

Margaret E. Bell-Gredler

LEARNING AND INSTRUCTION

THEORY INTO PRACTICE

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Theory into Practice

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Learning and Instruction

In memory of my beloved daughter,
Margaret Lynn,
and for her sister,
Elizabeth Lee

Preface

Early in the twentieth century, Edward Thorndike chided his fellow psychologists for not becoming involved in the problems of school learning. Maintaining that the appropriate psychological laboratory is the classroom and the proper subject of study is the student, Thorndike applied his theory, connectionism, to the analysis of several school subjects.

Today, partly as a result of the curriculum reforms of the 1960s, the problems of school learning are addressed in more depth by current theories. Each contemporary theory of learning provides important information about some facet of the learning process that may be implemented in the classroom. Therefore, the primary goal of this text is to present each theory's contribution to our understanding of human learning and the implications for the practitioner.

I am deeply indebted in the preparation of this manuscript to Albert Bandura, Robert Gagné, Bernard Weiner, and particularly B. F. Skinner. Each of these theorists took the time to personally review my interpretation of his work. Their comments and suggestions enhanced the discussions of their theories. I would also like to thank Frances O'Tuel, for her review of Jean Piaget's theory, and Joan Gallini, Ellen Potter, Donald Felker, and R. Stewart Jones, for their helpful suggestions in the later stages of manuscript preparation.

The search for a complete understanding of human learning has occupied philosophers, psychologists, and educators for centuries. The search itself is a rich and compelling enterprise that has yet to discover the ultimate capacity for human accomplishment.

Margaret E. Bell-Gredler

Learning and Instruction

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CHAPTER 1

The Role of Theory in Learning and Instruction

Man's power to change himself, that is, to learn, is perhaps the most impressive thing about him.

Thorndike, 1931, p. 3

WHY IS THE STUDY OF LEARNING IMPORTANT?

Learning is the process by which human beings acquire a vast variety of competencies, skills, and attitudes. Learning begins in infancy with the baby's acquisition of a few simple skills, such as holding its own bottle and recognizing its mother. During childhood and adolescence, a number of attitudes, values, and social interaction skills are acquired as well as competencies in various subject areas. In adulthood, the individual is expected to have mastered specific job tasks and other functional skills. Included are driving a car, balancing a checkbook, and getting along with others.

The human capacity for learning is an important characteristic that sets the species apart from all others. It provides benefits for both the individual and society. For the individual in our culture, the capacity for continued learning contributes to the development of highly diverse lifestyles. Sewing, basic home repair, water skiing, playing Scrabble, and mountain climbing are only a few of the leisure-time activities acquired through learning. In our society, we are not surprised to find engineers who are gourmet cooks and college professors who grow prize-winning roses.

For society, learning plays a key role in transmitting the culture's

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accumulated knowledge to new generations. It makes possible new discoveries and inventions that build on past developments. Our grandparents, for example, marveled at the changes in daily life brought by electricity. They were also intrigued with the new invention of the day, the telephone. Our children, in contrast, are growing up with electricity, the telephone, and television transmitted by satellite. They, in turn, are intrigued with that new invention, the microcomputer.

Both the individual and society have a vested interest in the successful management of learning. Individuals who have become skilled at self-directed learning are able to acquire a variety of new leisure-time and job skills. They also have developed the capacity to endow their lives with life-long creativity.

Society, on the other hand, cannot risk leaving the acquisition of learning to chance. Some system is needed for transmitting the cultural heritage and for training the young to take on productive adult roles in the society. In primitive societies, the collective wisdom and folklore often are acquired by each member, usually by word of mouth. In technological societies, the available knowledge and information is so vast that no one can begin to learn all of it. Instead, the members acquire some common knowledge and skills and then acquire expertise within a particular area. This process requires several years and often includes the learning of particular prerequisite knowledge, such as chemistry for pharmacists and music theory for symphony conductors.

The importance of learning to society is illustrated in an example by Edward Thorndike (1931). He hypothesized the outcome of the situation in which each new generation would only be able to learn those things that are half as difficult as the things currently learned. Thorndike noted that in such an event, most of the accomplishments of human civilization would be unusable in one generation and civilization itself would soon disappear from the face of the earth.

WHAT ARE THE SOURCES OF KNOWLEDGE ABOUT LEARNING?

Several sources of information about learning may be identified. Included are folklore or traditional wisdom, philosophy, empirical research, and learning theory.

Traditional Wisdom

Included in traditional wisdom are proverbs or maxims that often are derived from extensive experience. An example of a maxim is "Spare the rod and spoil the child." One problem with maxims, however, is that

the conditions of effective implementation are unclear. The example above implies that discipline is essential for child rearing; however, the extent, degree, and exact nature of the discipline are not identified.

Hilgard (1964, p. 404) notes that some individuals argue that teaching is an art. Therefore, more can be learned from good teachers than from either research or psychology. In other words, good teaching practice constitutes a "traditional wisdom" that can serve to teach others. Of course, much can be learned from skilled teachers. However, ignoring the possibility of improving instruction through well-designed research is like "returning medical practice to the prescientific physician because we still value the bedside manner" (Hilgard, 1964, p. 404).

Philosophy

Unlike folklore or traditional wisdom, which tend to be loosely organized, philosophers have developed systematic conceptions of learning. Some early examples and their particular limitations are discussed in Chapter 2.

Empirical Research

A quite different source of information about learning is that of empirical research. It includes experiments on objects and events in the physical world. Galileo, often referred to as the father of the scientific method, initiated experimentation with real objects. In one experiment, he timed the descent of falling objects from the top of a tower and found that a pound of feathers falls to earth at the same speed as a pound of lead. His experiments disproved the intuitive belief that a pound of lead will fall faster than a bag of feathers of the same weight.

The difficulty with the use of empirical research as the sole source of knowledge is that the studies conducted do not automatically advance our knowledge about important phenomena. For example, Suppes (1974) describes the period in educational research referred to as "the golden age of empiricism." This period, the decade of the 1920s, was characterized by questionnaires, surveys, and studies on almost every aspect of school life. The extensive data collection, however, did not contribute to an understanding of the basic processes of learning and instruction.

Theory

A fourth source of knowledge is theory. Briefly defined, a theory is a set of organized principles about particular events in the real world. One important characteristic of theory is that it "rescues the individual re-

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search finding from the momentary circumstance of time and place to give it a place in a broader world'' (McKeachie, 1976, p. 829).

Specifically, theories provide two advantages over the other knowledge sources. One is that principles, unlike maxims, are testable. Experiments may be conducted to determine whether the principle is verified by actual events. An example is the statement ''Practice with corrective feedback on performance facilitates the learning of motor skills.'' One way of testing this principle is to compare the performance of learners that have been given practice and feedback with the performance of learners taught other ways.

The second advantage of theories is that unlike isolated observations, they include generalizations about events and thus are applicable to several situations. The statement above about the relationship between the learning of motor skills and practice with feedback is a generalization that applies to simple skills, such as balancing on a beam, and to complex skills, such as playing tennis or fencing.

WHAT ARE THE FUNCTIONS OF LEARNING THEORY?

Four general functions of theory have been identified by Patrick Suppes (1974). These functions also apply to learning theory. Two functions, already mentioned, are that theories (1) serve as a framework for conducting research, and (2) provide an organizing framework for specific items of information. Also, they often (3) reveal the complexity of apparently simple events, and (4) reorganize prior experience (Suppes, 1974).

A Framework for Research

The importance of serving as a framework for research is to prevent the practice of data collection that does not contribute to an understanding of events. Bare empiricism, Suppes (1974, p. 6) notes, is a mental form of streaking, and nudity of body is much more appealing than nudity of thought.

Organization of Knowledge

The second function of theory is that it provides an organizing framework for specific items of information. All the contemporary learning theories, of course, fulfill this function. One example, however, is the set

of learning conditions developed by Robert Gagné (1970). Prior research into the elements of learning had indicated that some tasks are learned when the individual has established an association between a presented stimulus and a particular response. Other studies, however, indicated that learning occurs when the learner first reorganizes the stimulus situation and then applies a particular strategy appropriate for the situation. The theoretical position formulated by Gagné provides a synthesis of these discrepant findings. He proposes that more than one type of learning exists. That is, learning the letters of the alphabet is one type that requires the establishment of an association between each of the letters and the learner's mental or verbal response. In contrast, learning to solve algebraic equations is another type. Learning to solve problems requires that the learner reorganize the situation presented and apply several operations correctly and in the right sequence. The former type of learning is referred to as verbal information, whereas the latter is an intellectual skill (Gagné, 1970).

Identification of Complex Events

The third general function is that theory often reveals the complexity and subtlety of apparently simple events. A specific example is the nature and variety of factors that influence learning from models (Bandura, 1971). For the most part, early explanations were confined to the mimicry aspects of modeling. That is, the learner imitates the model and is rewarded for the behavior. However, Bandura's social learning theory (1) identifies the situation in which the observer performs the modeled behavior days or weeks later, and (2) identifies the learning conditions for this phenomenon. A relatively simple event, imitation, was found to be complex and to have important implications for learning and instruction.

More generally, an examination of contemporary theories indicates the variety of factors that influences what was once thought to be a relatively simple process (i.e., learning). In the classroom, the developmental level of the learner; the nature of the task; the models observed by the learner; the learner's capacity to receive, encode, and store the learning in memory; and the learner's perceptions of his or her work in terms of success or failure are all important influences.

Reorganization of Prior Experience

A fourth and related function of theory is that it reorganizes prior experience (Suppes, 1974). An example in physics that reorganized intuitive beliefs is the law of inertia: a body continues in its direction of