ESSENTIALS OF LEARNING

An Overview for Students of Education

SECOND EDITION

Robert M. W. Travers

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PREFACE

TEXTS for students of education may be written to prepare the reader either for a profession or for a trade. In preparing for a profession, the student may be expected to master not only the tools he will need to practice it, but also knowledge in those related disciplines upon which future advances in the profession may be based. In contrast, trainees preparing to enter a trade may be expected to master only the practices of the trade, delving little into the body of knowledge upon which such practices are based. If teaching is the chosen profession, the student may be expected to include in his background a familiarity with those aspects of psychology that have the most direct bearing on problems of education. That aspect which impinges most directly is the psychology of learning.

The author hopes that this book will serve, for students of education, a function analogous to that served by textbooks on physiology for students of medicine. The latter texts generally attempt to provide a comprehensive overview of current knowledge, with some emphasis on the theoretical issues involved, the problems to be solved, and the relationship of body mechanisms to healthful functioning. Although this volume indicates some of the implications of research results for educational practice, it does not suggest specific classroom procedures. It attempts to provide a firm foundation on which the student can build in further studies in the areas of curriculum and teaching methods, for it is in these latter areas that the applications of psychological knowledge are to be found.

The problem of teaching graduate courses in learning to students in colleges of education is not too different from the problem of teaching undergraduate courses. The typical graduate student is ten or twenty years removed from any courses he had in psychology. The typical specialized textbook on learning, written for students of psychology, presupposes knowledge of recent developments in psychology with which the student of education may not have had contact. Also, such texts do little to relate results of research to problems of education. The author hopes that this book will leave the student of education not only with some knowledge of the important research that is being undertaken in the field of learning, but also with some understanding of the significant implications which the knowledge thus acquired may have for educational planning. Perhaps the reader will also come to the last page with a better understanding of the degree to which education is based on faith rather

than knowledge, and how great the need is for expanding knowledge of the learning process.

Both the instructor and the students should use this book much the same way that other instructors with other students use a mathematics textbook. Instructor and students should work through the book together, with the instructor spending time on those sections that give the students special difficulty. It is not the kind of book on which the student is turned loose while the instructor delivers an independent set of lectures or leads discussions on only indirectly related topics. A course in a college of education based on this text would never be criticized either as being too easy or as lacking in content. The writer believes that this book reflects a trend in the professional literature of education, for some excellent texts already exist in other parts of the teacher-training curriculum that are far outside the reach of either one of these common criticisms.

The writer will continue to be grateful for the help given by the many who reviewed and criticized the various versions of the first edition. This second edition owes much to many discussions held with Dr. Ian Reid over a period of several years. The preparation of the chapter on transfer of training was greatly facilitated through daily interactions on the topic with Dr. R. L. R. Overing during the spring of 1965. Dr. Overing also read a draft of the chapter and offered many helpful criticisms.

R. M. W. T.

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Some Approaches to Learning

TWO DISTINCT approaches to research on learning can be clearly seen when one examines the history of the last century. One approach is based upon the point of view that research on learning is best conducted in schools and in realistic settings where education is actually in progress; the other is represented by those who have sought to study learning phenomena under simplified conditions in the laboratory. One cannot, on logical grounds alone, reject one of these research positions and embrace the other. The success achieved by one or the other will ultimately determine which one should be adopted, though the possibility exists that both may yield scientific knowledge. Perhaps time will show that both approaches have considerable merit. While more knowledge, to date, has been produced by laboratory studies of learning than by the study of learning in natural settings, this may merely mean that the time is not yet ripe for the direct study of classroom events related to learning. Keeping the latter possibility in mind, this chapter will attempt to review the major situations in which learning phenomena have been studied and attempt to indicate the problems as well as the advantages of each kind of situation for developing an organized body of knowledge about learning.

The Study of Learning in School Settings

Studies of learning in school situations have had a history of a little over half a century. Some of the earliest, if not *the* earliest, of such studies were conducted in the 1890–1900 period by Joseph Mayer Rice, a pioneer educational reformer who devoted the last half of his life to the reform of education. This task he pursued with almost fanatical vigor. Influenced by the German educational reformers, from whom he had acquired both his ideas and his enthusiasm, he believed that the American public would force educational reform on the schools if only the

facts were placed before them. He observed the performance of hundreds of teachers scattered over the eastern half of the United States and published a summary of his observations in a book entitled *The Public School System of the United States* (1893). The public was little impressed with his opinions, but this did not curb his zeal for educational reform. If his opinions were to be discounted, then perhaps the public might be impressed with facts. What appeared to be needed were data concerning the relevancy of various aspects of the teaching process to the achievement of the academic objectives, and such data Rice set out to collect. He administered tests of achievement in arithmetic, spelling, and language, and attempted to relate scores on these tests to the practices of the teachers. He was able to demonstrate that the time devoted to spelling had little to do with the accomplishment of the pupils. Indeed, his results indicated that the time devoted to spelling could generally be at least halved without depressing the level of skill acquired by the pupils.

The knowledge that Rice developed as a result of his work could not be considered scientific knowledge, but, rather, it represented a number of isolated facts about education. Such collections of isolated facts are not the makings of an organized body of scientific knowledge, however valuable they may be. There is a possibility that they might ultimately lead to the development of scientific knowledge, just as the accumulation of knowledge about the stars by Tycho de Brahe led to Kepler's formulation of an astronomical theory. Rice's work did not produce any direct educational reform, though it might have over the years; nevertheless, his work did have an influence on the development of educational research, for it was the beginning of a long series of educational investigations of classroom practices which are still continuing today.

During the half century that followed Rice's efforts at educational reform, numerous studies were undertaken that were designed to find relationships between the amount of learning occurring in schools and the conditions under which learning took place. Many of these were concerned with finding relationships between ratings of the personality traits of teachers and rate of learning of pupils. Others related characteristics of teachers, such as are measured by tests, to the level of achievement of the pupils.* Such studies became popular sources of doctoral dissertations and also occupied the time of many directors of research in school systems. These inquiries, in their day, could certainly be justified. What could be more logical than to improve education by finding out about the conditions that make for rapid learning and then by planning education so that these conditions occur in every classroom.

* See, for example, the annotated bibliography of such studies by Tiedeman and Domas (1950).

This recipe for improving education was warmly and widely accepted. Surely by midcentury such studies would provide a sound basis for educational reform, but these hopes and expectations were not to be realized despite the widespread effort that was devoted to correlating various aspects of learning conditions with outcomes. By midcentury, the major conclusion that could be drawn from such studies was that only very small and inconsistent relationships were generally found between teacher characteristics and practices and other aspects of the learning situation on the one hand and amount of learning on the other. Perhaps the main value of such studies has been to show the great complexity of the learning process in the classroom and the multiplicity of factors that may influence pupil learning. The influence of any one factor, or even the influence of the combination of several factors, may be so small that it may not show up in research using the crude techniques of measurement that are available. Certainly, studies relating learning conditions in school to pupil achievement have provided little basis for the improvement of education. The reform they were expected to bring simply has not materialized.

During the years between the two world wars a related type of research in schools began to serve what may be termed a political purpose. The emergence after World War I of the progressive-education movement resulted in the appearance of new practices, which a conservative public promptly attacked. The newly developed techniques for conducting research in schools appeared to educators to offer a means of defending the newer practices, if not of demonstrating that they were superior to those they replaced. Thus, during the thirties there appeared a considerable number of studies that attempted to compare the achievement of pupils in progressive schools with the achievement of pupils exposed to a more traditional curriculum. The major purpose of such studies was to defend newer practices rather than to advance knowledge of the educational process.

Studies comparing older and newer practices varied in ambitiousness from minor researches conducted to fulfill the requirements of a master's degree up to very elaborate and costly programs of research financed by foundations. The most elaborately conceived of these was a study developed under the auspices of the Progressive Education Association and designed to study the effects of a progressive curriculum in a group of thirty schools. It was conducted as part of what was known as the *Eight Year Study,* a study of these thirty schools. Methods of appraisal of the outcomes of learning in a progressive curriculum, developed as a part of this study, formed an important landmark in educational research. These methods are reported in a volume by Smith and Tyler (1942). Later some of the students from the thirty schools were followed up in

college to determine whether the progressive curriculum facilitated or interfered with intellectual and social development during the college years.

Excellent summaries have been made of such studies, which attempt to compare the effects of one teaching methodology with those of another; there would be little point in providing another review here. But the conclusions presented in such summaries do have considerable relevance to the present discussion, because they indicate the value and limitations of this approach to learning research. The main conclusions drawn from such studies have been summarized in a paper by Wallen and Travers (1963) as follows:

1. Differences in achievement of pupils exposed to different teaching methods are small and not generally consistent from study to study.

2. The method considered to be the experimental method in particular studies tends to show some slight superiority to the method described as the control method.

3. When teachers are asked to teach two classes by different methods, the teachers show only limited capacity for changing their pattern of behavior as they switch from method to method. This fact may account for the small differences between methods found in some of the studies.

4. Very few studies provide data indicating the way in which one method of teaching differs from another. Research workers usually report how the methods are *alleged* to differ, but few studies provide data indicating how the methods *actually* differ in terms of the recorded behavior of the teachers in the classroom.

5. Since information is generally lacking concerning the precise way in which teacher behavior differs in the two methods of teaching that are being compared, there is little basis for understanding any differences that may be found in the achievement of pupils exposed to the two methods. The situation is similar to that of an experiment in which some learning condition believed to be of vital consequence to the learning process is varied and the effects of this variation on learning noted, but in which the experimenter failed to record what was actually varied. Even if a typical study of the effects of various teaching methods turns up interesting differences, there is generally no way of finding out what such differences signify.

6. The results of the studies suggest that procedures for designing new teaching methods do not seem to take into account the major factors that influence learning. If they did, then the new teaching methods should produce markedly superior results to the older ones.

7. Even when two teaching methods differ markedly in the experiences that they provide for the children, the children exposed may still have many experiences in common. They may use the same textbook, consult

the same set of reference books, view the same visual and auditory aids. Such common experience in the two groups may produce learning that may well mask any differences produced by differences in method.

These conclusions lead to the position that the studies of teaching methods that have been undertaken have not resulted in anything resembling an organized body of knowledge, though some knowledge has been acquired. Here again, emphasis must be placed upon the fact that there is much knowledge available to humanity that is not scientific knowledge. The knowledge that such studies have yielded represents disconnected pieces of information. In addition, they have provided a certain understanding of some of the difficulties that face the person who wishes to acquire some insight into the learning process. Nowhere can be seen emerging the organized body of knowledge bound together by theoretical concepts of the kind that constitutes a science.

What has been said up to this point about the study of the learning process through direct study of the classroom fails to take note of a third type of classroom study, which has been highly productive, that came into being with the work of the great French psychologist Alfred Binet. In this approach an attempt is made to identify and measure characteristics of intellectual functioning that are of importance to the learning process. If the psychologist could measure capacities to perform intellectual functions, then the possibility is open of predicting the efficiency with which the individual can learn intellectual tasks. This Binet tried to do, and his famous test is an attempt to measure the child's capacity for performing those mental operations that must be performed successfully if the child is to learn at an adequate speed in school. For example, Binet and Simon (1905) postulated that the capacity to perform reasoning operations is important for success in schoolwork, and hence developed a series of problem situations through which the child's capacity to perform such operations could be tested. Research later demonstrated that the variable measured by such a test did appear to be related to the capacity to learn in school. Other research showed that, in the case of children of high-school age, there are a number of separate and distinct measurable characteristics that bear a clear relationship to the learning process and that show some stability over the years. Such variables, commonly referred to as aptitudes, have great significance for understanding the learning process. They have been discovered largely through the study of learning in school settings, and represent an area of application of psychology in which considerable success has been achieved. In addition, the knowledge produced by classroom studies in this area has come to acquire many of the characteristics of a scientific body of knowledge.

Laboratory Approaches to Learning

In many areas of scientific enquiry the scientist is limited to the study of phenomena as they occur in natural settings, but in other areas aspects of phenomena can be studied under simplified conditions in the laboratory. Great advantages accrue when this can be done, and history has shown that where laboratory approaches can be undertaken rapid advances are likely to be made. Of course, the word *rapid* must be interpreted conservatively. When the great physicist Cavendish obtained a numerical value of the gravitational constant, he concluded a phase of the work of Newton that had been begun a hundred years earlier. This may seem a long time, but this same century of experimentation in physics produced greater advances in knowledge of physics than the entire previous history of mankind.

The development of a laboratory science typically leaves the layman wondering what it is all about. It is a far cry from Faraday, working in his laboratory with wires and magnets, to the modern electric power station with its massive equipment serving the needs of mankind. (Indeed, there are stories of how visitors to the Faraday laboratory would chide him about the apparent uselessness of his work.) Even more obscure would be the relationship between the abstract mathematical work of Einstein and the development of the atomic bomb that fell on Hiroshima. Many in education today have a similar and understandable difficulty in seeing what laboratory studies of the eye-blink reflex or the learning of nonsense syllables can possibly have for the conduct of education in schools. Yet the fact is that most knowledge of learning has been derived from the study of learning situations which have little relevance on the surface to practical matters of education. The worth of laboratory studies must never be judged in terms of superficial appearance.

If the teacher is asked to divide learning situations into categories, he is likely to name such learning situations as English, mathematics, social studies, foreign languages, and so forth. If he has had some association with the progressive tradition, he may abandon subject-matter lines and suggest such categories as problem solving, information gathering, using reference sources, and many others which do not have much to do with the traditional curriculum. If the psychologist is asked to classify learning phenomena, he is likely to use an entirely different classification of learning, because he will think in terms of the situations in which learning has been systematically studied in the laboratory.

The experimental psychologist is likely to use an entirely different classification of learning phenomena from that used by the teacher.

Some experimental psychologists have favored a classification introduced by Skinner (1938) which divides all learning into classical conditioning and instrumental learning. Some recent writers prefer to sort learning phenomena into those in which the task of the learner emphasizes the acquisition of a muscular response and those in which the task involves mainly the organization of incoming information. We will have to look at both of these distinctions. In addition, some psychologists have tried to classify learning into a set of categories in which phenomena vary from the simple to the complex. Gagné (1964) provides such a classification in which the simplest learning is described as signal learning—learning to make a response when a particular signal is given—and in which the most complex learning is problem solving. Those who arrange learning phenomena in many categories from the simple to the complex have tended to imply that complex learning phenomena involve different laws of behavior than simple learning phenomena.

Our discussion of learning phenomena here will begin with the consideration of the distinction between classical and instrumental conditioning, since this twofold classification has had substantial impact on psychology as it has been applied to educational problems. This will be followed by a brief review of some of the main areas in which research on learning has been conducted and in which knowledge with important implications for education has been accumulated.

Classical Conditioning

A very large fraction of the work that has been undertaken in the study of learning has involved the study of phenomena that have come to be known as those of classical conditioning. The development of the concept of learning represented by classical conditioning must be attributed in its earlier stages to I. P. Pavlov (1849–1936) and V. M. Bechterev (1857–1957), two Russian physiologists of great stature who devoted much of their lives to the study of this aspect of learning. Some of the works of Pavlov (1927, 1928) have been translated and are available for English-speaking audiences.

Certain examples of classical conditioning had been noted for centuries before the Russian physiologists first developed experimental techniques for the study of the phenomena. Nearly a hundred and fifty years before Pavlov, Robert Whytt noted that salivation occurred not only in the presence of food, but also in the presence of objects associated with food and even when the idea of food flashed through the mind. In classical conditioning the starting point is always a response naturally elicited by some particular stimulus. These naturally occurring—that is, unlearned—forms of behavior are usually restricted to the few organs they in-

volve. Such restricted relationships between stimuli and responses are commonly called reflexes and are illustrated by phenomena such as the response of salivation to the presence of food in the mouth, the jerk of the knee which results from a tap on the patellar tendon, the contraction of the pupil of the eye when a bright light falls upon it, and the withdrawal of the hand from the surface of a hot stove. They are restricted behaviors but are not clearly divided off from more complex behaviors, which may also occur with little learning being involved. The typical mammalian female cleans off the young shortly after birth, and this complex behavior occurs with little identifiable learning. It differs from what are ordinarily called reflexes mainly in the complexity of the behavior and in the number of organs involved in the response.

A typical example of conditioning, and one with which Pavlov worked extensively, is based on the salivation reflex in response to food. This reflex represents the unlearned, or unconditioned, response to the food stimulus. If food is presented on a number of successive occasions, and if before each presentation a bell is rung, the bell acquires the property of eliciting the salivary response. One way of describing this situation is that there has been "stimulus substitution": the bell becomes a substitute stimulus for producing a salivary response. The bell is referred to as the "conditioned stimulus."

Pavlov undertook extensive studies using this particular kind of technique. The animal used was a dog, and the first step was to operate on the dog, moving the opening of one of the salivary ducts so that it emptied the saliva to the outside of the cheek. Here it was collected in a small bottle so designed that the number of drops of saliva could be easily recorded. During the period of experimentation the dog was held loosely in position by a harness. The first step in any series of experiments was for the dog to become habituated to the harness; but this is no problem, for the dog is a docile and cooperative laboratory creature and becomes a very easily managed animal in experimental situations provided the experimenter has some knowledge of the conditions that are likely to upset it. Once the dog became used to the experimental situation, experiments were run. Pavlov attempted to develop a series of laws of learning based on his conditioning data, and went far to establish a scientific approach to problems of learning.

Bechterev used a rather different technique in most of his work. In his technique the unconditioned response consisted of the raising of a paw when the plate on which the paw rested was electrically charged. Other stimuli, such as a bell or a light, would then be introduced to become the conditioned stimuli in the training series. This type of learning, in which the animal comes to anticipate an unpleasant stimulus by lifting its paw to avoid it, is sometimes referred to as "avoidance learn-