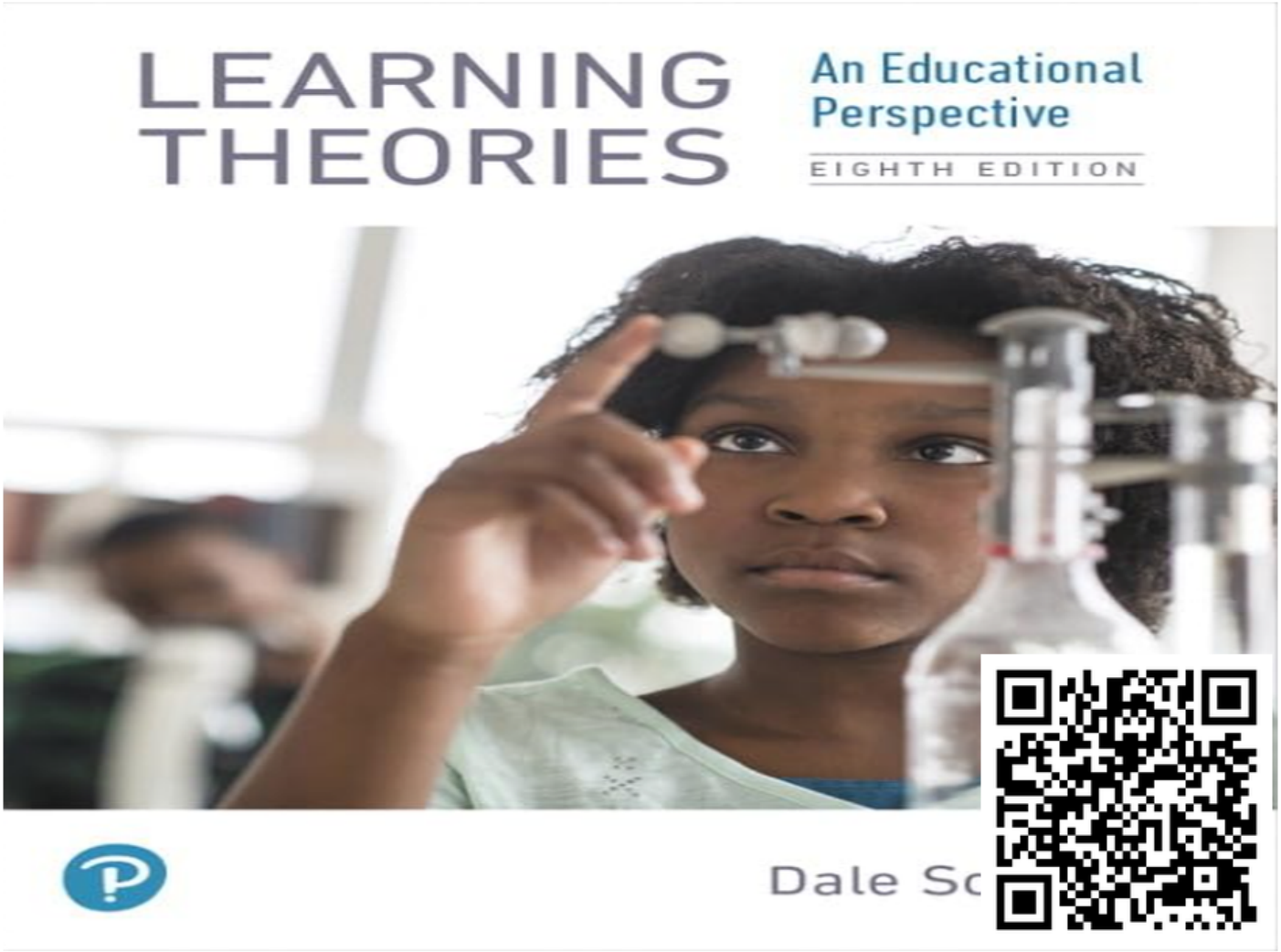

LEARNING THEORIES

An Educational Perspective

EIGHTH EDITION

Dale Schunk

Learning Theories

An Educational Perspective

Eighth Edition

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Dedication

To Albert Bandura, for helping me develop self-efficacy for leading a fulfilling life

Preface

Learning is a lifelong activity and fundamental to education. And the study of learning is crucial for everyone who wants to live a fulfilling life and help others do so. The better we understand learning, the better we can determine how to improve it.

Over the past several years, the study of learning by researchers has continued at a strong pace. This situation is desirable because it has resulted in theoretical refinements, improved research methodologies, and implications for instruction based on sound theory and research.

Although the study of learning has changed a lot since the first edition of this book was published in 1991, the primary objectives of this eighth edition remain much the same as those of the first edition: (a) to help students become knowledgeable of learning theoretical principles, concepts, and research findings, especially as they relate to education, and (b) to provide applications of principles and concepts in settings where teaching and learning occur. As in previous editions, the focus of the current edition is on cognition. Cognitive constructivist perspectives emphasize that learners are not passive recipients of information but rather actively seek, construct, and adapt their knowledge, skills, strategies, and beliefs.

STRUCTURE OF THIS TEXT

The text's 12 chapters are organized as follows. The introductory chapter covers learning theory, research methods, and learning issues, as well as historical foundations of the study of learning. Chapter 2 discusses the neuroscience of learning. A basic understanding of neuroscience assists readers in understanding the links between brain functions and cognitive and constructivist learning principles. Chapter 3 covers behaviorism, a dominant learning theory for many years. Current cognitive and constructivist theories and principles are the subject of Chapters 4–8: social cognitive theory; information processing theory—encoding and storage; information processing theory—retrieval and forgetting; cognitive learning processes; and constructivism. Chapters 9–11 cover topics relevant to and integrated with learning: motivation, self-regulated learning, and contextual influences. The final chapter asks learners to develop their own perspective on learning.

NEW TO THIS EDITION

Readers familiar with prior editions will notice content and organizational changes in this edition, which reflect new theoretical and research emphases. Several topics have been added including sections on educational data mining, positive behavior supports,

metacognition and epistemic thinking, Neo-Piagetian theories, self-regulation and technology, and future developments in the study of learning. The text has been revised to incorporate newer theoretical principles and research findings. These revisions are most evident in the chapters on constructivism and contextual influences. Sections on technology throughout the text have been revised to keep up with the latest educational uses of technology. Added to the ends of each of the first eleven chapters are two new sections: a chapter critique and a set of reflection questions that students can think about as they review the chapter and can be discussed in classes. To keep the text current and timely, new terms have been incorporated into the glossary. More than 200 new references have been added, and several dated references have been dropped.

Applications of learning principles have been a hallmark of this text since its inception and these continue to be present in this new edition. Each chapter except the introductory and concluding chapters contains a section on instructional applications. All chapters begin with vignettes that illustrate some principles discussed in the chapters. Throughout the chapters, there are many informal examples and detailed applications. Most of the applications involve K–12 settings, but applications also address other learning contexts including college students.

The text is designed for graduate students in education or related disciplines, as well as upper-level undergraduates interested in education. It is assumed that most students have taken a course in education or psychology and currently work in an educational capacity or anticipate pursuing an educational career. The text is appropriate for courses on learning and cognition, as well as any course that covers learning in some depth such as courses on motivation, educational psychology, human development, and instructional design.

ACKNOWLEDGEMENTS

Many people deserve thanks for their contributions to this edition. Over many years, there have been numerous professional colleagues who have assisted me to develop my thinking about learning processes and applications. I have acknowledged the contributions of these individuals in previous editions. For this edition, I want to gratefully thank Héfer Bembenutty, Herb Clark, Maria DiBenedetto, Jeff Greene, Judith Meece, Ellen Usher, Bernard Weiner, Allan Wigfield, Phil Winne, and Barry Zimmerman. My association with members of professional organizations has been most beneficial, especially the Motivation in Education and the Studying and Self-Regulated Learning Special Interest Groups of the American Educational Research Association, and Division 15 (Educational Psychology) of the American Psychological Association. It has been an honor for me to work with many excellent students, teachers, counselors, administrators, and superintendents. I also am indebted to several graduate and undergraduate student collaborators who assisted me on research projects.

I am most fortunate that again for this edition my editor at Pearson Education is Kevin Davis. Kevin unquestionably is one of the finest editors anyone could work with. He is highly encouraging and supportive, and his continued guidance has resulted in a better product. I also express appreciation to Casey Coriell and Janelle Rogers at Pearson

Education for their editorial assistance. I owe sincere thanks to the following reviewers of the eighth edition: Oris Griffin, James Madison University; James R. May, Oklahoma State University; Kerry Rice, Boise State University; Melissa Stormont, University of Missouri; and Ellie L. Young, Brigham Young University.

It is hard to believe that it has been almost 30 years since the first edition of this book was published. At that time, I proudly gave a copy to my parents, the late Mil and Al Schunk, for their love, encouragement and support. Since then, several friends have served as inspirations to me to continue to produce new editions. For this edition, I graciously thank Bill Gattis. And I am most grateful for my wife Maria and my daughter Laura, who was born shortly before the first edition was released. Laura is a remarkable young woman from whom I have learned so much and in whose life learning has made a profound difference.

Brief Contents

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1 Introduction to the Study of Learning

Russ Nyland teaches a graduate education course on learning and cognition. Toward the end of the semester, three students approach him: Jeri Kendall, Matt Bowers, and Trisha Pascella.

Jeri: Dr. Nyland, can we talk with you? It's late in the course, and we're still confused.

Russ: About what?

Jeri: Well, we've been studying all these theorists. It seems like they're saying different things, but maybe not. Skinner, Bandura, Vygotsky, and the others. They make different points, but then some of what they say seems to overlap what others say.

Matt: I'm confused too. I read these theorists and agree with what they're saying. But am I supposed to have only one theory, to believe one way and not others? There's a lot of overlap between theories.

Russ: You're right, Jeri and Matt; there is overlap. Most of what we've studied in this course involves cognition. Cognitive theories are alike because they say that learning involves changes in cognitions—knowledge, skills, beliefs. Most theorists also say that learners construct their knowledge and beliefs; they don't automatically adopt what somebody tells them.

Trisha: So then what should we do? Am I supposed to be something like an information processing theorist, a social cognitive theorist, a constructivist? That's what I'm confused about.

Russ: No, you don't have to be only one. There may be one theory that you like better than the others, but maybe that theory doesn't address everything you want it to. So then you can borrow from other theories. For example, when I was in grad school, I did research with a professor whose specialty was cognitive learning. There was another professor who did developmental research. I really liked her research, probably because I had been a teacher and was interested in development, especially the changes in students from elementary to middle school. So I was a learning theorist who borrowed from the developmental literature. I still do. It's okay to do that!

Jeri: Well, that makes me feel better. But it's late in the course, and I want to know what I should be doing next.

Russ: Tell you what—next class I'll spend some time on this. A good place to start is not to decide which type of theorist you are but rather determine what you believe about learning and what types of learning you're interested in. Then you can see which theory matches up well to your beliefs and assumptions and maybe do as I did—borrow from others.

Matt: Isn't that being eclectic?

Russ: Perhaps, but you may still have one preferred theory that you adapt as needed. It's okay to do that. In fact, that's how theories are improved—by revising and incorporating ideas that weren't in them originally.

Trisha: Thanks Dr. Nyland. This is really helpful.

Learning involves acquiring and modifying knowledge, skills, strategies, beliefs, attitudes, and behaviors. People learn cognitive, behavioral, linguistic, motor, and social skills, and these can take many forms. At a simple level, children learn to solve $2 + 2 = ?$, to recognize *y* in the word *daddy*, to tie their shoes, and to play with other children. At a more complex level, students learn to solve long-division problems, write term papers, ride a bicycle, and work cooperatively on group projects.

This book focuses on how human learning occurs, which factors influence it, and how learning principles apply in educational contexts. Animal learning is de-emphasized, which is not intended to downgrade its importance because we have gained much knowledge about learning from animal research. But human learning is fundamentally different from animal learning because human learning typically involves language and is more complex, elaborate, and rapid.

This chapter provides an overview of the study of learning. Initially, learning is defined and examined in settings where it occurs. An overview is given of some important philosophical and psychological precursors of contemporary theories that helped to establish the groundwork for the application of learning theories to education. The roles of learning theory and research are discussed, and methods commonly used to assess learning are described. The links between learning theories and instruction are explained, after which some critical issues in the study of learning are presented.

The opening scenario describes a situation that many students find themselves in when they take a course in learning, instruction, or motivation and are exposed to different theories. Students often think that they are supposed to believe in one theory and adopt the views of those theorists. They may be confused by the perceived overlap between theories.

As Russ Nyland says, that is normal. Although theories differ in many ways, including their general assumptions and guiding principles, many rest on a common foundation of cognition. This text focuses on these cognitive theories of learning, which contend that learning involves changes in learners' constructions: their thoughts, beliefs, knowledge, strategies, and skills. These theories differ in how they predict that learning occurs, which learning processes are important, and which aspects of learning they stress. Some theories are oriented more toward basic learning and others toward applied learning (and, within that, in different content areas); some stress the role of development, others are strongly linked with instruction; and some emphasize motivation (Bruner, 1985).

Russ advises students to examine their beliefs and assumptions about learning rather than decide which type of theorist they are. This is good advice. Theories are perspectives on learning. They are neither right nor wrong. Rather, they help us understand learning and act accordingly. Once we are clear about where we stand on learning in general, then the theoretical perspective or perspectives that are most relevant will emerge. As you study this text, it will help if you reflect on your beliefs and assumptions about learning and decide how these align with the theories.

This introductory chapter is important because it should prepare you for an in-depth study of learning by providing a framework for understanding learning and some background material against which to view contemporary theories. It also covers types of research to investigate learning and ways to assess it. These are topics that everyone interested in learning should be familiar with.

When you finish studying this chapter, you should be able to do the following:

- Define learning and identify instances of learned and unlearned phenomena.
- Distinguish between rationalism and empiricism, explain the major tenets of each, and discuss how rationalism and empiricism are reflected in contemporary learning theories and research.
- Discuss how the work of Wundt, Ebbinghaus, the Structuralists, and the Functionalists helped to establish psychology as a science.
- Describe the major features of different research paradigms.
- Discuss the central features of different methods of assessing learning, including educational data mining and criteria for assessment methods.
- Explain what value-added assessment of learning is and how it can be used to determine progress in student learning.
- Explicate the ways that learning theory and educational practice complement and refine one another.
- Explain differences between behavior and cognitive theories with respect to various issues in the study of learning.

LEARNING DEFINED

Although people agree that learning is important, they hold different views on the causes, processes, and consequences of learning (Alexander, Schallert, & Reynolds, 2009; Geary, 2009). There is no one definition of learning that is universally accepted by theorists, researchers, and practitioners. Despite disagreement about the precise nature of learning, the following is a general definition of learning that is consistent with this book's cognitive focus and that captures the criteria most educational professionals consider central to learning.

> *Learning is an enduring change in behavior, or in the capacity to behave in a given fashion, which results from practice or other forms of experience.*

Let us examine this definition in depth to identify three criteria of learning (Table 1.1).

One criterion is that *learning involves change*—in behavior or in the capacity for behavior. Change is a central ingredient of learning (Alexander et al., 2009). When people learn, they become capable of doing something differently. A key point is that we do not

Table 1.1
Criteria of learning.

■ Learning involves change
■ Learning endures over time
■ Learning occurs through experience

observe learning directly but rather its products or outcomes. In other words, *learning is inferential*—it is demonstrated based on what people say, write, and do. The definition also says that learning involves a changed capacity to behave in a given fashion because people can learn skills, knowledge, beliefs, and behaviors without demonstrating them at the time they learn them (Chapter 4).

A second criterion is that *learning endures over time*. This criterion excludes temporary behavioral changes (e.g., slurred speech) brought about by such factors as drugs, alcohol, and fatigue. Such changes are temporary because when the cause is removed, the behavior returns to its original state. Although learning is enduring, it may not last forever because forgetting occurs. Researchers debate how long changes must last to be classified as learned, but most people agree that changes of brief duration (e.g., a few seconds) do not qualify as learning.

A third criterion is that *learning occurs through experience* (e.g., practice, thinking, observation of others). This criterion excludes behavioral changes that are primarily determined by heredity, such as maturational changes in children (e.g., crawling, standing). Nonetheless, the distinction between maturation and learning often is not clear-cut. People may be genetically predisposed to act in given ways, but the actual development of the particular behaviors depends on the environment. Language offers a good example. As the human vocal apparatus matures, it becomes able to produce language such that children acquire language in much the same type of trajectory (Goldin-Meadow et al., 2014). The actual words produced, however, are learned from interactions with others. Although genetics are critical for children's language acquisition, teaching and social interactions with parents, teachers, and peers exert a strong influence on children's language achievements (Mashburn, Justice, Downer, & Pianta, 2009). In similar fashion, with normal development, children crawl and stand, but the environment must be responsive and allow these behaviors to occur. Children whose language and movements cannot be expressed freely in an environment may not develop normally.

PRECURSORS OF MODERN LEARNING THEORIES

The roots of contemporary theories of learning extend far into the past. Many issues addressed and questions asked by researchers today are not new but rather reflect the continuing desire for people to understand themselves, others, and the world about them.

It is important to understand the origins of contemporary learning theories, which this section traces beginning with philosophical positions on the origin of knowledge and its relation to the environment and concluding with some early psychological views on learning. This review is selective and includes historical material relevant to learning in educational settings. Readers interested in a more comprehensive discussion should consult historical sources (Bower & Hilgard, 1981; Heidbreder, 1933; Hunt, 1993).

Learning Theory and Philosophy

From a philosophical perspective, learning can be discussed under the heading of *epistemology*, which refers to the study of the origin, nature, limits, and methods of knowledge. How do we know? How do we learn something new? What is the source of knowledge? The complexity of how humans learn is illustrated in Plato's *Meno* (427?–347? B.C.):

> I know, Meno, what you mean . . . You argue that a man cannot enquire (*sic*) either about that which he knows, or about that which he does not know; for if he knows, he has no need to enquire (*sic*); and if not, he cannot; for he does not know the very subject about which he is to enquire (*sic*). (Plato, 1965, p. 16)

Two positions on the origin of knowledge and its relationship to the environment are rationalism and empiricism. These philosophies are recognizable in current learning theories.

Rationalism. *Rationalism* reflects the idea that knowledge derives from reason without recourse to the senses. The distinction between mind and matter, which figures prominently in rationalist views of human knowledge, can be traced to Plato, who distinguished knowledge acquired via the senses from that gained by reason. Plato believed that things (e.g., houses, trees) are revealed to people via the senses, whereas individuals acquire knowledge of ideas by reasoning or thinking about what they know. People have ideas about the world, and they learn (discover) these ideas by reflecting upon them. Reason is the highest mental faculty because through reason, people discover abstract ideas. The true nature of houses and trees can be known only by reflecting upon the ideas of houses and trees.

Plato escaped the dilemma expressed in *Meno* by assuming that true knowledge, or the knowledge of ideas, is innate and is brought into awareness through reflection. Learning is recalling what exists in the mind. Information acquired via the senses by seeing, hearing, tasting, smelling, or touching constitutes raw materials rather than ideas. The mind is innately structured to reason and provide meaning to incoming sensory information.

The rationalist doctrine also is evident in the writings of René Descartes (1596–1650), a French philosopher and mathematician. Descartes employed doubt as a method of inquiry. By doubting, he arrived at conclusions that were absolute truths and not subject to doubt. The fact that he could doubt led him to believe that the mind (thought) exists, as reflected in his dictum, "I think, therefore I am." Through deductive reasoning from general premises to specific instances, he showed that God existed and concluded that ideas arrived at through reason must be true.

Like Plato, Descartes established a mind–matter dualism; however, for Descartes, the external world was mechanical, as were the actions of animals. People are distinguished by their ability to reason. The human soul, or the capacity for thought, influences the body's mechanical actions, but the body acts on the mind by bringing in sensory experiences. Although Descartes postulated dualism, he also hypothesized mind–matter interaction.

The rationalist perspective was extended by the German philosopher Immanuel Kant (1724–1804). In his *Critique of Pure Reason* (1781), Kant addressed mind–matter dualism and noted that the external world is disordered but is perceived as orderly because order is imposed by the mind. The mind takes in the external world through the senses and

alters it according to subjective, innate laws. The world never can be known as it exists but only as it is perceived. People's perceptions give the world its order. Kant reaffirmed the role of reason as a source of knowledge but contended that reason operates within the realm of experience. Absolute knowledge untouched by the external world does not exist. Rather, knowledge is empirical in the sense that information is taken in from the world and interpreted by the mind.

In summary, rationalism is the doctrine that knowledge arises through the mind. Although there is an external world from which people acquire sensory information, ideas originate from the workings of the mind. Descartes and Kant believed that reason acts upon information acquired from the world; Plato thought that knowledge can be absolute and acquired by pure reason.

Empiricism. In contrast to rationalism, *empiricism* reflects the idea that experience is the only source of knowledge. This position derives from Aristotle (384–322 B.C.), who was Plato's student and successor. Aristotle drew no sharp distinction between mind and matter. The external world is the basis for human sense impressions, which, in turn, are interpreted as lawful (consistent, unchanging) by the mind. The laws of nature cannot be discovered through sensory impressions but rather through reason as the mind takes in data from the environment. Unlike Plato, Aristotle believed that ideas do not exist independently of the external world, which is the source of all knowledge.

Aristotle's contribution to psychology was his principles of association as applied to memory. The recall of an object or idea triggers recall of other objects or ideas similar to, different from, or experienced close in time or space, to the original object or idea. The more that two objects or ideas are associated, the more likely that recall of one will trigger recall of the other. Such associative learning is reflected in many learning theories (Shanks, 2010).

Another influential figure was British philosopher John Locke (1632–1704), who developed an empirical school of thought that stopped short of being truly experimental. In his *Essay Concerning Human Understanding* (1690), Locke noted that there are no innate ideas; all knowledge derives from two types of experience: sensory impressions of the external world and personal awareness. At birth, the mind is a *tabula rasa* (blank tablet). Ideas are acquired from sensory impressions and personal reflections on these impressions. What is in the mind originated in the senses. The mind is composed of ideas that have been combined in different ways. The mind can be understood only by breaking down ideas into simple units. This atomistic view of thought is associationist; complex ideas are collections of simple ones.

The issues Locke raised were debated by such profound thinkers as George Berkeley (1685–1753), David Hume (1711–1776), and John Stuart Mill (1806–1873). Berkeley believed that mind is the only reality. He was an empiricist because he believed that ideas derive from experiences. Hume agreed that people never can be certain about external reality, but he also believed that people cannot be certain about their own ideas. Individuals experience external reality through their ideas, which constitute the only reality. At the same time, Hume accepted the empiricist doctrine that ideas derive from experience and become associated with one another. Mill was an empiricist and associationist, but he rejected the idea that simple ideas combine in orderly ways to form complex ones.

Mill argued that simple ideas generate complex ideas, although the latter need not be composed of the former. Simple ideas can produce a complex thought that might bear little relation to the ideas of which it is composed. Mill's beliefs reflect the notion that the whole is greater than the sum of its parts, which is an integral assumption of Gestalt psychology (Chapter 5).

In summary, empiricism holds that experience is the only form of knowledge. Beginning with Aristotle, empiricists have contended that the external world serves as the basis for people's impressions. Most accept the notion that objects or ideas associate to form complex stimuli or mental patterns. Locke, Berkeley, Hume, and Mill are among the better-known philosophers who espoused empiricist views.

Knowing about philosophical positions that underlie learning theories helps us better understand the latter. Philosophical positions suggest the types of research conducted by researchers adopting different theoretical positions. Thus, theories that reflect a rationalist perspective are apt to be concerned with learners' perceptions of learning environments and ways that learners construct knowledge. These research methods might try to tap qualitative measures such as learners' reflections at various points during learning. In contrast, theories that reflect empiricism may place greater emphasis on environmental variables and the effects these might have on the associations made by learners. These theories may also examine how complex types of learning are built up from more basic ones. The research methods are likely to include measures and variables that can be quantified.

It should be emphasized that philosophical positions and learning theories do not neatly map onto one another; however, behavior theories (Chapter 3) typically are empiricist in their orientation whereas cognitive theories (Chapters 4–8) are more rationalistic. But overlap and exceptions occur. For example, most theories posit that some learning occurs through association. Cognitive theories stress association between cognitions and emotions; behavior theories emphasize the association of stimuli with responses and consequences. And more recent behavior theories have begun to include cognition (Chapter 3). Information processing (Chapters 5 and 6) seems highly empiricist at times, but it does emphasize the construction of knowledge. So we are left with complexity such that it is best not to overgeneralize how a particular philosophical position may manifest itself in a given learning theory.

Beginnings of the Psychological Study of Learning

Although the study of learning is probably "as old as the sun," the formal beginning of the psychological study of learning is more recent but difficult to pinpoint. Systematic psychological research began to appear in the latter part of the 19th century. Two persons who had a significant impact on learning theory are Wundt and Ebbinghaus.

Wundt's Psychological Laboratory. The first psychological laboratory was opened by Wilhelm Wundt (1832–1920) in Leipzig, Germany, in 1879, although William James had started a teaching laboratory at Harvard University four years earlier (Dewsbury, 2000). Wundt wanted to establish psychology as a new science. His laboratory acquired an international reputation with an impressive group of visitors, and he founded a journal to report psychological research. The first research laboratory in the United States was opened in 1883 by G. Stanley Hall (Dewsbury, 2000).

Establishing a psychological laboratory was particularly significant because it marked the transition from philosophical theorizing to an emphasis on experimentation and instrumentation (Evans, 2000). The laboratory included scholars who conducted research aimed at scientifically explaining phenomena (Benjamin, 2000). In his 1873 book *Principles of Physiological Psychology*, Wundt contended that psychology is the study of the mind. The psychological method should be patterned after the physiological method; that is, the process being studied should be experimentally investigated in terms of controlled stimuli and measured responses.

Wundt's researchers investigated such phenomena as sensation, perception, reaction times, verbal associations, attention, feelings, and emotions. Wundt also was a mentor for many psychologists who subsequently opened laboratories in the United States (Benjamin, Durkin, Link, Vestal, & Acord, 1992). Although Wundt's laboratory produced no great psychological discoveries or critical experiments, it established psychology as a discipline and experimentation as the method of acquiring and refining knowledge.

Ebbinghaus's Verbal Learning. Hermann Ebbinghaus (1850–1909) was a German psychologist who helped to validate the experimental method and establish psychology as a science. Ebbinghaus investigated higher mental processes by conducting research on memory (Erdelyi, 2010). He accepted the principles of association and believed that learning and the recall of learned information depend on the frequency of exposure to the material. Properly testing this hypothesis required using material with which participants were unfamiliar. Ebbinghaus invented *nonsense syllables*, which are three-letter consonant-vowel-consonant combinations (e.g., cew, tij).

Ebbinghaus often used himself as the subject of study (Erdelyi, 2010). In a typical experiment, he would devise a list of nonsense syllables, look at each syllable briefly, pause, and then look at the next syllable. He determined how many times through the list (trials) it took to him learn the entire list. He made fewer errors with repeated study of the list, needed more trials to learn more syllables, forgot rapidly at first but then more gradually, and required fewer trials to relearn syllables than to learn them the first time. He also studied a list of syllables some time after original learning and calculated a *savings score*, defined as the time or trials necessary for relearning as a percentage of the time or trials required for original learning. He found that meaningfulness of material made learning easier. The results of his research are compiled in the 1885/1964 book *Memory*.

Although important historically, there are concerns about this research. Ebbinghaus typically employed only one participant (himself), and it is unlikely he was unbiased or a typical learner. We also might question how well results for learning nonsense syllables generalize to meaningful learning (e.g., text passages). Nonetheless, Ebbinghaus was a careful researcher, and many of his findings later were validated experimentally. He was a pioneer in bringing higher mental processes into the experimental laboratory.

Structuralism and Functionalism

The work by Wundt and Ebbinghaus was systematic but confined to particular locations and of limited influence on psychological theory. The turn of the century marked the

beginning of more widespread schools of psychological thought. Two perspectives that emerged were structuralism and functionalism. Although neither exists as a unified doctrine today, their early proponents were influential in the history of psychology as it relates to learning.

Structuralism. Edward B. Titchener (1867–1927) was Wundt's student in Leipzig. Titchener became the director of the psychology laboratory at Cornell University in 1892 and imported Wundt's experimental methods into U.S. psychology.

Titchener's psychology, which eventually became known as *structuralism*, reflected empiricism because it represented a combination of associationism with the experimental method. Structuralists believed that human consciousness is a legitimate area of scientific investigation, and they studied the structure or makeup of mental processes. They postulated that the mind is composed of associations of ideas that to be studied must be broken down into single ideas (Titchener, 1909).

The experimental method used often by Wundt, Titchener, and other structuralists was *introspection*, a type of self-analysis. Participants in introspection studies verbally reported their immediate experiences following exposure to objects or events. For example, if shown a table, they might report their perceptions of shape, size, color, and texture. They were told not to label or report their knowledge about the object or the meanings of their perceptions. Thus, if they verbalized "table" while viewing a table, they were attending to the stimulus rather than to their conscious processes.

Introspection was a uniquely psychological process and helped to demarcate psychology from the other sciences. It was a professional method that required training in its use so that an introspectionist could determine when individuals were examining their own conscious processes rather than their interpretations of phenomena.

Unfortunately, introspection often was problematic and unreliable. It is difficult and unrealistic to expect people to ignore meanings and labels. When shown a table, it is natural that people say "table," think of uses, and draw on related knowledge. The mind is not structured to compartmentalize information so neatly, so by ignoring meanings introspectionists disregarded a central aspect of the mind. Watson (Chapter 3) decried the use of introspection, and its problems helped to rally support for an objective psychology that studied only observable behavior (Heidbreder, 1933). Edward L. Thorndike, a prominent psychologist (Chapter 3), contended that education should be based on scientific facts, not opinions (Popkewitz, 1998). The ensuing emphasis on behavioral psychology dominated U.S. psychology for the first half of the 20th century.

Another problem was that structuralists studied associations of ideas, but they had little to say about how these associations are acquired. Further, it was not clear that introspection was the appropriate method to study such higher mental processes as reasoning and problem solving, which are more complex than immediate sensation and perception.

Functionalism. While Titchener was at Cornell, other developments challenged the validity of structuralism. Among these was *functionalism*, the view that mental processes and behaviors of living organisms help them adapt to their environments (Heidbreder, 1933). This school of thought flourished at the University of Chicago with John Dewey (1867–1949)

and James Angell (1869–1949). Another prominent functionalist was William James (1842–1910). Functionalism was the dominant American psychological perspective from the 1890s until World War I (Green, 2009).

James's principal work was the two-volume series, *The Principles of Psychology* (1890), which is considered one of the greatest psychology texts (Hall, 2003). An abridged version was published for classroom use (James, 1892). James was an empiricist who believed that experience is the starting point for examining thought, but he was not an associationist. He thought that simple ideas are not passive copies of environmental inputs but rather are the product of abstract thought and study (Pajares, 2003).

James (1890) postulated that consciousness is a continuous process rather than a collection of discrete bits of information. One's "stream of thought" changes as experiences change. James described the purpose of consciousness as helping individuals adapt to their environments.

Functionalists incorporated James's ideas into their doctrine. Dewey (1896) believed that psychological processes could not be broken into discrete parts and that consciousness must be viewed holistically. "Stimulus" and "response" describe the roles played by objects or events, but these roles could not be separated from the overall reality (Bredo, 2003). Dewey cited an example from James (1890) about a baby who sees a candle burning, reaches out to grasp it, and experiences burned fingers. From a stimulus–response perspective, the sight of the candle is a stimulus, and reaching is a response; getting burned (pain) is a stimulus for the response of withdrawing the hand. Dewey argued that this sequence is better viewed as one large coordinated act in which seeing and reaching influence each other.

Functionalists were influenced by Darwin's writings on evolution and studied how mental processes helped organisms adapt to their environments and survive (Bredo, 2003; Green, 2009). Functionalists were interested in how mental processes (e.g., thinking, feeling, judging) operate, what they accomplish, and how they vary with environmental conditions. They also saw the mind and body as interacting rather than existing separately.

Functionalists opposed the introspection method, not because it studied consciousness but rather because of how it studied consciousness. Introspection attempted to reduce consciousness to discrete elements, which functionalists believed was not possible. Studying a phenomenon in isolation does not reveal how it contributes to an organism's survival.

Dewey (1900) argued that the results of psychological experiments should be applicable to education and daily life. Although this goal was laudable, it also was problematic because the research agenda of functionalism was too broad to offer a clear focus. Structuralists and functionalists believed in the value of research, but they approached it differently. Structuralism reflected the tenets of empiricism, whereas functionalism was better aligned with rationalism. But both perspectives had weaknesses involving research. These weaknesses paved the way for the rise of behaviorism as the dominant force in U.S. psychology (Chapter 3). Behaviorism reflected empiricism because it emphasized experimentation and observable phenomena, which helped to secure psychology's standing as a science (Asher, 2003; Tweney & Budzynski, 2000).

LEARNING THEORY AND RESEARCH

Theory and research are integral to the study of learning. This section discusses some general functions of theory, along with key aspects of the research process. Readers who are knowledgeable about these topics may wish to omit this section.

Functions of Theory

A *theory* is a scientifically acceptable set of principles offered to explain a phenomenon. Theories are perspectives on learning that provide frameworks for interpreting environmental observations. They also help to bridge the gap between research and education. Research findings can be organized and systematically linked to theories. Theories provide a scientific basis for education regarding how people think, feel, and act (Sternberg, 2008). Without theories, people might view research findings as disorganized collections of data, because researchers and practitioners would have no overarching frameworks to which the data could be linked. Even when researchers obtain findings that do not seem to be directly linked to theories, they still must attempt to make sense of data and determine whether the data support theoretical predictions.

Theories reflect environmental phenomena and generate new research through *hypotheses*, or assumptions that can be empirically tested. Hypotheses can be cast as statements of relation, such as, "*X* should relate positively to *Y*," or as if–then statements (e.g., "If I do *X*, then *Y* should occur)," where *X* and *Y* might be such events as "give students feedback on their progress in learning" and "promote their learning," respectively. Thus, we might test the hypothesis, "If we give students feedback on their progress in learning, then they should display better learning." A theory is strengthened when hypotheses are supported by data. Theories may require revision if data do not support hypotheses.

When researchers explore areas where there is little theory to guide them, they formulate research objectives or questions to be answered (e.g., "How will students' learning be affected when they receive feedback on their learning progress?"). Regardless of whether researchers are testing hypotheses or exploring questions, they need to specify the research conditions as precisely as possible.

Because research forms the basis for theory development and has important implications for teaching, the next section examines types of research and the process of conducting research. Readers familiar with this material may wish to omit this section.

Conducting Research

To specify the research conditions, researchers need to answer such questions as: Who will participate? Where will the research study be conducted? What procedures will be employed? What are the variables and outcomes to be assessed?

Researchers must define precisely the phenomena they are studying by providing conceptual and operational definitions. An *operational definition* defines a phenomenon in terms of the measures and procedures used to assess it. For example, a researcher might define *self-efficacy* (covered in Chapter 4) conceptually as one's perceived capabilities for

learning or performing a task and operationally by specifying the measures and procedure used to assess self-efficacy in the research study (e.g., one's score on a 30-item questionnaire administered privately before students received instruction). Ideally, conditions are specified so precisely that, after reading the description, another researcher could replicate the study.

Research studies that explore learning employ various types of *paradigms* (or *models*; Table 1.2). The following paragraphs describe the correlational, experimental, and qualitative paradigms, followed by a discussion of laboratory and field studies.

Correlational Research. *Correlational research* deals with exploring relations that exist between variables. A researcher might hypothesize that self-efficacy is positively correlated with (related to) achievement such that the higher the students' self-efficacy, the higher they achieve. To test this relation, the researcher might measure students' self-efficacy for solving mathematical problems and then assess how well they solve the problems. The researcher could statistically correlate the self-efficacy and achievement scores to determine the direction of the relation (positive, negative) and its strength (high, medium, low).

Correlational research helps to clarify relations among variables. Correlational findings often suggest directions for further research. If the researcher were to obtain a high positive correlation between self-efficacy and achievement, the next study might be an experiment that attempts to raise students' self-efficacy for learning and determine whether such an increase produces higher achievement.

A limitation of correlational research is that it cannot identify cause and effect. A positive correlation between self-efficacy and achievement could mean that (a) self-efficacy influences achievement, (b) achievement influences self-efficacy, (c) self-efficacy and achievement influence each other, or (d) both self-efficacy and achievement are influenced by other, nonmeasured variables (e.g., parents, teachers). To determine cause and effect, experimental studies are necessary.

Experimental Research. In *experimental research*, the researcher changes one or more (independent) variables and determines the effects on other (dependent) variables. A researcher could form two groups of students, systematically raise self-efficacy beliefs among students in one group and not among students in the other group, and assess achievement in the two groups. If the first group performs better, the researcher might

Table 1.2
Learning research paradigms.

Type	Qualities
Correlational	Examines relations between variables
Experimental	One or more variables are altered and effects on other variables are assessed
Qualitative	Concerned with description of events and interpretation of meanings
Laboratory	Project conducted in a controlled setting
Field	Project conducted in a natural setting (e.g., school, home, work)

conclude that self-efficacy influences achievement. While the researcher alters variables and assesses their effects on outcomes, she or he must hold constant other variables that potentially can affect outcomes (e.g., learning conditions).

Experimental research, which often is conducted by researchers in the empiricism tradition, can clarify cause–effect relations, which helps us understand the nature of learning. At the same time, experimental research often is narrow in scope. Such research typically involved quantitative data, which includes closed-ended information on beliefs and performance instruments (Creswell & Plano-Clark, 2007). Researchers typically study only a few variables and try to minimize effects of others, which is difficult to do and often unrealistic. Classrooms and other learning settings are complex places where many variables operate at once. To say that one or two variables cause outcomes may overemphasize their importance. It is necessary to replicate experiments and examine other variables to better understand effects.

Qualitative Research. The *qualitative research* paradigm is characterized by intensive study, descriptions of events, and interpretation of meanings. The theories and methods used are referred to with various labels including qualitative, ethnographic, participant observation, phenomenological, constructivist, and interpretative (Erickson, 1986). It is often conducted by researchers in the rationalist tradition.

Qualitative research is especially useful when researchers are interested in the structure of events rather than their overall distributions, when the meanings and perspectives of individuals are important, when actual experiments are impractical or unethical, and when there is a desire to search for new potential causal linkages that have not been discovered by experimental methods (Erickson, 1986). Qualitative research is varied and can range from analyses of verbal and nonverbal interactions within single lessons to in-depth observations and interviews over longer periods. Methods may include observations, use of existing records, interviews, and think-aloud protocols (i.e., participants talk aloud while performing tasks). It is not the choice of method that characterizes this approach—all of the aforementioned methods could be used in correlational or experimental studies—but rather the depth and quality of data analysis and interpretation.

A qualitative researcher might be curious about how self-efficacy contributes to the development of skills over time. She or he might work with a small group of students for several weeks. Through observations, interviews, and other forms of data collection, the researcher might examine how students' self-efficacy for learning changes in relation to their learning in reading, writing, and mathematics.

Quantitative and qualitative methods can be used together in a research study, which is known as *mixed-methods research* (Creswell & Plano-Clark, 2007). Qualitative research yields rich sources of open-ended data, which are more intensive and thorough than those typically obtained with quantitative methods. This model also can raise new questions and fresh perspectives on old questions that often are missed by traditional methods. A potential limitation is that qualitative studies typically include only a few participants, who may not be representative of a larger population of students or teachers. This limits generalization of findings beyond the research context. Another limitation is that data collection, analysis, and interpretation can be time-consuming and therefore impractical for students wanting to graduate and professors wanting to build their publication records! But

as a research model, this paradigm offers a useful approach for obtaining data typically not collected with other methods.

Laboratory and Field Research. *Laboratory research* is conducted in controlled settings, whereas *field research* is conducted where participants live, work, or attend school. During the first half of the 20th century, most learning research was conducted on animals in laboratories. Today most learning research is conducted with people, and much is done in field settings. Any of the preceding research models (experimental, correlational, qualitative) can be applied in the laboratory or the field.

Laboratories offer a high degree of control over extraneous factors that can affect results, such as equipment noises (e.g., ringing phones), people talking, windows to look out of, and other persons in the room who are not part of the study. Light, sound, and temperature can be regulated. Laboratories also allow researchers to leave their equipment set up over lengthy periods and have all materials at their immediate disposal.

Such control is not possible in the field. Schools are noisy, and often it is difficult to find space to work. There are numerous distractions: Students and teachers walk by, bells ring, public announcements are made, and fire drills are held. Rooms may be too bright or dark, cold or warm, and they may be used for other purposes so researchers have to set up equipment each time they work. Interpreting results in light of these distractions can be a problem.

An advantage of field research is that results are highly generalizable to other similar settings because studies are conducted where people typically learn. In contrast, generalization of laboratory findings to the field is done with less confidence. Laboratory research has yielded many important insights on learning, and researchers often attempt to replicate laboratory findings in the field.

Whether the laboratory or the field is employed depends on such factors as the purpose of the research, availability of participants, costs, and how the results will be used. The laboratory adds control but loses some generalizability, and vice versa with the field. In the field, researchers try to minimize extraneous influences so that they can be more confident that their results are due to the variables they are studying.

ASSESSMENT OF LEARNING

Because learning is inferential, we do not directly observe it but rather its products—what learners say and do. Researchers and practitioners who work with students may believe that students have learned, but to be more certain, they must assess learning's outcomes. *Assessment* involves "a formal attempt to determine students' status with respect to educational variables of interest" (Popham, 2014, p. 8). In school, the educational variable of interest most often is student achievement in different areas (e.g., reading, writing, mathematics, science).

Student achievement always has been critical, but its importance has been underscored in recent years by legislation and standards. For example, the federal government's No Child Left Behind (NCLB) Act of 2001 (Shaul & Ganson, 2005) has many provisions. Among

the most significant are the requirements for annual testing of students in grades 3 through 8 and again in high school in reading and mathematics and for school systems to show increases in students making adequate yearly progress in these subjects. *The Common Core State Standards for English Language Arts and Mathematics* (National Governors Association Center for Best Practices and Council of Chief State School Officers, 2010; White & DiBenedetto, 2015), which are designed to promote college and career readiness, were adopted by many states. The Every Student Succeeds Act of 2015 made several changes to NCLB's provisions including giving states freedom to select their goals for test proficiency, English language proficiency, and graduation rates. However, states remain accountable to the federal government, and their accountability systems must include at least four indicators: proficiency on state tests, English language proficiency, a third academic indicator, and one other indicator such as student engagement and postsecondary readiness. Collectively, these standards and legislation ensure that accountability for student learning will continue to receive attention.

Two points are noteworthy with respect to this text. Although accountability often leads to testing being the means of assessment, the latter includes many measurement procedures besides testing (described below). Researchers and practitioners want to know whether learning has occurred, and there may be procedures other than testing that provide evidence of student learning (Popham, 2014). Second, students' skills in content areas often are the learning outcomes assessed, but researchers and practitioners may also be interested in other forms of learning. For example, they may want to know whether students have learned new attitudes or self-regulation skills or whether students' interests, values, self-efficacy, and motivation have increased as a result of content learning.

This section covers ways to assess outcomes of learning. These methods include direct observations, written responses, oral responses, ratings by others, and self-reports (Table 1.3).

Table 1.3
Methods of assessing learning.

Category	Definition
Direct observations	Instances of behavior that demonstrate learning
Written responses	Written performances on tests, quizzes, homework, papers, and projects
Oral responses	Verbalized questions, comments, and responses during learning
Ratings by others	Observers' judgments of learners on attributes indicative of learning
Self-reports	People's judgments of themselves
■ Questionnaires	Written ratings of items or answers to questions
■ Interviews	Oral responses to questions
■ Stimulated recalls	Recall of thoughts accompanying one's performances at given times
■ Think-alouds	Verbalizing aloud one's thoughts, actions, and feelings while performing a task
■ Dialogues	Conversations between two or more persons