

GLOBAL  
EDITION



# Practical Research

## *Planning and Design*

ELEVENTH EDITION

Paul D. Leedy • Jeanne Ellis Ormrod



ALWAYS LEARNING

PEARSON

# Practical Research

## PLANNING AND DESIGN

**ELEVENTH EDITION**

**GLOBAL EDITION**

**Paul D. Leedy**

*Late of American University*

and

**Jeanne Ellis Ormrod**

*University of Northern Colorado (Emerita)*

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# Preface

## NEW TO THE ELEVENTH EDITION

Every year brings exciting new strategies in research methodologies, making any updated edition of *Practical Research* a joy to write. With this eleventh edition, the book has been revised in numerous ways. As always, every page has been revisited—every word, in fact—and many minor changes have been made to tighten the prose or enhance its clarity. Also, discussions of technology-based strategies have been updated to reflect not only new software options but also the increasing technological sophistication of most of our readers.

Probably the two most noteworthy changes in this edition are the addition of a new chapter and a reorganization of some of the other chapters. In response to reviewers' requests, the tenth edition's chapter "Qualitative Research" has been expanded into two chapters, "Qualitative Research Methods" and "Analyzing Qualitative Data." Discussions of quantitative research methods now precede (rather than follow) discussions of qualitative methodologies, and the chapter on analyzing quantitative data now immediately follows the two chapters on quantitative methodologies.

Other significant changes in the eleventh edition are these:

- **Chapter 1.** Revision of Figure 1.1 and accompanying text to include seven (rather than six) steps in order to better align with discussions that follow in the chapter; new section on philosophical underpinnings of various methodologies; new discussion of quantitative vs. qualitative vs. mixed-methods research (moved from its previous location in Chapter 4); discussion of the iterative nature of research; expansion of Table 1.1; revision of the guidelines for using word processing software to focus on features that readers may not routinely use in their day-to-day writing.
- **Chapter 2.** Introduction of the idea of *a priori* hypotheses (to distinguish them from hypotheses that researchers might form midway through a study); new discussion about identifying the limitations (as well as delimitations) of a proposed study.
- **Chapter 3.** Elimination of outdated sections "Using Indexes and Abstracts" and "Locating Relevant Government Documents," with electronically based strategies in those sections being incorporated into the sections "Using Online Databases" and "Surfing the Internet"; relocation of the discussion of database creation to the Practical Application "Planning a Literature Search."
- **Chapter 4.** Better balance between discussions of quantitative and qualitative approaches; addition of design-based research to what is now Table 4.2 (previously Table 4.5).
- **Chapter 6 (formerly Chapter 8).** New discussion of rubrics; omission of a random numbers table (because such tables are widely available on the Internet); expanded discussion of possible biases in descriptive research; new Guidelines feature ("Identifying Possible Sampling Bias in Questionnaire Research"); new Checklist feature ("Identifying Potential Sources of Bias in a Descriptive Study").

- **Chapter 7 (formerly Chapter 9).** New section on possible biases in quantitative research; new Checklist (“Identifying Potential Sources of Bias and Potential Threats to External Validity in an Experimental, Quasi-Experimental, or Ex Post Facto Study”).
- **Chapter 8 (formerly Chapter 11).** New example (regarding a cancer prognosis) as an illustration of the limitations of a median as a predictor; addition of the five-number summary as a possible indicator of variability in ordinal data.
- **Chapter 9 (formerly Chapter 6).** Focus now on general design, planning, and data collection in qualitative research, with data analysis being moved to the new Chapter 11; new section on validity and reliability; expanded discussion of how cultural differences can influence interviews; relocation of the extensive example in international relations (formerly in the chapter “Descriptive Research”) to this chapter, where it is more appropriately placed.
- **Chapter 10 (formerly Chapter 7).** Expanded discussion of possible biases in primary and secondary sources; updated and expanded list of online databases.
- **Chapter 11 (new chapter).** Greatly expanded discussion of qualitative data analysis; new Checklist (“Pinning Down the Data Analysis in a Qualitative Study”); new Sample Dissertation (by Society for Research in Child Development award winner Christy Leung).
- **Chapter 12 (formerly Chapter 10).** Expanded discussion of mixed-methods designs, with a new fifth category, *multiphase iterative designs*; new Conceptual Analysis Exercise (“Identifying Mixed-Methods Research Designs”); new section on sampling; expanded discussion of data analysis strategies; new Practical Application section discussing helpful software for analyzing mixed-methods data; new section on systematic reviews.
- **Chapter 13 (formerly Chapter 12).** Better balance between quantitative and qualitative research reports; reorganization and revision of the section “Essential Elements of a Research Report” (formerly titled “Planning a Research Report”); updated discussion of APA style for electronic resources; new Guidelines feature (“Writing a Clear, Coherent Report”).

## THE PURPOSE OF THIS BOOK

*Practical Research: Planning and Design* is a broad-spectrum, cross-disciplinary book suitable for a wide variety of courses in basic research methodology. Many basic concepts and strategies in research transcend the boundaries of specific academic areas, and such concepts and strategies are at the heart of this book. To some degree, certainly, research methods do vary from one subject area to another: A biologist might gather data by looking through a microscope, a historian by examining written documents from an earlier time period, and a psychologist by administering certain tests or systematically observing people’s behavior. Otherwise, the basic approach to research is the same. Regardless of the discipline, the researcher identifies a question in need of an answer, collects data potentially relevant to the answer, analyzes and interprets the data, and draws conclusions that the data seem to warrant.

Students in the social sciences, the natural sciences, education, medicine, business administration, landscape architecture, and other academic disciplines have used this text as a guide to the successful completion of their research projects. *Practical Research* guides students from problem selection to completed research report with many concrete examples and practical, how-to suggestions. Students come to understand that research needs planning and design, and they discover how they can effectively and professionally conduct their own research projects. Essentially, this is a do-it-yourself, understand-it-yourself manual. From that standpoint, it can be a guide for students who are left largely to their own resources in carrying out their research projects. The book, supplemented by occasional counseling by an academic advisor, can guide the student to the completion of a successful research project.

## LEARNING ABOUT THE RESEARCH PROCESS IS AN ESSENTIAL COMPONENT OF ACADEMIC TRAINING

All too often, students mistakenly believe that conducting research involves nothing more than amassing a large number of facts and incorporating them into a lengthy, footnoted paper. They reach the threshold of a master's thesis or doctoral dissertation only to learn that simply assembling previously known information is insufficient and unacceptable. Instead, they must do something radically different: They must answer a question that has never been answered before and, in the process, must discover something that no one else has ever discovered. Something has gone tragically wrong in the education of students who have, for so many years of their schooling, entirely misunderstood the true nature of research.

Research has one end: the discovery of some sort of "truth." Its purpose is to learn what has never before been known; to ask a significant question for which no conclusive answer has previously been found; and, by collecting and interpreting relevant data, to find an answer to that question.

Learning about and doing research are of value far beyond that of merely satisfying a program requirement. Research methods and their application to real-world problems are skills that will serve you for the rest of your life. The world is full of problems that beg for solutions; consequently, it is full of research activity! The media continually bring us news of previously unknown biological and physical phenomena, life-saving medical interventions, and groundbreaking technological innovations—all the outcomes of research. Research is not an academic banality; it is a vital and dynamic force that is indispensable to the health and well-being of Planet Earth and its human and nonhuman inhabitants.

More immediate, however, is the need to apply research methodology to those lesser daily problems that nonetheless demand a thoughtful resolution. Those who have learned how to analyze problems systematically and dispassionately will live with greater confidence and success than those who have shortsightedly dismissed research as nothing more than a necessary hurdle on the way to a degree. Given the advantages that a researcher's viewpoint provides, considering an academic research requirement as annoying and irrelevant to one's education is simply an untenable position.

Many students have found *Practical Research* quite helpful in their efforts both to understand the nature of the research process and to complete their research projects. Its simplification of research concepts and its readability make it especially suitable for those undergraduate and graduate students who are introduced, perhaps for the first time, to genuine research methodology.

We hope we have convinced you that a course on research methodology is not a temporary hurdle on the way to a degree but, instead, an unparalleled opportunity to learn how you might better tackle any problem for which you do not have a ready solution. In a few years you will undoubtedly look back on your research methods course as one of the most rewarding and practical courses in your entire educational experience.

Pearson would like to thank the following people for their work on the Global Edition:

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*No man is an island, entire of it selfe; every man is a peece of the Continent, a part of the maine . . .*

So wrote John Donne, the great dean of St. Paul's Cathedral in the 17th century. And so do we authors write in the 21st century.

Those who have had a part in the making of this book, known and unknown, friends and colleagues, gentle critics and able editors—all—are far too many to salute individually. Those of you who have written in journals and textbooks about research methods and strategies, the generations of graduate and undergraduate students whom we authors have taught and who have also taught *us*, the kindly letters and e-mail messages that so many of you have written to describe how this book has helped you in your own research endeavors—to all of you, I extend my acknowledgment and appreciation wherever you may be. You have had the greater part in bringing this book through its previous ten editions. I am especially grateful to the reviewers of the eleventh edition, who recently offered many good suggestions for strengthening the book so that it can better assist novice researchers in the 21st century: Brian Belland, Utah State University; Robert Hayden, Michigan State University; Walter Nekrosius, Wright State University; Lloyd Rieber, University of Georgia; and Susan Twombly, University of Kansas.

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No author is an island, entire of itself. Paul and I have had many hands guiding our pens and many minds adding richness and depth to our thoughts. All of you have been exceedingly helpful, all of you have been “a peece of the Continent, a part of the maine.” For that, I offer my humble and hearty thanks.

*Jeanne Ellis Ormrod*

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## PART IV Qualitative Research

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# Chapter 1

## The Nature and Tools of Research

In virtually every subject area, our collective knowledge about the world is incomplete: Certain questions remain unanswered, and certain problems remain unsolved. Systematic research provides many powerful tools—not only physical tools but also mental and social tools—that can help us discover possible answers and identify possible solutions.

### Learning Outcomes

- 1.1 Distinguish between (a) common uses of the term *research* that reflect misconceptions about what research involves and (b) the true nature of research in academic settings.
- 1.2 Describe the cyclical, iterative nature of research, including the steps that a genuine research project involves.
- 1.3 Distinguish among positivism, postpositivism, constructivism, and pragmatism/realism as philosophical underpinnings of a research project.
- 1.4 Identify examples of how six general research tools can play significant roles in a research project: (a) the library and its resources, (b) computer technology, (c) measurement, (d) statistics, (e) language, and (f) the human mind.
- 1.5 Describe steps you might take to explore research in your field.

In everyday speech, the word *research* is often used loosely to refer to a variety of activities. In some situations the word connotes simply finding a piece of information or taking notes and then writing a so-called “research paper.” In other situations it refers to the act of informing oneself about what one does not know, perhaps by rummaging through available sources to locate a few tidbits of information. Such uses of the term can create considerable confusion for university students, who must learn to use it in a narrower, more precise sense.

Yet when used in its true sense—as a systematic process that leads to new knowledge and understandings—the word *research* can suggest a mystical activity that is somehow removed from everyday life. Many people imagine researchers to be aloof individuals who seclude themselves in laboratories, scholarly libraries, or the ivory towers of large universities. In fact, research is often a practical enterprise that—given appropriate tools—*any* rational, conscientious individual can conduct. In this chapter we lay out the nature of true research and describe the general tools that make it possible.

### WHAT RESEARCH IS NOT

Following are three statements that describe what research is not. Accompanying each statement is an example that illustrates a common misconception about research.

1. ***Research is not merely gathering information.*** A sixth grader comes home from school and tells her parents, “The teacher sent us to the library today to do research, and I learned a lot

about black holes.” For this student, research means going to the library to find a few facts. This might be *information discovery*, or it might be learning *reference skills*. But it certainly is not, as the teacher labeled it, research.

2. *Research is not merely rummaging around for hard-to-locate information.* The house across the street is for sale. You consider buying it and call your realtor to find out how much someone else might pay you for your current home. “I’ll have to do some research to determine the fair market value of your property,” the realtor tells you. What the realtor calls doing “some research” means, of course, reviewing information about recent sales of properties comparable to yours; this information will help the realtor zero in on a reasonable asking price for your own home. Such an activity involves little more than searching through various files or websites to discover what the realtor previously did not know. Rummaging—whether through records in one’s own office, at a library, or on the Internet—is not research. It is more accurately called an *exercise in self-enlightenment*.

3. *Research is not merely transporting facts from one location to another.* A college student reads several articles about the mysterious Dark Lady in William Shakespeare’s sonnets and then writes a “research paper” describing various scholars’ suggestions of who the lady might have been. Although the student does, indeed, go through certain activities associated with formal research—such as collecting information, organizing it in a certain way for presentation to others, supporting statements with documentation, and referencing statements properly—these activities do not add up to true research. The student has missed the essence of research: the *interpretation* of data. Nowhere in the paper does the student say, in effect, “These facts I have gathered seem to indicate such-and-such about the Dark Lady.” Nowhere does the student interpret and draw conclusions from the facts. This student is approaching genuine research; however, the mere compilation of facts, presented with reference citations and arranged in a logical sequence—no matter how polished and appealing the format—misses genuine research by a hair. Such activity might more realistically be called *fact transcription*, *fact documentation*, *fact organization*, or *fact summarization*.

Going a little further, this student would have traveled from one world to another: from the world of mere transportation of facts to the world of interpretation of facts. The difference between the two worlds is the distinction between transference of information and genuine research—a distinction that is critical for novice researchers to understand.

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## WHAT RESEARCH IS

**Research** is a systematic process of collecting, analyzing, and interpreting information—*data*—in order to increase our understanding of a phenomenon about which we are interested or concerned.<sup>1</sup> People often use a systematic approach when they collect and interpret information to solve the small problems of daily living. Here, however, we focus on *formal research*, research in which we intentionally set out to enhance our understanding of a phenomenon and expect to communicate what we discover to the larger scientific community.

Although research projects vary in complexity and duration, in general research involves seven distinct steps, shown in Figure 1.1. We now look at each of these steps more closely.

1. *The researcher begins with a problem—an unanswered question.* Everywhere we look, we see things that cause us to wonder, to speculate, to ask questions. And by asking questions, we strike a spark that ignites a chain reaction leading to the research process.

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<sup>1</sup>Some people in academia use the term *research* more broadly to include deriving new equations or abstract principles from existing equations or principles through a sequence of mathematically logical and valid steps. Such an activity can be quite intellectually challenging, of course, and is often at the heart of doctoral dissertations and scholarly journal articles in mathematics, physics, and related disciplines. In this book, however, we use the term *research* more narrowly to refer to *empirical* research—research that involves the collection and analysis of new data.

**FIGURE 1.1** ■  
The Research Cycle



An inquisitive mind is the beginning impetus for research; as one popular tabloid puts it, “Inquiring minds want to know!”

Look around you. Consider unresolved situations that evoke these questions: What is such-and-such a situation like? Why does such-and-such a phenomenon occur? What does it all mean? With questions like these, research begins.

2. *The researcher clearly and specifically articulates the goal of the research endeavor.* A clear, unambiguous statement of the problem one will address is critical. This statement is an exercise in intellectual honesty: The ultimate goal of the research must be set forth in a grammatically complete sentence that specifically and precisely answers the question, “What problem do you intend to solve?” When you describe your objective in clear, concrete terms, you have a good idea of what you need to accomplish and can direct your efforts accordingly.

3. *The researcher often divides the principal problem into more manageable subproblems.* From a design standpoint, it is often helpful to break a main research problem into several subproblems that, when solved, can resolve the main problem.

Breaking down principal problems into small, easily solvable subproblems is a strategy we use in everyday living. For example, suppose you want to drive from your hometown to a town many miles or kilometers away. Your principal goal is to get from one location to the

other as expeditiously as possible. You soon realize, however, that the problem involves several subproblems:

- Main problem: How do I get from Town A to Town B?
- Subproblems:
1. What route appears to be the most direct one?
  2. Is the most direct one also the quickest one? If not, what route might take the least amount of time?
  3. Which is more important to me: minimizing my travel time or minimizing my energy consumption?
  4. At what critical junctions in my chosen route must I turn right or left?

What seems like a single question can be divided into several smaller questions that must be addressed before the principal question can be resolved.

So it is with most research problems. By closely inspecting the principal problem, the researcher often uncovers important subproblems. By addressing each of the subproblems, the researcher can more easily address the main problem. If a researcher doesn't take the time or trouble to isolate the lesser problems within the major problem, the overall research project can become cumbersome and difficult to manage.

Identifying and clearly articulating the problem and its subproblems are the essential starting points for formal research. Accordingly, we discuss these processes in depth in Chapter 2.

*4. The researcher identifies hypotheses and assumptions that underlie the research effort.* Having stated the problem and its attendant subproblems, the researcher sometimes forms one or more hypotheses about what he or she may discover. A **hypothesis** is a logical supposition, a reasonable guess, an educated conjecture. It provides a tentative explanation for a phenomenon under investigation. It may direct your thinking to possible sources of information that will aid in resolving one or more subproblems and, as a result, may also help you resolve the principal research problem.

Hypotheses are certainly not unique to research. In your everyday life, if something happens, you immediately try to account for its cause by making some reasonable conjectures. For example, imagine that you come home after dark, open your front door, and reach inside for the switch that turns on a nearby table lamp. Your fingers find the switch. You flip it. No light. At this point, you identify several hypotheses regarding the lamp's failure:

*Hypothesis 1:* A recent storm has disrupted your access to electrical power.

*Hypothesis 2:* The bulb has burned out.

*Hypothesis 3:* The lamp isn't securely plugged into the wall outlet.

*Hypothesis 4:* The wire from the lamp to the wall outlet is defective.

*Hypothesis 5:* You forgot to pay your electric bill.

Each of these hypotheses hints at a strategy for acquiring information that may resolve the nonfunctioning-lamp problem. For instance, to test Hypothesis 1, you might look outside to see whether your neighbors have lights, and to test Hypothesis 2, you might replace the current light bulb with a new one.

Hypotheses in a research project are as tentative as those for a nonfunctioning table lamp. For example, a biologist might speculate that certain human-made chemical compounds increase the frequency of birth defects in frogs. A psychologist might speculate that certain personality traits lead people to show predominantly liberal or conservative voting patterns. A marketing researcher might speculate that humor in a television commercial will capture viewers' attention and thereby will increase the odds that viewers buy the advertised product. Notice the word *speculate* in all of these examples. Good researchers always begin a project with open minds about what they may—or may *not*—discover in their data.

Hypotheses—predictions—are an essential ingredient in certain kinds of research, especially experimental research (see Chapter 7). To a lesser degree, they might guide other forms

of research as well, but they are intentionally *not* identified in the early stages of some kinds of qualitative research (e.g., see the discussion of grounded theory studies in Chapter 9).

Whereas a hypothesis involves a prediction that may or may not be supported by the data, an **assumption** is a condition that is taken for granted, without which the research project would be pointless. Careful researchers—certainly those conducting research in an academic environment—set forth a statement of their assumptions as the bedrock upon which their study rests. For example, imagine that your problem is to investigate whether students learn the unique grammatical structures of a language more quickly by studying only one foreign language at a time or by studying two foreign languages concurrently. What assumptions would underlie such a problem? At a minimum, you must assume that

- The teachers used in the study are competent to teach the language or languages in question and have mastered the grammatical structures of the language(s) they are teaching.
- The students taking part in the research are capable of mastering the unique grammatical structures of any language(s) they are studying.
- The languages selected for the study have sufficiently different grammatical structures that students might reasonably learn to distinguish between them.

Aside from such basic ideas as these, however, careful researchers state their assumptions, so that other people inspecting the research project can evaluate it in accordance with *their own* assumptions. For the beginning researcher, it is better to be overly explicit than to take too much for granted.

5. *The researcher develops a specific plan for addressing the problem and its subproblems.*

Research is not a blind excursion into the unknown, with the hope that the data necessary to address the research problem will magically emerge. It is, instead, a carefully planned itinerary of the route you intend to take in order to reach your final destination—your research goal. Consider the title of this text: *Practical Research: Planning and Design*. The last three words—*Planning and Design*—are especially important ones. Researchers plan their overall research design and specific research methods in a purposeful way so that they can acquire data relevant to their research problem and subproblems. Depending on the research question, different designs and methods are more or less appropriate.

In the formative stages of a research project, much can be decided: Are any existing data directly relevant to the research problem? If so, where are they, and are you likely to have access to them? If the needed data *don't* currently exist, how might you generate them? And later, after you have acquired the data you need, what will you do with them?<sup>2</sup> Such questions merely hint at the fact that planning and design cannot be postponed. Each of the questions just listed—and many more—must have an answer early in the research process. In Chapter 4, we discuss several general issues related to research planning. Then, beginning in Chapter 6, we describe strategies related to various research methodologies.

6. *The researcher collects, organizes, and analyzes data related to the problem and its subproblems.* After a researcher has isolated the problem, divided it into appropriate subproblems, identified hypotheses and assumptions, and chosen a suitable design and methodology, the next step is to collect whatever data might be relevant to the problem and to organize and analyze them in meaningful ways.

The data collected in research studies take one of two general forms. **Quantitative research** involves looking at amounts, or *quantities*, of one or more variables of interest. A quantitative researcher typically tries to measure variables in some numerical way, perhaps by using

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<sup>2</sup>As should be apparent in the questions posed in this paragraph, we are using the word *data* as a plural noun; for instance, we ask “Where *are* the data?” rather than “Where *is* the data?” Contrary to popular usage of the term as a singular noun, *data* (which has its origins in Latin) refers to two or more pieces of information. A single piece of information is known as a *datum*, or sometimes as a *data point*.



commonly accepted measures of the physical world (e.g., rulers, thermometers, oscilloscopes) or carefully designed measures of psychological characteristics or behaviors (e.g., tests, questionnaires, rating scales).

In contrast, **qualitative research** involves looking at characteristics, or *qualities*, that cannot be entirely reduced to numerical values. A qualitative researcher typically aims to examine the many nuances and complexities of a particular phenomenon. You are most likely to see qualitative research in studies of complex human situations (e.g., people's in-depth perspectives about a particular issue, the behaviors and values of a particular cultural group) or complex human creations (e.g., television commercials, works of art). Qualitative research is not limited to research problems involving human beings, however. For instance, some biologists study, in a distinctly qualitative manner, the complex social behaviors of other animal species; Dian Fossey's work with gorillas and Jane Goodall's studies of chimpanzees are two well-known examples (e.g., see Fossey, 1983; Goodall, 1986).

The two kinds of data—quantitative and qualitative—often require distinctly different research methods and data analysis strategies. Accordingly, three of the book's subsequent chapters focus predominantly on quantitative techniques (see Chapters 6, 7, and 8) and three others focus largely on qualitative techniques (see Chapters 9, 10, and 11). Nevertheless, we urge you *not* to think of the quantitative–qualitative distinction as a mutually exclusive, *it-has-to-be-one-thing-or-the-other* dichotomy. Many researchers collect both quantitative and qualitative data in a single research project—an approach sometimes known as **mixed-methods research** (see Chapter 12). Good researchers tend to be *eclectic* researchers who draw from diverse methodologies and data sources in order to best address their research problems and questions (e.g., see Gorard, 2010; Onwuegbuzie & Leech, 2005).

7. *The researcher interprets the meaning of the data as they relate to the problem and its subproblems.* Quantitative and qualitative data are, in and of themselves, *only* data—nothing more. The significance of the data depends on how the researcher extracts *meaning* from them. In research, uninterpreted data are worthless: They can never help us answer the questions we have posed.

Yet researchers must recognize and come to terms with the subjective and dynamic nature of interpretation. Consider, for example, the many books written on the assassination of U.S. President John F. Kennedy. Different historians have studied the same events: One may interpret them one way, and another may arrive at a very different conclusion. Which one is right? Perhaps they both are; perhaps neither is. Both may have merely posed new problems for other historians to try to resolve. Different minds often find different meanings in the same set of facts.

Once we believed that clocks measured time and that yardsticks measured space. In one sense, they still do. We further assumed that time and space were two different entities. Then along came Einstein's theory of relativity, and time and space became locked into one concept: the time–space continuum. What's the difference between the old perspective and the new one? It's the way we think about, or interpret, the same information. The realities of time and space have not changed; the way we interpret them has.

Data demand interpretation. But no rule, formula, or algorithm can lead the researcher unerringly to a correct interpretation. Interpretation is inevitably a somewhat subjective process that depends on the researcher's hypotheses, assumptions, and logical reasoning processes.

Now think about how we began this chapter. We suggested that certain activities cannot accurately be called research. At this point you can understand why. None of those activities demands that the researcher draw any conclusions or make any interpretations of the data.

We must emphasize two important points related to the seven-step process just described. First, *the process is iterative*: A researcher sometimes needs to move back and forth between two or more steps along the way. For example, while developing a specific plan for a project (Step 5), a researcher might realize that a genuine resolution of the research problem requires addressing a subproblem not previously identified (Step 3). And while interpreting the collected data (Step 7), a researcher may decide that additional data are needed to fully resolve the problem (Step 6).

Second, *the process is cyclical*. The final step in the process depicted in Figure 1.1—interpretation of the data—is not *really* the final step at all. Only rarely is a research project a one-shot effort that completely resolves a problem. For instance, even with the best of data, hypotheses in a research project are rarely proved or disproved—and thus research questions are rarely answered—beyond a shadow of a doubt. Instead, hypotheses are either *supported* or *not supported* by the data. If the data are consistent with a particular hypothesis, the researcher can make a case that the hypothesis probably has some merit and should be taken seriously. In contrast, if the data run contrary to a hypothesis, the researcher *rejects* the hypothesis and turns to other hypotheses as being more likely explanations of the phenomenon in question. In either case, one or more additional, follow-up studies are called for.

Ultimately, then, most research studies don't bring total closure to a research problem. There is no obvious end point—no point at which a researcher can say “*Voilà!* I've completely answered the question about which I'm concerned.” Instead, research typically involves a cycle—or more accurately, a *helix* (spiral)—in which one study spawns additional, follow-up studies. In exploring a topic, one comes across additional problems that need resolving, and so the process must begin anew. Research begets more research.

To view research in this way is to invest it with a dynamic quality that is its true nature—a far cry from the conventional view, which sees research as a one-time undertaking that is static, self-contained, an end in itself. Here we see another difference between true research and the nonexamples of research presented earlier in the chapter. Every researcher soon learns that genuine research is likely to yield as many problems as it resolves. Such is the nature of the acquisition of knowledge.

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## PHILOSOPHICAL ASSUMPTIONS UNDERLYING RESEARCH METHODOLOGIES

Let's return to Step 4 in the research process: *The researcher identifies hypotheses and assumptions that underlie the research effort*. The assumptions underlying a research project are sometimes so seemingly self-evident that a researcher may think it unnecessary to mention them. In fact, the researcher may not even be consciously aware of them! For example, two general assumptions underlie many research studies:

- The phenomenon under investigation is somewhat lawful and predictable; it is *not* comprised of completely random events.
- Cause-and-effect relationships can account for certain patterns observed in the phenomenon.

But are such assumptions justified? Is the world a lawful place, with some things definitely causing or influencing others? Or are definitive laws and cause-and-effect relationships nothing more than figments of our fertile human imaginations?

As we consider such questions, it is helpful to distinguish among different philosophical orientations<sup>3</sup> that point researchers in somewhat different directions in their quests to make sense of our physical, social, and psychological worlds. Historically, a good deal of research in the natural sciences has been driven by a perspective known as **positivism**. Positivists believe that, with appropriate measurement tools, scientists can objectively uncover absolute, undeniable *truths* about cause-and-effect relationships within the physical world and human experience.

In the social sciences, most researchers have been less self-assured and more tentative, especially within the past few decades. Some social scientists take a perspective known as **postpositivism**, believing that true objectivity in seeking absolute truths can be an elusive goal. Although researchers might strive for objectivity in their collection and interpretation

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<sup>3</sup>Some writers use terms such as *worldviews*, *epistemologies*, or *paradigms* instead of the term *philosophical orientations*.

of data, they inevitably bring certain *biases* to their investigations—perhaps biases regarding the best ways to measure certain variables or the most logical inferences to draw from patterns within the data. From a postpositivist perspective, progress toward genuine understandings of physical, social, and psychological phenomena tends to be gradual and probabilistic. For example, recall the earlier discussion of hypotheses being either *supported* or *not supported* by data. Postpositivists don't say, "I've just proven such-and-such." Rather, they're more likely to say, "This increases the probability that such-and-such is true."

Still other researchers have abandoned any idea that absolute truths are somewhere "out there" in the world, waiting to be discovered. In this perspective, known as **constructivism**, the "realities" researchers identify are nothing more than human *creations* that can be helpful in finding subjective meanings within the data collected. Constructivists not only acknowledge that they bring certain biases to their research endeavors but also try to be as upfront as possible about these biases. The emphasis on subjectivity and bias—rather than objectivity—applies to the phenomena that constructivist researchers study as well. By and large, constructivists focus their inquiries on people's *perceptions* and *interpretations* of various phenomena, including individuals' behaviors, group processes, and cultural practices.

Many of the quantitative methodologies described in this book have postpositivist, probabilistic underpinnings—a fact that becomes especially evident in the discussion of statistics in Chapter 8. In contrast, some qualitative methodologies have a distinctly constructivist bent, with a focus on ascertaining people's *beliefs* about truth, rather than trying to pin down absolute, objective truths that might not exist at all.

Yet once again we urge you *not* to think of quantitative research and qualitative research as reflecting a mutually exclusive, *either-this-or-that* dichotomy. For instance, some quantitative researchers approach a research problem from a constructivist framework, and some qualitative researchers tend to think in a postpositivist manner. Many researchers acknowledge *both* that (a) absolute truths regarding various phenomena may actually exist—even if they are exceedingly difficult to discover—and (b) human beings' self-constructed beliefs about those phenomena are legitimate objects of study in their own right. You might see the labels **pragmatism** and **realism** used in reference to such a philosophical orientation (e.g., see R. B. Johnson & Onwuegbuzie, 2004; Maxwell & Mittapalli, 2010).

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## TOOLS OF RESEARCH

Every professional needs specialized tools in order to work effectively. Without hammer and saw, the carpenter is out of business; without scalpel or forceps, the surgeon cannot practice. Researchers, likewise, have their own set of tools to carry out their plans.

The tools that researchers use to achieve their research goals can vary considerably depending on the discipline. A microbiologist needs a microscope and culture media; an attorney needs a library of legal decisions and statute law. By and large, we do not discuss such discipline-specific tools in this book. Rather, our concern here is with general tools of research that the great majority of researchers of all disciplines need in order to collect data and derive meaningful conclusions.

We should be careful not to equate the *tools* of research with the *methodology* of research. A **research tool** is a specific mechanism or strategy the researcher uses to collect, manipulate, or interpret data. The **research methodology** is the general approach the researcher takes in carrying out the research project; to some extent, this approach dictates the particular tools the researcher selects.

Confusion between the tool and the research method is immediately recognizable. Such phrases as "library research" and "statistical research" are telltale signs and largely meaningless terms. They suggest a failure to understand the nature of formal research, as well as a failure to differentiate between tool and method. The library is merely a place for locating or discovering certain data that will be analyzed and interpreted at some point in the research process. Likewise, statistics merely provide ways to summarize and analyze data, thereby allowing us to see patterns within the data more clearly.

Six general tools of research are these:

1. The library and its resources
2. Computer technology
3. Measurement
4. Statistics
5. Language
6. The human mind

In the following sections, we look more closely at each of these general tools.

## The Library and Its Resources

Historically, many literate human societies used libraries to assemble and store their collective knowledge. For example, in the seventh century B.C., the ancient Assyrians' Library of Nineveh contained 20,000 to 30,000 tablets, and in the second century A.D., the Romans' Library of Celsus in Ephesus housed more than 12,000 papyrus scrolls and, in later years, parchment books as well.<sup>4</sup>

Until the past few decades, libraries were primarily repositories of concrete, physical representations of knowledge—clay tablets, scrolls, manuscripts, books, journals, films, and the like. For the most part, any society's collective knowledge expanded rather slowly and could seemingly be contained within masonry walls. But by the latter half of the 20th century, people's knowledge about their physical and social worlds began to increase many times over, and at the present time it continues to increase at an astounding rate. In response, libraries have evolved in important ways. First, they have made use of many emerging technologies (e.g., microforms, CDs, DVDs, online databases) to store information in more compact forms. Second, they have provided increasingly fast and efficient means of locating and accessing information on virtually any topic. And third, many of them have made catalogs of their holdings available on the Internet. The libraries of today—especially university libraries—extend far beyond their local, physical boundaries.

We explore efficient use of a library and its resources in depth in Chapter 3. For now, we simply want to stress that the library is—and must be—one of the most valuable tools in any researcher's toolbox.

## Computer Technology



As a research tool, the personal computer is now commonplace. Personal computers have become increasingly compact and portable—first in the form of laptops and more recently in the forms of iPads, other tablet computers, and smartphones. In addition, computer software packages and applications have become increasingly user friendly, such that novice researchers can easily take advantage of them. But like any tool—no matter how powerful—computer technology has its limitations. Yes, computers can certainly calculate, compare, search, retrieve, sort, and organize data more efficiently and accurately than you can. But in their present stage of development, they depend largely on people to give them directions about what to do.

A computer is not a miracle worker—it cannot do your thinking for you. It can, however, be a fast and faithful assistant. When told exactly what to do, it is one of the researcher's best friends. Table 1.1 provides suggestions for how you might use computer technology as a research tool.

## Measurement

Especially when conducting quantitative research, a researcher needs a systematic way of *measuring* the phenomena under investigation. Some common, everyday measurement instruments—rulers, scales, stopwatches—can occasionally be helpful for measuring easily observable variables,

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<sup>4</sup>Many academic scholars would instead say “seventh century BCE” and “second century CE” in this sentence, referring to the more religiously neutral terms *Before Common Era* and *Common Era*. However, we suspect that some of our readers are unfamiliar with these terms, hence our use of the more traditional ones.

**TABLE 1.1** ■ The Computer as a Research Tool

<i>Part of the Study</i>	<i>Relevant Technological Support Tools</i>
Planning the study	<ul style="list-style-type: none"> <li>● Brainstorming assistance—software used to help generate and organize ideas related to the research problem, research strategies, or both.</li> <li>● Outlining assistance—software used to help structure various aspects of the study and focus work efforts.</li> <li>● Project management assistance—software used to schedule and coordinate varied tasks that must occur in a timely manner.</li> <li>● Budget assistance—spreadsheet software used to help in outlining, estimating, and monitoring the potential costs involved in the research effort.</li> </ul>
Literature review	<ul style="list-style-type: none"> <li>● Literature identification assistance—online databases used to help identify relevant research studies to be considered during the formative stages of the research endeavor.</li> <li>● Communication assistance—computer technology used to communicate with other researchers who are pursuing similar topics (e.g., e-mail, Skype, electronic bulletin boards, list servers).</li> <li>● Writing assistance—software used to facilitate the writing, editing, formatting, and citation management of the literature review.</li> </ul>
Study implementation and data gathering	<ul style="list-style-type: none"> <li>● Materials production assistance—software used to develop instructional materials, visual displays, simulations, or other stimuli to be used in experimental interventions.</li> <li>● Experimental control assistance—software used to physically control the effects of specific variables and to minimize the influence of potentially confounding variables.</li> <li>● Survey distribution assistance—databases and word processing software used in combination to send specific communications to a targeted population.</li> <li>● Online data collection assistance—websites used to conduct surveys and certain other types of studies on the Internet.</li> <li>● Data collection assistance—software used to take field notes or to monitor specific types of responses given by participants in a study.</li> </ul>
Analysis and interpretation	<ul style="list-style-type: none"> <li>● Organizational assistance—software used to assemble, categorize, code, integrate, and search potentially huge data sets (such as qualitative interview data or open-ended responses to survey questions).</li> <li>● Conceptual assistance—software used to write and store ongoing reflections about data or to construct theories that integrate research findings.</li> <li>● Statistical assistance—statistical and spreadsheet software packages used to categorize and analyze various types of data sets.</li> <li>● Graphic production assistance—software used to depict data in graphic form to facilitate interpretation.</li> </ul>
Reporting	<ul style="list-style-type: none"> <li>● Communication assistance—telecommunication software used to distribute and discuss research findings and initial interpretations with colleagues and to receive their comments and feedback.</li> <li>● Writing and editing assistance—word processing software used to write and edit successive drafts of the final report.</li> <li>● Dissemination assistance—desktop publishing software and poster creation software used to produce professional-looking documents and posters that can be displayed or distributed at conferences and elsewhere.</li> <li>● Presentation graphics assistance—presentation software used to create static and animated slides for conference presentations.</li> <li>● Networking assistance—blogs, social networking sites, and other Internet-based mechanisms used to communicate one's findings to a wider audience and to generate discussion for follow-up studies by others in the field.</li> </ul>

such as length, weight, or time. But in most cases, a researcher needs one or more specialized instruments. For example, an astronomer might need a high-powered telescope to detect patterns of light in the night sky, and a neurophysiologist might need a magnetic resonance imaging (MRI) machine to detect and measure neural activity in the brain.

In quantitative research, social and psychological phenomena require measurement as well, even though they have no concrete, easily observable basis in the physical world. For example, an economist might use the Dow-Jones Industrial Average or NASDAQ index to track economic growth over time, a sociologist might use a questionnaire to assess people's attitudes about

marriage and divorce, and an educational researcher might use an achievement test to measure the extent to which school children have learned something. Finding or developing appropriate measurement instruments for social and psychological phenomena can sometimes be quite a challenge. Thus, we explore measurement strategies in some depth when we discuss the research planning process in Chapter 4.

## Statistics

Statistics tend to be more useful in some academic disciplines than in others. For instance, researchers use them quite often in such fields as psychology, medicine, and business; they use statistics less frequently in such fields as history, musicology, and literature.

Statistics have two principal functions: to help a researcher (a) describe quantitative data and (b) draw inferences from these data. **Descriptive statistics** summarize the general nature of the data obtained—for instance, how certain measured characteristics appear to be “on average,” how much variability exists within a data set, and how closely two or more characteristics are associated with one another. In contrast, **inferential statistics** help the researcher make decisions about the data. For example, they might help a researcher decide whether the differences observed between two experimental groups are large enough to be attributed to the differing experimental interventions rather than to a once-in-a-blue-moon fluke. Both of these functions of statistics ultimately involve summarizing the data in some way.

In the process of summarizing data, statistical analyses often create entities that have no counterpart in reality. Let’s take a simple example: Four students have part-time jobs on campus. One student works 24 hours a week in the library, a second works 22 hours a week in the campus bookstore, a third works 12 hours a week in the parking lot, and the fourth works 16 hours a week in the cafeteria. One way of summarizing the students’ work hours is to calculate the arithmetic mean.<sup>5</sup> By doing so, we find that the students work, “on average,” 18.5 hours a week. Although we have learned something about these four students and their working hours, to some extent we have learned a myth: None of these students has worked exactly 18.5 hours a week. That figure represents absolutely no fact in the real world.

If statistics offer only an unreality, then why use them? Why create myth out of hard, demonstrable data? The answer lies in the nature of the human mind. Human beings can cognitively think about only a very limited amount of information at any single point in time.<sup>6</sup> Statistics help condense an overwhelming body of data into an amount of information that the mind can more readily comprehend and deal with. In the process, they can help a researcher detect patterns and relationships in the data that might otherwise go unnoticed. More generally, statistics *help the human mind comprehend disparate data as an organized whole*.

Any researcher who uses statistics must remember that calculating statistical values is not—and must not be—the final step in a research endeavor. The ultimate question in research is, *What do the data indicate?* Statistics yield *information* about data, but conscientious researchers are not satisfied until they determine the *meaning* of this information.

Although a book such as this one cannot provide all of the nitty-gritty details of statistical analysis, we give you an overview of potentially useful statistical techniques in Chapter 8.

## Language

One of humankind’s greatest achievements is language. Not only does it allow us to communicate with one another but it also enables us to think more effectively. People can often think more clearly and efficiently about a topic when they can represent their thoughts in their heads with specific words and phrases.

<sup>5</sup>When the word *arithmetic* is used as an adjective, as it is here, it is pronounced with emphasis on the third syllable (“ar-ith-MET-ic”).

<sup>6</sup>If you have some background in human memory and cognition, you may realize that we are talking about the limited capacity of *working memory* here (e.g., see Cowan, 2010; G. A. Miller, 1956).

For example, imagine that you're driving along a country road. In a field to your left, you see an object with the following characteristics:

- Black and white in color, in a splotchy pattern
- Covered with a short, bristly substance
- Appended at one end by something similar in appearance to a paintbrush
- Appended at the other end by a lumpy thing with four smaller things coming out of its top (two soft and floppy; two hard, curved, and pointed)
- Held up from the ground by four spindly sticks, two at each end

Unless you have spent most of your life living under a rock, you would almost certainly identify this object as a *cow*.

Words—even those as simple as *cow*—and the concepts that the words represent enhance our thinking in several ways (J. E. Ormrod, 2012; also see Jaccard & Jacoby, 2010):

1. **Words reduce the world's complexity.** Classifying similar objects and events into categories and assigning specific words to those categories can make our experiences easier to make sense of. For instance, it's much easier to think to yourself, "I see a herd of cows," than to think, "There is a brown object, covered with bristly stuff, appended by a paintbrush and a lumpy thing, and held up by four sticks. Ah, yes, and I also see a black-and-white spotted object, covered with bristly stuff, appended by a paintbrush and a lumpy thing, and held up by four sticks. And over there is a brown-and-white object . . ."
2. **Words allow abstraction of the environment.** An object that has bristly stuff, a paintbrush at one end, a lumpy thing at the other, and four spindly sticks at the bottom is a concrete entity. The concept *cow*, however, is more abstract: It connotes such characteristics as *female*, *supplier of milk*, and, to the farmer or rancher, *economic asset*. Concepts and the labels associated with them allow us to think about our experiences without necessarily having to consider all of their discrete, concrete characteristics.
3. **Words enhance the power of thought.** When you are thinking about an object covered with bristly stuff, appended by a paintbrush and a lumpy thing, held up by four sticks, and so on, you can think of little else (as mentioned earlier, human beings can think about only a very limited amount of information at any one time). In contrast, when you simply think *cow*, you can easily think about other ideas at the same time and perhaps form connections and interrelationships among them in ways you hadn't previously considered.
4. **Words facilitate generalization and inference drawing in new situations.** When we learn a new concept, we associate certain characteristics with it. Then, when we encounter a new instance of the concept, we can draw on our knowledge of associated characteristics to make assumptions and inferences about the new instance. For instance, if you see a herd of cattle as you drive through the countryside, you can infer that you are passing through either dairy or beef country, depending on whether you see large udders hanging down between two of the spindly sticks.

Just as *cow* helps us categorize certain experiences into a single idea, so, too, does the terminology of your discipline help you interpret and understand your observations. The words *tempo*, *timbre*, and *perfect pitch* are useful to the musicologist. Such terms as *central business district*, *folded mountain*, and *distance to k* have special meaning for the geographer. The terms *lesson plan*, *portfolio*, and *charter school* communicate a great deal to the educator. Learning the specialized terminology of your field is indispensable to conducting a research study, grounding it in prior theories and research, and communicating your results to others.

Two outward manifestations of language usage are also helpful to the researcher: (a) knowing two or more languages and (b) writing one's thoughts either on paper or in electronic form.

**The Benefits of Knowing Two or More Languages** It should go without saying that not all important research is reported in a researcher's native tongue. Accordingly, many doctoral programs require that students demonstrate reading competency in one or two foreign languages