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DANE • CARHART EVALUATING RESEARCH THIRD EDITION

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THIRD EDITION

EVALUATING RESEARCH

METHODOLOGY FOR PEOPLE WHO NEED TO READ RESEARCH

FRANCIS C. DANE • ELLIOT CARHART

Evaluating Research

Third Edition

For Linda & Lindsay

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Evaluating Research

Methodology for People Who Need to Read Research

Third Edition

Francis C. Dane and Elliot Carhart

Radford University

SAGE

Los Angeles | London | New Delhi
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BRIEF CONTENTS

DETAILED CONTENTS

PREFACE

Welcome to the world of research. Having taught research methods in one form or another many times over many years, we know that you probably are taking this course because it is required and not because you have an intrinsic interest in understanding and using research. Whether you do or do not have an intrinsic interest in research, we have written this text with you, the student, foremost in mind. Our goal is to enable you to have the knowledge required to evaluate research and critically use empirical results as you attempt to engage in evidence-based practice in your profession.

We have tried to present the material with a style designed to pique your interest. We thoroughly enjoy research, the methods employed to produce it, and the application of research results to practice and policy, and we have tried to convey that enjoyment throughout this manuscript. We admit to a straightforward attempt to help you achieve that same level of enjoyment. For those who are thrilled about this course, welcome to the family; for those not so thrilled, we hope to welcome you to the family by the time you finish reading this book. Either way, we want you to develop a greater appreciation for the ways in which consuming research can add to our understanding of the way the world works and how we can enhance our efforts to improve the world, which is basically what practice should be—a way to improve the world.

Trying to convey our enjoyment of research is not the only aspect designed to make your mastery of the material more efficient. The running glossary is one example. The first time a new term is introduced, it appears in **boldface** type. Definitions appear in the text in *italics*, so you don't have to interrupt reading to find the term in the back of the book. The most important definitions appear in brief versions in the margins, just in case you need a reminder as you get a page or two ahead of when you first encountered the word. In case you can't remember a definition and can't remember where in the text the definition is, there is also an end glossary.

This third edition has many updated examples of research that span a wide range of research topics and disciplines. Every chapter has been reworked to focus more intently on how to use research to engage in evidence-based practice. There is a new chapter on how to access research, an expanded chapter on qualitative research, and a heavily updated chapter on conceptual statistics as well as a slightly different order of the chapters to bring them more in line with the order in which you will encounter information in a research article.

Finally, we encourage you to contact us with your reactions to the book. We would appreciate any comments, good or bad, that you have about this book. Send an e-mail to us; Frank's address is fdane@radford.edu; Elliot's address is ecarhart@radford.edu. If you prefer to send anonymous comments, Frank's postal address is RUC 907, 101 Elm Avenue, Roanoke, VA, 24014, USA, and Elliot's postal address is RUC Emergency Services, 101 Elm Avenue, Roanoke, VA, 24014, USA. Compliments are always delightful, but complaints are the source of improvement. If you don't like something, let one of us know. We will try to change it in the next edition. In the meantime, we hope you enjoy your sojourn into research. It really is exciting.

Frank Dane & Elliot Carhart
Roanoke, VA

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Although the author line contains only our names, this book was not written without considerable input from many different people. There are too many to list everyone, but some deserve specific mention. We remain grateful to Vicki Knight, SAGE acquisitions editor, for seeing the realized promise in the first edition and suggesting a second, and to Leah Fargostein, SAGE acquisitions editor, who shepherded the second, suggested the third, and saw us through to the completion of what you now are reading. Everyone else at SAGE who was involved in the project also deserves a great deal of gratitude. They made the process of revising as painless as possible. Please pay attention to the names listed on the copyright page and thank them if you ever run into them, for they, too, made this book possible.

The reviewers who provided careful, informed commentary also deserve thanks, for they improved the content more than we could have done on our own.

Frank is particularly grateful to Dr. Jeffery Aspelmeier, Chair of Psychology at Radford University, for his support during the completion of the revision, and to all of the RUC Library staff, especially Head Librarian Jamie Price, without whose assistance in accessing research articles the content of this book would have suffered greatly. Frank has lost count of the number of people who piqued his interest in, provided information about, and generally enhanced his knowledge about, skills in, and experience with conducting research as well as his passion for communicating about research. There are too many to list, but he does have to mention Jackie Dane Fussell, partly because it was she who first taught him the value and thrill of satisfying curiosity, and partly because, even though she is no longer with us, he still can imagine her saying, “What, you wrote a book and didn’t mention your mother?” Finally, Frank’s greatest acknowledgment, gratitude, and thanks are reserved for Linda Dane. Her companionship, love, trust, encouragement, confidence, and all things valuable are without limit.

Elliot is grateful for the influence of countless individuals who have fueled his intellectual curiosity and, in varying ways over time, helped shape his passion for teaching and research. By extension, they, too, have contributed to this book. In addition, Elliot explicitly owes a debt of gratitude to Joshua Salzman and Dr. Frank Dane for the countless hours and immeasurable energy they both put forth serving as research mentors and scholarly collaborators. During Salzman's tenure as director of the Critical Care Research Center at Regions Hospital (St. Paul, MN), he graciously shared his knowledge, experience, and perspective, coupled with the unwavering provision of encouragement. Similarly, Dr. Dane's contributions as a mentor and friend are beyond measure, and Elliot is particularly grateful for the opportunity to join his mentor in writing this book. Finally, and most importantly, Elliot wishes to express his infinite gratitude for Lindsay, Logan, and Wyatt Carhart and their unwavering support, patience, and love.

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1

INTRODUCTION

How can our intellectual life and institutions be arranged so as to expose our beliefs, conjectures, policies, positions, sources of ideas, traditions, and the like—whether or not they are justifiable—to maximum criticism, in order to counteract and eliminate as much intellectual error as possible?

—W. W. Bartley (1962, pp. 139–140)

OVERVIEW

This chapter is an introduction to research. Like most introductions, it is a broad overview of what is to come. Admittedly, it is also an attempt to pique your interest. You will learn what research is (and is not), and you will become familiar with the broad goals that commonly drive the pursuit of any given research project. As part of this journey, you will also develop a mental framework for consuming research, a foundation upon which you will further develop your ability to understand and evaluate research conducted by others. We'll also try to dispel some common misconceptions about research and we'll explain how, with few exceptions, no single research method is necessarily better than any other. Lastly, you will learn about some of the most common ethical concerns specific to conducting research, and specifically how those ethical principles apply to consumers of research.

INTRODUCTION

You may have a song (or two) to which you have attached so much meaning that you want to stop everything when you hear it and concentrate on listening and conjuring memories associated with the song. For one of us that song is "Who'll Stop the Rain?" (Fogerty, 1970) performed by Credence Clearwater Revival. For those of you who have not heard the tune, the rain is a metaphor for the confusions and mysteries of life. Somewhere behind all those rain clouds is the sun, answers to the mysteries of life. Although everyone has been looking for the sun, the singer continues to wonder who'll stop the rain. As you read this, you may be wondering the same about research, the course you are taking, and this book. What you need now is some sun, but all you see is rain. We'll try to provide some sun, although we don't promise to clarify the mysteries of life.

We need not point out how important getting things right in healthcare has been, is, and will be in our lives. We also need not point out that programs, therapies, treatments, and other things don't always work out the way they should; they often involve unintended consequences, are sometimes more costly than necessary, and occasionally don't do much of anything. In Fogerty's words, they can become "five year plans and new deals, wrapped in golden chains." Like noted methodologist Campbell (1969, 1971), we believe understanding research methods will help you to learn enough to remove some of those golden chains. In our complex and rapidly changing world, we cannot afford to be armchair theorists trying "whatever" in hopes that it works, nor can we depend upon others' opinions, however well considered, as we search for understanding and try to make the world a better place. We need to use research to sort what we already have as well as to point the way to more useful treatments and programs. But incorporating research into our everyday, professional behavior must involve more than accepting on faith what "the experts" write. The plethora of dissemination outlets for research reports enables just about anyone to claim to have published a scientific report, often without any review, so we can no longer count on the experts to be, well, experts. We need to become experts ourselves, not in conducting research but in critically evaluating research done by others so that we can determine whether or not that research is good enough to apply to and incorporate into our professional activities. Without the ability to read research critically, we cannot truly engage in evidence-based practice (APA Presidential Task Force on Evidence-Based Practice, 2006; Sackett et al., 2000).

Therefore, this book is about research: what it is, how to evaluate it, how to tell people about it, and how to use it. It is about trying to find an answer to the question posed by Bartley, and it is about stopping Fogerty's rain. As you read further, you will come to realize that research is one of the means by which people avoid making intellectual errors. That is, research is a part of life, a particularly exciting part of life that involves trying to discover the whys and wherefores of the world in which we live. As you learn about research, we hope you will also have some fun and maybe, just maybe, you might even find the sun.

Definitions

It is always best to start at the beginning when attempting to learn a new topic, and for research that beginning is a definition of research. Unfortunately, it is not easy to arrive at a single definition of research. The online edition of the *Oxford English Dictionary* (http://www.OED.com) includes the definition "systematic investigation or inquiry aimed at contributing to knowledge of a theory, topic, etc., by careful consideration, observation, or study of a subject." Then, there is Kerlinger's (1973) definition: "systematic, controlled, empirical, and critical investigation of hypothetical propositions about the presumed relationships among natural phenomena" (p. 11). Both of these definitions, however, are a little too restrictive, because research is not always systematic and it is not always careful and controlled. Even when research does fit the above description, the process can still feel surprisingly messy at times. At the same time, even poorly conducted research is still research.

When it comes down to what is important, the definition of research is rather simple. **Research** is *a critical process for asking and attempting to answer questions about the world*. Sometimes asking and attempting to answer questions involves a questionnaire, sometimes an interview, sometimes an experiment, and sometimes an entirely different method. Simple definitions, however, can be misleading. There is more to research than its definition, or this would be the last page of the book.

Research, as a critical process, is one of the tools we use to achieve Bartley's state of maximum criticism. We do so not by pointing out only negative qualities of a particular topic but by examining all of its qualities—good, bad, or indifferent. Regardless of the condition(s) to which our practice is brought to bear, the ultimate subject of our criticism is human behavior, something about which all of us already know a great deal. That knowledge, however, can sometimes get in our way. If, for

Research a critical process for asking and attempting to answer questions example, we fail to examine critically some aspect of human behavior because "everyone knows it is true," then we have fallen short of the goal of evidence-based practice. We should, instead, be like a little child who continually asks "Why?" Of course, we are more sophisticated than little children, but we need to return to research to evaluate the answers we obtain to our questions. As critical questioners, we need not believe every answer we obtain. For that matter, research enables us to ascertain whether or not we have even asked the appropriate question.

One of the appropriate questions we must ask is, simply, "Why pay any attention to research?" To answer this, we must make a brief foray into **epistemology**, *the study of the nature of knowledge, of how we know what we know*. In the late 19th century, Peirce (1877) codified the four primary methods we use to decide how we know what we know: (1) a priori method, (2) authority, (3) tradition, and (4) science. As we consider each of the four methods, keep in mind that there are questions that are more amenable to one of these methods than another; no method of knowing is best for all questions.

Also known as logic, intuition, and sometimes faith, the **a priori method** *defines knowledge as anything that appears to make sense, to be reasonable*. There are some advantages to the a priori method, not the least of which is the ease with which we can develop certainty or relieve ourselves of doubt. Thus, Descartes (1637/1993) employed the a priori method to arrive at his famous decision about how he could be certain that he was real, that he (and the rest of us) existed: *cogito ergo sum*. As you might suspect, developing certainty is also the chief disadvantage of the a priori method; it is all too easy to close inquiry prematurely because we hit upon a reasonable answer. Thus, many people are certain that most medieval people believed the earth was flat (Russell, 1991), some are certain that aliens from outer space have abducted people (Carroll, 2005), and others are certain that the best way to prevent teen pregnancy is by teaching abstinence (O'Donnell et al., 2007). Like all of the other methods of inquiry, the a priori method does not guarantee that the knowledge developed will be useful knowledge. The quality of knowledge derived in this way is a function of the quality of the reasoning employed by the individual producing the knowledge.

In the context of epistemology, **authority** involves *believing something because the source of the knowledge is accepted as inherently truthful*. As children, for example, we believed our parents. Sometimes the belief was correctly placed—stove burners can be hot—and sometimes not—tooth fairies do not exchange our baby teeth for money or

Epistemology the study of how we know what we know prizes. As adults, we rely on authority as an epistemological method when we accept an expert's conclusion simply because the person is an expert. This can lead to positive outcomes, such as a much-needed prescription for hypertension medication, or it can lead to negative outcomes, such as sterilizing people because they are "mentally defective" (Gejman & Weilbaecher, 2002). When we rely on authority for knowledge, the quality of the knowledge rests upon the quality of the authority.

Tradition involves *believing something because of historical precedent or because it has always been believed*. For example, we tend to eat oysters only in months that include an "r" in the name. The reasoning is sound; warmer weather makes safe storage and transportation more difficult, and bacteria are more plentiful in warmer water (Miliotis & Watkins, 2005), but rapid refrigeration at harvest makes the tradition less important now than it was before such techniques were developed. A very different tradition, shaking hands when meeting someone, may have its roots in demonstrating that one is not capable of holding or reaching for a weapon (Morris, 1971). Such concerns are not as relevant as they once were, but the tradition continues with a very different rationale. We now believe we can determine someone's personality from their handshake, and we use that belief to project a desired impression of ourselves (Chaplin et al., 2000). We continue to engage in the behavior because "we've always done it that way" and to believe knowledge is produced from the tradition, even when the original reasons no longer make sense. Thus, what we know from tradition may be useful but only as long as the reasons for the tradition are valid.

Science, *the process of using systematic, empirical observation to improve theories about phenomena based on a set of rules that defines what is acceptable knowledge*, enables us to develop knowledge by testing our explanations of the world against what we can observe in the world. For example, we know that training nurses in advanced cardiac life support techniques (ACLS) increases the success of in-hospital cardiopulmonary resuscitation about fourfold (Dane et al., 2000). The researchers systematically compared the resuscitation outcomes of people who were discovered to be in distress by an ACLS-trained nurse with the outcomes of people who were discovered by a nurse not yet trained in ACLS. Prior to that study, many people believed ACLS training for nurses would benefit patients who required resuscitation, but that explanation was not tested. Unlike other ways of knowing, however, science includes continual testing of explanations. As you will learn in the next chapter, no theory is ever accepted as true, never again to be examined. Similarly, science continues to

Science the process of using systematic, empirical observation to improve theories develop new questions based on obtained answers. For example, other researchers have demonstrated that nurses trained in ACLS are as capable of leading a resuscitation attempt as are physicians (Gilligan et al., 2005). Thus, while the knowledge we obtain from science is only as good as the data generated from research, the continual generation of data serves to produce an accumulation of knowledge in which misinterpretations of data are corrected instead of perpetuated.

In summary, the four different ways of knowing are equally useful, depending upon the questions being asked and the knowledge desired. (See Table 1.1 for a summary of epistemological methods.) Science cannot, for example, determine how we can know we are real, and a priori reasoning cannot determine whether ACLS training for nurses prolongs lives. Science cannot explain why we began to shake hands, but tradition cannot determine whether or not we can learn something about a person's personality by shaking their hand. Science is best used to gain knowledge about empirically testable ideas or explanations. That covers an extremely large number of phenomena but does not cover all phenomena. We hope to convince you that science, through empirical research, is an effective way to make decisions about the utility of what we do as professionals.

UNDERSTANDING CHECK

Consider the four epistemological methods through which we decide how we know what we know, then try to think of at least one example of knowledge you can attribute to each method.

TABLE 1.1 ⬢ A Summary of Epistemological Methods

Method	Process for Establishing Knowledge, Deciding What Is Truthful
A priori	Accepting information because it makes sense or is reasonable through the application either of intuition or deductive logic
Authority	Accepting information because the source is believed to be inherently truthful or knowledgeable
Tradition	Accepting information because it has always been accepted; historical precedent in one's family, government, society, culture, or other socialization unit
Science	Accepting information because it was obtained through systematic, empirical observation

GOALS OF RESEARCH

The ultimate goals of research are to formulate questions about testable phenomena and to find answers to those questions. Nestled within these are other goals toward which researchers strive. No one can ask all of the questions and no one can find all of the answers to even a single question, so researchers need to find some way to organize what we attempt to do. The immediate goals of research—exploration, description, prediction, explanation, and action—provide us with an organization for how to evaluate research.

Exploration

Exploratory research *involves an attempt to determine whether or not a phenomenon exists*. It is used to answer questions of the general form, "Does *X* happen?" Exploratory research may be very simple, such as noting whether men or women (or boys or girls) are more likely to sit toward the front of a classroom. If one or the other gender does sit in front more often, then we may have discovered a social phenomenon that merits further investigation (Okpala, 1996). More recently, Elmer et al. (2015) used a registry of intensive-care patients who had to be reintubated during the course of their treatment to investigate whether or not complications were different and/or more numerous for the first compared to the last intubation. They did find that complications were more frequent with the last intubation. Their discussion section contains some material regarding potential reasons for this difference, but they and other researchers will have to conduct considerably more research as they follow up on this finding.

Exploratory research may also be very complex, and sometimes the object of exploratory research is the research process itself. For example, building upon Durkheim's (1951/1897) and many other researchers' work on suicide, Jacobs (1967) noted that researchers were generally failing to consider an important source of information about suicide—the notes left behind by those who committed the act. His analysis of the content of such notes revealed that many people valued some degree of uncertainty in their lives. Specifically, people who wrote the notes appeared to prefer the uncertainty of death to the certainty that life would continue to become worse.

Exploratory research involves an attempt to determine whether a phenomenon exists

Regardless of the topic of exploratory research, the basic question addressed by the researchers involves whether or not something exists or is happening. A myriad of questions usually follow the initial finding, but those additional questions do not detract from the finding per se. Even though they, and we, cannot yet explain why last intubations tend to involve more complications than first intubations, Elmer et al.'s (2015) finding, like those of all exploratory research, needs to be somehow incorporated into the understanding and practice of those who may deal with patients who need to be reintubated.

Description

Descriptive research *involves examining a phenomenon to characterize it more fully or to differentiate it from other phenomena*. Munsterberg (1913), for example, began his inquiries into the consistency and accuracy of eyewitness testimony after wondering about his own perceptions following a burglary at his home. He wondered why he thought, and testified, that the burglars had broken through a basement window when they had actually forced open a door. Since he first questioned his own perceptions and began conducting systematic research on the topic, a number of researchers have been investigating eyewitness accuracy and applying their results to courtrooms and other settings (Strauss & Smith, 2009). Empirical attempts to describe more comprehensively the limits of eyewitness accuracy have been conducted from the time of Munsterberg's first musings to the present (Rounding et al., 2014), and they are likely to continue well into the future. Indeed, even the most recent studies on eyewitnesses have some basis in the research Munsterberg conducted at the beginning of the previous century.

Perhaps the most extensive descriptive research is that conducted by the US Bureau of the Census. The goal is to count and describe the characteristics of the entire US population, and the impact of this research is extensive. Billions of dollars in federal, state, and municipal aid shift with the changing population. Congressional districts appear and disappear, and hundreds of researchers rely on these data to assess the representativeness of their own research samples (e.g., DiBennardo & Gates, 2014).

Descriptive research involves examining a phenomenon to characterize it more fully

Descriptive research captures the flavor of an object or event at the time the data are collected, but that flavor may change over time. The US Census Bureau, for example, repeats its very costly research every 10 years, engages in interim data collection every year, and updates results regularly (Salvo & Lobo, 2013). Other research results may change even more rapidly. Research on unemployment is conducted monthly, and public opinion polls about certain issues may be conducted as often as every day.

Research results are not timeless, simply because change is one of the complexities inherent in our world. Descriptive research should be evaluated the way one might evaluate a photograph; it captures a moment in time but should not be compared to a video.

Prediction

Sometimes the goal of research is **prediction**, *identifying relationships that enable us to speculate about one thing by knowing about some other thing*. While this may seem complicated, it really is not. We all conduct and use the concept of predictive research every day. **Predictive research** *involves any study in which the purpose is to determine whether a relationship between variables exists such that one can use one of the variables in place of another*. We know, for example, about the relationship between hours on a clock and the probability of a certain business being open. Or we understand the relationship between a thermometer reading and the necessity of a coat when going outside. Or we know about the relationship between the scores on entrance exams and performance in the first year of college (Camara & Kimmel, 2005) or graduate school (Kuncel et al., 2001).

Predictive research also gives clues about whether or not one variable is the cause of another. We can learn from the research of Angela Lee Duckworth and her colleagues, for example, that the personality variable known as *grit* may be an important component of success. There are studies in which grit is related to success in spelling bees (Duckworth et al., 2011), to performance in elite colleges (Duckworth et al., 2007), to performance as a teacher (Duckworth et al., 2009), and even to success in Army Special Operations Forces training (Eskreis-Winkler et al., 2014). Note the careful wording of the first sentence in this paragraph—"clues about" causes. Because Duckworth and her colleagues were not able to create different levels of grit among their participants—they could not control grit—they were not able to test grit directly as a cause of success.

Predictive research is any study to determine whether a relationship between variables exists

Explanation

Explanatory research *involves examining a cause–effect relationship between two or more phenomena*. It is used to determine whether or not an explanation (cause–effect relationship) is valid or to determine which of two or more competing explanations

Explanatory research involves examining cause–effect relationships is more valid. Explanatory research usually involves creating two or more groups of participants by manipulating some aspect of the situation and assigning participants to the groups that were created.

Oermann et al. (2011), for example, conducted an experiment to test whether or not brief periods of practice were sufficient to maintain nursing students' cardio-pulmonary resuscitation (CPR) skills for a year. To do this, they assigned some of the students to complete six minutes of practice per month, while the other students were not assigned any practice time. Every three months, some students from both groups were tested on hand placement, compression rate, compression depth, ventilation rate, and ventilation volume. While both groups were able to maintain proper rates, students in the brief-practice group were better able to maintain proper compression depth (push hard enough to get enough blood flowing) and proper ventilation volume (get enough air into the lungs). From this study, we learn that practice is a cause of performance for some CPR skills. Oermann et al. did not test specific explanations for the practice effect, however, so we don't know why practice helps to maintain skills, but we do know that practice causes better performance of CPR skills.

Action

Research can also be used to attempt to do something about a particular phenomenon. **Action research** *refers to research conducted to solve a social problem* (Lewin, 1946). Action research can involve any of the previously mentioned goals but adds the requirement of finding a solution, of doing something to improve conditions, of generally making the world a better place beyond adding new knowledge. For example, Becker and Seligman (1978) noted that many people continue to run their air conditioners even though the outside temperature is lower than the temperature inside their house. To address this problem, Becker and Seligman conducted an experiment to test potential solutions to this instance of wasted energy. They created four different groups by providing some people with a chart showing them how much energy they were using, other people with a light that flashed whenever the outside temperature was lower than the inside temperature, still other people with both chart and light, and still others with neither chart nor light. They measured the amount of electricity used by each of the four groups and discovered that the charts did not alter people's energy efficiency. The signaling

Action research is conducted to solve a social problem device, however, decreased electricity consumptions by about 16%. Through their action research, they provided a solution to the problem of wasted electricity: a simple signaling device.

Action research, in general, is an extremely important aspect of science, for it is through action research that we are able to test applications of other research results. We might all want to make the world a better place, but the complexity of the world requires that we test proposed solutions to problems before applying them on a large scale.

Research goals affect the ways in which we attempt to evaluate and eventually apply research. It would not be appropriate to reject research because it did not meet goals it was not designed to meet. We should not, for example, devalue Becker and Seligman's research because they did not explain why flashing lights created more efficient use of energy. Explaining why was not part of their project. We do need to understand the initial goals of every research project, but understanding the goals is only the beginning of evaluating research. The five goals of research are described in Table 1.2.

UNDERSTANDING CHECK

How might your understanding of the five goals of research influence how you interpret the findings reported in a scholarly article?

TABLE 1.2 ⬢ The Five Goals of Research Expressed as Abstract and as Concrete Questions

Abstract Questions	Concrete Questions
Exploration: Does it exist?	Do suicide notes contain any information about people's motivations concerning suicide?
Description: What are its characteristics?	How accurate are eyewitnesses?
Prediction: To what is it related?	Is grit related to success in life?
Explanation: What causes it?	Does practice maintain CPR skills?
Action: Can this be used to solve a problem?	Can feedback about outside temperature be used to help people to conserve energy?

EVALUATION OF RESEARCH

Before we apply research results, we have to accept them as reasonable, which means we need to be able to know the extent to which they are worthwhile. Evidence-based practice involves much more than simply paying attention to the latest research. We need to evaluate research results and the methods used to produce them, and we need to do so critically. Critical evaluation involves noting both positive and negative aspects, the good and the bad. Critical evaluation also involves noting the indifferent and irrelevant, the things to which research is not related. As consumers of research, we need to be able to determine which research project is relevant and which is not. To construct a systematic framework for evaluating research, we have borrowed some familiar questions from journalism: who, what, where, when, why, and how. These questions will be used throughout the remainder of the text, which also allows us to provide a preview of what is to come in subsequent chapters.

Who

The *who* of a research project involves three different questions: Who are the researchers? Who are the participants? Who are the consumers? The answers, of course, vary from project to project, and all have something to do with how one evaluates the project.

We learn from the first page of a research article the names of the authors, but asking about the researchers involves more than simply discovering their names. What we really want to know is something about the characteristics of the researchers, their competence, and their biases. We presume researchers are competent until we learn otherwise, but once we learn otherwise, we should be unwilling to consider their research seriously. For example, you would be hard-pressed to find anyone willing to place a great deal of faith in research conducted by Sir Cyril Burt in light of his fraudulent research on intelligence (Hearnshaw, 1979). It may sound cruel, but our recommendation is to discount all research by someone for whom a research article is retracted on the grounds of misrepresentation.

Beyond outright fraud, one rarely has specific information about a researcher's reputation at the outset of a career in evaluating research. As you read critically, however, you will develop opinions about specific researchers as you read their work. Some write better than others, some include more detail than others, and some make you think more than others. As an evaluator of research, it is important to avoid letting judgments about the researcher weigh too heavily in our judgments about their research. Science is about the data, not about who collected them. When we allow ourselves to become over- or underimpressed by someone's writing or institution, then we are no longer engaged in science; we are engaging in authority or another of Peirce's ways of knowing.

In the abstract and method sections of an article, we learn about the participants in a research project. They, too, are an important consideration in the evaluation of research. Should you read Oermann et al. (2011), for example, you would learn that their participants included nursing students from 10 different programs throughout the United States and included different types of nursing programs: diploma, associate degree, and baccalaureate. The comprehensive source of their participants means that their results should be given different weight than results obtained from students in a single institution or a particular type of nursing program.

The intended consumers of research also play a role in one's ability to evaluate a project. Researchers tend to write their reports for other researchers as opposed to the general public. They often use jargon that they expect readers to understand. At this point, the phrase *a 2 × 2 factorial design* probably doesn't mean much to you, but it denotes a specific research design. The design carries with it a variety of assumptions, implications, and techniques, all of which would be very time consuming, not to mention boring, to describe every time someone wrote about it. Inability to understand jargon makes it difficult to evaluate research, which is one of the reasons for the glossary in this text. At the completion of this course, you will be evaluating research quite differently from the way you evaluate it now.

What

We learn about the *what* of research primarily from the introduction, in which researchers explain the topic as well as the theory on which the research is based. It should be obvious that different research topics require different methods. Attempting to interview people who have committed suicide is ridiculous, not to mention macabre. On the other hand, an interview or survey is entirely appropriate for a project dealing with energy use. What may not be so obvious is that different questions about the same research topic may require different methods. If researchers are interested in perceptions about electricity use, interviews may be just what they need to use. But if they are interested in actual electricity use, then they might do as Becker and Seligman (1978) did and read meters instead of asking people how much electricity they used.

Through the theory they use as they derive their research questions, researchers also affect the manner in which they conduct the research. Sales (1972), for example, specifically tested Marxist theory, so he included economic conditions (one of the major components of Marxist theory) as one of his research measures. If instead he was interested in theories about psychological depression, he probably would have used some sort of depression scale and ignored economic indicators. Both economics and depression may be related to membership in a religious organization (Jenkins, 2003), but which variable gets included in a single research project is determined by the theory from which the research question is derived. The evaluation of research involves assessing whether or not what is included in research is appropriate to the theory on which it is based.

Beyond the level of theory, **worldview**, *the basic set of untestable assumptions underlying all theory and research*, also plays an important role in research. Kamin (1974), for example, pointed out that researchers were willing to accept the notion that men and women did not differ in intelligence, and so those developing intelligence tests generally excluded from intelligence tests items that produced gender differences. They were not, however, so willing to accept the notion that racial and ethnic minorities were as intelligent as themselves. Thus, early measures of intelligence did not exhibit a gender bias but did exhibit a number of racial and ethnic biases. Political beliefs may also affect the topic one selects for research (Frank, 1981). Understanding a particular researcher's worldview is generally not something one obtains from a single article, however. Worldview is something we come to know from a collection of someone's articles, including responses to commentary about the research.

Where

Worldview the basic set of untestable assumptions underlying all theory and research

Also from the method section, we learn about the *where* of research, which includes the physical and social environment in which the research was conducted. Certain conditions are possible in one setting but not in another, and some settings do not allow certain types of research to be conducted at all. We cannot, for example, legally study jury deliberations in any systematic fashion by recording what occurs in the deliberation room, although some researchers have been able to do so under extraordinary circumstances (Devine et al., 2001; Ellison & Buckhout, 1981; Simon, 1975). Similarly, we cannot ethically examine reactions to an emergency by shouting "Fire!" in a theater. On the other hand, we can study simulations of juries (Cox et al., 2013) as well as simulations of emergencies (Helton et al., 2014; Kaplan et al., 2012). Bringing trials or emergencies into a research laboratory may introduce an element of artificiality, but artificiality alone is not grounds for devaluing a research project. Just as it is with other evaluation questions, it is necessary to engage in critical assessment of the relationship between the physical setting and the research goals.

The influence of the social environment may include very general aspects of the society as well as cultural biases. Someone doing research in a country without a jury system—Japan, for example—might never decide to use a jury simulation to study group decision-making. Similarly, the belief in the United States and Canada that beauty was in the eye of the beholder kept social scientists from systematically studying the effects of physical attractiveness until the 1960s. The first few studies about physical attractiveness, however, blew that belief right out of the water. After decades of research and its attendant publicity, few of us have any trouble responding to a question that begins with "On a scale from 1 to 10, how attractive is …?" and even fewer of us doubt our rating will agree with those of many others (Adams, 1977; Rhodes et al., 2005).

When

From the year of publication, we learn the time frame of a particular study. Time frame may, of course, alter its utility, but it can also be the major purpose of the study. Science operates on the basis of cumulative knowledge most of the time (see, e.g., Fleck, 1979). Each bit of information adds to what is already known. In 1990, for example, it was concluded that a daily, low-dose aspirin was useful for preventing cardiovascular disease (Ewy, 2014). As daily use became prevalent, the relationship between daily aspirin and other diseases could be studied (Illingworth & Parmet, 2015), including cancer (Orenstein & Yang, 2015), and eventually to very specific genotypes (Rupp, 2011). During that same time period, there were occasional reports of complications concerning aspirin (e.g., Patel et al., 2015), but such reports did not negate the earlier research. Someone paying attention only to the latest research might well have felt as though they were the ball in a ping-pong match—take it, don't take it, take it, don't take it, take it—but research should not be consumed one study at a time in a vacuum, so to speak. Knowing when research was conducted allows us to place it in the context of existing information about the research topic.

Changes in conditions over time may themselves be the focus of research, and such information comes from the method section of the research article. Oermann et al. (2011), for example, found no differences between the brief-practice and no-practice groups in terms of adequacy of CPR compression depth in the first three to nine months of their study. By 12 months, however, the differences were considerable, and those differences remained even after a refresher course.

Why

We have already dealt with the general reasons why research is done: exploration, description, prediction, explanation, and action. From the introduction of the article, we also learn more specific reasons. We learn, for example, what the authors think about how the research results fit into the existing knowledge about the topic.

Our critical consumption of the introduction gives us contextual information about the research. Because we want to know about all of the research relevant to a specific topic, we use the introduction to learn of the existence of additional research to include in the evidence relevant to our professional practice. Oermann et al. (2011), for example, cited 12 different studies about the decline in CPR skills that occur over time and another eight studies about the utility of practice to reduce or prevent such declines. If we are reading Oermann et al. to learn about preventing the decline of CPR skills and did not already know about all 20 studies, then we have additional information to incorporate into our body of evidence. Reading critically about research, however, means that we have to get and read the additional articles. We should not merely accept what Oermann et al. wrote about the other research; that would be using Oermann et al. as authority (Peirce, 1877) instead of engaging in science.

How

The goals of research affect how it is done (its methods), and so we turn to some of those methods as a way to preview the remainder of this text. The design and procedures are likely to be the most critically evaluated aspects of research and so deserve the greatest amount of attention.

The *how*s of research range from the manner in which one obtains an idea to the ways in which one writes about the research results, and understanding each of these is useful in our attempts to consume research conducted by others. Nestled between these two activities are issues concerning measurement, design, data analyses, and interpretations. In addition, there are many aspects of research that may or may not be relevant to a particular research project. Scale construction and obtaining large, representative samples are just two examples of such aspects.

Like most of life, research can be extremely boring if you only read about it with no particular purpose in mind. Although you may not be able to apply everything discussed in this text, you can think about the relevancy of various topics to your professional interests throughout the text. As you continue to read, think about how you might use the information you are reading in your current or your intended profession. Imagination cannot replace activity, but imagination is better than nothing. At some point, and we hope it is soon, you may be in a position to prepare a research-based manuscript, even if it's only a memo suggesting a change in process in your workplace. If you have thought about it ahead of time, you'll be able to take advantage of the opportunity.

UNDERSTANDING CHECK

In what ways might the use of jargon, and other related nuances of scholarly writing, create challenges for consumers of research?

ETHICS OF CONSUMING RESEARCH

We continue to be amazed that codes of ethics for researchers, particularly those who do research on human beings, did not emerge until the middle of the 20th century. To that point, the public, including researchers, assumed that scientists had sufficient integrity to make formal guidelines and regulations unnecessary, but the torture and other inhumane treatment of concentration camp inmates by the Nazis during World

War II convinced the world community that guidelines were necessary, and the Nuremberg Code was enacted (Nuremberg Military Tribunal, 1949). The code emphasized the importance of **informed consent**, *the process by which potential research participants are provided with all the information necessary to allow them to make a reasonable decision concerning their participation*, and a balance of risks and benefits such that the latter outweighed the former (Gorman & Dane, 1994). Expansion of the code for physicians and other medical researchers resulted in the Declaration of Helsinki (World Medical Association, 1964), which further clarified the relationship between research and treatment.

In the United States, breaches of research ethics, again primarily in biomedical research (see, e.g., Jones, 1993), led to the passage of the 1974 National Research Act. The act included the creation of the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979; Seiler & Murtha, 1981), the purpose of which was to recommend an overall policy for research with human participants. The commission provided a report that led to a number of changes in the ways in which biomedical and behavioral research is conducted. Eventually, in 1981, a formal set of regulations was adopted in the United States ("Final regulations amending basic HHS policy for the protection of human research subjects," 1981). The Federal Policy for the Protection of Human Subjects, which was known as the Common Rule, mandated the establishment of institutional review boards (IRB) to conduct prior review and continuing oversight of all human subjects research conducted within the purview of any institution or organization that received federal funds. The Common Rule was amended in 1985 and again 2017 ("Revised Common Rule," 2017). The latter of these revisions, which took effect in 2018 became to be known as the Revised Common Rule, while the previous common rule is now identified as the pre-2018 Common Rule. As one might expect, this latest iteration was foremost intended to enhance existing protections of human subjects in research, yet the Revised Common Rule also aimed to reduce some of the administrative and regulatory burdens that developed over time as a result of changes with the types of human subjects research commonly being conducted (Basic HHS Policy for Protection of Human Subjects, 2018). While the regulatory authority of the Revised Common Rule is limited to the United States, similar developments in

Informed consent the process of enabling potential research participants to make a reasonable decision concerning participation other countries have led to a nearly global adoption of some form of guidelines or regulations concerning the conduct of human subjects research (Office for Human Research Protections, 2007).

The existing regulations and guidelines provide considerable direction as researchers attempt to balance the mutual obligations of developing new knowledge (Cook, 1981; Mindick, 1982) and treating individuals involved in our research with proper consideration (Dane, 1990). If you find yourself in a position to conduct research, or direct others to conduct research, you should become familiar with these guidelines and regulations. For the purpose of consuming research, however, it is more important to understand the principles that are used to guide the development of such regulations and to recognize the ways in which these principles apply to research consumption.

Ethical Principles of Research

In the Belmont Report, the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (1979) established three principles by which all research should be guided—respect for persons, beneficence, and justice—and to these have been added trust and scientific integrity (Dane, 2006, 2007b; Dane & Parish, 2006). These five principles will form the basis of our discussion of the ethics of research consumption.

Respect for Persons

Respect for persons is a principle derived from the ethical theory proposed by Immanuel Kant (1788/1997), from which we obtain the admonition never to use another human being merely as a means to an end; that is, this principle involves maintaining others' **autonomy**, *the ability to direct oneself, particularly through the exercise of independent processing of information*. We see this implemented, among other ways, in the presumption of informed consent for research participants. In the context of research consumption, respect for persons involves giving researchers proper credit, representing others' work accurately, and providing comprehensive information to those who will benefit from our consumption of research.

At this point in your academic experience, you are well familiar with the requirement to use quotation marks or other, similar conventions whenever you use

Autonomy is the ability to direct oneself someone else's words; to do otherwise is plagiarism. The purpose of this convention is to ensure that the individual who wrote the words receives credit for having done so and to prevent readers from thinking that the words are ours instead of the original author's. Similarly, whenever we obtain information from another source or use an idea obtained from someone else's work, we give credit by citing the source from which we obtained the information or idea; again, this prevents readers from thinking that the information or idea is original to us. Giving researchers proper credit, however, involves going beyond the usual conventions to avoid plagiarism; we also do so through the manner in which we write about the research. Thus, we should refer to the authors, not to unnamed researchers or "research" (see, e.g., American Psychological Association, 2020). For example, when describing the research mentioned in Chapter 1, we should write "Oermann et al. (2011) demonstrated that brief practice periods maintained CPR skills" instead of writing "Research has demonstrated that brief practice periods maintained CPR skills (Oermann et al., 2011)." While both sentences provide credit to Oermann et al. for the information, the former makes it clear that Oermann et al. conducted the research; the latter refers only to Oermann et al. as the source of the information and could mean that anyone conducted the research about which we learned from reading Oermann et al.

Just as we respect others by giving them proper credit as the sources of the information we use, we also respect others by representing their work accurately. Obviously, we want to convey correctly information we obtain from others, but accuracy goes beyond getting it right in the sense that we must avoid oversimplifying research results. Rector (2002), for example, reported that an evaluation of the Not Me, Not Now abstinence-only advertising campaign (Doniger et al., 2001) included a reduction in pregnancy rates among 15-year-old teens but did not report that Doniger et al. also found no change in pregnancy rates among women aged 17. The failure to report the additional results oversimplifies the results and could mislead those reading the report, leaving them to think that the change in pregnancy rates was longer lasting than it actually was. Conveying the complications sometimes demonstrated in research can be difficult, but our ethical obligation to respect individuals, those who reported the research and those who will read our review of that research, requires that we overcome such difficulty. Accurately reporting results also involves making sure that our readers understand what was measured in the research we review. The Union of Concerned Scientists (2006), for example, reported numerous examples in which government reports concerning abstinence-only sex education programs labeled various programs as effective without noting that *effective* was defined in terms of attendance or changes in attitudes about sexual behavior; actual sexual behavior was not measured in the research included in these reports. There is, of course, nothing wrong with considering attitude change to be a desired outcome, but it is inaccurate, and therefore undermines autonomy, when one implies that changes in attitudes toward sexual activity are synonymous with changes in sexual behavior per se.

Finally, we demonstrate respect for persons when our reports about research are comprehensive, when they include all relevant research and not just those studies that conform to our preferences or those of our intended audience. Imagine your reaction upon reading about a researcher who reported only part of the data, only those data that were consistent with a conclusion drawn by the researcher even before data were collected. We hope your reaction would include outrage and a general conclusion akin to "That's not right" or "That's dishonest." Indeed, such behavior would be evidence of a lack of respect for one's audience through undermining autonomy by misleading the readers; it would be dishonest. A failure to present all relevant studies in a review of research, too, would be similarly dishonest.

In summary, respect for persons, in the context of consuming research, involves giving credit where it is due, accurately reporting research procedures and results, and comprehensively reporting the available, relevant research. To do anything less undermines the autonomy of our audience; it reduces the accuracy or amount of information for decision-making available to our audience members.

Beneficence

While researchers have an ethical obligation to generate new knowledge (Cook, 1981; Mindick, 1982), they also have an ethical obligation to do so in a manner that promotes the public good (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). The notion that knowledge is beneficial in and of itself has a long tradition in Western thought (see, e.g., Plato, 2005), and so, to some extent, researchers satisfy both ethical obligations simply by producing new knowledge. As research consumers, as we engage in evidence-based practice, we also have an ethical obligation to promote the public good, to engage in beneficence (Illingworth & Parmet, 2015; Orenstein & Yang, 2015). We, too, partially fulfill that obligation simply by producing new knowledge.

It may seem strange to think that a consumer of others' work produces new knowledge—after all, the information already exists in the original research reports we consume—but a good review goes beyond simply noting what others have found in their research. Yet even simply noting what others have done can be beneficent in the sense that a list and description of sources in a single document makes information available in a more convenient format. Nevertheless, a good review involves using the information in existing sources to make a particular point, to draw a conclusion that would not have been obvious from reading only one or two of the original sources.

Of course, one can argue that engaging in evidence-based practice is itself another way in which to promote beneficence. As noted long ago by Mead (1969), increases in knowledge often precipitate fear about how that knowledge will be used. A careful review of research knowledge before putting it into practice can be used to reduce such fear. Reviews can be used to identify ways to improve practice, as opposed to recommend only "yes" or "no," in much the same way that research is used to improve scientific theories. The absence (or insufficiency) of empirical research can be used to promote additional research on a specific practice, process, program, or problem in general. Many people also tend to be afraid of research as a result of experience or hearsay regarding misuse of such efforts (see, e.g., Posavac, 1994), but a careful, comprehensive review of research can be used to allay such fears. Thus, the ethical obligation of beneficence (promoting the public good) is relevant to reviewing research; indeed, the obligation can be met by ensuring widespread dissemination of research reviews.

Justice

In the context of conducting research, the ethical obligation for justice refers generally to ensuring that risks and benefits associated with research are distributed equally throughout the population (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). For example, toward the end of the 20th century, a great deal of attention was focused on the underrepresentation of women included as subjects in biomedical research (Mastroianni et al., 1999). This meant that men were much more likely to benefit from the results of such research and that too little attention was paid to women's health issues, which eventually came to be perceived as patently unfair or unjust. More recently, we see that the risks associated with stem cell research are being inequitably borne by those governmental regions that allow such research (Dane, 2007a).

It may seem puzzling to think in terms of risks associated with reviewing existing research: After all, how likely is it that someone could be harmed by your writing about research that has already been done? But reviews can have considerable impact, particularly when they are used to influence practice. Consider, for example, the American Heart Association (2006) review of research that produced the compression-only guidelines for CPR. That produced a major change in the way almost everyone learned (or relearned) CPR, which affected millions of people. The change to compression-only CPR continued to receive empirical support (Ewy, 2014).

Again, we return to the notion that careful writing is important, but meeting one's ethical obligation of justice involves going beyond careful writing. You have already read about the difficulties inherent in generalizing from research results, and this becomes particularly relevant when reviewing research for evidence-based practice. It becomes quite important to consider the range of research subjects included in the relevant research and compare that range to the diversity of individuals who will be affected by the practice.

Trust

As we learned earlier, the enterprise of science relies heavily on trust. Although a scientific approach is self-correcting, scientists have to rely on each other and trust each other because it is logistically impossible to double-check everything, to look over each scientist's shoulders to ensure that they are doing exactly what was presented in a research report. Thus, those reading about research on the effects of training nurses in ACLS (Dane et al., 2000) have to trust that the researchers correctly identified which nurses were trained and which were not, that they correctly identified which patients survived a resuscitation attempt and which did not, that they actually conducted the statistical analyses they wrote about, and so on. The self-correcting nature of science will determine whether or not the sample they used was unique—if no one else can replicate the results they obtained, then their sample was unique—but ultimately, the entire scientific community must trust that they did the research the way they described doing the research. Eventually, their research was replicated by Moretti et al. (2006).

So, too, those reading our reviews of and recommendations regarding research must trust that we actually read and understand the research reports we include in our reports; they must trust that we made a good-faith effort to identify all relevant research, and so on. Our willingness to enter the scientific community as consumers of research creates an ethical obligation to be as trustworthy as those who produced the research. Beyond simple honesty, those who will read our reports and those who will be otherwise affected by the content of our reports are owed a high degree of competency in the construction of those reports.

Regardless of the discipline in which evidence-based practice is engaged, all those who are affected must place a considerable amount of trust in those who develop, analyze, and implement the practice (Gille et al., 2015; Svara, 2007; Yarborough, 2014). As with other ethical obligations, honest, comprehensive, careful, and expert review and application of research brings us quite far along the path of fulfilling the obligation of trust. Independently evaluating the quality of the research, for example, meets this obligation much better than merely accepting researchers' conclusions because they're the experts. We know that the self-correcting nature of research means that, indeed, errors are made; thus, we become part of the self-correcting process by examining critically all research we review. Even though we may have biases about what conclusions we would like to include in our review, we have an obligation to set aside those biases and ensure that our conclusions are based on sound, methodological principles rather than on personal preferences.

Scientific Integrity

The ethical obligation for scientific integrity involves having respect for the scientific process itself and acting accordingly. For researchers, this involves, quite simply, "doing good research" in all that the phrase entails (Committee on Assessing Integrity in Research Environments, 2002). For consumers of research, this involves adopting a scientific approach to reading, understanding, and reporting on others' research, even if one is not actually a scientist. Thus, it involves behaving like a scientist when using science as the basis for commenting on programs or policies.

In addition to intellectual honesty, accuracy, fairness, and respect for those involved directly and indirectly, scientific integrity involves giving careful consideration to actual and potential conflicts and, if relevant, explicitly declaring those conflicts and comprehensively trying to overcome such conflicts. Just as we learned earlier in this chapter, one important part of critically reviewing research involves assessing the *who* of research, and an important part of reviewing research ethically involves making potential readers aware of who we, the reviewers, are and what biases might have influenced our review. Although it is best to avoid conflicts of interest, it is probably not possible to do so entirely (Adams, 2007; Kimmelman, 2007; Pachter et al., 2007). A program or practice you are reviewing may be the *raison d'être* for your department and an unfavorable review may put your position in jeopardy, or the program or practice may be a favorite of influential policymakers. In such circumstances, even the best attempt to be objective may not be fully successful. In a very well-known study, for example, Rosenthal and Fode (1963) demonstrated that merely telling undergraduate researchers that research rats were "bright" as opposed to "dull" resulted in "bright" rats performing better in a discrimination task. Similarly, Rosenthal and Jacobson (1966) demonstrated that, compared to a **control group** (*the group in a study composed of individuals who received the original treatment or no treatment at all; the group to which the treatment group is compared*), randomly assigned first- and second-grade students gained 10–15 intelligence quotient (IQ) points after their teachers were falsely informed that the students had scored highly on a "test for intellectual blooming" (p. 115). (The effect was not obtained among students in Grades 3–8.) In neither study was there any evidence of cheating (such as falsely reported scores) among the researchers or teachers; Rosenthal and Jacobson believed the effect was much more subtly produced, probably without the researchers' or teachers' intentional efforts or awareness. In healthcare, the placebo effect is well known (Kisaalita et al., 2014).

Given that we cannot avoid conflicts of interest entirely and that we cannot avoid bias entirely when we have a conflict of interest, you may be tempted to think that there is nothing to be done and that we simply cannot meet the ethical obligation for scientific integrity, but you would be mistaken in that conclusion. There are tactics we can employ to overcome bias in a conflicted-interest situation. Perhaps the most important of these is becoming aware of the conflict (Cain et al., 2005). In the

Rosenthal et al. studies (Rosenthal & Fode, 1963; Rosenthal & Jacobson, 1966), for example, neither the student researchers nor the teachers were aware that the information presented by the experimenters could bias them; you are in a much better position because you are now aware that even seemingly innocuous information can produce bias. Knowledge of potential bias is necessary but not sufficient; we also need to consider carefully and objectively how the bias could affect our decisions about the research we are reviewing. In other words, we need to think critically about our own thought processes and make our reasoning explicit (Moore & Loewenstein, 2004). Cooper (1998) refers to this as the "*60 Minutes* Test," as in thinking about how we would explain our decision if we were facing one of the interviewers on the CBS television show. Thus, while we make notes about one or another research project, we should keep asking ourselves questions such as these: Is this note correct? Would the project researchers agree with my characterization of their research? Could someone else argue with my notation? The text in our review must also match the notes we have taken.

In general, then, the ethical obligations with respect to consuming research are somewhat different than those for conducting research, despite the obligations having been based on the same five principles: respect for persons, beneficence, justice, trust, and scientific integrity. With the exception of scientific integrity, as opposed to integrity in general, you probably noticed that the obligations are very much the same as those included in the code of ethics, guidelines for responsible conduct, or other requirements established by the professional organizations of which you are a member. When we are functioning as experts, we must pay considerable attention to the actual and potential impacts we have on nonexperts. Similarly, when we function as research experts, we must pay attention to the actual and potential effects of our actions.

UNDERSTANDING CHECK

What are your ethical responsibilities as a research consumer and how do they differ from those responsibilities associated with conducting research?

Summary

- Research can be defined in many ways, the most general of which is a process through which questions are asked and answered systematically. As a form of criticism, research can include the question of whether or not we are asking the right question.
- The ultimate goal of research is to be able to answer the questions asked. However, exploration, description, prediction, explanation, and action are different ways to ask the same question.
- Exploration involves attempting to determine whether or not a particular phenomenon exists.
- Description involves attempting to define a phenomenon more carefully, including distinguishing between it and other phenomena.
- Prediction involves examining the relationship between two things so as to be able to make educated guesses about one by knowing something about the other.
- Explanation also involves examining the relationship between two things but specifically involves trying to determine whether or not one causes the other.
- Action involves using research to attempt to solve a social problem. Action research may involve any of the other goals of research, but it includes a specific application.
- Evaluating research involves the questions *who*, *what*, *where*, *when*, *how*, and *why*. Researchers, participants, and consumers of research may all affect the outcome of the research as well as the manner in which the outcome is interpreted.
- The topic, theory, and worldview on which research is based are also involved in evaluating research critically, as are the physical location of the research and the social climate in which it is conducted.
- Research results are not timeless, mainly because the world itself is dynamic. Changes in research results, however, can themselves become the focus of research.
- Ethics for scientific research were not formally codified until the second half of the 20th century. The first of these, the Nuremberg Code, was in response to the Nazi atrocities. Currently, research conducted in the United States, which involves human participants, falls under the regulatory authority of the Department of Health & Human Services (HHS).
- There are five primary principles that guide ethical research: respect for persons, beneficence, justice, trust, and scientific integrity. These same principles can be used to guide ethical consumption of research.
- Respect for persons involves giving researchers proper credit, representing others' work accurately, and providing comprehensive information to those who will benefit from our consumption of research.

- Beneficence involves promoting the public good.
- Justice refers generally to ensuring that risks and benefits associated with research, including the consumption of research, are distributed equally throughout the population.
- Trust involves much more than honesty; those who will read our reports and those who will be otherwise affected by the content of our reports are owed a high degree of competency in the construction of those reports.
- Scientific integrity involves intellectual honesty, accuracy, fairness, and giving careful consideration to and, if relevant, explicit declaration of conflicts of interest and a comprehensive effort to overcome such conflicts.

Exercises

1. Obtain a popular-press report (newspaper, magazine, blog, etc.) about an issue of interest and determine whether the information in the report is based on a priori reasoning, appeal to authority, tradition, or scientific content. (Note: There may be a mixture of types of epistemological methods represented in any given report.)
2. Obtain a popular-press report containing reference to scientific research. Decide what kind of purpose is attributed to the research. (Ideally, choose a report that contains enough information about the research so that you can later track down the article[s] on which the report is based.)
3. Using a new popular-press report or one you used in the other exercises, answer as many of the who/what/where/when/how/why questions as possible.

2

THE SCIENTIFIC APPROACH

It [science] is not perfect. It is only a tool. But it is by far the best tool we have, self-correcting, ongoing, [and] applicable to everything. It has two rules. First: there are no sacred truths; all assumptions must be critically examined; arguments from authority are worthless. Second: whatever is inconsistent with the facts must be discarded or revised.

—Carl Sagan (1980, p. 333)

OVERVIEW

This chapter contains a description of the scientific approach as it applies to the theory and practice of research. You will learn why science, despite being the best approach to research, is not subject to proof from outside its own logical system. Scientific knowledge and its growth are a function of agreement, and you will learn how agreement is facilitated by the use of inductive reasoning. You will also learn about distinctions between scientific and nonscientific research, various misconceptions about science, and the importance of theory in the research process. You will learn how to use theory and other resources to facilitate your understanding, critical evaluation, and application of research.

INTRODUCTION

Many people think of scientific research as something done by intelligent-but-absent-minded people wearing white coats while surrounded by strange-looking equipment with blinking lights. Some may think of scientists as despoilers of a simple, nontechnical lifestyle. Others may think of scientists as the harbingers of an idyllic age. None of these views is correct; one of the goals of this chapter is to dispel these and other myths about science. Science is not something one does; rather, it is an approach toward doing things, and one of the most important things scientists do is research. Scientists certainly do not all wear white laboratory coats nor do we all use strange equipment, with or without blinking lights. Some scientists may be extremely intelligent or absent minded, but these qualities do not make a person a scientist; neither does adopting a scientific approach necessarily make someone intelligent or absent minded.

We noted in Chapter 1 that everyone, not just scientists, does research. What distinguishes scientific from other kinds of research is not the activity itself but the approach to the activity. Scientific research is, among other things, systematic. There are other guidelines about what is and what is not scientific research as well as guidelines about what to do with scientific research once we have it, including ethical guidelines. Scientists know what these guidelines are, agree about them, and attempt to adhere to them. Nonscientists either do not know them or do not consistently use them. It is not research that distinguishes scientists from nonscientists; it is the approach one takes toward research. As we also mentioned in Chapter 1, science is a systematic approach to the discovery of knowledge based on a set of rules that defines what is acceptable knowledge. Just as there are rules for such things as tennis or international diplomacy, there are rules for science. And just like tennis or international diplomacy, not everyone necessarily operates according to the same set of rules.

A PHILOSOPHY OF SCIENCE

Years ago, one of us was discussing religion with a friend. We disagreed about many things, but we were calmly discussing the relative merits of our personal beliefs. At one point, the friend was asked to explain why she believes what she does. She replied very simply, “I believe it because I know it’s true.” When asked how she knew it was true, she said, “I know in my heart it’s true.” Still, she could not explain why she believes what she believes. In all fairness, we both thought we were correct, but neither of us could logically prove we were correct in any absolute sense. At best, we could point out that we were not alone in our beliefs. Of course, most people accept the notion that there is no absolute proof when the topic is religious beliefs. What many people do not understand is that the same is true about science.

Any set of rules that defines what is acceptable, empirical knowledge may be called a **philosophy of science**. Among philosophers of science and among scientists, however, there is more than one accepted philosophy. This is partly because philosophers, like members of any other discipline, are developing, changing, and assessing new ideas and formulations in an attempt to improve upon what we know. Whatever their differences, however, all philosophers of science need to address the same four basic questions: (1) When is something true? (2) If we have more than one explanation, how can we tell which one is better? (3) How can we put what we know into practice? and (4) Why do we do it the way we do it?

In this chapter, we will concentrate on a particular philosophy of science called *nonjustificationism* (Strauss & Smith, 2009; Weimer, 1979). The name of this viewpoint is derived from the position that a scientific approach cannot be justified—proven valid—except through unproven assumptions; **Nonjustificationism** is a *philosophy of science for which the major premise is that we cannot logically prove that the way we go about doing research is correct in any absolute sense*. While this conclusion may seem outlandish right now, the remaining discussion should help you understand why this outlandish conclusion is quite logical and not at all inconsistent with a scientific approach to understanding the world.

When Is Something True?

This first question to be answered through any philosophy of science is usually called the question of **rational inference**—*a philosophical problem concerning the difficulty inherent in supporting any claim about the existence of a universal truth*. Just as with the conversation about religious beliefs, in which there was more than one truth, there is more than one solution to the problem of rational inference. In order to be scientific, whatever we accept as our answer to the question of when something is true (i.e., our interim solution to the rational inference problem) must be based on **facts**—*objectively verifiable phenomena or characteristics available to anyone who knows how to observe them*. Recall Sagan's (1980) second rule of science: Whatever does not

Philosophy of science set of rules that defines acceptable, empirical knowledge

Nonjustificationism the way we go about doing research cannot be proved correct

Facts objectively verifiable phenomena or characteristics available to anyone agree with the facts is wrong and must be changed or rejected completely. Although the statement is simple, deciding how to go about the process is a little more complex.

Behavioral scientists, for example, are interested in understanding how people interact with each other at a variety of different levels. We want to understand as much about people and human phenomena as possible. No matter how many facts we have, however, we cannot understand them until we have a way to summarize those facts. Summarizing facts—making them comprehensible—is what theories are all about.

But anyone can make up a theory about human behavior. Given enough time, just about everyone in the world can articulate some sort of theory for any given phenomenon. Thus, we have the equivalent of a very large warehouse that is full of theories. This imaginary warehouse contains as many different theories about people as there are people in the world, multiplied by the number of different theories each of those individuals has for each of the various phenomena that make up human behavior. Clearly, we need to imagine a very large (and probably quite disorganized) warehouse. Of course, each discipline has its own warehouse of theories, so deciding what to do with all the theories in all the sciences can be somewhat daunting, but it is not impossible.

At a very simple level, all we have to do is compare each theory in the warehouse to the facts: If the theory does not fit the facts, we change it or throw it out of the warehouse. This process may sound good, but it just does not work that way. Theories are made up of **concepts**—*abstract words that are used to represent concrete phenomena*. We can point to concrete examples of concepts, but the concepts themselves are abstract. For example, conflict, as a theoretical concept, is not the same thing as a family argument or a revolution. Family argument and revolution are, of course, concrete examples of conflict, but they are only examples and not complete definitions. No matter how compellingly practical a concept may be, it is only an approximation of reality, and any given concrete phenomenon is only an approximation of a concept (Wartofsky, 1968). Theories symbolize, represent, or summarize the real world in which we live and behave, but the concepts within the theories are not the same thing as the real world. Because concepts are abstract and the facts we rely on to test them are concrete, deciding whether or not a theory fits the facts is rather difficult.

Concepts abstract words used to represent concrete phenomena

Inductive reasoning a process of generalization

This difficulty arises because we must rely on inductive reasoning when connecting facts to a theory. **Inductive reasoning** is *a process of generalization; it involves applying specific information to a general situation or future events*. That is, we are generalizing from a concrete fact to an abstract theory. As an example, consider the guidance issued by the US Centers for Disease Control (CDC) regarding the use of face coverings in the early months of the COVID-19 pandemic. In late February 2020, approximately six weeks after the first case of COVID-19 was detected in the United States, the CDC was not yet recommending the use of face masks by the general public as a means to help prevent the spread of this novel virus. While the full rationale behind the CDC's guidance is unclear, it's likely that the decision to not recommend universal masking earlier in the pandemic stemmed in part from a lack of context-specific evidence demonstrating the efficacy of cloth masks, along with the need to make inferences regarding the incubation period, transmissibility, and likelihood of asymptomatic/presymptomatic transmission. Such inferences were derived from generalizations of our limited knowledge of pathogens associated with previous disease outbreaks, of a similar nature, including those caused by other types of coronaviruses (e.g., SARS-CoV & MERS-CoV).

Several months into the pandemic, the CDC issued a press release which recommended the use of universal masking practices (Centers for Disease Control and Prevention, 2020). This new recommendation was made in part as a result of newly reported research findings, although the only sources cited by the CDC within the initial guidance recommending in favor of the practice of universal masking consisted of an editorial (Brooks et al., 2020) and a case report (among the weakest forms of evidence) which suggested cloth face masks might provide protection against transmission of SARS-CoV-2 (Hendrix et al., 2020), the virus which causes COVID-19. Still, evidence accumulated over time and we now know that transmission does occur from asymptomatic people (Kronbichler et al., 2020) and the characteristics of SARS-CoV-2 were later determined to differ from those types from which we made inferences regarding the characteristics of SARS-CoV-2.

Despite the inability of inductive reasoning to lead us to absolute truth, we must rely on it in any scientific approach to research. We simply cannot let all those theories pile up in the warehouse until we have all the facts nor can we wait for all the facts before we begin to construct theories to put in the warehouse. Instead, we simply accept the notion that inductive reasoning is the best process of generalization we have until something better comes along.

We have simplified the arguments involved in this issue, but the basic point of the rational inference problem is rather simple: Inductive inferences cannot be proved true. Nevertheless, we need to use them to construct theories until we have evidence to the contrary. If we have enough contrary evidence, we can throw a theory out of our warehouse, but that does not mean that any of the theories remaining in the warehouse are true. We are left with no choice but to provide support for a theory by trying to show that alternative, competing theories are not true. If we make a prediction from a theory and test the prediction and if the prediction fits the facts, then we have *not* proved the theory to be true; instead, we have failed to prove that the theory is false. It is difficult to think in terms of double negatives—Theory *X* is not not-true—but that is the logic forced on us by the rational inference problem. Thus, research in which we test between two competing theories is more efficient than research in which we test only one theory because comparing theories is one way to deal with the rational inference problem.

How Can We Tell Which Theory Is Better?

The absence of absolute truth does not limit what we can learn in a scientific approach, but we are faced with a particular path in our quest to learn about behavior and other real-world phenomena. We can, as mentioned above, test between two different theories and decide which one is better. Testing between theories is like a grand tournament in which every theory is pitted against every other theory; the theory with the best win–loss record at the end of the tournament is the winner. That does not mean that the winning theory is true—only that it is the best theory we have until another, better theory is entered in the tournament. Like all tournaments, the tournament of scientific theories has some rules about which theories are entered and how many times a theory must lose in order to be eliminated.

The rules of the grand tournament of science bring us to the problem called **criteria for growth**—finding *standards that can be used to decide whether one explanation is better than another*. We all know, for example, that as an explanation of the apparent movement of the sun across the sky, current theories of astronomy are more accurate (but less poetic) than the myth of Helios, the sun god, waking every morning and driving his fiery chariot across the sky. We would scoff at anyone who seriously believed the Helios explanation, just as any ancient Greek would have scoffed at our current theories. How we came to decide that astronomy is better than mythology involves our criteria for growth: paradigms and facts.

Theories, whether in or out of our imaginary warehouse, do not exist in a vacuum. Every theory is related to at least one other theory through shared concepts or propositions. Kuhn (1962) was the first to use the term *paradigm* (pronounced "pair-a-dime") to describe such groups of related theories. A **paradigm** is *a logical system that encompasses*

Paradigm theories, concepts, models, procedures, and techniques *theories, concepts, models, procedures, and techniques*. The earth-centered solar system, for example, was once a paradigm in physics, just as instinct was once a paradigm in psychology (McDougall, 1908). At the time McDougall was theorizing about human behavior, the predominant explanations included some notion about instinctual processes; there was an instinct for survival, one for aggression, and so on. New observations about behavior were interpreted in terms of existing instincts, and if new observations did not fit, then new instincts were invented to account for the observations.

During the time in which a particular paradigm is accepted, which Kuhn (1962) referred to as a period of *normal science*, research is directed toward solving problems related to matching current theories with observations. At such times, research tends to be directed toward refining theories, toward trying to make them better, such as inventing new instincts to fit research observations. New research and the refinements of theories add to the strength of the paradigm, which in turn leads to the perception that the paradigm, including its associated theories and procedures, is the best way to explain what goes on in the world.

Eventually, however, problems with the paradigm emerge as more and more information cannot be fit into the existing theories. We note "eventually" because no matter how reasonable or useful a paradigm may be, it, too, is based on inductive reasoning and thus cannot be considered universal truth. When enough problems emerge and an alternative paradigm, complete with its own theories and procedures, arises that fits the observations better, then the old paradigm gives way to a new one during what Kuhn calls a *scientific revolution*. Thus Galileo started a scientific revolution with his notion of a sun-centered solar system, although it took years before the followers of the earth-centered paradigm accepted the new paradigm. Then the new paradigm becomes *the* paradigm and the field returns again to normal science until the next paradigm shift occurs.

Underlying all of normal and revolutionary science is reliance on facts. Observations are considered facts when people can point to concrete examples of the observation. Although it may seem tautological to require facts to be observable, that very requirement is one of the reasons McDougall's instinct theories eventually gave way to modern explanations of behavior; there was no way to observe—to be able to point to concrete examples of—the processes by which instincts influence behavior. Today, of course, we have some evidence for instinctual processes as one of several possible explanations for some behaviors (see, for example, Lea & Webley, 2006; Snyder, 1987), but we do not use instinct as the primary explanatory concept for all behavior.

In addition to being observable, facts must also be objective. Within a scientific approach, **objectivity** means *that an observation can be replicated, observed by more than one person under a variety of different conditions*. If several other researchers note the same effect under different conditions, then we have a fact, an objective observation that needs to be incorporated into existing theories. If, however, you are the only researcher who can demonstrate a particular effect, it is not objective.

During normal science, theories are compared on the basis of their fit into the existing paradigm as well as our ability to use them to account for the existing facts. During revolutionary science, comparisons occur between old and new paradigms, but the basis for such comparisons remains the existing facts. Then, upon return to normal science, theories within the current paradigm are again evaluated in terms of their fit with the facts. It is important to note, however, that because a new paradigm may redefine what is an acceptable fact, the facts may change from time to time (Fleck, 1979).

Instances in which the results of a given study cannot be replicated represent a type of scientific failure (i.e., failure to observe expected outcomes). To some extent, such failures are an inherent component of scientific inquiry and frequently stem from overgeneralization of prior research findings or methodological failures including inadequate statistical power (Guttinger & Love, 2019). These failures, which have occurred in virtually all fields of study, can be considered essential to the scientific advancement, with their value being derived largely from the resulting process of reconciling conflicting results (Redish et al., 2018).

Still, the value of such failures must be viewed relative to the frequency in which they occur within a single discipline. In recent years, the social sciences, among other fields of study, have encountered an increased frequency of unsuccessful attempts to replicate previous study findings, a situation described as a replication crisis. While not limited to any one discipline, psychology has seemingly faced the greatest scrutiny, fueled in part by the findings of Nosek and colleagues (Open Science Collaboration, 2015) who reported less than 40% of studies they attempted to replicate led to the same results as the original published studies. Despite the resulting widespread criticism of psychological research some researchers have seized the opportunity to study this reproducibility problem, leading to recommendations for researchers to improve the reproducibility of their work (Shrout & Rodgers, 2018).

Objectivity
observations that can be replicated or observed by others