of these outcomes are made clear. To understand the learning differences and the memory–storage differences among these five outcomes is an intriguing challenge for cognitive theory.

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