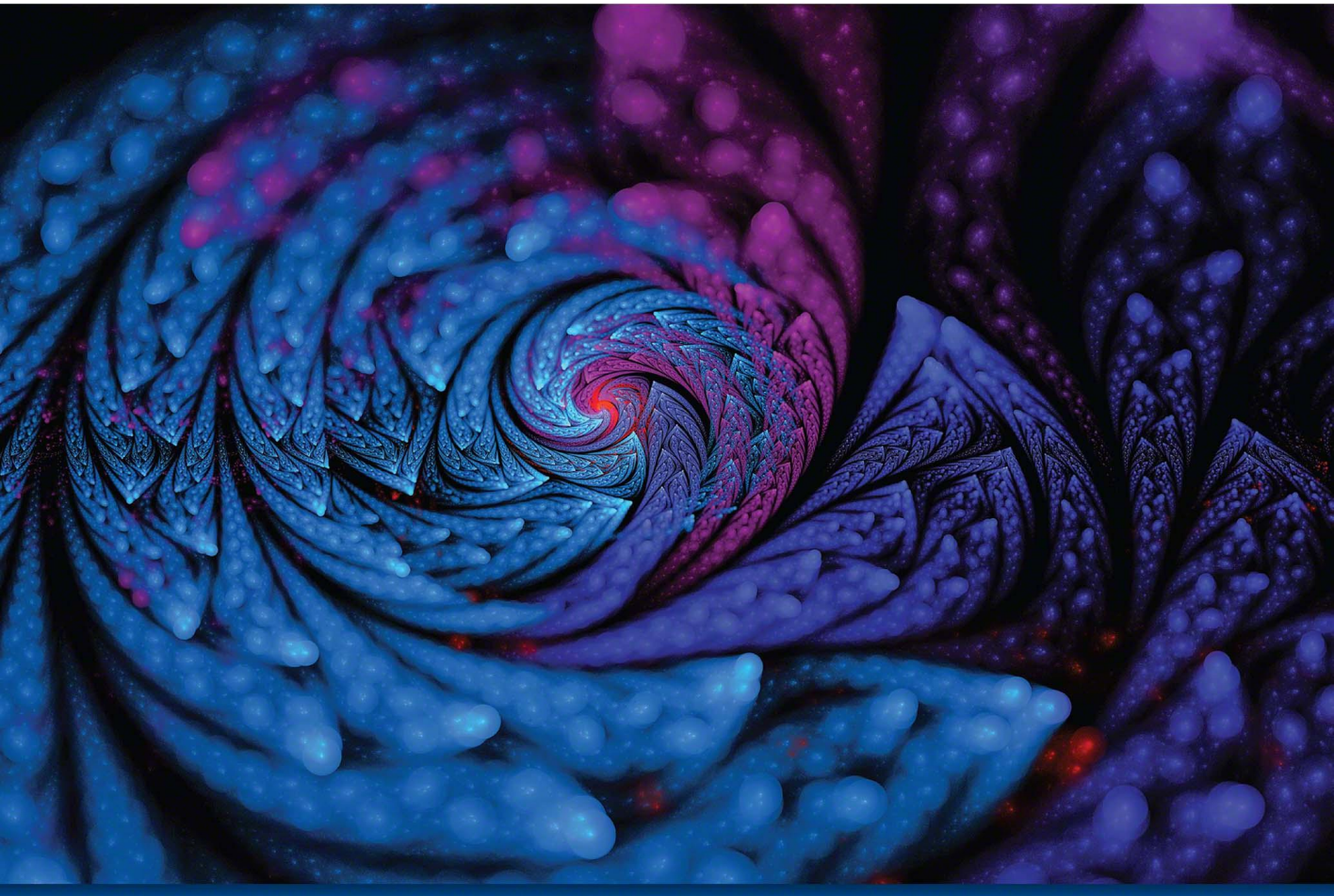
EVALUATING RESEARCH IN COMMUNICATION DISORDERS

EIGHTH EDITION



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Evaluating Research in Communication Disorders

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Dedicated to the Memories of

Ira M. Ventry
1932–1983

and

Dale Evan Metz
1947–2020

"Technical progress evolves through applied scientific research and propagation of the knowledge acquired. It is not enough to pursue the knowledge of wine in the laboratory alone, it must be spread through the wineries in order for this knowledge to become part of daily practice. Moreover, the faster scientific progress advances, the greater risk there is of widening the gap between what we know and what we do. It is necessary to narrow this gap and speed up evolution."

—Emile Peynaud, *Knowing and Making Wine*
(New York: Wiley, 1984, p. vii)

Preface

Unlike classics of art, music, and literature, a classic text such as *Evaluating Research in Communication Disorders* calls for continual revision and updating. But, despite the ever-present fear that any change may undermine a valuable resource that has "withstood the test of time," it nonetheless remains that the value of any resource is inherently tied to its ability to address contemporary needs and concerns. One of the most prominent concerns today is the implementation of evidence-based practice. From the time Canadian physician David Sackett and his colleagues set forth the standard definition of evidence-based medicine in 1996, the "conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients" has been embraced increasingly by health care professionals, including those who practice audiology and speech–language pathology. That's not to say that there had been no prior relationship between research and practice in our discipline. As stressed in the first chapter, our discipline and its professions took root in early research laboratories and their associated training programs. Furthermore, although the phrase "evidence-based practice" had not yet been popularized in 1980 when Ira Ventry and Nicholas Schiavetti coauthored the first edition of this book, they nonetheless sought to advance its basic tenet: to promote research literacy as a means to inform clinical decision making and thus improve practice. Herein lies the thread that unites the more than two score years and eight editions of this textbook.

There are many worthy texts that aim to educate the reader on how to do useful and competent research (several of which are cited in this text). However, from the outset, this work was conceptualized as "a guide for clinicians and students" in becoming better "consumers of the literature" in their discipline. With the current emphasis on evidence-based clinical decision making, the ability to critically evaluate research has never been as important as it is today. Without question, it has become an indispensable core competency for any practicing clinician. That's not to suggest that this book has no relevance for the nascent researcher. Clearly, the ability to conduct good and meaningful research depends on one's ability to critically read, understand, and evaluate the research done by others. Indeed, it is our sincere hope that students reading this book will be inspired to pursue a career as a researcher, a researcher-practitioner, or a clinical investigator.

Just a few quick internet searches hint at the ubiquity of an evidence-based focus in clinical education and the delivery of professional services. Searches (conducted on May 1, 2020) of "evidence-based practice," for instance, resulted in approximately a billion hits on Google and 2,880,000 hits on Google Scholar. In addition, at least 144,650 and 11,000 unique publications were identified using the PubMed and Education Resources

Information Center (ERIC) databases, respectively. In fact, an ASHAWire search referenced 9,200 "evidence-based practice" articles among American Speech-Language-Hearing Association publications alone!

The eighth edition of *Evaluating Research in Communication Disorders* thus maintains the vision and purpose of earlier editions, updated and expanded to better reflect the most recent trends in research and practice. Using the structure of a research article as a guide, the text takes the reader from the Introduction to the Conclusions, providing copious illustrative excerpts from the research literature along the way. After addressing the critical evaluation of each section of a research article, the text uses this information as the foundation for practical ways to employ evidence-based practice in routine clinical decision making and to translate research findings to practice.

Much of the current organization of text material was informed by the first author's extensive experience as a course instructor, as well as from generous feedback and insightful suggestions from others who have used this text. Also crucial in the development of this text was past experience as an editor and article manuscript reviewer for several research journals in communication sciences and disorders. We've been pleased that the majority of feedback has been quite positive and encouraging. Several comments from both students and instructors were particularly helpful about ways to improve the text to better match their needs within the confines of a single-semester course. Addressing evidence-based practice as a means to provide context for the evaluation of research articles in many ways distinguishes this text from most others, which focus primarily on the conduct of research studies and the statistical analysis of data. As a book with a principal focus on reading, understanding, and evaluating our professional literature, we've stressed the different research designs and types of publications that can inform all components of evidence-based practice. This helps frame our discussions of qualitative research, narrative literature reviews, and clinical tutorials.

The present edition concludes with Chapter 10, Translating Research into Practice, which has been extensively reworked to reinforce the principles of evidence-based practice and strategies to help close the gap between what is known from the research literature and what is done routinely in clinical settings. With the research–practice gap in mind, the chapter addresses not only the most effective use of systematic reviews, meta-analyses, qualitative evidence syntheses, and clinical practice guidelines, but also the growing fields of implementation science and interprofessional collaborative practice. In this way, Chapters 1 and 10, with their emphasis on evidence-based practice, serve as "bookends" to our coverage of scientific research and research literacy in communication sciences and disorders.

As in past editions, each chapter includes "Exercises in Critical Reading," which direct the reader to the literature and, in as practical a manner as possible, highlight a key concept and/or skill that was addressed in that chapter. Our belief is that this text will serve little purpose if students neither hone their critical reading skills by perusing the literature in our field nor develop the skills necessary to support evidence-based practice. In constructing these exercises, we tried to include research articles that reflect the remarkable breadth of speech, language, swallowing, and hearing studies represented in our literature. In several instances, students have the option of reading one or more articles to complete the exercise, allowing them to compare articles or select those that hold the greatest interest for them. As a supplement to the readings in the text, lecture, and discussion, we've found it useful

to assign the exercises to small groups of students who can then present their answers (and a brief overview of the article) to the remainder of the class.

Despite extensive revision, the current edition has attempted to remain true to the spirit of the text as developed by coauthors Nicholas Schiavetti and Dale Evan Metz. If we've been successful in this effort, the seminal influence of Ira Ventry should also be in clear evidence.

New to This Edition

In revising the text, I've attempted to keep in mind the sorts of questions that students typically ask, as well as many common misconceptions. Wherever possible, description and context have been added in anticipation of such questions and misunderstanding. Specifically, the eighth edition of *Evaluating Research in Communication Disorders* features the following changes to ensure that the material is current and comprehensive, while meeting the needs of students, instructors, and practitioners:

- Reorganization of material to aid the development of evaluation skills, critical thinking ability, and reinforcement of key concepts
- New excerpts from the research literature to maintain currency, while retaining other classic excerpts that best exemplify concepts
- New exercises in critical reading for each chapter to facilitate instruction, learning, and application
- Expansion of the final chapter of the text to more thoroughly and comprehensively address the translation of research into clinical practice
- New material on:
  - Distinguishing science, nonscience, and pseudoscience (Chapter 1)
  - Open-access research journals (Chapter 1)
  - Digital literacy and fluency with digital information (Chapter 1)
  - The research–practice gap (Chapters 1 and 10)
  - The Toulmin approach to the analysis of rational arguments (Chapter 2)
  - The "Common Rule" regarding the protection of human subjects (Chapter 6)
  - The evaluation of clinical practice guidelines using GRADE and GRADE–CERQual (Chapter 10)
  - Dissemination bias in systematic reviews (Chapter 10)
  - Health services research (Chapter 10)
  - The nature and use of gray literature (Chapter 10)
  - Dissemination and implementation science (Chapter 10)
  - The Consolidated Framework for Implementation Research and the innovation–decision process (Chapter 10)
  - Interprofessional education and collaborative practice (Chapter 10)
- Expanded discussions of:
  - Research–practice relationships, implementing evidence-based practice, assessing levels of evidence, and quality of clinical guideline recommendations (Chapters 1, 3, 5, and 10)

- Treatment outcome, effectiveness, and efficacy studies (Chapters 3, 4, 5, and 10)
- Explanatory trials, treatment fidelity, study replication, and the assessment of validity (Chapters 4, 5, and 10)
- Statistical significance testing and interpretation (Chapters 7, 8, and 10)
- Analyzing research abstracts (Chapter 9)
- The use of systematic reviews and syntheses of qualitative evidence to inform clinical decision making (Chapter 10)

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We gratefully acknowledge permission granted by the American Speech-Language-Hearing Association, the Voice Foundation, and the authors to reprint selections from their journal articles. Special thanks to Dr. Linda Murdock at the University of Montevallo and several anonymous reviewers whose critical appraisal of the previous edition has been very helpful for developing the current edition of *Evaluating Research in Communication Disorders*. Thanks to Rebecca Fox-Gieg, Bridget Daly, and Neha Sharma at Pearson and to Sujatha Subramanian, Ramkumar Palani, and Seetha Perumal, our SPi Global project managers, for their efforts on our behalf. Also, as recognized in every previous edition, much of the success—if not the very existence of this work—is owed to the efforts of Ray O'Connell. Although gone, he remains, as ever, the guardian angel of this book.

It is with sadness that I note that we have lost two authors of the various editions of this text. The original senior author of the first edition, Ira Ventry, passed away in 1983 just as the second edition was being written, and our dear friend and colleague Dale Metz died in March of 2020 as this, the eighth, edition was being completed. They did much to shape our perspective on the role of research in advancing clinical practice and it is my sincere hope that students reading this book will be inspired to pursue a career that will extend their work in their own clinical endeavors.

I am indebted to Teresa Tripp and the rest of my outstanding staff at East Carolina University, without whom I would be unable to balance my responsibilities as dean in the College of Allied Health Sciences with the time needed to prepare this revision. And, finally, a warm thank-you to my wife, Jennifer Orlikoff, without whose 35 years of love and encouragement, I would be unable to balance my life at all.

Robert F. Orlikoff
Greenville, North Carolina

Brief Contents

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CHAPTER

1

Evidence-Based Practice in Communication Disorders

The purpose of this book is to help practitioners and students in communication disorders become critical readers of the research literature in their discipline. By "critical readers" we do not mean to suggest that our intent is to cause students to devalue or disregard their foundational literature. No, indeed. A **critic** is "one who forms and expresses judgments of the merits, faults, value, or truth of a matter," and the word *critical* is used, here and throughout, to mean "characterized by careful, exact evaluation and judgment" ("Critic/Critical," 2000). A **critical review** of the research literature helps inform clinical decision making. Our basic premise is that sound clinical practice should be based, in large measure, on relevant basic and applied research rather than on pronouncements by authorities, intuition, or dogma. As Siegel (1993) has stated, "clinicians need to have enough familiarity with research to judge whether the claims are reasonable and to determine just how closely the proposed clinical procedures adhere to the research methods and the underlying theory" (p. 36). In short, critical readers are critical thinkers, and critical thinking is the foundation of effective professional practice.

Before considering the research literature in communication sciences and disorders, let's first reflect on what, precisely, is meant by *research*. As described several years ago by Reynolds (1975):

> As its root meaning ("to search again") implies, most research either results in a rediscovery, and hence a confirmation, of already known facts and principles or represents another painstaking attempt to answer a formerly unanswered question in an objective and repeatable fashion. But research also means the search for and the discovery of formerly misunderstood or unconceived principles and facts. (p. 13)

In its broadest sense, research is an organized way to seek answers to questions (Houser & Bokovoy, 2006). As such, it should be immediately apparent that research is by no means the sole purview of the "laboratory scientist." Clinicians continually ask—and strive to answer—questions about a number of core practical issues relating to evaluation, diagnosis, prognosis, treatment, and case management, among many other things. These professionals perform assessments *for* intervention and assessments *of* intervention, employing the principles of research to enhance their knowledge base and to perfect their clinical skills. They engage in empirical inquiry regarding the appropriateness and effectiveness of their treatment, make supported arguments that affect healthcare policy and

service delivery, and, yes, they participate in "scientific research activities" to present and publish their findings so as to advance their discipline (Bernstein Ratner, 2018; Bloom et al., 2009; Golper et al., 2006; Hall & Roussel, 2017; Johnson, 2016; Lum, 2002; Stevenson et al., 2016). The "essential quality that differentiates a profession from other vocations," Baumgartner and his coauthors (2021) remind us, "is the continuous pursuit and dissemination of new knowledge."

KNOWLEDGE ACQUISITION

How does one acquire knowledge? On what basis does one accept new information as accurate or truthful? Such questions are the broad concern of **epistemology**, the study of the nature and foundation of knowledge. We've equated research with the acquisition of knowledge, but knowledge can be acquired in numerous ways. In a highly influential essay, the scientist and philosopher Charles Sanders Peirce (1877) outlined four general methods that are used to *know* something. According to Peirce, the pursuit of knowledge is driven by an inherent avoidance of doubt, largely because uncertainty interferes with our ability to "guide our desires and shape our actions."

The **method of tenacity** was described by Peirce as perhaps the most common means of "fixing belief." This method avoids "the irritation of doubt" by a steadfast adherence to the views we already hold. These views are typically those we find most agreeable and are retained not by the pursuit of truth, but by preference, personal opinion, and habit. This "way of knowing" often requires people to shield themselves from competing or contradictory opinions or evidence. Peirce recalls an instance when a friend advised him to avoid reading a particular newspaper article because it might result in a change of opinion, warning him that, by shaking the confidence in held beliefs, he might reject what he already knows to be true. Although recognizing that it is a very popular means of establishing what people believe, the method of tenacity was derided by Peirce as one that, ultimately, "will be unable to hold its ground in practice."

Peirce refers to a second way of knowing as the **method of authority**. Instead of focusing on the individual as does the method of tenacity, the method of authority focuses on a community. Within the method of authority, people accept knowledge from an individual or group of individuals who have been, in some way, designated as authoritative producers of knowledge. An example of the method of authority is the belief that there will be a permanent change to Earth's climate as a consequence of global warming simply because an institution, say a government or academy, insists that it's true. Haines and Jones (1994) note that, throughout history, leaders in health care "have occasionally endorsed treatments that have subsequently been shown to be ineffective or even dangerous." The method of authority is not necessarily unsound, depending on how the authority acquired its knowledge. In the United States, for example, citizens generally accept the authority of the U.S. Food and Drug Administration regarding prescription medicines and food safety—but much of its authority is based on sound scientific evidence. The method of authority may be unsound, however, if everyone merely accepts the word of authority without examining or questioning the qualifications of the *source* of its knowledge. Peirce acknowledges that the method of

authority is more successful than the method of tenacity in "fixing belief," but this, he feels, is more a consequence of reducing competing opinions than of the veracity or soundness of authoritative knowledge.

The third way of knowing is the **method of intuition**. It's also called the *method of pure rationalism*, the *method of congruity*, or as originally named by Peirce, the *a priori method*. This method of knowing relies on the use of pure reason based on prior self-evident assumptions. Little or no consideration is given to the role of experience in the acquisition of knowledge. As philosopher Bertrand Russell (1928) noted: "The extent to which beliefs are based on evidence is very much less than believers suppose." A serious limitation of intuition is that experience may show that a self-evident truth is not a valid assumption in a logical system and, if an a priori assumption is incorrect, the conclusion will be incorrect. For example, a conclusion drawn from basing a purely logical argument on the a priori assumption that Earth, not the sun, is the center of our solar system will be incorrect. With the exception of mathematics, pure rationalism is not used exclusively to develop scientific principles. Despite the limitations of pure rationalism, elements of rationalistic thinking are central to scientific inquiry in communication disorders and other disciplines. We discuss the relationship of rationalism and experience and their roles in scientific inquiry further in the following section.

The fourth method of knowing is the **method of science**. The word *science* is derived from the Latin word *scire*, which means "to know," and the method of science is widely heralded as the most powerful and objective means available to gain new knowledge. Peirce heralds the scientific method because it bases belief on the "reality" of external evidence, separate from fashion and preference, as well as from personal or group conviction. For example, in a recent book, *Truth Doesn't Have a Side*, neuropathologist Bennet Omalu (2017) chronicles how, against much opposition, evidence led him to connect the head injuries of U.S. football players to later cognitive dysfunction in a condition known as chronic traumatic encephalopathy (Omalu et al., 2005).

Peirce also points out that, while there is no way to incorrectly apply the methods of tenacity, authority, or intuition because they all function largely to endorse currently held beliefs, the method of science is very specific about its application. The method of science can, indeed, endorse currently held beliefs, but it can also call those beliefs into doubt. All scientific knowledge is derived from **scientific research**, which—in accord with Peirce's view—Kerlinger and Lee (2000, p. 14) define as the "*systematic, controlled, empirical, amoral, public, and critical investigation of natural phenomena*."

The words used in the preceding definition, italicized in the original, have conceptual importance, and they highlight many of the themes and concepts we introduce in this text. As such, let's briefly examine these terms. The words *systematic* and *controlled* imply that scientific investigation is tightly disciplined and conducted in a manner that methodically rules out alternative explanations for a finding. Systematic control over events during the execution of a scientific investigation promotes confidence in the research findings. The word *empirical* implies that the beliefs must be subjected to outside independent tests; subjective beliefs must "be checked against objective reality." The word *amoral* implies that knowledge obtained from scientific research does not have moral value. Research findings are not "good" or "bad." Rather, research findings are considered in terms of their reliability and validity. Interpretation is tied to the data, not on preferences, biases, or what is popularly

known as "spin." Finally, the word *public* implies that scientific research is evaluated by other independent individuals of equal knowledge and training prior to being published in a professional journal. This process is called "peer review," and we have more to say about the peer-review process later in this chapter.

Scientific research depends on a complex interplay of two distinct lines of inquiry, namely, *empiricism* and *rationalism*. **Empiricism** is a philosophical doctrine that knowledge is gained through experience and evidence. Empiricists generally rely on inductive reasoning; that is, they use evidence from specific cases to make inferences about general principles. To be accepted into the realm of knowledge, explanations of phenomena must be based on evidence gained from observations of phenomena, and critical evaluation of the accuracy of observations is necessary before the observations can be accepted as evidence. This critical, self-correcting activity of empiricism is the core of scientific venture and a necessary requisite of sound research.

Rationalism is a philosophy that assumes knowledge must be gained through the exercise of logical thought. Rationalists generally rely on deductive reasoning; that is, the use of general principles to make inferences about specific cases. Rationalism is often referred to as a *schematic*, *formal*, or *analytic* endeavor because it deals with abstract models, and the logical criticism of propositions is necessary for the acceptance of explanations into the realm of knowledge.

Various schools of thought differ in the extent to which science relies on empiricism and rationalism (Webb, 2018). In linguistics, for instance, Noam Chomsky (1968) insisted that rational consideration rather than empirical inquiry is necessary for the development of a theory of language. In psychology, B. F. Skinner (1953) relied on empirical evidence for a functional analysis of behavior and shunned the exclusively rational approach. Although these two examples illustrate the extreme ends of the continuum of rational and empirical thought, many positions regarding the integration of empirical evidence and rational inquiry exist along this continuum. Psychoacoustician S. S. Stevens (1968) suggested the term *schemapiric* for the "proper and judicious joining of the schematic with the empirical" and concluded that both are essential in scientific study.

THE SCIENTIFIC METHOD

To understand the research enterprise (i.e., common knowledge gathering) in communication disorders, it's necessary to understand the general scientific framework within which these research activities operate. Science is a search for knowledge concerning general truths or the operation of general laws, and it depends on the use of a systematic method for the development of such knowledge. This *scientific method* includes the recognition of a problem that can be studied objectively, the collection of data through observation or experiment, and the drawing of conclusions based on an analysis of the data that have been gathered.

Scientific research may be directed toward the development of knowledge per se, that is, to verify or refute some theoretical or empirical position, in which case it's called **basic research**, or it may be undertaken to solve some problem of immediate consequence, in

which case it's called **applied research**. In recent years, professionals in many disciplines have realized that basic research and applied research are not entirely separate or oppositional activities. Research that was conducted for the sake of basic knowledge may turn out to have an important application. Research conducted to solve an immediate problem may provide basic information concerning the nature of some phenomenon. Indeed, basic research provides the broad base of knowledge that is the foundation for the development of practical solutions to recognized problems and needs. Noted medical essayist Lewis Thomas (1974) suggested that research scientists "all hanker, collectively, to become applied scientists as soon as [they] can, overnight if possible. It takes some doing, however. Everyone forgets how long and hard the work must be before the really important applications become possible" (p. 116).

There have been instances in the past of acrimonious opposition between people identified with the so-called basic and applied schools, and such opposition has resulted in communication failures that have hindered rather than advanced the development and application of scientific knowledge. Many now recognize the importance of both basic and applied research, as well as the need for clear communication between researchers with more basic orientations and those with more applied orientations.

Whether directed toward basic or applied knowledge, two major types of research may be identified: *descriptive* and *experimental*. **Descriptive research** examines group differences, developmental trends, or relationships among factors via objective measurements, various kinds of tests, surveys, and/or naturalistic observations. **Experimental research** examines causation through observation of the consequent effects of manipulating certain events or characteristics under controlled conditions. These two types of research are different empirical approaches to the development of knowledge.

Scientific Theory

Statements formulated to explain phenomena are called theories (Best & Kahn, 2006; Bordens & Abbott, 2018). Unlike in everyday parlance, where a "theory" can mean little more than a conjecture or hunch, a **scientific theory** is established through empirical and rational inquiry. Empirical facts alone are meaningless unless they are linked through propositions that confer meaning on them (Rummel, 1967; Sidman, 1960). By coherently summarizing and organizing existing knowledge, theories establish a framework from which meaningful generalizations can be made. In Skinner's (1972) words, a theory is "a formal representation of the data reduced to a minimal number of terms" used to succinctly identify and outline cause-and-effect relationships.

One of the fundamental principles of the scientific method maintains that the best test of our understanding of cause–effect relationships lies in our ability to predict and/or control phenomena. According to science philosopher Karl Popper (1959), "Theories are nets to catch what we call 'the world': to rationalize, to explain, and to master it. We endeavour to make the mesh ever finer and finer" (p. 59). In this regard, theories represent not only the ultimate aspiration of the scientific method, but the ultimate aspiration of clinical practice as well.

Another purpose of a scientific theory is to facilitate the modeling of phenomena or various processes. Some models may be **physical**, such as when a manipulable plastic

representation of the vocal tract is used to study certain aspects of velopharyngeal function (e.g., Guyette & Carpenter, 1988) or when an animal or biological specimen is used as an analogue of human physiology or behavior. Alipour and Scherer (2000), for instance, used a larynx from a human cadaver to examine glottal airway dynamics, whereas Bauer and her coinvestigators (2008) studied chinchillas to relate tinnitus to different types of cochlear trauma. Rosenfield and his colleagues (2000) even proposed an animal model of stuttering using zebra finch songbirds! Other models may be **conceptual**, as is the case for psycholinguistic models of speech development (e.g., Baker et al., 2001) or **computational**, such as mathematical models of the vocal folds and the velopharyngeal mechanism (e.g., Galindo et al., 2017; Inouye et al., 2015; Zhang, 2016) or biomechanical models of the speech articulators based on imaging data (e.g., Stavness et al., 2013) that can be used to construct digital or virtual simulations. Regardless of their construction, a model serves as a simplified conceptualization that can be tested to see whether it is consistent with what is observed or fits empirical data. In this way, models are useful ways to test our understanding, generate insight, and gauge our ability to predict and control phenomena.

A prominent theory or group of theories gives rise to what another philosopher of science, Thomas Kuhn (1970), defined as a **scientific paradigm**. A *paradigm* is the collective way in which a community of researchers and clinicians identify the problems and the methods of investigation for their discipline. Both theory and paradigm construction depend on the dynamic nature of scientific inquiry. Theories depend on the philosophical doctrines of empiricism (defined earlier as the objective observation, measurement, and/or testing of the phenomena of interest) and **determinism**, the assumption that the universe is lawful. Continuing empirical and rational investigation is necessary for theory verification or modification when the theory does not adequately explain observed facts. Theories, then, either become more refined or are abandoned, to be replaced by more useful characterizations.

Rather than being a solitary pursuit, research is a communal activity that builds on the work of others. On occasion, an unexpected discovery, an innovative hypothesis, the development of new technology, or a novel method of investigation may even result in a "paradigm shift" that provides a new framework for proposing research questions, obtaining information, and acquiring knowledge. A critical reader of research should recognize the theoretical organization of empirical evidence and the empirical confirmation of theories as two activities that coalesce to form Stevens's (1968) "schemapiric view" of the research enterprise.

Many factors contribute to the longevity, or lack thereof, of any particular theory. Bordens and Abbott (2018) have listed five essential factors that can figure centrally in the life of a theory. The first factor is *accountability*, the ability of a theory to "account for most of the existing data within its domain." They explain that the amount of data accounted for is *most* and not *all* because some of the data germane to the theory may be unreliable. Second, theories must have *explanatory relevance*, meaning that the "explanation for a phenomenon provided by a theory must offer good grounds for believing that the phenomenon would occur under the specified conditions" of the theory. The third factor is that of *testability*, relating to a theory's possibility of "failing some empirical test." That is, *to be considered scientific, a theory must be verifiable as well as falsifiable*. Being *predictive* of novel events or new phenomena is the fourth characteristic of a sound theory. That is, a theory should be able to predict phenomena "beyond those for which the theory was originally designed."

Finally, a good theory is *parsimonious*; that is, it should adopt the fewest and/or simplest set of assumptions in the interpretation of data. It's in this sense that many researchers refer to the principle of Occam's razor: *Do not increase, beyond what is necessary, the complexity of an explanation*. If such frugality sounds rather austere and monkish, note that the principle is ascribed to William of Occam, a fourteenth-century Franciscan friar. For modern researchers and clinicians this principle establishes a valuable criterion for selecting from among competing theories that have equal explanatory power.

Nonscience. We have noted that the purpose of the scientific method is to acquire knowledge. Many disciplines, especially those in the arts and humanities, however, do not employ the scientific method to gain knowledge or characterize behavior. Although applying systematic techniques, nonsciences such as history and philosophy are no less legitimate an academic pursuit than the sciences. For instance, there is great value in the endeavor to determine what constitutes good, moral, and ethical behavior—a topic that has concerned philosophers for millennia. And few would deny the importance of art, music, and literature in explaining the human experience.

Like scientists, historians and philosophers often support their positions and advance explanations based on evidence and through logical argument. However, unlike scientists, their positions cannot be subjected to empirical testing to support one view over another. For example, it's not possible to empirically test an explanation for why Napoleon embarked on his ill-fated invasion of Russia. Lacking the use of the method of science, such explanations may be considered valid, but they cannot be considered *scientific*.

Pseudoscience. Unlike a nonscience, ***pseudoscience*** (also known as *false science*) is a set of ideas, beliefs, or practices that are tied to theories advanced as if they were scientific when they are not. Although pseudoscience may attempt to support a claim, its methods for doing so do not share the same precision and thoroughness as a true science. Gordin (2017) noted that "the more attractive science is, the more people with unorthodox ideas want to model themselves upon it, and the greater the public appetite for doctrines with the appearance of science." The pseudosciences of astrology, palmistry, and crystal healing are just a few noteworthy examples. Finger (2020) provides an interesting historical review of the "debunking" of phrenology, the eighteenth-century pseudoscientific belief that, by measuring protrusions on the skull, certain mental traits can be predicted. However, as Lilienfeld (1998) has pointed out, the distinction between science and pseudoscience is often "more a matter of degree than of kind." Indeed, science and pseudoscience do have many characteristics in common and both may attempt to garner support for a belief or practice (Garrett & Cutting, 2017; Hansson, 2017; Lilienfeld et al., 2015; Volkers, 2019). Some pseudosciences have, in fact, developed into a true scientific pursuit. For instance, when the germ theory of disease was first proposed in the sixteenth century, it was unquestionably a pseudoscience. Only later, through the careful and systematic application of the scientific method, was a scientific theory advanced that many diseases result from pathogenic microorganisms too small to be seen with the unaided eye.

Although science and pseudoscience share many features, there are several hallmarks that help differentiate the false from the true (McFarlane et al., in press). According to Lilienfeld and his colleagues (2018), even though there is no one distinguishing criterion,

there exist many "warning signs" of pseudoscience of which the critical thinker should take note. Discussed in some detail by both Finn and his coauthors (2005) and Lilienfeld and his coauthors (2012), these signs include:

1. Little, if any, reliance on the existing scientific knowledge base;
2. Vaguely defined, unsystematic, and irreproducible testing of ideas;
3. Contradictory evidence is ignored, dismissed, or explained away;
4. Overreliance on personal experience, testimonials, and anecdotes;
5. Acceptance of mysterious causes and beliefs, with little concern for identifying tangible underlying mechanisms;
6. Lack of independent scientific review or the replication of results by others;
7. No modification of claims or practices in the face of contradictory evidence; and
8. Support is based more on belief and faith than on objective evidence.

These warning signs may not constitute a definitive test of a scientific claim, but, as Lilienfeld and his colleagues (2018) advise, the degree of skepticism for a given claim should rise with the number of presenting signs.

In response to the observed proliferation of strongly promoted "alternative" therapies, Lof (2011) has warned clinicians to become skilled at distinguishing pseudoscience from science. It can be quite compelling to read testimonials of great successes with a new "breakthrough" procedure, to be promised "immediate results," and to be presented with astounding before-and-after comparisons (Gambrill, 2012; Matute et al., 2011; Torres et al., in press). However, those with a scientific perspective naturally call the legitimacy of provocative statements into question and look to the scientific literature for supporting evidence. To think scientifically is "to become more aware of your biases and to take advantage of the tools of science to try to compensate for them," note Lilienfeld and his coauthors (2018). Similarly, Lee and Hunsley (2015) warn that, "without the controls afforded by scientific practices and scientific thinking, unsystematic clinical observations can lead to erroneous conclusions about the value of a clinical procedure."

When pseudoscientific "testing" is conducted, it's almost always done with the intent to *confirm* a claim. In general, but not always, the possibility of refuting the claim is never considered. For this reason, independent, unbiased testing is often unwelcome and any disconfirming evidence is likely to be attributed to some failure of the test or the test environment rather than to some fault in the claim itself. Whereas scientific knowledge is gained through testing and retesting, adherents of pseudoscience largely believe themselves to be convinced of the veracity of an idea or practice, and therefore have little need for further verification (Callaghan, 2019; González-Méijome, 2017; Gordin, 2017; Kumar, 2019). Conversely, true scientific research, as succinctly expressed by Best and Kahn (2006), "is a process of *testing* rather than *proving*, and it implies an objectivity that lets the data lead where they will."

The 2020 novel coronavirus pandemic is a recent example where, in the absence of a scientifically tested treatment, there was a great deal of reliance on anecdotal evidence regarding the effectiveness of medications used to treat unrelated conditions (Gorski, 2020; Shaikh, 2020) and the spread of a substantial number of misinformed claims and beliefs, promoted largely through social media and messaging (Bascaramurty, 2020; Johnson, 2020). Unfortunately, this was far from the only instance when certain pseudoscientific

health practices have "gone viral." As a consequence, combating unsupported, and at times unsafe, pseudoscientific remedies has become an increasingly important responsibility of health-science researchers and healthcare providers.

The Conduct of Scientific Research

Although most descriptions of scientific research suggest strict adherence to a clearly outlined series of logical steps, the reality is that the scientific method, while systematic, is not governed by a rigid set of prescribed actions that must be followed dogmatically during each point in the process. As noted by Lilienfeld and his coauthors (2012), "science is not a body of accumulated facts and figures, nor is it a monolithic truth-gathering device that is identical across diverse disciplines," adding that "there are multiple scientific methods, each tailored to answer different kinds of questions." Nonetheless, consideration of the following simplified outline relates the general framework that underlies empirical research:

1. Stating a *problem* to be investigated;
2. Delineating a *method* for investigation of the problem;
3. Presenting the *results* derived from the method of investigation; and
4. Drawing *conclusions* from the results of the investigation.

Statement of the Problem. The researcher usually begins with the formulation of a general problem, a statement of purpose, a research question, or a hypothesis. In some cases, there may be a general statement followed by its breakdown into a number of specific subproblems or subpurposes. Whether researchers choose to present their topics with a statement of the problem, a purpose, a research question, or a hypothesis seems to be a matter of personal preference and, in fact, there is disagreement among researchers as to which of these linguistic vehicles is best for conveying the nature of the topic under investigation. We are not interested here in the polemics surrounding the choice of wording in presenting the topic to be investigated. We are more concerned that researchers provide a *clear* and *concise* statement of what is being investigated.

But the problem statement does more than simply specify *what* is being studied; it should also contain some indication of the meaningfulness or relevance of the topic under investigation by placing it in context. The real purpose of the statement is to specify *why* a problem is worth studying. This is generally accomplished by establishing a **rationale** for the study by presenting reasoned arguments supported by the published literature on the topic of investigation. This review may provide a historical background of the research to date and perhaps provide a summary or organization of the existing data so that the reader has an overview of what is known, what is not known, and what is equivocal concerning this general topic. Eventually, the review should culminate in a statement of the *need for*—and *significance of*—the particular study.

Method of Investigation. After stating the research problem and providing its rationale by placing it in perspective relative to the existing literature, the researcher outlines a strategy for investigating the problem. This is done by describing the method of investigation. Based on the research problem and the accompanying rationale, the researcher delineates

the selection of who (or what) was the *subject* of investigation; the *materials* that were used to test, train, observe, or measure; and the specific *procedure* that was followed. Because the method is closely associated with how the research question is to be answered, if the statement of the problem is unclear, it will be difficult, if not impossible, to evaluate the appropriateness of the method of investigation. In short, the method of investigation addresses *how* the study is to be conducted and on (or with) *whom*.

Results of Investigation. Quite simply, the results of investigation addresses *what*, specifically, was yielded from the method of investigation previously described. The researcher objectively reports the results, often supplemented by tables and figures to summarize and organize the data. Tables and figures are usually easier to understand than a simple listing of all the individual or raw data. It's important for a researcher to present a specific breakdown of the results as they relate to the specific subcomponents of the problem that had been outlined earlier.

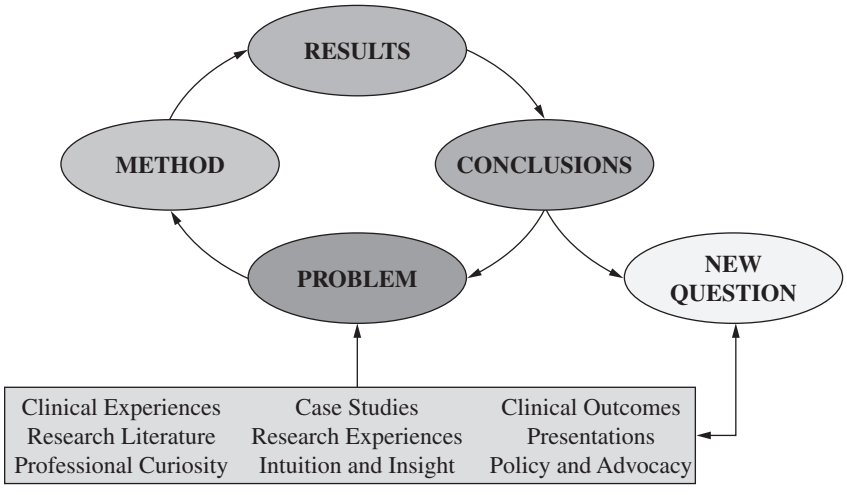
Conclusions. After outlining the results, the researcher puts forward an interpretation, discussing the implications and drawing conclusions from them that reflect on the original statement of the problem. The discussion may address the results in relation to previous research, theoretical implications, practical implications, and suggestions for further research. In many respects, the discussion and conclusions represent a recasting of the introduction and rationale in light of the new information provided by the current results. Thus, whereas the results of investigation details *what* was found, the discussion and conclusions that follow address the overarching question, *So what?* Very often the discussion and conclusions raise a question of their own, *Now what?*, to which the researcher may offer some suggestions. How conclusions are reached and the way in which they point the direction for future research highlights the way in which the scientific method works to build knowledge.

This simplified discussion of the manner in which the common steps in empirical research are reported in a journal article may give beginning readers the impression that research is a drab activity that follows a single lockstep pattern. It's difficult to understand the excitement and creativity inherent in the design and execution of an empirical study unless the student or practitioner experiences it directly. Many researchers do not faithfully follow the orderly steps just outlined in conducting their research; adjustments may be made to meet the needs of a researcher in a given situation. Skinner (1959) captured some of the flavor of scientific creativity and excitement in his famous statement: "Here was a first principle not formally recognized by scientific methodologists: when you run onto something interesting, drop everything else and study it" (p. 363).

Rather than being constrained by a linear progression of steps, the flow of the research process is more appropriately viewed as a circular "springboard." As diagrammed in Figure 1.1, the conclusions reached address not only the original problem but lead to novel lines of inquiry as well. It is an iterative process that "depends upon asking increasingly complex or new questions whose answers in turn develop additional questions" (Association of College and Research Libraries, 2016). However, as Skinner's (1959) statement suggests, new research questions can be raised at any point in the research process, especially when devising and implementing the method of investigation. Various unforeseen factors that

prevent the clear interpretation of results or the ability to derive trustworthy conclusions can also prompt new lines of investigation. Although finding the unexpected is often regarded as the true joy of the research process, there is a great deal of satisfaction in being able to clarify a potentially valuable research question. As Bloom and his coauthors (2009) have noted, "if we can clearly identify what our problem is, we have taken a major step toward its solution" (p. 57). In empirical research, we *test by observing* and *observe by testing*. Experienced investigators recognize that—rather than relying on introspection or even a thorough review of the literature—the most useful questions are often revealed through active participation in empirical research.

FIGURE 1.1 A Simplified Depiction of the Research Process.



The common steps just outlined, then, are meant to illustrate the major components of the scientific method as reflected in the structure of most journal articles that report empirical research and should not be construed as an inviolate set of rules for defining *the* scientific method. The best way for students of communication disorders to appreciate these steps is to read journal articles that report empirical research. Sustained experience in the reading of empirical research will enable the student to eventually assimilate the concept or process of moving from the formulation of a problem that can be attacked empirically to the drawing of conclusions based on empirical evidence.

Research in Communication Sciences and Disorders

It's extremely difficult to paint a complete picture of the great variety of research conducted within the field of communication disorders. No one has done it, and we do not do it here. The data that would form the basis of such a picture are simply not available. A few generalizations should help, however, in understanding the broad scope of research activities that, either directly or indirectly, advance our understanding of communication disorders.

Although relatively few communication disorders specialists are involved in full-time research (American Speech-Language-Hearing Association [ASHA], 2018a), the research enterprise in the discipline is much broader than would appear from surveys of the ASHA membership. One obvious reason is that not everyone involved in communication disorders research is necessarily a member of ASHA. Another is that many people who conduct research do so in conjunction with other professional activities. Perhaps the best example of such a person is the academician whose primary responsibility is teaching. Such an individual is often involved in his or her own research or supervises doctoral dissertations or master's theses. The same person publishes the results of his or her research not only to advance knowledge but also to advance his or her own standing in the academic community because "publish or perish" is still commonplace in university life. But it's also readily apparent when attending professional meetings or perusing professional journals that a large percentage of research is conducted by clinicians working in a wide variety of clinical settings.

Also of note is that much of the research appearing in our periodical literature is done by people working outside audiology and speech–language pathology. Many disciplines contribute to the scientific underpinnings of communication disorders, including the *physical* or *natural sciences* (such as physics and the specializations of engineering, acoustics, and technology), the *biological* or *life sciences* (such as biology and the specializations of genetics, anatomy, physiology, neurology, and biochemistry), the *social* or *behavioral sciences* (primarily psychology, sociology, anthropology, and communication), and the *health sciences* (particularly medicine, dentistry, physical therapy, and occupational therapy). Important contributions are also made by linguistics, special education, and the humanities, especially music and the performance arts. The number of published articles that relate directly or tangentially to the interests of professionals in communication disorders attest to the numbers and different interests and backgrounds of individuals involved in the research enterprise. Both the areas studied and the settings in which studies are conducted are almost as numerous as the researchers themselves—all working to provide the knowledge and tools that audiologists and speech–language pathologists can use to attack and solve clinical problems in communication disorders.

The breadth of research in communication disorders poses a substantial challenge for the practitioner and student because virtually all types of research strategies are represented in our literature. In addition to providing a comprehensive research base in the clinical education of students, the greater challenge is ensuring an ample supply of skilled researchers trained *within* the discipline of communication sciences and disorders. It would be unreasonable to expect researchers from other disciplines to conduct the majority of research studies that advance knowledge in our discipline and to explore issues of direct clinical import to audiologists and speech–language pathologists. As emphasized in a 1994 technical report prepared by the Research and Scientific Affairs Committee of ASHA:

> If we fail to provide an expanding knowledge base, the inevitable outcome will be loss of autonomy for the professions, leaving us with a technical, rather than professional, image among other health care providers. In large measure, it's the capacity to create its own knowledge base and clinical methods that distinguish autonomous human service professions from technical occupations. (p. 2)

EVIDENCE-BASED PRACTICE

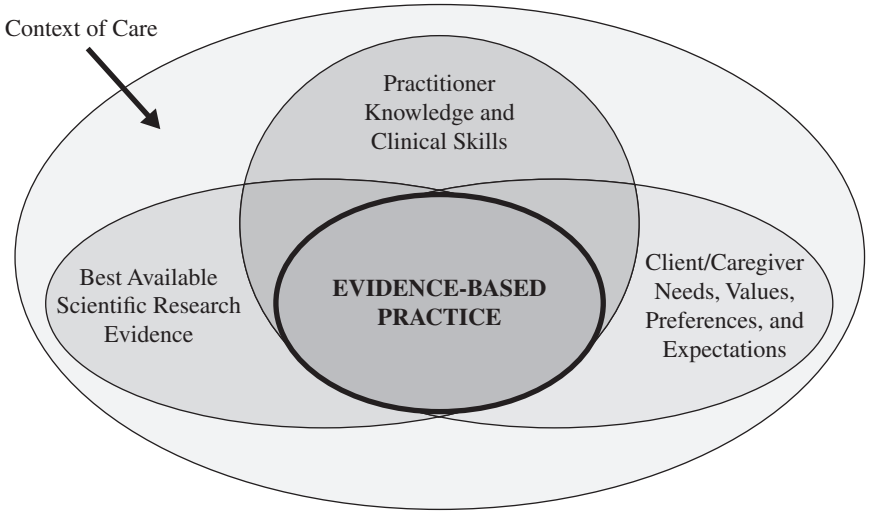
When clinicians engage in **evidence-based practice (EBP)**, they "recognize the needs, abilities, values, preferences, and interests of individuals and families to whom they provide clinical services and integrate those factors along with best current research evidence and their clinical expertise in making clinical decisions" (ASHA, 2005a). Bernstein Ratner (2006, pp. 257–258) characterizes the most effective clinicians as "data seekers, data integrators, and critical evaluators of the application of new knowledge to clinical cases," who recognize that "even if something appears to work, new information may assist the therapeutic process to work *better*." In our opinion, a more appropriate term for EBP would be *evidence-informed practice*. What most agree upon, however, is that EBP depends most critically upon our ability as professionals to adopt a "questioning attitude toward practice" by "cultivating a spirit of inquiry" (Melnyk & Fineout-Overholt, 2019). At its heart, EBP is an *approach to clinical problem solving* (Davis et al., 2018; Kazdin, 2008; Lowis et al., 2019; Rosenburg & Donald, 1995; Tahan et al., 2016).

Although intuitively attractive, if not self-evident, Dollaghan (2004) suggests that EBP represents "a radical re-thinking of what we 'know' about clinical decision-making in communication disorders and new criteria for deciding when we know it" (p. 392). But scientific evidence "is only helpful to professionals and their clients if health service providers seek it out, understand it, and apply it" (Bernstein Ratner, 2006, p. 265). EBP, according to Johnson (2006), signals "an opportunity for growth and development for those willing to assume a critical, questioning attitude and to invest time and energy in learning new skills to enhance clinical decision making and, perhaps ultimately, client outcomes" (p. 22). It's not the intent of EBP to disregard the important role that clinical experience and patient perspectives are known to play in practice, but rather to consider them "against a background of the highest quality scientific evidence that can be found" (Dollaghan, 2004, pp. 392–393). As illustrated in Figure 1.2, EBP does not attempt to remove the practitioner from determining the method of diagnosis, treatment, or management (Guyatt et al., 2015; Haynes et al., 2002; Straus et al., 2019), but to provide a framework from which to judge the available evidence and effectively use that information to make informed decisions within the practitioner's own clinical environment, otherwise known as the *context of care*. According to Harold (2019), "clinical expertise and research evidence aren't two sides of a coin, but two pieces of a puzzle," noting that "while research won't solve all our treatment problems, it will make us better problem-solvers."

Well-grounded professions, according to Ruscello (1993), are those that are best poised to "meet the challenges of the future." Improving the services audiologists and speech–language pathologists provide to individuals with communication disorders will require not only a discipline with a robust research base, but practitioners who are "active consumers of this research." To do so, say Fineout-Overholt and Stillwell (2011), clinicians must learn to incorporate "good information-seeking habits into a daily routine." In short, for the ability to address the challenges of future practice, a clinician needs to know not only if an approach is likely to be effective, but how and why. Such understanding is, as Meline and Paradiso (2003) describe it, "the ultimate goal for science." They note further that although it is common for clinicians to "rely on observable changes

without knowing the mechanisms of change," when "the observable changes rely on the scientific method for verification (not casual observation), they are credible evidence for practice" (p. 274).

FIGURE 1.2 Evidence-Based Practice Is a Decision-Making Process That Integrates External Scientific Evidence with Practitioner Expertise and Client Perspectives to Improve Clinical Outcomes.



Being highly contextual and specific to a given client or clinical practice, EBP is not meant to be used by any authority, institution, or organization to prescribe, endorse, or otherwise "micromanage" individual clinical decisions. Rather, the implementation of EBP is best viewed as a systematic *process*, one that cannot be dictated or standardized in any handbook or manual (Bernstein Ratner, 2011; Justice, 2008a). It's a critically important process, one that is tied to our professional accountability for ensuring the use of "best practices" (Apel & Self, 2003) as well as the recognition that the assessment, intervention, and management of communication disorders is ever changing and necessitates a customized approach. Although the art and science of clinical practice involves uncertainties and probabilities, EBP works toward improving outcomes by promoting informed and defensible choices, discouraging those that grow out of professional tradition or authority, or solely out of the tenacity or intuition of the clinician. In short, *accountable* clinicians strive to demonstrate that the treatment they employ is not only viable, but preferable to others in meeting their clients' needs. Along with considering the available intervention options, clinicians need to assess their probable effectiveness in the types of "real-world conditions" in which clients are likely to find themselves (Wong & Hickson, 2012).

Describing medical practice, Freeman and Sweeny (2001) noted that, whereas some physicians report that "evidence had clarified practice, focused clinical effort, and sometimes radically altered practice," many others find themselves "shaping the square peg of

the evidence to fit the round hole of the patient's life." It's now understood that the best evidence-informed practice requires the clinician to custom-fit evidence-based decisions to the individual who, more often than not, has a unique and "messy" personal and medical history. Not only might a client present a unique cluster of symptoms, but he or she will also possess customs, beliefs, and perspectives toward health care that are culturally determined (Birkel et al., 2003; Castillo & Guo, 2011; Chen et al., 2008; Helms, 2015; Huey et al., 2014; Hwa-Froelich & Vigil, 2004; Maul, 2015; Verdon et al., 2015). As professionals, clinicians who wish to ensure the effectiveness of their intervention "must be prepared to provide services that are responsive to this diversity" (ASHA, 2004). The ability to participate in the activities of daily living is strongly impacted by "integrated patterns of human behavior that include language, thoughts, communications, actions, customs, beliefs, values, and institutions of racial, ethnic, religious, or other groups" (ASHA, 2017). This **cultural competence**, according to an earlier 2011 ASHA position statement,

> involves understanding the unique combination of cultural variables that the professional and patient/client bring to interactions. These variables include, for example, age, ability, ethnicity, experience, gender, gender identity, linguistic background, national origin, race, religion, sexual orientation, and socioeconomic status.

The statement concludes that "culturally competent professionals must have knowledge, understanding of, and appreciation for cultural and linguistic factors that may influence service delivery from the perspective of the patient/client and his or her family as well as their own."

Framing a Clinical Question

To a large extent, EBP depends on clinicians who routinely employ critical thinking in their practices. "Essential critical thinking competencies," notes DiYanni (2016),

> include evaluation and self-direction. Evaluation through informed and sound judgments, and through considering values, is central to the process of critical thinking. Self-direction includes self-awareness and self-regulation—managing your thinking and your motivation for thinking. Critical thinking also involves asking productive questions. Asking the right kinds of questions is as important as answering them. (p. 4)

Because of the breadth of the literature and the complexity of the clinical environment, the search for scientific evidence will be of little assistance to the clinician who is unclear about the clinical question in need of consideration. After all, it's not the literature that prompts a practical clinical decision, but rather the specific needs of the client. Accordingly, Schlosser and Raghavendra (2004) have proposed a seven-step EBP process to assist clinicians in applying the research literature to guide and advance their practice:

1. *Asking* a well-built question;
2. *Selecting* evidence sources;
3. *Implementing* a search strategy;
4. *Appraising* and *synthesizing* the evidence;

5. *Applying* the evidence;
6. *Evaluating* the application of evidence; and
7. *Disseminating* the findings.

Schlosser and O'Neil-Pirozzi (2006) argue that "the asking of well-built questions" is of primary importance to EBP, because all that follows will depend on it. Posing a focused and answerable question allows the clinician to narrow the search for evidence and to perform a better assessment of the relevance and feasibility of the findings. For these reasons, we turn our discussion of EBP to the matter of formulating useful clinical questions.

Clinicians make use of the literature to inform their decisions on assessment, treatment, management, and advocacy. The clinical question guides the search for evidence. *Without a clear question, there can be no clear answers*. Researchers also construct answerable questions, but they tend to direct their attention toward entire groups or classes of individuals. Clinicians, however, typically ask questions that concern, first and foremost, the individual client in need of services (Jerger, 2008). Hargrove and her colleagues (2008) offer several examples of the types of questions a practitioner might pose when trying to determine the viability of using such treatment options as Vitalstim, SpeechEasy, group therapy, or specific exercises with their clients.

To be most useful as a guide to practice, clinical questions need to be as narrow in focus as possible. It would be helpful, for instance, to specify for whom an intervention is intended and under which circumstances. For example, would an intervention be more effective or more efficient than other available options for a prelingually deaf 7-year-old girl with a cochlear implant. Or, would a specific technique provide important information when assessing the voice of professional singers with vocal-fold nodules. In most cases, the clinician's ability to search for and identify valuable evidence is enhanced when the clinical question is specific about patient characteristics, the nature of the impairment or disability, the type of intervention, or the behavior or capability he or she wishes to target. Clinical questions are necessarily variable and diverse, addressing issues of prevention, screening, assessment, treatment, management, and service delivery—among many others. They are also dependent on the unique case histories and life circumstances that largely define the clinical environment. For all of these factors, clinicians need to not only *ask* a clinical question, but to contextually *frame* it in such a way that it is customized for a particular clinical decision. According to Schön (1987),

> the problems of real-world practice do not present themselves to practitioners as well-formed structures. Indeed, they tend not to present themselves as problems at all but as messy, indeterminate situations. . . . When a practitioner sets a problem, he chooses and names the things he will notice. . . . Through complementary acts of naming and framing, the practitioner selects things for attention and organizes them, guided by an appreciation of the situation that gives it coherence and sets a direction for action. (p. 4)

A common technique for framing clinical questions is to use a formalized rubric or template. Originally developed to facilitate the framing of questions in evidence-based medicine, the **PICO template** is now widely used by many healthcare professionals (Dollaghan, 2007; Falzon et al., 2010; Friesen-Storms et al., 2017; Hickson et al., 2013; Richardson et al., 1995). PICO is an acronym that represents the key elements within its

framework: P is the *patient* (or, alternatively, the *population* of interest or the identified *problem*), I is the *intervention* or *issue* being considered, C is the *comparison* with available alternatives, and O stands for specific clinical *outcomes* (Table 1.1). As indicated in Figure 1.3, the PICO template may be used to construct many types of focused clinically relevant questions. Johnson (2006, p. 23), for instance, offers the following example:

> "Does group, as compared with individual, language intervention result in greater expressive language growth for preschool children with delays in language production?" In this case, P = preschool children with delays in language production, I = group language intervention, C = individual language intervention, and O = expressive language growth.

FIGURE 1.3 A Framework for Asking Different Types of PICO Questions.

Etiology
Are **P** *who* **I** *compared with those who* **C** *at greater risk for developing* **O** *?*

Prediction
For **P**, *how does* **I** *compared with* **C** *predict (or influence) future* **O** *?*

Prevention
In **P**, *is* **I** *better than* **C** *in preventing* **O** *?*

Diagnosis
When assessing **P**, *is* **I** *more accurate than* **C** *for diagnosing* **O** *?*

Intervention
When working with **P**, *does* **I** *or* **C** *result in better* **O** *?*

Management
Do **P** *who receive* **I** *compared with* **C** *report greater (or fewer)* **O** *?*

TABLE 1.1 Components of a PICO-Constructed Question

	Component	Examples
P	*Patient/client, Population, or Problem*	Age; sex; culture; ethnicity; health status; condition or attribute; impairment; disorder; disability; handicap
I	*Intervention or Issue*	Therapeutic strategy/approach; risk factor/behavior; assessment tool/technique; service delivery; referral; case management
C	*Comparison/alternative*	Alternative therapeutic strategy/approach; placebo; no intervention; alternative assessment tool/technique; no risk factor/behavior
O	*Outcome*	Short-term goal; long-term goal; function; normalcy; ability, mastery, accuracy, or skill; cost effectiveness; satisfaction; quality of life; sociability; employability; accuracy of assessment/diagnosis; rate of recurrence/relapse; accuracy of prediction/prognosis

Dollaghan (2007, p. 10) provides another example of a PICO-constructed question: "*In adults who sustained severe traumatic brain injury (TBI) at least 1 year previously* (P), *does a program of cognitive strategy instruction* (I) *lead to significantly better job performance ratings* (O) *than no intervention* (C)?"

Be aware, however, that answerable and searchable clinical questions need not follow the P-I-C-O sequence, and there has been some criticism that the PICO format is insufficient for framing many important clinical questions (e.g., Huang et al., 2006). In response, Schlosser and his associates (2006, 2007) have proposed an expanded **PESICO template**. In addition to the traditional PICO, in the PESICO rubric E stands for communication *environments* (or "setting-related issues") and S stands for the relevant *stakeholders*, such as parents and family members, friends, and employers, whose perspectives and attitudes "may directly or indirectly influence the decision." Others have modified the original PICO template by appending a T for *timeframe* (Fineout-Overholt & Stillwell, 2011; Haynes et al., 2006; Khalifeh, 2017). Clinicians often ask questions that address how quickly change can be effected, especially with respect to short-term goals or ultimate clinical outcomes. Thus, the PICO template can serve as an important template when searching for evidence not only about the *effectiveness* of intervention, but about its *efficiency* as well. That is, when comparing equally effective treatments, one method may achieve an outcome sooner than other alternatives. This is likely to be an important consideration in EBP.

Still another rubric, developed specifically for evidence-based library and information professionals (Booth, 2006; Booth & Brice, 2004), may prove helpful for framing some types of clinical questions in audiology and speech–language pathology. In the **SPICE template**, S stands for the *setting* in which the intervention will occur, P represents the *perspective* of the person or population affected by the intervention, I is the *intervention*, C is the *comparison* with available alternatives, and E represents the *evaluation* or measured *effect*. Whichever system or framework is used to formulate focused and answerable questions, doing so is a requisite skill for arriving at the most relevant and practical evidence-based decisions. It's a skill that requires a great deal of practice by the student and routine implementation by the professional.

Audiologists and speech–language pathologists need to seek evidence that what they do is effective. The value of credible evidence is weighed by its ability to *validate* current treatment approaches and to *guide* the development of improved and alternative approaches (Houser & Bokovoy, 2006). "One of the chief reasons it is critical to be able to test a treatment claim," according to Finn and his colleagues (2005),

> is because it is only through contradictory or disconfirming evidence that a scientific discipline is able to correct mistakes, misconceptions, or inaccuracies. This process, when combined with a receptive attitude to new ideas and a willingness to change, lies at the heart of a scientific approach to knowledge. . . . The goal of science is not to prove that something is correct but to determine what is true. (p. 174)

In general, **treatment effectiveness** may be established when, in routine application, an intervention results in a "clinically significant improvement in a client's communication skills" (Bain & Dollaghan, 1991). However, to determine improvement, there needs to be a procedure for tracking positive **clinical outcomes**. But "outcomes" can be assessed in a multitude of ways, depending on what aspect of treatment benefit the practitioner chooses

to evaluate (Bagatto et al., 2011; Ching, 2012; Duff, 2019; Humes & Krull, 2012; Olswang, 1993). Frattali (2013, p. 9) describes *outcomes* as a "multidimensional concept" defined by "all consumers of care" comprising "clinicians, teachers, employers, administrators, payers, and the clients/families themselves." Discussed in more detail in Chapter 5, outcomes can be used in several potentially useful ways. For instance, assessed outcomes following a course of treatment can be contrasted with the long-term therapy goals or objectives (Laplante-Lévesque et al., 2012). But outcomes might address issues of clinical administration, mode of service delivery, cost-effectiveness, vocation, sociability, or overall quality of life (e.g., ASHA, 2018b; Coufal et al., 2018; Golper & Frattali, 2013).

Reflective Practice

Good outcomes may be attributed as much or more to the skill of the clinician as to the treatment itself (e.g., Enderby & John, 1999; Kent, 2006). Indeed, Bernstein Ratner (2006) points out that it would be rare to find a clinician

> who adheres strictly to a small set of well-specified treatment approaches; I cannot recall fielding too many calls over the years that asked me to recommend a practitioner of a treatment rather than a "good therapist." Another problem in linking outcomes specifically to treatments: Fitting the treatment to the client. Thinking about therapies, therapists, and clients as though they are freely exchangeable and recombinable elements may not be wise. (p. 260)

As unique as are the clinical cases themselves, it's evident that each practitioner brings his or her own body of knowledge, clinical skills, experiences, and preferences to the clinical environment (Garrett & Cutting, 2015). These factors are central to not only the clinician's ability to appraise and evaluate the application of the *evidence* but to assessing the appropriateness of a clinical *decision* and the effectiveness of an intervention as provided. Barnett (1997, p. 1) defined "critical being" as a combination of critical reason, critical self-reflection, and critical action. "Critical persons," he notes, "are more than just critical thinkers," they are individuals who are "able critically to engage with the world and with themselves as well as with knowledge."

Schön (1983) has promoted the concept of **reflective practice**, which refers to the critical evaluation of the clinician's own practice to assess outcome, what may have affected the outcome, whether the intervention was appropriate, and how intervention and outcome may affect future clinical questions and decisions. By using critical introspection to examine the possible reasons for an outcome, a clinician may be able to identify important gaps in his or her knowledge and expertise. This internal "debriefing process" also promotes better use of EBP to improve service delivery by leading toward more effective and efficient clinical alternatives (Boudreau et al., 2012; Schön, 1987). Common reflective approaches include written reflection and reflective group discussion (Caty et al., 2015, 2016). Reflection may be an important component in "practice-based learning" that, in many cases, may require a "reframing" of clinical questions and a retrospective (an informed, after-the-fact) search for evidence. As described by De Vera Barredo (2005):

> Evidence-based practice and reflective practice are essential to the professional development of an individual and the advancement of any profession. The former provides a sound

> research-based foundation for clinical practice and professional growth while the latter allows the practitioner to continually assess and reassess practice for the purpose of personal improvement. (p. 3)

According to Schön (1983, p. 69), "when someone reflects-in-action, he becomes a researcher in the practice context," relying no longer on received wisdom or answers to questions posed by others. Such practice-based evidence informs Schlosser and Raghavendra's (2004) final step in the EBP process, disseminating findings. When practitioners and stakeholders share EBP experiences and outcomes at clinical and professional conferences or in journals and newsletters, they may benefit other practitioners, improve EBP, and advance the profession. DiYanni (2016) refers to this as thinking "independently and interdependently," which both act to "spur progress and spark innovation."

Research–Practice Relationships

With the rise of EBP as the guiding principle of service delivery in audiology and speech–language pathology, there has been a welcome reassessment of the presumed dichotomy between the "researcher" and the "practitioner," between professionals who are "scientific" and those who are "clinical."

One prevailing misconception is that researchers tend to be antisocial types who work in an isolated sterile laboratory to explore problems that have little or no relevance to humanity, much less to the practicing clinician. In reality, most researchers are highly concerned about people, particularly those with communication disorders, and it's this concern that inspires their research. Indeed, a large number of today's researchers have strong clinical backgrounds and extensive clinical experience. Several leading researchers have played important professional roles in communication disorders separate from their research activities. Even for those researchers who do not participate in clinical practice and whose work has no immediate application, their underlying motivation is often to answer questions that may have considerable relevance to clinical practice in the future. As Houser and Bokovoy (2006) have observed:

> Research used to be something that was done in a laboratory; a researcher or scientist never touched a patient. Now research is an integral part of practice. Research is everywhere: in the news, on the internet, as the highlight of every clinical or management conference, and quoted by your patients. (p. 3)

As we have said, a major aim of this text is to assist clinicians and students to arrive at reasoned decisions about the adequacy of the research reported in our journals and to make independent judgments about the relevance of that research to their clinical activities. It's important for all professionals not only to become critical consumers of research literature, but also to see clinical practice itself as an applied experimental science. Yet, many have noted a longstanding disconnect between research and clinical practice (e.g., Apel, 2011; Crooke & Olswang, 2015; Jerger, 1963; Logemann, 2000; Ringel, 1972; Ruscello, 1993; Siegel & Spradlin, 1985; Wambaugh & Bain, 2002). The essence of this disconnect appears to be based on the pervasive notion that research does little to inform clinical routine and

a benighted model that segregates producers of research from consumers of research in communication disorders. Frankly, for too long have communication disorders and the communication sciences been viewed as separate disciplines. It has been well recognized that the speech, language, and hearing sciences are often seen by both students and clinicians as a rite of passage, if not a downright barrier, to entering the professions of audiology and speech–language pathology. In truth, audiology and speech–language pathology might more correctly be considered applied speech, language, and hearing sciences. By the same token, the speech, language, and hearing sciences might more correctly be labeled basic audiology and speech–language pathology.

It's not a matter of researchers and clinicians vying to "own" the literature in their discipline; rather, both need to take responsibility for it. Friel-Patti (1994), for instance, describes a "commitment to theory" shared by researchers and clinicians. She notes that, just as "experienced and successful clinicians understand the importance of research findings for building a sound rationale for intervention," in many cases researchers are compelled "to test hypotheses arising from [clinical] observations that do not accord well with current theory." Often, according to Friel-Patti,

> the individuals themselves and their presenting complex of symptoms or their response to an intervention technique compel us to reconsider current theory and reexamine intervention practices in order to generate better theories and methods. Thus, clinicians and researchers alike have reasons to seek improved theoretical models and more effective intervention practices. (p. 30)

Thus, researchers, clinicians, and researcher–practitioners share a "questioning approach" to practice that motivates the continuing search for answers based on the scientific method of investigation (Finn, 2011).

Surveying the limited evidence base in some areas of practice, Ebbels (2017) noted that speech–language clinicians "may need to use evidence that is only partially related to their clinical situation and to place more reliance on their clinical expertise while waiting for more relevant evidence to emerge," suggesting the "alternative solution" working toward creating "their own evidence." In addition to our goal of helping students and clinicians develop the critical skills required for reading research, we hope this text serves as a foundation to bridge the perceived gap between "clinician" and "researcher." It's also our fervent hope that this text serves as an entrée for those students who plan a career in research or for practitioners who are interested in conducting research within a clinic, hospital, or school setting. It must be emphasized, however, that this is not a text on how to *do* research; it is a text on how to *read* research. It will become apparent, however, that intelligent evaluation of research has much in common with the intelligent conduct of research.

It's generally accepted that advances in diagnostic and treatment protocols for a particular disorder are derived from scholarly research (Katz, 2003). A simplified example from the field of medicine illustrates this point. Scholarly research to map the human genome has shed light on previously unexplained causes of certain disorders. Many forms of cancer, bipolar disorder, obesity, and other abnormal conditions are now known to be, at least partially, genetically based (Gerber, 2001; Robin, 2008; Shprintzen, 1997). Such research leads to potential advances in diagnostic procedures like the identification of individuals

with a predisposition to a particular disorder and advances in treatment procedures like gene replacement therapy. In this scenario, research leads to advances in practice in a rather straightforward fashion. However, the research–practice relationship in communication disorders may take several forms (Crooke & Olswang, 2015; Olswang & Prelock, 2015; Raghavendra, 2010). Ingram (1998) proposed three distinct relationships, or lines of communication, that may exist between research and practice: (1) research-driven communication, (2) practice-driven communication, and (3) shared-interest communication.

Research-Driven Relationships. Research-driven communication centers on the reporting of research findings and the manner in which they are implemented in practice. In 1897, after training with Edward Wheeler Scripture at Yale University in the first laboratory in the United States devoted to the study of speech behaviors, Carl Emil Seashore began developing the country's first research and training program in speech and hearing at the University of Iowa. To do so, Seashore brought together professionals from the disciplines of psychology, linguistics, elocution, music, medicine, biology, and child development (Moeller, 1976). According to Wendell Johnson (1955), a former student, it was Seashore's firm belief that the education of effective speech and hearing professionals relied critically on "dependable" knowledge and treatment options, which are only possible through scientific research. As Johnson wrote, "there must be productive laboratories before there can be worthwhile classrooms and there must be worthwhile classrooms before there can be effective clinics." He noted that the speech pathology and audiology program at the University of Iowa began not with a clinic but by "designing a laboratory" and educating strong researchers.

Communication driven by research is essential to the development of a discipline and a clinical profession. In the preface to his research-driven text, *Speech Pathology*, another of Seashore's students, Lee Edward Travis (1931), acknowledges this, writing that:

> As I see it, the new books dealing with disorders of speech are too elementary and too narrow. Serious students find too little of . . . theoretical, clinical, or scientific interest in them. They have not kept pace with research in the biological sciences and often have devitalized the field by adherence to old problems and theories and in some instances by adherence to obsolete data. This condition is to be expected as long as speech pathology is in its growing pains. (p. vii)

Although communication sciences and disorders may still be experiencing a few of those growing pains, a multitude of books, opportunities to attend wide-ranging professional conferences, printed and online journals, and various Internet resources are now available. These can be seen as repositories of knowledge, and those in practice may then select from them that which they deem most useful. However, breakdowns in this line of communication occur when researchers fail to describe the nature and conduct of their studies clearly and concisely and to present the significance of their work in terms that practitioners can directly appreciate. Researchers, even those based primarily in the laboratory, are often asked to speculate on the specific applications of their research findings when, in fact, the clinician may be in the best position to do so. Research-driven lines of communication also fail when clinicians are unable to judge the quality and integrity of the information source and the limitations in research methods and analysis that allow valid and reliable adaptations of findings to their clinical practice.

Practice-Driven Relationships. Practice-driven communication concerns the manner in which clinicians express their interests to researchers regarding their information needs and the input they provide to promote research (Ingram, 1998). This can range from suggestions prompted by unexpected clinical observations to highly developed clinician-initiated research proposals. Often the aim of practice-driven research is to assist professionals in making better and more informed clinical decisions (Brown, 2006; Crooke & Olswang, 2015; Fulcher-Rood et al., 2018; Raghavendra, 2010). The value of practice-driven research lies in the clinician's unique position to identify pertinent areas of research that would not be apparent as readily to researchers who may be based primarily in a laboratory.

Although not all research findings may impact directly and immediately on the clinical enterprise, many research topics and paradigms show great promise for both the researcher and the clinician. For example, Siegel (1993) argued that research on treatment effectiveness "makes a natural bridge between the requirements of careful research and the needs of clinical practice" (p. 37). Similarly, Olswang (1993) suggested that research on clinical efficacy (effectiveness) can address both applied clinical questions and questions of a more theoretical nature, noting:

> For those of us driven by both clinical practice and theory, we have found our playground. Efficacy research allows us to function within our split interests—addressing practice and the needs of the individual while investigating theory and the underlying mechanisms of communication. What we need is further research with this two-pronged approach, advancing our clinical and theoretical knowledge. Our profession and discipline indeed depend on both. (p. 126)

Potentially hundreds of legitimate research questions fall under the general rubric of treatment efficacy research. For example, carefully controlled group studies could investigate the relative efficacy of two or more intervention paradigms designed to improve dysarthric speech, time-series designs could be employed to investigate the immediate and long-term effectiveness of fluency-enhancing protocols, and case studies could be used to investigate clinical strategies for increasing language output in children who are language delayed. An area rich with research potential, treatment efficacy research is discussed in detail in Chapter 5.

Shared-Interest Relationships. Shared-interest communication is based on the reasonable assumption that a continuum of interests exists between researchers and practitioners and that the most effective communication will occur when interests overlap. The inauguration of ASHA's Special Interest Groups was meant to mutually benefit research efforts and clinical practice by providing a vehicle to encourage researcher–clinician interactions and to assist the growing number of professionals who may be best described as *researcher-practitioners* or *clinician-investigators* (McConville & Thibeault, 2014; Silverman, 1998; Tabor & Hambrecht, 1997).

Although researchers may work alone, conducting scientific investigations is not necessarily a solitary pursuit. Researchers often collaborate with statisticians, laboratory technicians, students, colleagues, and many other professionals in related disciplines. Just as clinical practice is improved through multidisciplinary participation, such collaborative efforts enhance the conduct of meaningful research as well (Feuerstein et al., 2018;

Goldstein et al., 2019; Green, 2008; Ovretveit et al., 2014; Raghavendra, 2010). This is true even for researchers who are also engaged in their own clinical practice. Perhaps this form of researcher–clinician relationship is best thought of as a true research partnership.

A 1994 ASHA technical report specified the following regarding the role of research and the importance of shared-interest relationships in communication sciences and disorders:

> As science-based professions, speech–language pathology and audiology require an expanding knowledge base from which new diagnostic and therapeutic methods can derive. Obviously, the professions cannot rely on serendipity to reveal more effective clinical procedures; neither will clinical experience alone suffice. Rather, the creation of new clinical methods should result from the combined efforts of different groups engaged in a variety of activities, from researchers conducting very basic experimentation concerning fundamental processes and mechanisms in communication to practitioners delivering clinical services to clients with communication disorders. Especially critical to the development of new clinical methods are researchers who bridge the gap between basic research and clinical practice. A fundamental task of these researchers is to apply newly discovered basic knowledge and emerging technology to issues of clinical practice. Researchers trained in the discipline of communication sciences and disorders are especially well suited to this role, due both to their knowledge of clinical issues and to their experience conducting systematic research. (p. 2)

"A true collaboration between researchers and practitioners," Feuerstein and her colleagues (2018) suggest, "must acknowledge the expertise of both participants, recognizing the importance of the researchers' scientific rigor and the practitioners' in-depth understanding of applied issues." In fact, Moodie and her colleagues (2011, pp. 11–12) call for an "active collaboration" in all stages of the research process, "including designing the research questions, shared decision-making regarding methodology, data collection and tools development involvement, interpretation of the findings, and dissemination and implementation of the research results."

The professions of audiology and speech–language pathology are constantly changing, growing, and evolving. To ensure that the growth of the knowledge base is truly substantive, it must rest, we believe, on a scientific and research basis, a basis that must be understood and incorporated into clinical practice. Haynes and Johnson (2009) provide excellent discussions regarding the role research plays in helping meet the challenges of practice.

THE EDITORIAL PROCESS IN THE PUBLICATION OF A RESEARCH ARTICLE

A common myth is that if an article appears in print, it must be worthwhile, valuable, and a significant contribution to the literature and to our knowledge. Alas, this is simply not the case. Inadequate research is reported, trivial problems are investigated, and articles vary tremendously in quality and value (Greenhalgh, 1997). There is good research and there is poor research, both of which may be published. Perhaps a brief description of the publication process will help you understand how an article gets published and how the quality of research can vary from one article to the next.

The breadth of the discipline of communication sciences and disorders is reflected in the number of journals devoted to publishing original research articles that address hearing, speech, voice, language, and swallowing, among other topics of key interest to audiologists and speech–language pathologists. Appendix B lists many of the common English-language journals in communication disorders along with a brief description of their content and focus. Despite the variety of topics and formats used, as well as the fact that the specific editorial process differs from journal to journal, commonalities in the review process cut across most of these archival publications. As an example, let's use an applied research article submitted for publication to the *American Journal of Speech-Language Pathology* (*AJSLP*), one of the journals published by ASHA. This journal is directed to professionals who provide services to individuals with communication disorders. Manuscripts that deal with the nature, assessment, prevention, and treatment of communication disorders are invited. Note that the *Journal of Speech, Language, and Hearing Research* (*JSLHR*), also published by ASHA, solicits articles concerned with theoretical issues and research in "the broad field of communication sciences and disorders." Manuscripts submitted to *AJSLP* are considered on the basis of clinical significance, conformity to standards of evidence, and clarity of writing. The journal welcomes philosophical, conceptual, or synthesizing essays, as well as reports of clinical investigations. The details are contained in the Instructions for Authors (see ASHA, 2018c) that defines, in a general way, the scope and emphasis of the journal, thus helping potential contributors to decide whether *AJSLP* or, perhaps, *JSLHR* is the appropriate journal for their manuscript.

The editorial staff of *AJSLP* consists of an editor-in-chief and 10 editors with subject-matter expertise in such areas as fluency disorders, neurogenic communication disorders, dysphagia, voice disorders, and communication disorders in early childhood. In addition, *AJSLP* retains 45 editorial board members, all of whom are knowledgeable in one or more areas of communication disorders and have agreed to review about 8–10 article submissions per year (Pietranton, 2018). Overall editorial policy is established by the editor-in-chief and must be consistent with the general guidelines set by the ASHA Journals Board.

On receipt of a manuscript, a decision is made into whose purview the manuscript falls. An editor is then assigned to oversee the review process and to serve as a reviewer. Next, the manuscript is forwarded by the editor to two editorial board consultants who, after careful evaluation of the manuscript, recommend one of four alternatives: (1) accept for publication as is, (2) accept contingent on the author agreeing to make certain revisions recommended by the reviewers, (3) defer decision pending major revisions and another review by two different editorial consultants, and (4) reject outright. No matter which alternative is recommended, the final decision to accept or reject lies with the editor-in-chief. If a decision to reject is reached, the evaluations by the reviewers are forwarded to the author, usually with an extensive explanation of why the submission is not publishable, even with substantial revision by the authors. The editorial board consultants are not identified to the author and the consultants do not know the name of the author or the author's institutional affiliation. That is, manuscripts are subjected to a "blind" review in which reviewers are ostensibly unaware of the identity of the author.

Although every effort is made to arrive at a publication decision quickly, the review process can be time-consuming, especially if extensive revision is requested. The revisions may require considerable work on the part of the author, data may have to be reanalyzed

or displayed differently, tables and figures may have to be added or deleted, and portions of the manuscript may have to be rewritten. Obviously, the more revisions required, the less likely is a manuscript to be accepted, particularly if a journal has a backlog of manuscripts already accepted for publication. All of this necessitates considerable correspondence between the author and the editor and, perhaps, even another review by two more editorial board members. It's for these reasons that considerable time may elapse between the date the manuscript is received and the date it is finally accepted.

How, then, do inadequate or marginal manuscripts end up being published? Despite the care that is taken to select knowledgeable and informed editorial consultants, not all editorial consultants have the same level of expertise, have comparable research or evaluative skills, are equally familiar with a given area, use the same standards in evaluating a manuscript, and give the same amount of time and energy to the evaluation process. One of our journals, the *Journal of Fluency Disorders*, periodically surveys the consulting editors regarding their interests and expertise in an attempt to provide competent and balanced manuscript reviews. Another, the *Journal of Voice*, provides an annual performance report that, among other things, lists each reviewer's "turnaround time" to facilitate more punctual manuscript reviews. Most every journal provides reviewers with a copy of the correspondence between the editor and the author. This provides the opportunity to read the other reviewer's critique of the manuscript and to see how both sets of comments and suggestions have served to inform the editor's recommendations to the author.

The research sophistication found among members of a profession or discipline can have a pronounced effect on the character and quality of its journals. Equally important, however, is the great care of the journal staff to ensure a high degree of excellence in what is called the **peer-review process**. Despite everyone's devotion to quality, journal articles indeed differ in excellence, and educated readers of research have the responsibility of being able to identify those differences. The objective of the critical evaluation is to discern the good from the poor. A stance of healthy skepticism is good both for the reader and, in the long run, for the researcher and the profession.

THE CHALLENGE OF CYBERSPACE

Over the last few decades, as technology has supplanted industry, information has become a commodity. The Internet, in particular, has transformed the way we disseminate information and ask questions. As of 2010, for instance, all ASHA research journals ceased print publication and began publishing exclusively online. Subscribers now have access to not only the most current issues, but to a complete digital archive that, for ASHA journals, dates back to 1936. Never before have students and professionals had greater or quicker availability to all manner of facts, observations, analyses, and opinions. In fact, so much information is obtained now via digital technology that libraries may refer to their reference staff as *CyberLibrarians* or *cybrarians* ("Cybrarian," 2006). The proliferation of information resources has been extraordinarily helpful to students, researchers, and practitioners, but the abundance of choice has raised some serious challenges. "Just because there are more technologies and tools available than ever before," note Alexander and his colleagues

(2016), "does not mean that they are being harnessed effectively." Recognizing this issue even before the advent of the World Wide Web, the American Library Association (1989) promoted the concept of **information literacy**, which addresses those skills that allow individuals to "recognize when information is needed and have the ability to locate, evaluate, and use [it] effectively."

The consequence of this digital orientation to knowledge acquisition is that many individuals, particularly students, now equate research with entering "keywords" or "search terms" into a web search engine, such as Google, Bing, and Yahoo! Search. The response to such queries is typically a lengthy and unsorted list of websites that provide access to multiple media, including images, audio and video files, slide presentations, blogs, commercial products, services, and various "factual analyses." In a famous *New York Times* editorial, columnist Thomas Friedman (2002) commented that, while the Internet represents a means to educate a large number of people quickly, it nonetheless remains "an electronic conduit for untreated, unfiltered information" that has the potential for rapidly conveying ignorance and misinformation. Indeed, the recognition and proliferation of what has become known as "fake news"—the dissemination of false and sensationalized information disguised as legitimate fact-based news reporting—has become a global concern.

Traditionally, publishers of scholarly journals rely on individual and library subscriptions to cover the cost of publication. With the advent of the Internet, many research journals have become "open access," meaning that they are available to the public online, free of charge. In these cases, the publication costs are assumed by the authors, research sponsors, academic institutions, or a professional society. Most of these scholarly **open-access journals** exercise the same rigorous scrutiny and review to article submissions as those that are only available via subscription. However, there has been a great increase in so-called "predatory publishers" whose journals are distinguished by a lack of peer review, very low rejection rates, and extremely high article publication fees (Cuschieri, 2018; Grzybowski et al., 2017; Nahai, 2015; Shamsser et al., 2017; Wang et al., 2019). Unfortunately, there has also been a growing number of "predatory open-access journals" in recent years (e.g., Manca et al., 2017). It's therefore particularly important for the critical reader to understand the editorial review process employed by the open access publisher. One resource is the Directory of Open Access Journals (DOAJ; www.doaj.org), which lists scholarly open-access journals that employ a peer-review process.

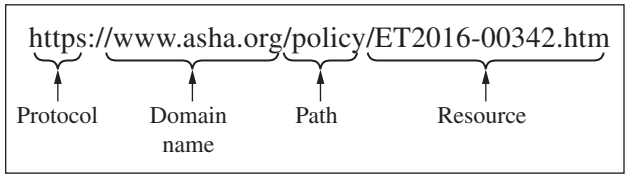
The challenge thus comes not from having access to *too much* information; it stems from one's professional responsibility to judge the authenticity, validity, and reliability of the many sources of information. "Outlier worldviews and pockets of irrational belief have always existed," notes Volkers (2019), the difference now being that it's "easier than ever to see them" as "the internet and social media have given a voice to anyone and everyone." Beyond "feeling lucky," the best way to do so is to evaluate how the knowledge was acquired. With respect to data and data-based conclusions, this requires a critical reading of the problem rationale, method of investigation, empirical results, and interpretation of findings. Unlike the majority of research journals, most of the material posted on the Internet is not peer reviewed and many times is not verified or supported by empirical research. The tremendous value of the Internet resides less in its postings than in its ability to provide access to searchable databases that allow users to find journal articles that relate to the topic of interest (Robinson et al., 1996). And, to which any cybrarian can attest, databases

often provide links to digital copies of entire journal articles, including those "in press," which have not yet been published officially, whether in print or online. Implementation of database searches for literature retrieval is now a critically important skill to practice and master. Unfortunately, it's one that remains difficult for many (Guo et al., 2008; Hoffman et al., 2013; Kloda & Bartlett, 2009; Ratcliff et al., 2013; Swartz et al., 2015). Both Cox (2005) and Dennis and Abbott (2006) provide a great deal of guidance in this regard, and we encourage you to consult these sources.

Uniform Resource Locators

Electronic journal publishing and the online environment has expanded tremendously in recent years. Because the electronic dissemination of information has become so prominent, it may be helpful to review some of the key elements of retrieving electronic resources. A **uniform resource locator (URL)** is the "web address" used to map digital information on the Internet (Figure 1.4). A string of letters, numbers, and other symbols, the URL allows a computer to retrieve a specific resource, such as a web page or digital document, from the web server where it's housed, known as the *host*. The URL begins with an *application protocol* that establishes communication between computer and host. URLs most commonly begin with "http" or "https," which stand for the "hypertext transfer protocol" or "hypertext transfer protocol secure," followed by a colon and two slashes that serve to separate the protocol from the subsequent web address. The term *hypertext* refers not only to the text displayed on a user's computer or smartphone screen, but also to displayed spreadsheets, figures, graphics, video, and sound. It also refers to *hyperlinks* that allow users to access additional hypertext via a mouse click or, increasingly, by touching the device display.

FIGURE 1.4 The Components of a Uniform Resource Locator (URL). In This Example, the URL Is the Web Address for the *Code of Ethics*, a Hypertext Document on the ASHA Website.



Following the protocol, the next component of the URL is the host name or address (also known as the *domain name*) that may or may not include "www" for the "World Wide Web." For example, https://www.sciencedirect.com is a host site operated by the publisher Elsevier that provides access to its journal articles in electronic form. Another site, https://lshss.pubs.asha.org, is maintained by ASHA to host access to its journal *Language, Speech, and Hearing Services in Schools*. Note that domain names include an extension that may provide important information about the host. For commercial sites, the extension ".com" is often used, whereas nonprofit organizations use a ".org" extension. Other common

extensions are ".edu" and ".gov" for educational institutions and government agencies, respectively. More recent extensions include ".info" for sites that seek to provide information and related resources and ".tv" for sites that feature multimedia content. The domain extension may also represent a country code, such as ".ca" for a site based in Canada, ".de" for a site in Germany, ".uk" for a site within the United Kingdom, or ".cn" for one based in China.

A URL may end with a forward slash after the domain name, which is often the case with a host's "home page." When searching for a resource, such as an electronic document, however, the document file name will follow, often with a "path" from the host home page to that resource. The path to a document varies quite a bit in length and form. Be aware that a tilde (~) in the URL path is often used to identify a personal home page. In such cases, the personal home page is likely to be the source, rather than the host.

An electronic document may take many forms, including hypertext, images, graphics, audio, video, and files generated by word processing, spreadsheet, and presentation programs. Accordingly, the format of the resource is often—but not necessarily—identified by its own extension. Among the multitude of file extensions are ".htm" or ".html" (for HyperText Markup Language, or HTML), ".doc" or ".docx" (for Microsoft Word documents), ".pdf" (for Portable Document Format, or PDF), and ".wav" or ".mp3" (among the many audio file formats). At present, most electronic journal articles are available in PDF and HTML format.

Although the Internet provides access to online articles published in reputable scholarly journals, it likewise offers easy access to a great deal of incorrect, misleading, and questionable information. Baumgartner and Hensley (2013, p. 63) pose the following questions for evaluating the credibility of information found on the Internet:

- *What is the source of the information?* Determine whether the domain name (host organization) and/or personal home page is appropriate for the type of information provided. Also, judge the source's purpose for providing the information. Is there bias? Is there a product or service for sale?
- *Who is the author?* Determine the specific authorship of the electronic document to judge whether that individual (or group of individuals) is knowledgeable and appropriate for the information provided. Is the author's intent to inform or persuade?
- *Is the information current?* Determine when the electronic document was written, when it was posted to the website, and if it has been updated since then.
- *Are references provided?* Determine if the electronic document includes some documentation of its sources of information. Is the electronic document unsubstantiated opinion or is verifiable evidence provided? In lieu of references, are there active links to other credible websites?

In addition to the above considerations, a major problem with electronic resources is that, unlike printed books and journal articles, they can be modified over time. But more importantly, host sites can change domain names or disappear entirely, as can the paths that lead to the desired resources. Typically, an "HTTP 404" or "File or Directory Not Found" error message occurs when a user attempts to follow a "broken" or "dead" hyperlink. This does not mean that an electronic journal article, for instance, no longer exists, but rather that it cannot be located based on the URL entered. The nature of the Internet is such that links to and locations of resources cannot be considered permanent.

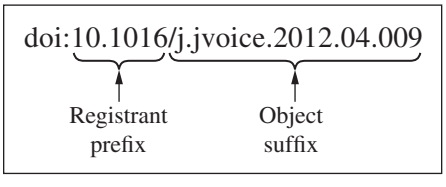
The Digital Object Identifier System

In addition to the fluidity of web addresses, the file name of a resource is arbitrary and changeable. For example, an electronic article may be named according to author, date of publication, journal volume, journal pages, topic, title, or an inscrutable series of numbers, letters, and/or symbols. Fortunately, a system has been developed to address the arbitrariness of naming electronic resources and the impermanence of their locations on the web. This system employs what is known as a **digital object identifier (DOI)**, which is composed of a string of characters that uniquely and permanently identify an electronic document. In fact, *digital objects* include not only documents in digital form (such as journal articles), but other types of digital entities, including image, audio, or video files. The DOI system focuses on the digital object itself rather than the web address where it's located. The unequivocal identification of an electronic publication by assigning a unique DOI greatly facilitates the search for that resource regardless of where it's housed on the Internet. DOIs are used by electronic **databases**, such as *PubMed* (https://www.ncbi.nlm.nih.gov/pubmed), the Education Resources Information Center (*ERIC*; https://eric.ed.gov/), and *PsycINFO* (https://www.apa.org/pubs/databases/psycinfo/) that act like an electronic filing system that allows users to search for and retrieve digital objects, including journal articles, technical reports, and conference proceedings. DOIs are also used by "registration agencies," such as CrossRef, which facilitate the linking of online resources across publishers.

As shown in Figure 1.5, DOIs include a digital identifier composed of a numerical prefix and a suffix separated by a forward slash. All DOI prefixes begin with "10." to represent the DOI registry (www.doi.org), followed by a sequence of four or five digits that are unique to the organization or publisher that has registered the DOI. For instance, a prefix of "10.1044" identifies ASHA as the DOI registrant, a prefix of "10.3766" identifies the registrant as the American Academy of Audiology, and a prefix of "10.1159" identifies the registrant as Informa Healthcare, publishers of many journals, including the *International Journal of Audiology* and *Logopedics Phoniatrics Vocology*.

The DOI suffix is a sequence of printable characters that is unique to the electronic document. The suffix can be of any length and is assigned by the publisher of a journal article at the time it becomes available electronically. The object suffix, like a file name, may simply consist of a string of digits or include some identifying information, including journal name, year of publication, or author. Regardless of how the suffix is constructed, it remains uniquely and perpetually tied to its digital object. Furthermore, even in the event that the ownership of the digital object changes, the DOI—both prefix and suffix—does not change from that which was first assigned.

FIGURE 1.5 The Components of a Digital Object Identifier (DOI). In This Example, the Registrant Prefix Identifies the Publisher as Elsevier, the Resource Suffix Assigned to a Research Article by Orlikoff and His Coinvestigators (2012) That Was Published Electronically in the *Journal of Voice*.



Primary, Secondary, and Tertiary Information Sources

In general, whether digital or in print form, information can be derived from what are considered primary, secondary, or tertiary sources depending on their purpose and the extent to which they depend on outside interpretation or abridgment. **Primary sources** are usually the first appearance of research results in the literature, providing a formal presentation of the information in its original form. For instance, Hua and his coinvestigators (2012) conducted a research study and found that adults with a unilateral cochlear implant and a substantial hearing loss in the opposite ear performed better on speech threshold and recognition tests when a contralateral hearing aid was used in conjunction with the implant. Their article, "Cochlear Implant Combined with a Linear Frequency Transposing Hearing Aid," serves as a primary source for this and the other research findings they report.

By contrast, **secondary sources** describe, explain, or interpret the information contained in primary sources. They may generalize, synthesize, or otherwise recast the original information to provide a broad overview or support a perspective on a particular topic in communication disorders. Most textbooks and book chapters represent secondary sources of information, as do the many review articles and tutorials found in professional journals.

For example, Neils-Strunjas and her colleagues (2006) provide an overview of several primary sources of information on dysgraphia in Alzheimer's disease. After placing them in a historical context, the authors, with the aid of hindsight, discuss the clinical and research significance of the various studies. As with many such critical narrative reviews, even though the overview offers secondary access to the research results, it remains the primary source for the conclusions and recommendations offered by Neils-Strunjas and her coauthors.

In another example, Cacace and McFarland (1998) wrote an article that addressed the lack of empirical evidence supporting central auditory processing disorders (CAPD) as a specific auditory dysfunction. They contended that the evaluation of CAPD in school-age children was based on an assumption that an auditory-specific deficit underlies many learning problems and language disabilities. From their extensive review of the then-current research literature on the topic, Cacace and McFarland concluded there was insufficient evidence to support the unimodal auditory-specific deficit assumption and suggested that multimodal perceptual testing be used to help clarify the true underlying nature of CAPD.

Usually much more comprehensive than the literature review found in the introduction to a typical research article, reviews provide a historical perspective of trends in the development of thought about a specific topic and demonstrate how these trends may have shaped research approaches to these issues. Such literature reviews are important in synthesizing research developments to date, organizing our thinking regarding how past research has contributed to our present knowledge, and suggesting new avenues for exploration. They are valuable also in theory construction and in placing data into theoretical perspective.

Comprehensive reviews of the research literature also illuminate what Boring (1950) has referred to as the **zeitgeist** (German: "time spirit") or the prevailing outlook characteristic of a particular period or generation. The zeitgeist influences research trends

along specific lines and may stifle other directions, but it may also shift to generate new research trends. An example of a potential zeitgeist change is an article published by Hixon and Weismer (1995) in which they reexamined published data from the "Edinburgh study" (Draper et al., 1959), widely considered a classic in the literature on speech breathing. Acknowledging that "the Edinburgh study has had a forceful, pervasive, and lasting impact on the speech sciences and is considered by many to be the definitive account of speech breathing function," Hixon and Weismer nonetheless outlined several measurement and interpretive flaws that suggest the conclusions are of dubious validity. Rather than a lamentation, their analysis showcases the scientific method in action. Indeed, they concluded that "there is still much to be learned about speech breathing and its role in human communication. Our hope for this article is that it will stimulate thinking and serve a useful tutorial purpose for those who will follow" (p. 58). In a sense, Hixon and Weismer's critique serves as a strong impetus to conduct new and productive research in speech breathing processes.

Lastly, there are publications that represent **tertiary sources** of information. A tertiary source typically provides information collated from various sources to present a broad and rudimentary overview of a topic. For example, brochures, Wikipedia entries, and some elementary texts may be considered tertiary sources of information. A distillation of knowledge derived from both primary and secondary sources, tertiary sources largely reformat and condense material so as to be easily accessible to readers with limited background on the topic. Tertiary sources can serve a very important function in the dissemination of knowledge. For instance, they can help educate the public, influence policymakers, prepare students in preprofessional study, and, of course, inform clients and their families about the nature and treatment of communication disorders. For most professionals, however, the information provided is simply too far removed from the source material to allow an adequate critical assessment of how the information was obtained or interpreted by the primary or secondary authors involved. Nonetheless, it's important to keep in mind that the appropriateness of an information source depends critically on the nature of the question being asked. There are several kinds of evidence and different types of claims for which evidence is provided. As Pring (2004a) notes: "Evidence that water boils at 100 degrees Centigrade at sea level would be very different from the evidence to indicate that a rock face is 100 million years old or that Caesar really did cross the Rubicon."

Background and Foreground Questions

Although the primary aim of this text is to lead the clinician through the process of research evaluation, a fundamental prerequisite to an intelligent critique is the fund of substantive knowledge possessed by the research consumer. To illustrate, let's take a primary source of information, such as a research article on stuttering. Let's further consider the introductory section devoted to outlining the research question and the significance of the study. How can one evaluate the author's rationale without some knowledge of the literature on stuttering? Have important citations been omitted because they are inconsistent

with the author's purpose? Can the reader understand the theoretical framework within which the author is operating? Has the author misinterpreted or misunderstood previous research? The only way the reader can answer these questions is to have a knowledgeable background in the subject of stuttering. The identical problem exists for the editorial consultant; that is why journals have large rosters of reviewers. The information explosion in communication disorders has made it almost impossible for one person to be truly expert in all substantive areas.

Skill in critically assessing research articles naturally improves as the knowledge base of the reader expands. Practicing these skills by reading the research literature fosters more complete and efficient knowledge acquisition. It tests our understanding by placing our knowledge in perspective. Evaluating research articles often calls our assumptions into question and reveals gaps in our knowledge. Critical reading, like EBP in general, requires the integration of external evidence, internal reason, and a practical sense of purpose and application. This is admittedly a demanding task but one that will allow us to arrive at more informed decisions with a fuller appreciation of the implications and consequences. According to the Association of College and Research Libraries (2016),

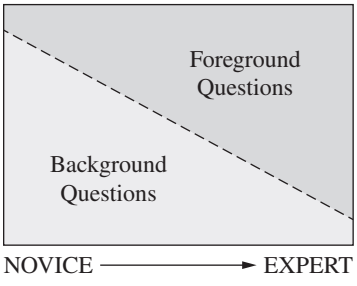
> The act of searching often begins with a question that directs the act of finding needed information. Encompassing inquiry, discovery, and serendipity, searching identifies both possible relevant sources as well as the means to access those sources. Experts realize that information searching is a contextualized, complex experience that affects, and is affected by, the cognitive, affective, and social dimensions of the searcher. Novice learners may search a limited set of resources, while experts may search more broadly and deeply to determine the most appropriate information within the project scope. Likewise, novice learners tend to use few search strategies, while experts select from various search strategies, depending on the sources, scope, and context of the information needed. (p. 9)

The types of clinically framed questions that we've been discussing, whether constructed using a PICO(T), PESICO, or SPICE template, involve the targeted search for knowledge that can be applied to the immediate concerns of a specific patient or population within a clinical practice. Sometimes referred to as **foreground questions**, the answers typically require primary sources of information, but secondary sources (such as systematic reviews of a topic) may also prove helpful. Providing the evidentiary basis for specific clinical decisions, foreground information is meant for "just-in-time" application to a clinical case or caseload. Using terminology borrowed from manufacturing, it can be said that when a clinician poses a foreground question, there is a demand to "pull" information to help address a current clinical need. Booth (2006) has accordingly called for the formulation of "clear and present questions" when seeking highly focused foreground answers.

Although foreground questions represent the structure that supports EBP, not all clinical questions have immediate and specific application. So-called **background questions** are those that inquire about general clinical or professional information. Often answered using secondary and tertiary information sources, background questions typically address such issues as the nature of a disorder, its cause, common symptoms, and treatment options.

Because these types of questions ask for general knowledge, textbooks and narrative review articles often serve as the most valuable background resources for answers. Seeking a broader response than more client-specific foreground questions, background questions address the "who, what, when, where, why, and how" of clinical practice. Examples of such questions would be "Who benefits from group therapy?" "What causes Bell's palsy?" "How do you assess chronic tinnitus?" and "What are the treatment options for apraxia of speech?" As diagrammed in Figure 1.6, beginning clinicians tend to ask far more background than foreground questions. With experience, an expanding knowledge base, and greater skill in EBP, more expert clinicians shift toward a greater percentage of targeted foreground questions to inform their practice.

FIGURE 1.6 The Relative Proportion of Background and Foreground Questions Posed by Clinicians with Different Levels of Experience and Expertise.



Representing the knowledge base for clinical practice, background information can be considered appropriate for "just-in-case" application to practice. With background questions, there is a "push" of information to the clinician to be organized and stored for later clinical use, if and when needed. All clinicians may expand their inventory of background information by critically reviewing published tutorials on specific clinical techniques, narratives that describe new theories or concepts, and even research articles on topics of interest if not of immediate clinical utility (e.g., Baker et al., 2001; Neils-Strunjas et al., 2006; Robin, 2008). Recognizing the importance of such engagement with the literature, many certification and licensing agencies now mandate a "continuing education" requirement for practitioners.

If foreground questions establish the structure of EBP, background questions provide the supporting foundation for EBP. That is, background knowledge is crucial for the construction of useful and answerable foreground questions. Furthermore, as EBP calls for an integration of practitioner knowledge and skill, clinical outcomes depend on the use of background questions and the literature that supports their answer. We are well aware that this is not a text on stuttering, aphasia, autism, voice disorders, cleft palate, or audiometry; therefore, we've made the assumption that practitioners and students will approach a journal article with some background on the topic dealt with in the article. Although we attempt to

provide a framework for evaluation, that framework must rest on a substantive knowledge-based foundation.

Digital Literacy and Information Fluency

The evolution of information literacy—in step with the rapid development of digital technology, an ever-growing focus on EBP, and the critical consumption of research literature—has given rise to the concept of *digital literacy*. Information literacy, as we discussed earlier, concerns the knowledge and skills to identify a question or need and to search for the most appropriate sources of information. This, as you may recall, is central to becoming a critical consumer of the research literature. **Digital literacy** builds on information literacy by addressing not only the means by which people acquire and assess information, but also the ways in which they can leverage digital technology to critically, collaboratively, and creatively produce solutions to problems and meet specific needs.

Although with varying degrees of success (e.g., Horrigan, 2016), the vast majority of the world's population now "access, analyze, evaluate, create, and participate in civic life through digital media" (Turner et al., 2017). Such media are not only the means through which most of us learn new things, but also through which we teach, communicate, and invent. "Part of digital literacy," explain Alexander and his colleagues (2016), "is not just understanding *how* a [digital] tool works but also *why* it is useful in the real world and *when* to use it." They view digital literacy as a movement from a "passive, basic use of technology to more intuitive, innovative applications." Digital literacy is thus crucial for critical consumption as well as the consequent evidence-informed action that underpins EBP. It is also central to the dissemination and implementation of evidence-based innovations, an issue that we discuss in more detail at the conclusion of this text.

Digital information fluency refers to the skills and digital "mindset" needed "to reliably achieve desired outcomes through the use of technology" (Briggs & Makice, 2012). Heitin (2016), for instance, points out that reading digital text requires additional abilities to effectively utilize embedded hyperlinks, videos, audio clips, images, interactive graphics, share buttons, or comments; that is, those digital "features that force the reader to stop and make decisions rather than simply reading from top to bottom." She adds that the digitally fluent reader determines, among other things, "when to click on videos or hyperlinks, how long to stray from the initial text, and whether and how to pass the information along to others," perhaps in the form of "email, blogs, and Tweets, as well as creating other forms of media, such as videos and podcasts." A mere 5 years from the initial popularization of the Internet, the National Research Council (NRC; 1999) claimed that digital literacy was "too modest a goal in the presence of rapid change, because it lacks the necessary 'staying power,'" presciently recognizing that, "as the technology changes by leaps and bounds, existing skills become antiquated and there is no migration path to new skills." Those fluent with digital technology, notes the NRC, "are able to express themselves creatively, to reformulate knowledge, and to synthesize new information." This, coupled with a desire to solve problems using evidence and critical thinking, will be the hallmark of the next generation of professionals to advance clinical practice.

Key Terms

Applied research 5
Background questions 33
Basic research 4
Clinical outcome 18
Computational model 6
Conceptual model 6
Critic 1
Critical review 1
Cultural competence 15
Database 30
Descriptive research 5
Determinism 6
Digital information fluency 35
Digital literacy 35
Digital object identifier (DOI) 30
Empiricism 4
Epistemology 2
Evidence-based practice (EBP) 13
Experimental research 5
Foreground questions 33
Information literacy 27
Method of authority 2
Method of intuition 3
Method of science 3
Method of tenacity 2
Open-access journals 27
Peer-review process 26
PESICO template 18
Physical model 5
PICO template 16
Primary source 31
Pseudoscience 7
Rationale 9
Rationalism 4
Reflective practice 19
Scientific paradigm 6
Scientific research 3
Scientific theory 5
Secondary source 31
SPICE template 18
Tertiary source 32
Treatment effectiveness 18
Uniform resource locator (URL) 28
Zeitgeist 31

Exercises in Critical Reading

1. Read the following article:

Nail-Chiwetalu, B. J., & Bernstein Ratner, N. (2006). Information literacy for speech-language pathologists: A key to evidence-based practice. *Language, Speech, and Hearing Services in Schools*, *37*, 157–167. https://doi.org/10.1044/0161-1461(2006/029)

What strategies do Nail-Chiwetalu and Bernstein Ratner suggest for improving information literacy skills? What are some of the "parallels" between information literacy and implementing evidence-based practice?

2. Read the following article:

Hansson, S. O. (2017). Science denial as a form of pseudoscience. *Studies in History and Philosophy of Science*, *63*, 39e47. https://doi.org/10.1016/j.shpsa.2017.05.0 02

Why does Hansson feel that broadening the definition of science to include the humanities will help simplify "discussions on science denial and other forms of pseudoscience"? How does he distinguish between "science denialism" and "pseudotheory promotion"?

3. Read the following article:

Dennis, J., & Abbott, J. (2006). Information retrieval: Where's your evidence? *Contemporary Issues in Communication Science and Disorders*, *33*, 11–20. https://www.asha.org/uploadedFiles/asha/publications/cicsd/2006SInformationRetrieval.pdf

Summarize Dennis and Abbott's suggestions for implementing an effective strategy for searching the research literature. How do they recommend using electronic databases for information retrieval?

4. Read the following article:

Apel, K. (2011). Science is an attitude: A response to Kamhi. *Language, Speech, and Hearing Services in Schools, 42,* 65–68. https://doi.org/10.1044/0161-1461(2009/09-0036)

Describe Apel's argument that clinical practice is "scientific." What does he suggest is the role of "external verification and validation" in clinical practice? What might he consider some of the real and perceived differences among "scientists," "researchers," and "clinicians"?

5. Read the following article:

Blischak, D. M., & Cheek, M. (2001). "A lot of work keeping everything controlled": A class research project. *American Journal of Speech-Language Pathology*, *10*, 10–16. https://doi.org/10.1044/1058-0360(2001/002)

According to Blischak and Cheek, how does active participation in a class research project help develop skill in critically evaluating research? Why do they consider the replication of previous results an important research activity?

6. Read the following article:

Finn, P. (2011). Critical thinking: Knowledge and skills for evidence-based practice. *Language, Speech, and Hearing Services in Schools*, *42*, 69–72. https://doi.org/10.1044/0161-1461(2010/09-0037)

How does Finn define "critical thinking"? Describe his view on why it is relevant for the process of evidence-based practice. What are some of the common thinking errors he discusses with respect to making decisions based on the method of intuition rather than the scientific method?

7. Read the following research article:

Muttiah, N., Georges, K., & Brackenbury, T. (2011). Clinical and research perspectives on nonspeech oral motor treatments and evidence-based

practice. *American Journal of Speech-Language Pathology, 20,* 47–59. https://doi.org/10.1044/1058-0360(2010/09-0106)

Describe how Muttiah and her colleagues use their review of literature to assess the evidence for implementing nonspeech oral motor treatments for children with developmental speech-sound disorders. What were the perspectives of clinicians and researchers regarding these controversial treatments for which "there are conflicts between the research evidence, clinical expertise, and client values"?

8. Read the following article:

Bernstein Ratner, N. (2011). Some pragmatic tips for dealing with clinical uncertainty. *Language, Speech, and Hearing Services in Schools*, *42*, 77–80. https://doi.org/10.1044/0161-1461(2009/09-0033)

What does Bernstein Ratner propose that clinicians do to balance certainty and uncertainty in their clinical practice? Why does she place importance on recognizing "what we do not know" in treatment decisions? What distinction does she make between *information* and *knowledge*?

9. Read the following article:

Kent, R. D. (2006). Evidence-based practice in communication disorders: Progress not perfection. *Language, Speech, and Hearing Services in Schools*, *37*, 268–270. https://doi.org/10.1044/0161-1461(2006/030)

What concerns does Kent raise regarding the role of researchers and research in the discipline of communication disorders and the practice of audiology and speech–language pathology? In what ways does he feel that *theory* is insufficiently emphasized in the evaluation of scientific evidence? What importance does he place on clinical experience and skill in identifying assessments and interventions?

10. Read the following research article:

Zipoli, R. P., Jr., & Kennedy, M. (2005). Evidence-based practice among speech-language pathologists: Attitudes, utilization, and barriers. *American Journal of Speech-Language Pathology, 14,* 208–220. https://doi.org/10.1044/1058-0360(2005/021)

What did Zipoli and Kennedy find regarding speech–language pathologists' attitudes toward research and EBP? What potential limitations and perceived barriers did they identify? Do you agree with the two strategies they propose that clinical fellows use to promote more "positive attitudes toward research and to further develop some of the prerequisite skills needed for EBP"?

11. Read the following article:

Shune, S., & Moon, J. B. (2012). Neuromuscular electrical stimulation in dysphagia management: Clinician use and perceived barriers. *Contemporary Issues in Communication Science and Disorders*, *39*, 55–68. https://www.asha.org/uploadedFiles/ASHA/Publications/cicsd/2012F-Neuromuscular-Electrical-Stimulation.pdf

How do Shune and Moon address the "viability" of treating dysphagia with neuromuscular electrical stimulation despite current controversies regarding research evidence? In particular, what issues do they raise with respect to clinical decisions to *not* use a particular technique?

12. Read the following articles:

Schlosser, R. W., Koul, R., & Costello, J. (2007). Asking well-built questions for evidence-based practice in augmentative and alternative communication. *Journal of Communication Disorders, 40,* 225–238. https://doi.org/10.1016/j.jcomdis.2006.06.008

Schlosser, R. W., Wendt, O., Bhavnani, S., & Nail-Chiwetalu, B. (2006). Use of information-seeking strategies for developing systematic reviews and engaging in evidence-based practice: The application of traditional and comprehensive Pearl Growing. *International Journal of Language and Communication Disorders*, *41*, 567–582. https://doi.org/10.1080/13682820600742190

Describe the PESICO template that Schlosser, Koul, and Costello promote for developing "well-built" clinical questions. Why do they suggest that the way in which the clinical problem is formulated will have an impact on all subsequent steps of the "EBP process"? Provide your own example of a well-constructed PESICO question. Briefly describe the "Building Block," "Most Specific Facet First," and "Successive Fractions" search strategies discussed by Schlosser and his colleagues (2006). How do they define traditional and comprehensive "Pearl Growing" and why do they feel that they are "an important addition to the arsenal of EBP search strategies for practitioners"?

CHAPTER

2 The Introduction Section of the Research Article

The Introduction section of the research article is of the utmost importance to the critical reader of research literature. It is in this section that the investigator presents his or her rationale for doing the research. If the author fails in this task, the remainder of the article is likely to founder as well. It cannot be emphasized too strongly that the research problem, as described in the introduction to the article, is the thread that ties together the Method, the Results, and the Discussion sections. In essence, the good introduction is very much like an effective legal brief. Just as a legal brief is designed to persuade the judge or jury, so, too, is the introduction designed to convince the reader of the need for and the value of the study being proposed.

The reader's ability to critique a research study is strongly influenced by the way in which the article is written. Therefore, it may be helpful to identify a few of the features that distinguish this type of writing from most other forms of written communication. In many respects, the writing style used in research articles reflects the principles of the scientific method. That is, it is a style guided by rational and empirical thought. However, even though journals stipulate their own style and format, there remains no one correct way to express an idea. The variety of ways ideas are communicated stems from the individual manner in which authors approach the writing task. In general, assessing the quality of writing requires the reader to judge whether the author's objectives were met effectively.

THE NATURE OF TECHNICAL WRITING

Research articles, as well as clinical notes and reports, are examples of **technical writing**. Sometimes called *scientific writing*, the aim of any technical communication is to convey information efficiently and provide a clear understanding of the material. For many people, however, technical writing means dry and tedious instructional manuals. Others associate technical material with impenetrable text marked by convoluted sentence construction. Lanham (2007) has befittingly labeled such writing "ritual mystification" for its use of obscure, ostentatious, and jargon-filled vocabulary. It is therefore not surprising that it's the popular belief that technical writing is necessarily difficult to read and comprehend. Unfortunately, this conception is fostered also by the fact that, as with other forms of literature, good technical writing is relatively rare. At its best, however,