Overview

The six chapters of Part I introduce basic principles for evaluating communicative disorders research. Part I lays the foundation for evaluation of the excerpts from research articles that are presented in Part II and the complete articles found in Part III.

Chapter 1 discusses principles of scientific method, empirical and rational knowledge, theory construction, the relationship between clinical and research enterprises, and the improvement of clinical practice through the application of research findings.

As Kent (1983, p. 76) has said:

A profession that provides its own research base is much more in charge of its own destiny than a profession that doesn’t . . . . As clinical practice changes, it will change in large part in response to new knowledge gained through research.

Common ground in clinical and research activities and in basic and applied research is considered in Chapter 1 and emphasis is placed on the critical evaluation of research as an important activity for all professionals in the field: clinicians and researchers, consumers and producers of research. As Kent (1983, p. 76) further stated:

It is tempting to cast a discussion of research into a simple framework in which master’s graduates are viewed as users of research and Ph.D. graduates are seen as the producers of research. However, this simplistic framework has important exceptions, and failure to recognize these exceptions may lead us into a faulty first step.

The tension between basic research and practical application is not unique to our field. Gershenfeld (1995, p. 50) clearly expressed it in his essay “Why I Am/Am Not a Physicist”:

There is a vigorous battle being fought between the defenders of curiosity-driven basic research and the proponents of applied development to solve practical problems. I would like to suggest that this polarization risks satisfying neither camp, because it misses the deeper and much more interesting interrelationship between research and application. Neither curiosity nor practice arises in a vacuum [emphasis ours].
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Such polarization does not need to exist. An excellent example of the blending of curiosity and practice in our field can be seen in the series of articles on physical examination of speech breathing structures that was published in the American Journal of Speech-Language Pathology by Hixon and Hoit. Donald A. Robin, editor of the journal, made the following remarks in his “From the Editor” overview of the August 2000 issue that included the third Hixon and Hoit article (Robin, 2000, p. 178):

I would like to point the readership to a series of papers on clinical examination of the diaphragm, abdominal wall, and rib cage by Hixon and Hoit. In this issue is the third and last paper (examination of the rib cage wall) in a series that presents up-to-date clinical examination of the breathing-for-speech mechanism. The previous two papers can be found in *AJSLP* 7 (4), 37–45, and *AJSLP* 8, 335–346. This series of papers represents what I think are among the best examples of the integration between science and clinic. The research foundations of the clinical methods described is well known and has been the focus of Tom Hixon’s since the late 1960’s; since the 1980’s, Jennifer Hoit has been part of this impressive systematic research program. The three papers in this Journal guide the clinician in the clinical examination of the speech breathing system and provide a strong basis for the assessment procedures described. The protocols arise from the combined science and clinical efforts of Hixon and Hoit. I will leave to you to read these excellent papers but want to point out to the readership what I think are superlative efforts in merging clinic and science with the highest degree of scholarship.

Robin’s comments exemplify the basic theme of this book that is presented in Chapter 1: *Scientific research is the foundation upon which sound clinical practice should rest.*

The primary focus of Chapter 2 is research strategies in communicative disorders. Commonalities and differences among various experimental and descriptive research strategies are discussed and examples are presented of various approaches. Relationships among independent and dependent variables are discussed and different strategies for examining different kinds of variables are explored. Chapter 3 discusses research design in communicative disorders and examines some basic principles of many group and single-subject designs commonly encountered in the research literature. Measurement issues in communicative disorders are the topic of Chapter 4. Measurement is defined, different levels of measurement are specified, and some general and specific factors that affect the quality of measurements, especially reliability and validity, are discussed.

Chapter 5 considers the important topic of evaluating treatment efficacy research, which, perhaps more than any other area, exemplifies the linkage of research and clinical enterprise. Using the framework of Campbell and Stanley (1966) for the evaluation of research designs in educational psychology, this chapter discusses the important criteria of internal and external validity and factors that may jeopardize them. Some specific treatment efficacy research designs are reviewed relative to these factors and some matters concerning meta-analysis and research ethics are also considered.

Chapter 6 concludes Part I with an overview of important principles in the organization and analysis of data for consumers of research. The purpose of this chapter is to familiarize readers with some terminology, concepts, and statistical methods, without a lengthy discussion of calculation procedures. The material in this chapter, along with the examples in Part II, is intended to assist students in the reading of the results section of a research
article. It is beyond the scope of this book to teach statistics per se and it is assumed that graduate students in communicative disorders will have at least a one-semester introductory course in statistics. Chapters 6 and 9 review the major terms and concepts of a semester’s survey of statistics and provide relevant examples from the communicative disorders literature.

Part II will follow with excerpts from the communicative disorders research literature that provide specific examples of the concepts discussed in Part I. Part III will then follow with two complete articles reprinted, one in speech-language pathology and one in audiology, for students to evaluate on the basis of the concepts presented in Part I and exemplified in Part II.

Throughout their reading of this book, students should be mindful of the statement made by Kent (2001, p. 457):

Research is intrinsically futuristic, always directed to the next experiment, the next theoretical advance, the next challenge to the standard view. Research is a frontier phenomenon, and its practitioners work on the horizon of possibilities.

We hope that you will open your eyes wide to these possibilities.

REFERENCES


Beliefs are tentative, not dogmatic; they are based on evidence, not on authority.
—Bertrand Russell (1945)
History of Western Philosophy

The purpose of this book is to help practitioners and students in communicative disorders become critical readers of the quantitative research literature in the field. 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” (The American Heritage College Dictionary, 1997). Practitioners should be able to evaluate published research critically. The book, then, facilitates the practitioner’s use of the research literature to improve, modify, and update clinical practice through reasoned assessment and evaluation of the literature relevant to clinical practice. Our goal stems from the basic premise that sound clinical practice should be based, in large part, on the relevant basic and applied research rather than on pronouncements by authorities, intuition, or dogma. As Siegel (1993, p. 36) 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. Informed clinicians need not be sophisticated researchers, but they should have had first-hand experience with research during their graduate education to help them understand the limitations and the possibilities of research and the decisions that face researchers at so many turns in the conduct of a study.

Qualitative research will not be discussed in this text and the rationale for limiting our discussion to quantitative research is summarized cogently by Cizek (1995). Readers interested in a popular treatment of qualitative research are referred to Dilullo and Wolter (2004). Readers interested in a more detailed treatment of qualitative research are referred to Babbie (2004) and the Special Forum on Qualitative Research that was published in the May 2003 issue of the American Journal of Speech-Language Pathology: A Journal of Clinical Practice.
Let’s first consider a basic question asked by Reynolds (1975): “What is research?” Reynolds goes on to answer his question as follows (p. 13):

Research is the cornerstone of an experimental science. Both the certainty of the conclusions and the rapidity of the progress of an experimental science depend intimately and ultimately on its research. 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. Research is, in practice, a two-pronged fork with one tine in the past and the other in the future. An experiment attempts to confirm or deny what is already believed to be true and at the same time to go beyond existing knowledge toward either a more comprehensive body of facts or, if possible, toward a general principle around which all the known and verifiable facts about a subject may cluster in a logical, predictable, and sensible whole.

The whole point of the text is to assist the clinician and student to arrive at reasoned decisions about the adequacy of the research reported in our journals and to make independent judgments about the relevance of the research to their clinical activities. In the process, we hope to dispel some of the more common myths about the research article, myths such as “You must be a statistician to read the literature” or “If it is in print, it must be good” or “The more difficult to read, the more scholarly an article must be.”

In addition to our goal of helping clinicians develop the critical skills required in reading research, we have two additional goals: we hope the book serves as a bridge between clinician and researcher; and we view the text as a foundation, as a first course for the student who plans a career in research or for practitioners interested in conducting research within a clinic or school setting. It must be emphasized, however, that this is not a book on how to do research; it is a book 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.

**Research-Practice Relationships in Communicative Disorders**

It is generally accepted that advances in diagnostic and treatment protocols for a particular disorder are derived from scholarly research. 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, manic-depressive illness, obesity, and other abnormal conditions are now known to be, at least partially, genetically based (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 the above scenario, the research-practice relationship appears straightforward and cooperative; research leads to advances in practice. The research-practice relationship in communicative disorders, however, may not be quite so straightforward or cooperative. Dr.
Jeri Logemann, President of the American Speech-Language-Hearing Association in the year 2000, discussed the research-practice relationship in communicative disorders in *The ASHA Leader*. She stated:

> There are comments that I find disturbing, but luckily, hear only occasionally. The clinician, for instance, who says, “I don’t read journals because they’re all research and that’s over my head.” Or the researcher who says, “It’s unimportant whether a clinician reads my research or not, because it’s really for other researchers.” (Logemann, 2000, p. 2)

This apparent disconnection between research and clinical practice is not unique to the discipline of communicative disorders and it is not a new problem. Debate on this topic has appeared frequently in the communicative disorders literature since the early 1960s and “is as keen now as ever” (Robin, 1999, p. 194). The essence of this disconnection appears to be due to a conventional notion that research does little to inform clinical practice and an idealized model that segregates producers of research from consumers of research in communicative disorders.

The currency and relevance of the research-practice relationship in communicative disorders was underscored poignantly in a special February 1998 issue of the journal *Topics in Language Disorders*. This special issue, subtitled *New Directions: Science and Service for the 90’s and Beyond*, featured seven articles devoted to discovering methods to bridge the gap between research and clinical practice. The underlying theme of and motivation for each article was expressed succinctly in the journal’s lead article in which Ingram (1998, p. 1) stated:

> Effective communication between research and practice is as fundamental in the field of speech-language pathology as in any field that provides services to the community.

He went on to say:

> … there needs to be an effective means for reliable results from research to be communicated to … clinicians. Further, clinicians must have confidence in the researchers in their field and in ways to communicate their needs to them.

Ingram (1998) proposed that three distinct relationships, or lines of communication, exist between research and practice and that effective use of these lines of communication would mutually benefit research efforts and clinical practice. The three lines of communication proposed by Ingram are (a) *shared-interest communication*, (b) *research-driven communication*, and (c) *practice-driven communication*.

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 where interests overlap the most. Ingram suggested that shared-interest communication could be enhanced by initiating a regular survey of research and researchers that addresses the types and nature of research being conducted in the field. Such surveys could inform both researchers and clinicians about research directions and, perhaps, encourage collaborative efforts. Ingram pointed out that a number of professional organizations, such as ASHA, attempt to provide a broad range of clinical research presentations at
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their annual conventions in an effort to foster research-practice relationships. Also, ASHA’s Special Interest Groups serve as a vehicle that encourages researcher/clinician interactions.

Research-driven communication regards the manner “in which research findings are reported and converted into practice” (Ingram, 1998, p. 2). Ingram suggested that adequate outlets for the distribution of research findings currently exist in the form of books, professional conventions, printed and online journals, and the Internet. He added the caveat, however, that there is so much research information available that clinicians may feel overwhelmed and not know how to use it effectively in their practice. Ingram (1998, p. 9) offered some suggestions that could assist clinicians in the application of current research findings to their practices, and, consistent with the philosophy of this book, stressed that.

Graduate programs need to continue to focus on training students to access and reach judgments on their own about applied research.

Practice-driven communication concerns the manner in which clinicians express their interests to researchers regarding their information needs and the input they provide to the initiation of research (Ingram, 1998). To facilitate practice-driven communication, Ingram suggested a survey of clinicians that would examine the extent of satisfaction, or lack thereof, with research in the field. He also proposed the establishment of Internet bulletin boards that would enable clinicians to express their needs directly to researchers. Such an effort might also facilitate clinician-initiated research proposals. ASHA’s American Speech-Language-Hearing Foundation has taken an active role in fostering practice-driven communication by awarding grants to individuals conducting germane clinical research.

Additionally, ASHA has taken a proactive stance regarding the integration of research and clinical practice. Three articles published recently in The ASHA Leader stress the need and potential for such integration (Katz, 2003; Ramig, 2002; Wambaugh & Bain, 2002). A related and important ASHA initiative regards the call to instantiate mandates in the Code of Ethics that require clinicians to “provide services that are based on careful, professional reasoning” (Apel & Self, 2003, p. 6). Apel and Self (2003, p. 6) state that, “By engaging in evidence-based practices, clinicians abide by these ethical codes while best serving their clients.”

Evidence-Based Practice (EBP)

Evidence-based practice (EBP) requires clinicians to integrate high-quality scientific clinical research evidence with individual clinical expertise to ensure ethical and optimal client management (Dollaghan, 2004; Sackett, Straus, Richardson, Rosenberg, & Haynes, 2000). Dollaghan (2004, p. 12) asserts that “EBP offers us a framework and a set of tools by which we can systematically improve in our efforts to be better clinicians, colleagues, advocates, and investigators.” ASHA has recently established the National Center for Treatment Effectiveness in Communicative Disorders and is currently coordinating a National Institutes of Health–funded effort to promote clinical research that will support EBP.

Evidence-based practice is hardly unique to communicative disorders. Consider the following quotation by Poggi (2003, p. 4):
Every day we expect people to base their practices on evidence that demonstrates proven results—doctors diagnosing patients, lawyers advising clients, and educators teaching our children. In fact, the U.S. Congress that passed the No Child Left Behind Act of 2001 believes so strongly in the use of scientifically based research that it is referenced over 100 times within the pages of the legislation—in every section and on every topic.

Despite the widespread acclaim for EBP, at least two fundamental issues confront clinicians who wish to establish an EBP. The first issue confronting the individual who wants to establish an EBP is locating relevant, germane sources of clinical evidence in a timely fashion. Dollaghan (2004, p. 4) suggests that “no practitioner has the time” to scour hundreds of journals and textbooks for clinical evidence. Dollaghan and other EBP proponents like Schlosser (2004) suggest using “high-yield sources” that are easily accessible via the Internet. For example, the Agency for Healthcare Research and Quality supports a website (www.guideline.gov) that is a compilation of clinical evidence reviews from a large number of disciplines on a wide variety of topics. Seven additional high-yield source websites are cited in Dollaghan’s (2004) article. Additional EBP-related websites are provided by Goldstein (2004).

The second issue regards the clinician’s understanding of the “levels of evidence” used in treatment efficacy research and EBP. The term levels of evidence refers to a classification system that establishes a hierarchy of evidence based on scientific quality and rigor (Robey, 2004). Consistent with the purpose of this book, levels of evidence are discussed in detail in Chapter 5.

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 grounds of knowledge. Knowledge can be acquired in various ways, and Kerlinger and Lee (2000, pp. 6–8) discussed Charles Sanders Pierce’s notion of “four general ways of knowing” as an approach to understanding the ways in which knowledge has been acquired historically.

The first way of knowing is called the method of tenacity. In this method of knowing, people hold firmly to certain beliefs because they have always known them to be true and frequent repetition of the belief enhances its ostensible validity. Perpetuating the notion that the world is flat, even in the face of overwhelming contradictory evidence, is an example of the method of tenacity.

The second way of knowing is called the method of authority. 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 believing that the sun revolves around the earth because a historical institution such as a government or religion insists that it is true. 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,
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however, if everyone merely accepts the word of authority without examining or questioning the qualifications of the source of its knowledge (Kerlinger & Lee, 2000).

The third way of knowing is called the a priori method. It is also called the method of pure rationalism or the method of intuition. This method of knowing relies on the use of pure reason based on prior assumptions that are considered to be self-evident with little or no consideration given to the role of experience in the acquisition of knowledge. 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 the earth, not the sun, is the center of our galaxy, 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 important to scientific inquiry in communicative disorders and other disciplines. We will 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. Scientific knowledge is gained from scientific research, which is defined by Kerlinger and Lee (2000, p. 14) in the following manner:

Scientific research is systematic, controlled, empirical, amoral, public, and critical investigation of natural phenomena. It is guided by theory and hypotheses about the presumed relations among such phenomena.

The words used in the above definition have conceptual importance and they refer to many of the themes and concepts that will be introduced in this text. As such, it is worthwhile to examine briefly Kerlinger and Lee’s (2000, p. 14) explanations of their intended meanings. The words systematic and controlled imply that scientific investigation is tightly disciplined and conducted in a manner that methodically rules out alternative explanations of a particular finding. Systematic control over events during the execution of a scientific investigation engenders 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. 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 will 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 philosophy that assumes that knowledge must be gained through experience. Empiricists generally rely on inductive reasoning; that is, they use evidence from particular 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 endeavor and is a necessary requisite of sound research.

Rationalism is a philosophy that assumes that 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 they rely on empirical and rational endeavors. In linguistics, for instance, Chomsky (1968) insisted that rational consideration rather than empirical inquiry is necessary for the development of a theory of language. In psychology, Skinner (1953) relied on empirical evidence for a functional analysis of behavior and eschewed 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. Stevens (1968, p. 850) suggested the term schemapiric for the “proper and judicious joining of the schematic with the empirical,” and concluded (p. 856):

Science presents itself as a two-faced, bipartite endeavor looking at once toward the formal, analytic, schematic features of model-building, and toward the concrete, empirical, experiential observations by which we test the usefulness of a particular representation. Schematics and empirics are both essential to science, and full understanding demands that we know which is which.

Scientific Method

Siegel and Ingham (1987, p. 100) argued that the discipline of communicative disorders, as a science, “shares models, methods, and concepts with a larger community.” They went on to say that most people “in the field of communicative disorders belong to the community of behavioral science.”

Although not all research findings may impact directly and immediately on the clinical enterprise, there are many research topics and paradigms that show great promise for both the researcher and the clinician. For example, Siegel (1993, p. 37) argued that treatment efficacy research “makes a natural bridge between the requirements of careful research and the needs of clinical practice.” Similarly, Olswang (1993) suggested that clinical efficacy research can address both applied clinical questions and questions of a more theoretical nature. Specifically, Olswang (1993, p. 126) stated:

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.

There are potentially hundreds of legitimate research questions that fall under the general rubric of treatment efficacy research. 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 single-subject designs could be used to investigate clinical strategies for increasing language output in children who are language delayed. It goes beyond the scope of this text to discuss all the potential treatment efficacy investigations, but the area is rich with research potential. Wertz (1993, p. 38) asked if the question “Does therapy work?” serves as a legitimate research question and proceeded to answer the question by responding:

It seems to me that the question is not only appropriate for research; it is essential for clinical practice. The rationale for not asking appears weak.

In summary, we see the communicative disorders profession as primarily a clinical enterprise. It is an enterprise that is changing, growing, and developing. 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.

Behavioral science, which has been differentiated from physical and natural sciences in the past, is that branch of science that deals with the development of knowledge concerning human or animal behavior. In recent years, physical and natural sciences (e.g., physics and biology) have been combined with the traditional behavioral sciences (e.g., psychology and sociology) for interdisciplinary research on many aspects of behavior. Areas of study such as sociobiology, neuropsychology, psychoacoustics, and vocal physiology illustrate considerable overlap among the behavioral, physical, and natural sciences in the study of human or animal behavior. Similarly, many disciplines contribute to the scientific underpinnings of communicative disorders. Physics, biology, physiology, computer science, speech science, hearing science, psychology, and psycholinguistics contribute directly or indirectly to the discipline of communicative disorders. These disciplines provide the knowledge and tools required to attack and solve clinical problems in communicative disorders.

To understand the research enterprise (i.e., common knowledge gathering) in communicative disorders, it is necessary to understand the general framework of behavioral science 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 systematic method is commonly called the scientific method. The 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, in which case it is called basic research, or it may be undertaken to solve some problem of immediate social or economic consequence, in which case it is called applied research. In recent years, professionals in many disciplines have realized that basic and applied research are not entirely separate or opposed activities. A piece of research that was done for the sake of basic knowledge may turn out to have an important application; a piece of research done to solve an immediate problem may provide basic information concerning the nature of some phenomenon. In the past, there have been instances of acrimonious opposition between people identified with the so-called basic and applied schools, and such op-
position has resulted in communication failures that have retarded rather than advanced the development of knowledge. Today, many people recognize the importance of both basic and applied research, as well as the need for clear communication between researchers with more basic orientations and professionals with more applied orientations.

Within the framework of behavioral science, two major types of research may be identified: descriptive and experimental. Descriptive research examines group differences, developmental trends, or relationships among variables through the use of laboratory measurements, various kinds of tests, and naturalistic observations. Experimental research examines causation through observation of the effects of the manipulation of certain variables on other variables under controlled conditions. These two types of research are different empirical approaches to the development of knowledge.

Theory Construction in Behavioral Science

Empirical and rational inquiry leads to the development of theories that are statements formulated to explain phenomena. Kerlinger and Lee (2000, p. 11) stated that theory is the “ultimate aim of science” and defined a theory as

a set of interrelated constructs (concepts), definitions, and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena.

Rummel (1967) discussed the relationship of rational and empirical inquiry in theory construction and stated that empirical facts alone are meaningless unless they are linked through propositions that confer meaning on the facts. According to Rummel (1967, p. 454):

A scientific theory consists of two components: analytic and empirical. The analytic component is the linking of symbolic statements through chains of reasoning that obey logical or mathematical rules but that have little or no operational-empirical content. . . . This analytic component of theories can be the creation of the scientist’s imagination, the distillation of a scholar’s experience with the subject matter, or a tediously built structure slowly erected on a foundation of numerous experiments, investigations, and findings. The empirical component of theories is operational. It fastens the abstract analytic part of a theory to the facts.

Theories generally fall into one of two broad categories (Sidman, 1960). First, they may be generalizations, developed after the facts are in, that try to synthesize the available empirical evidence into a coherent explanation of a phenomenon. Skinner (1972, p. 100) has called such a theory “a formal representation of the data reduced to a minimal number of terms.” Second, theories may be tentative generalizations or conjectures that can be subjected to future empirical confirmation—as such, they are often called hypotheses. The first kind of theory looks back at available data and employs a formal logic to synthesize this empirical evidence; the second kind looks ahead to future empirical and rational inquiry for verification of the theory. Empirical and rational inquiry is necessary for verification of a theory or for its modification if observed facts do not fit the theory. A knowledgeable consumer of research should recognize the theoretical organization of empirical evidence and
the empirical confirmation of theories as two activities that coalesce to form the “schematic-piric view” in the behavioral sciences.

Bordens and Abbott (2002, p. 44) suggested that some theories have “stood the test of time, whereas others have fallen by the wayside.” Many factors contribute to the longevity, or lack thereof, of any particular theory, and Bordens and Abbott (2002, pp. 44–46) have listed five essential factors that can figure centrally in the life of theory. The first is the theory’s ability to “account for most of the existing data within its domain.” They explained that the amount of data accounted for is not all because some of the data germane to the theory may be unreliable. Second, theories must have explanatory relevance. Explanatory relevance means 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 condition is that of testability. Bordens and Abbott (2002, p. 44) stated:

A theory is testable if it is capable of failing some empirical test. That is, the theory specifies outcomes under particular conditions, and if these outcomes do not occur, then the theory is rejected.

The theory’s ability to predict novel events or new phenomena is the fourth characteristic of a sound theory. A theory should predict phenomena “beyond those for which the theory was originally designed.” Such new phenomena were not taken into account when the theory was originally formulated. Finally, the theory should be parsimonious (i.e., it should adopt the fewest and/or simplest set of assumptions in the interpretation of data).

Common Steps in Behavioral Science Research

Examination of articles in the behavioral science literature reveals some common steps taken in empirical research. These steps exemplify the nature of the scientific approach discussed more thoroughly in texts such as Kerlinger and Lee (2000) and Bordens and Abbott (2002). Consideration of this simplified outline may enable consumers to understand the general framework underlying empirical research and to realize that the different types of research to be discussed here are variations on a common theme of empirical inquiry.

The common steps in empirical research are

Statement of a problem to be investigated  
Delineation of a method for investigation of the problem  
Presentation of the results of this investigation  
Drawing conclusions from the results about the problem

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 pur-
pose, 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 it is they are investigating.

The problem statement should also contain some material on the meaningfulness or relevance of the topic under investigation by placing it in context. This is generally accomplished by establishing a rationale for the study through a review of the literature that has already been published on the particular topic to be investigated. 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 the particular study and a statement of the 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 accomplished through the description of the method of investigation. It is common to find the Method section of an article divided into three subsections: (1) participants, (2) materials, and (3) procedures. Although there are variations on these subsections, the important questions we are concerned with are How was the study carried out? Did the method provide valid and reliable results?

Participants. In this section of the research article, the researcher describes the people (or animals) that were studied. A careful description is generally provided of the relevant characteristics of the participants (e.g., number of participants, age, gender, intelligence, type of speech or hearing disorder, etc.). The important point is how well the general population under consideration is defined and how well the sample of participants represents the population the researcher wishes to study.

Materials. In this section, the researcher describes the various tests, instruments, apparatus, or training materials used and may also describe the situation or environment in which the study took place. Information about the calibration, reliability, and validity of tests or instruments used is also presented here.

Procedure. In this section, the researcher describes how the materials were used to study the participants.

Results of Investigation

Here, the researcher presents the results of the collection of data by means of the method of investigation just described. Tables and figures are often used 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 is important for a researcher to present a specific breakdown of the results as they relate to the specific subcomponents of the problem presented at the beginning of the article.

**Conclusions**

After presenting the results, the researcher draws conclusions from them that reflect on the original statement of the problem. The conclusions are often cast in the form of a discussion of the results in relation to previous research, theoretical implications, practical implications, and suggestions for further research.

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 pattern. It is difficult to understand the excitement and creativity inherent in the design and execution of an empirical study unless the student experiences it directly. In fact, all researchers may not necessarily follow the orderly steps just outlined in doing their research; adjustments may be made to meet the needs of a researcher in a particular situation. Skinner (1959, p. 363) has 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.*

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.

We also want to point out that readers are likely to encounter some articles that do not report original empirical research data, but, instead, review the existing literature on a particular topic in communicative disorders. These reviews are usually much more comprehensive and detailed than the literature review found in the introduction to a typical research article. They provide a historical perspective of trends in the development of thought about a particular topic and demonstrate how these trends may have shaped research approaches to these topics. Discussion of method and theory in historical research is beyond the scope of this book and readers are referred to Barzun and Graff (1970) for a general overview of historical research. A few brief points should be made about literature reviews as they relate to the commonalities of empirical research.

First, such 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. Second, such devices are valuable in theory construction and in placing data into theoretical perspective. Third, such reviews are important sources of critical evaluation of the research literature.

For example, Cacace and McFarland (1998) wrote a critical review regarding 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-aged children is based on an assumption that an auditory-specific deficit underlies many learning problems and language disabilities. From their extensive review of the extant research literature on the
topic, Cacace and McFarland (1998, p. 355) concluded that there is 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.

Finally, comprehensive reviews of the research literature also help to illuminate what Boring (1950) has referred to as the zeitgeist (German: “time spirit”), or the prevailing outlook that is characteristic of a particular period or generation. The zeitgeist influences research trends along particular lines and may proscribe 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 a complex study of speech breathing (Draper, Ladefoged, & Whitteridge, 1959) that has become known as the Edinburgh study. Hixon and Weismer (1995, p. 42) asserted 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. Indeed, it is widely afforded the status of a classic.

In a detailed critique, Hixon and Weismer (1995) pointed out several measurement and interpretive flaws in the Edinburgh study that serve to invalidate the study. In a sense, Hixon and Weismer’s critique serves as a strong impetus to conduct new research in speech breathing processes. Hixon and Weismer (1995, p. 58), in fact, stated:

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.

The best way for students of communicative disorders to appreciate the common steps in empirical research that we have discussed thus far 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. Many students report that the reading of literature reviews is as important as the reading of original empirical articles in developing an appreciation of the common steps in empirical research.

The Nature of Research in Communicative Disorders

It is extremely difficult to paint a complete picture of the research enterprise in communicative disorders. No one has done it and we will 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 impinge, either directly or indirectly, on communicative disorders.

Although relatively few communicative disorders specialists are involved in full-time research (American Speech-Language-Hearing Association, 1999), the research enterprise in communicative disorders is much broader than would appear from surveys of the ASHA membership. One obvious reason is that not all people who are involved in communicative
disorders research are members of ASHA. More important, though, is that many people are involved in research activities on less than a full-time basis. Perhaps the best example of such a person is the academician whose primary job 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. Other part-time researchers include doctoral students and clinicians working in a variety of clinical settings. Finally, much of the research appearing in the periodical literature is done by people working outside of communicative disorders. These include individuals such as otolaryngologists, experimental psychologists, psycholinguists, and neurophysiologists. The numbers of published articles that relate directly or tangentially to the interests of professionals in communicative disorders attest to the numbers and different interests and backgrounds of individuals involved in the communicative disorders research enterprise.

The areas investigated are equally diverse, ranging, for example, from the study of the effects of noise on the hearing sensitivity of chinchillas to the study of hearing-aid evaluation procedures, from a study of infant respiration to a study of the most efficient way to teach esophageal speech, from the study of how children acquire language to the study of how people with aphasia relearn speech and language. The areas studied are almost as numerous as the people involved in their study.

The settings in which research is conducted are equally varied. Language acquisition of a typically developing child is studied in the naturalistic environment of the child’s home; the efficiency of an auditory site-of-lesion test is evaluated in the audiology clinic. The chinchilla’s hearing sensitivity is investigated within the confines of a laboratory; the effects of noise on human hearing sensitivity may be studied in a factory setting. Stuttering behavior may be investigated in a laboratory, clinic, or school. In broad terms, normal processes are usually but not always studied in a laboratory setting; the study of disordered communication is frequently but not always carried out in a clinical setting.

Finally, as we will see in Chapter 2, the research strategies in communicative disorders are also diverse, ranging from survey studies performed in the field to experimental research performed in the laboratory.

Research Ethics

In addition to having a responsibility to communicate relevant findings, the researcher has other important ethical responsibilities—responsibilities that are inherent in the research process. Several professional associations have codes of ethics that specify the ethical constraints placed on investigators who do research with human participants. For example, participants must have the freedom to decline to participate in a research project or to withdraw from the project at any time. The welfare and dignity of participants must be protected at all times. The investigator must protect the confidentiality of information obtained during the course of the study. The investigator must protect participants from physical and mental discomfort, harm, and danger. Investigators must honor all agreements and commitments made to participants. More complete descriptions of these ethical obli-
The ethical responsibilities placed on the researcher are as stringent as those required of clinicians, especially when the researcher is using human participants. In fact, researchers have both ethical and legal responsibilities to protect the rights of both human and nonhuman living participants. Many institutions are required to have an Institutional Review Board that studies research proposals to ensure that the welfare of participants is scrupulously maintained, especially if the institution is interested in obtaining governmental funds for the conduct of the research. Suffice it to say that researchers have important obligations to a varied constituency—to their audience, their participants, their institutions, their profession, and themselves.

The Editorial Process in the Publication of a Research Article

One common myth that needs to be dispelled early is that if an article appears in print, it must be worthwhile, valuable, and a significant contribution to the literature and to our knowledge. This is simply not the case. Inadequate research is reported, trivial problems are investigated, and articles vary tremendously in quality and value. Perhaps a brief description of the publication process will help the reader understand how an article gets published and how the quality of research can vary from one article to the next.

Although the editorial process differs from journal to journal, there are commonalities in the review process that cut across most journals. (For a description of the editorial process for articles published by the American Psychological Association, the reader should consult the Association’s Publication Manual [American Psychological Association, 2001]). Let us use, as an example, a clinical research article submitted for publication to the American Journal of Speech-Language Pathology: A Journal of Clinical Practice (AJSLP), one of the journals published by ASHA. At the time of writing, the journal was directed to professionals who provide services to persons with communicative disorders. Manuscripts that deal with the nature, assessment, prevention, and treatment of communicative disorders were invited. Note that the Journal of Speech, Language, and Hearing Research (JSLHR), also published by ASHA, “invites papers concerned with theoretical issues and research in the communication sciences.” 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 research. The details are contained in the Information for Authors section of each issue, a section that defines, in a general way, the scope and emphasis of the journal, thus helping potential contributors to decide whether AJSLP is the appropriate journal for their manuscript.

The editorial staff of AJSLP consists of an editor and several associate editors in areas such as fluency and fluency disorders, neurogenic communication disorders, dysphagia, voice disorders, and communication disorders in early childhood. In addition, there are more than one hundred editorial consultants, all of whom are knowledgeable in one or
more areas of communicative disorders. Overall editorial policy is established by the editor and must be consistent with the general guidelines set by the Publication Board of ASHA.

On receipt of a manuscript, a decision is made into whose purview the manuscript falls. An associate editor is then assigned to oversee the review process and to serve as a reviewer. Next, the manuscript is forwarded by the associate editor to two editorial 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. If a decision to reject is reached, the evaluations by the reviewers are forwarded to the author, sometimes with a marked copy of the manuscript. The editorial consultants are not identified to the author and the editorial 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 consultants. It is for these reasons that considerable time may elapse between the date the manuscript is received and the date it is finally accepted.

How 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 journal in the field of communicative disorders, 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.

Finally, the research sophistication found among members of a profession or discipline can have a pronounced effect on the character and excellence of its journals. Equally important, however, is the great care of the journal staff to ensure a high degree of excellence in the review process. Despite everyone’s devotion to quality, journal articles indeed differ in excellence, and educated consumers of research have the responsibility of being able to identify those differences.

**Some Myths and a Caveat**

One of our goals is to explode some of the myths surrounding research and the evaluation of research. We have noted already that the appearance of an article in a journal is no guar-
antee of the article’s quality. There is good research and there is poor research, both of which may be published. The objective of the critical evaluation is to discern which is which. A stance of healthy skepticism is good both for the reader and, in the long run, for the researcher and the profession.

A major obstacle standing in the path of the consumer of research is the attitude that one must have a solid background in statistics before one can intelligently read the research literature. A similar attitude is that research and statistics are synonymous. Nothing could be further from the truth. For example, Plutchik (1983) stated that statistical analysis is not an end in itself and cannot ensure meaningful conclusions simply by its application to experimental data. This view continues to be held by current authors of research design textbooks such as DePoy and Gitlin (1994, p. 237), who pointed out that “conducting statistical analysis is just one action process in research.” No matter how excellent and sophisticated the statistical treatment, a major weakness in any other part of the research study or article vitiates the value of the statistical analysis. A trivial problem is still trivial no matter how sophisticated the statistical analysis. A poorly conceived research design remains poorly conceived, despite a complex statistical approach. The inferences and generalizations drawn from the data may be appropriate and fair but the statistical analysis does not ensure this.

Statistical analysis is an essential tool for the researcher, but research and statistical treatment are not the same. A serious weakness in any part of a research article—introduction (rationale), method, data analysis, or discussion—weakens the whole.

Another myth, perhaps less widely held, is that the researcher is characteristically a recluse in a white coat isolated in the ivy-covered laboratory working on problems that have little relevance to human life, no less to the practicing clinician. Again, this is not true. Most researchers are concerned about people with communicative disorders, and it is this concern that continues to motivate their research. In fact, many of today’s researchers have strong clinical backgrounds and extensive clinical experience. Many researchers, while perhaps not involved in research that has immediate application, are doing research that tomorrow may have considerable relevance to clinical practice. Researchers usually do not go out of their way to be obtuse or uncommunicative; some may not write well, but the poor writing is unintentional. A number of leading researchers have played important roles in the nonresearch professional aspects of communicative disorders. Some researchers are haughty and aloof; so, too, are some clinicians.

Now for the caveat. Although we are attempting to lead the interested clinician through the process of research evaluation, a fundamental prerequisite to intelligent consumership is the fund of substantive information possessed by the reader. To illustrate, let us take a research article on stuttering and, further, let us consider the introductory section devoted to developing the need for the study and the purpose 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 strong 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 communicative disorders has made it almost impossible for one person to be truly knowledgeable in all substantive areas.
PART I / Basic Considerations in Evaluating Research

This is not a book on stuttering, aphasia, cleft palate, or audiometry; therefore, we have 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 have provided a framework for evaluation, the framework must rest on a substantive foundation that the reader must have.

Study Questions

1. Read the following article:
   Examine the relationship between the physical and behavioral measurements used in this study.

2. Read the following article:
   What are the major issues raised by Cacace and McFarland regarding the empirical evidence that suggests central auditory processing disorders are related deficits in the auditory system exclusively?

3. Read the following article:
   Summarize Stevens’s viewpoint on the relationship between the schematic and empirical aspects of science. What is the meaning of Stevens’s reference to the two faces of Janus?

4. Read the following articles:
   Discuss the manner in which the authors deal with the relationship of empirical evidence to theory. Are theories cited that represent a synthesis of previous evidence? Are new theories advanced that need to be confirmed by future empirical evidence?

5. Read the following article:
   What does Perkins say about the relationships among research, theory, and therapy?
6. Read the following article:
Contrast the “myths and realities” of EBP discussed by Schlosser.

7. Read the following article:
From the example provided in the text, explain why a clinician’s decision not to use a new treatment program is evidence-based practice.

8. Read the following article:
Discuss why it is important to have a solid research base in communicative disorders. What is the future for online publishing of ASHA journals?

REFERENCES