GREGORY J. PRIVITERA

RESEARCH METHODS for the BEHAVIORAL SCIENCES

THIRD EDITION

Research Methods for the Behavioral Sciences

Third Edition

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Research Methods for the Behavioral Sciences

Third Edition

Gregory J. Privitera
St. Bonaventure University

SAGE

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FOR INFORMATION:

SAGE Publications, Inc.
2455 Teller Road
Thousand Oaks, California 91320
E-mail: order@sagepub.com

SAGE Publications Ltd.
1 Oliver's Yard
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B 1/I 1 Mohan Cooperative Industrial Area
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• Brief Contents •

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• About the Author •

St. Bonaventure University

Gregory J. Privitera is a professor of psychology at St. Bonaventure University where he is a recipient of its highest teaching honor, The Award for Professional Excellence in Teaching, and its highest honor for scholarship, The Award for Professional Excellence in Research and Publication. Dr. Privitera received his PhD in behavioral neuroscience in the field of psychology at the State University of New York at Buffalo and continued to complete postdoctoral research at Arizona State University. He is an author of multiple books on statistics, research methods, and health psychology, in addition to authoring more than three dozen peer-reviewed scientific articles aimed at advancing our understanding of health and well-being. He oversees a variety of undergraduate research projects at St. Bonaventure University, where dozens of undergraduate students, many of whom are now earning graduate degrees at various institutions, have coauthored research in his laboratories. For his work with students and fruitful record of academic and research advisement, Dr. Privitera was awarded Advisor of the Year by St. Bonaventure University in 2013. The first edition of this text was a recipient of the "Most Promising New Textbook" National Award from the Text and Academic Authors Association. In addition to his teaching, research, and advisement, Dr. Privitera is a veteran of the U.S. Marine Corps, and he is married with two children: a daughter, Grace, and a son, Aiden. Notably, Dr. Privitera is also the author of *Statistics for the Behavioral Sciences* (3rd edition) and *Essential Statistics for the Behavioral Sciences* (2nd edition).

• Acknowledgments •

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To all those at SAGE Publications, I am so very grateful to share in this experience and work with all of you. It is your vital contributions that have made this book possible and so special to me. Thank you.

I especially want to thank the thousands of research methods students across the country. It is your pursuit of scientific inquiry that has inspired this contribution. My hope is that you take away as much from reading this book as I have in writing it.

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• Preface •

The third edition of *Research Methods for the Behavioral Sciences* uses a problem-focused approach to introduce research methods in a way that fully integrates the decision tree—from identifying a research question to choosing an appropriate analysis and sharing results. This book begins with an introduction to the general research process, ethics, identifying and measuring variables, conducting literature reviews, selecting participants, and more. Research designs are then introduced in a logical order, from the least controlled (nonexperiments and quasi-experiments) to the most controlled (experiments). Throughout each chapter, students are shown how to structure a study to answer a research question (design) and are navigated through the challenging process of choosing an appropriate analysis or statistic to make a decision (analysis). This book integrates statistics with methods in a way that applies the decision tree throughout the book and shows students how statistics and methods fit together to allow researchers to test hypotheses using the scientific method. The following are unique features in this book to facilitate student learning:

- **Strengthened organization of research design:**
  - **Follows a problem-focused organization.** This book is organized into five main sections. Each section builds upon the last to give a full picture of the scientific process. In Section I, Scientific Inquiry, students are introduced to the process and ethics of engaging in the scientific method. In Section II, Defining and Measuring Variables, Selecting Samples, and Choosing an Appropriate Research Design, students are shown how to define and measure scientific variables, and methods used to select samples and choose an appropriate research design are described (Chapters 4–6). Sections III and IV fully introduce each type of research design from Nonexperimental Research Designs (Chapters 7–8) to Quasi-Experimental and Experimental Research Designs (Chapters 9–12), respectively. In Section V, Analyzing, Interpreting, and Communicating Research Data, students are shown how to summarize and describe statistical outcomes in words (using American Psychological Association [APA] style) and graphs. Also included is a full chapter that introduces how to use APA style to write manuscripts and gives an introduction to creating posters and giving talks (Chapters 13–15). The organization of this book is "problem focused" in that it introduces the scientific process as it would be applied from setting up a study, to conducting a study, to communicating the outcomes observed in that study—all while applying the decision tree to engage further the critical thinking skills of students.
  - **Ethics in Focus sections in each chapter.** Ethical considerations are often specific to a particular research design or methodology. For this reason, the topic of ethics is not only covered in Chapter 3, but at least one Ethics in Focus section is also included in each chapter. These sections review important ethical issues related to the topics in each chapter. This allows professors the flexibility to teach ethics as a separate section and integrate discussions of ethics throughout the semester. This level of organization for ethics is simply absent from most comparable research methods textbooks.

- **Introduces three broad categories of research design.** In truth, research design is complex. Many designs are hybrids that cannot be neatly fit into a single type of category or research design. For this reason, I simplify research designs into those that do not show cause (nonexperimental and quasi-experimental) and those that can show cause (experimental). For example, other books may introduce correlational designs as being separate from a nonexperiment. However, such a distinction is often unnecessary. The correlational design is an example of a nonexperiment—it does not show cause. Instead, the organization in this book focuses on understanding how, when, and why research designs are used and the types of questions each design can and cannot answer.
- **Chapters organized from least control to most control.** This book transitions from research designs with the least control (nonexperimental) to those with the most control (experimental). There is a logical progression as research designs are introduced in this book that is clearer than the organization you will find in many comparable textbooks. Students can clearly distinguish between the types of research designs they read, and this level of clarity can make it easier for students to understand how to appropriately select research designs to answer the many research questions that researchers ask.

- **Reduced bias in language across research designs:**
  - **Research design is introduced without bias.** Research designs are introduced as being used to answer different types of questions. I avoid referring to all studies as "experiments." In that spirit, experiments are instead introduced as answering different types of research questions. It is emphasized throughout this book that the ability to demonstrate cause does not make a design superior to other designs; it simply allows researchers to answer different types of questions (i.e., research questions pertaining to cause).
  - **The qualitative research design and perspective is given fair coverage.** While many textbooks appropriately focus on quantitative methods that make up most of the research conducted in the behavioral sciences, many omit or even are dismissive of qualitative methodology. This bias can mislead students into thinking that all research is quantitative. Although this book does emphasize quantitative methods because these methods are the most-used methodology in the behavioral sciences, fair coverage of qualitative methods is also included. In Chapter 7, for example, a section is included to introduce qualitative research, and in Chapter 15, an overview for reporting qualitative outcomes is included.

- **Emphasis on statistical technologies:**
  - **Guide for how to use IBM® SPSS® Statistics* with this book.** It can be difficult to teach from a textbook and a separate SPSS manual. The separate manual often does not include research examples or uses language that is inconsistent with language used in the textbook, which can make it difficult for students to learn. This book corrects for this problem by incorporating SPSS coverage into the book, which begins with the guide at the front of the book, "How to Use SPSS With This Book." The guide provides students with an easy-to-follow, classroom-tested overview of how SPSS is set up, how to read the Data View and Variable View screens, and how to use the SPSS in Focus sections in the book. This guide gives students the familiarization they need to be able to apply the SPSS instructions given in the book.

*SPSS is a registered trademark of International Business Machines Corporation.

- **SPSS in Focus sections in the chapters.** Most research methods textbooks for the behavioral sciences omit SPSS, include it in an appendix separate from the main chapters in the book, or include it in ancillary materials that often are not included with course content. In this book, SPSS is included in each appropriate chapter, particularly for experimental design chapters where specific designs are generally associated with specific statistical tests. These SPSS in Focus sections provide step-by-step, classroom-tested instruction using practical research examples for how the data measured using various research designs taught in each chapter can be analyzed using SPSS. Students are supported with annotated screenshot figures and explanations for how to read and interpret SPSS outputs.

- **Engages student learning and interest:**
  - **Conversational writing style.** I write in a conversational tone that speaks to the reader as if he or she is the researcher. It empowers students to view research methods as something they are capable of understanding and applying. It is a positive psychology approach to writing that involves students in the process and decisions made using the scientific process. The goal is to motivate and excite students by making the book easy to read and follow without "dumbing down" the information they need to be successful.
  - **Written with student learning in mind.** There are many features in this book to help students succeed. Many figures and tables are given in each chapter to facilitate student learning and break up the readings to make the material less intimidating. Key terms are bolded and defined on a separate text line, as they are introduced. Each defined term is included in a glossary, and these terms are also restated at the end of each chapter to make it easier for students to search for key terms while studying. In addition, margin notes are included in each chapter to summarize key material, and many reviews and activities are included at the end of each chapter to test learning and give students an opportunity to apply the knowledge they have learned.
  - **Learning objectives and learning objective summaries.** Learning objectives are stated in each chapter to get students focused and thinking about the material they will learn and to organize each chapter and to allow students to review content by focusing on those learning objectives they struggle with the most. In addition, a chapter summary organized by learning objective is provided at the end of each chapter. In this summary, each learning objective is stated and answered. Hence, not only are learning objectives identified in each chapter, but they are also answered at the end of each chapter.
  - **Learning Checks** are inserted throughout each chapter for students to review what they learn, as they learn it. Many research methods textbooks give learning check questions with no answer. How can students "check" their learning without the answers? Instead, in this book, all learning checks have questions with answer keys to allow students to actually "check" their learning before continuing their reading of the chapter.
  - **MAKING SENSE sections** support critical and difficult material. A research methods course can have many areas where students can struggle, and the MAKING SENSE sections are included to break down the most difficult concepts and material in the book—to make sense of them. These sections, included in most chapters in the book, are aimed at easing student stress and making research methods more approachable to students. Again, this book was written with student learning in mind.

- **APA Appendices** support student learning of APA style. The appendices include an APA writing guide (A.1); an APA guide to grammar, punctuation, and spelling (A.2); a full sample APA-style manuscript from a study that was published in a peer-reviewed scientific journal (A.3); and instructions for creating posters using Microsoft PowerPoint, with a sample poster and a poster template given (A.4). Also included are instructions for using randomization (B.1) and constructing a Latin square (B.2), a general instructions guide for using SPSS (C.1), and statistical tables for common tests (C.2). Hence, this book provides the necessary support for students who are asked to complete a research project, and complete an APA-style paper, poster, or talk. Few books provide this level of comprehensive supportive materials.

In addition, there is one more overarching feature that I refer to as *teachability*. Although this book is comprehensive and a great reference for any undergraduate student, it sometimes can be difficult to cover every topic in this book. For this reason, the chapters are organized into sections, each of which can largely stand alone, to give professors the ability to more easily manage course content by assigning students particular sections in each chapter when they cannot teach all topics covered in a chapter. Hence, this book was written with both the student and the professor in mind. Here are some brief highlights of what you will find in each chapter.

Chapter 1 is a traditional introductory chapter. Students are introduced to scientific thinking, the steps of the scientific method, the goals of science, and more. A key feature in this chapter is the distinction made between qualitative and quantitative research and between basic and applied research, as well as tips provided to help students distinguish between pseudoscience and science. These distinctions are not often made in a Chapter 1, if at all, but can be important in helping students identify key perspectives in conducting research.

Chapter 2 introduces students to what constitutes scientific ideas and provides guidelines for developing these ideas into hypotheses and theories. A full introduction to using online databases is provided, with suggestions provided for conducting an effective literature review. In addition, difficult concepts such as induction versus deduction and confirmational versus disconfirmational strategies are introduced, with many illustrations included to guide student learning.

Chapter 3 provides a full overview of key historic events related to ethics in behavioral research that led to the Nuremberg Code and the Belmont Report. Examples of historical events in psychology are also included, in addition to more recent examples. Students are further introduced to the standards and procedures set by institutional review boards for humans and institutional animal care and use committees for animals. A key feature in this chapter is the inclusion of each APA ethical standard stated in the APA code of conduct.

Chapter 4 identifies the types of variables researchers measure and the scales of measurement for data and describes ways to identify the reliability and validity of scientific measures. Note that validity and reliability of research design (e.g., internal and external validity) are not discussed in this chapter in order to focus chapter content only on the validity and reliability of measurement to avoid confusion.

Chapter 5 introduces sampling procedures, including nonprobability and probability sampling methods. Although the types of sampling are often included as a section within a chapter, this book devotes a full chapter to this topic—doing so allows for full coverage of sampling techniques, along with the many advantages and limitations associated with each sampling method. The concept of sampling error is also identified, with a section showing how to identify this error in SPSS output tables.

Chapter 6 establishes an organization for introducing research design in subsequent chapters. A tree diagram for experimental, quasi-experimental, and nonexperimental

designs is provided. These figures outline the different types of research design that fall into each category—and each design is introduced in the book. In addition, extensive illustrations associated with introducing common threats to internal and external validity are included to facilitate student learning on a topic that is often difficult for students. In addition, concepts such as manipulation, randomization, control, and individual differences are defined and explained because these concepts will be used in later chapters to distinguish between different research designs.

Chapter 7 introduces three nonexperimental designs: naturalistic designs, qualitative designs (phenomenology, ethnography, and case study), and existing data designs (archival, content, and meta-analysis). Qualitative and existing data designs often use techniques that build on those used with a naturalistic design, which is why these designs are grouped in the same chapter. For clarity, each design is described under a separate heading. A key feature for this chapter is the introduction of the qualitative perspective prior to introducing qualitative designs, which clearly distinguishes it from the quantitative perspective.

Chapter 8 introduces two more nonexperimental designs: survey designs and correlational designs. These designs are grouped in the same chapter because surveys are often used in correlational research. Suggestions are provided to help students write good survey items, and a section focused on issues related to sampling bias is included. For clarity, each design is described in a separate heading.

Chapter 9 introduces many quasi-experimental designs: one-group, time series, nonequivalent control group, and developmental designs. Quasi-experimental designs are clearly defined in that each design includes a quasi-independent variable and/or lacks a control group. In a separate heading, the first experimental design is introduced: single-case designs (reversal, multiple-baseline, and changing-criterion designs). The single-case designs are taught as experimental designs because they can demonstrate unambiguous cause and effect, which is the traditional way to introduce such designs.

Chapter 10 introduces the between-subjects experimental design for two groups and more than two groups. Also, this chapter begins by introducing what criteria must be met to qualify a study as an experiment (randomization, manipulation, and control/comparison). These criteria are used to distinguish the types of experimental designs introduced in the book. This chapter is unique in that statistical methods are introduced with research design in order to distinguish between methodological control (of individual differences) and statistical control (of statistical error). Each design is introduced in the full context of a research example so that students can clearly see how a research problem or hypothesis is tested from design to analysis.

Chapter 11 introduces the within-subjects experimental design for two groups and more than two groups. The chapter begins with a clear description of the conditions that must be met for such a design to qualify as an experiment. Issues related to counterbalancing and order effects are discussed. As in Chapter 10, statistical methods are introduced with research design in order to distinguish between methodological control (of order effects and individual differences) and statistical control (of statistical error). Each design is introduced in the full context of a research example so that students can clearly see how a research problem or hypothesis can be tested from design to analysis.

Chapter 12 introduces the factorial experimental design for the between, within, and mixed factorial designs. To illustrate the features of this design, many examples in the chapter are for the between-subjects factorial design. As in Chapters 10 and 11, statistical methods are introduced with research design in order to distinguish between methodological control (of order effects and/or individual differences) and statistical control (of statistical error), which is particularly useful for identifying main effects and interactions. Each design is introduced in the full context of a research example so that students can clearly see how a research problem or hypothesis can be tested from design to analysis.

Chapter 13 introduces descriptive statistics, graphing data, and statistical measures of reliability. The chapter introduces measures of frequency, central tendency, and variability and shows how to graph such measures. Calculations of measures of reliability (i.e., Cronbach's alpha and Cohen's kappa) are also introduced to reinforce topics first introduced in Chapter 4.

Chapter 14 introduces the logic of significance testing, each major test of significance, effect size, and confidence intervals. Each significance test is introduced with a decision tree diagram to support how to choose among the many parametric and nonparametric tests available for analyzing data. Effect size is introduced for *t* tests, analysis of variance (ANOVA), correlations, and the chi-square test. How to compute and interpret effect size are also discussed. In addition, estimation and the use of confidence intervals are described, with particular emphasis placed on how to read and interpret confidence intervals.

Chapter 15 includes a full introduction to writing an APA-style manuscript. Each section of the manuscript is described and illustrated using a sample manuscript. Suggestions for how to organize and write APA-style manuscripts are included. In addition, writing and presenting posters is discussed, with a final section providing suggestions for giving good presentations. Hence, this chapter meaningfully introduces each way of communicating research.

Appendix A fully supports the content covered in Chapter 15. It includes an APA writing guide (A.1); an APA guide to grammar, punctuation, and spelling (A.2); a full sample APA-style manuscript from a study that was published in a peer-reviewed scientific journal (A.3); and instructions for creating posters using Microsoft PowerPoint, with a sample poster and poster template given (A.4). These resources give students guidelines to support their APA writing.

Appendix B includes a random numbers table (B.1) with directions for using this table to randomly sample or randomly select participants in a study. The random numbers table supports concepts taught in Chapter 5 (random sampling) and Chapter 6 (random assignment). Also given are directions for constructing a Latin square (B.2) to support concepts taught in Chapter 11 (within-subjects designs).

Appendix C includes a general instructions guide for using SPSS (C.1). Throughout this book, these instructions are provided with an example for how to analyze and interpret data. However, it would be difficult for students to thumb through the book to find each test when needing to refer to these tests later. Therefore, this appendix provides a single place where students can go to get direction for any statistical test taught in this chapter. Also given with each instruction is where in the book they can go to find an example of how to compute each test. Also included are statistical tables for the *t* test, ANOVA, Pearson correlation, and chi-square (C.2) to support statistical material taught in Chapters 5, 7, 10, 11, 12, and 14.

New to This Edition

The third edition provides substantive changes that have improved clarity of content, linkage to learning objectives, connections across the text for design and analysis, and scholarship substantially updated throughout. The changes allow for more comprehensive presentation of the material, based on years of feedback from colleagues, instructors, and students, that is more illustrative in nature and meaningful for students. Three major overarching themes to the revisions are apparent. A broad summary of changes in the third edition is given briefly here.

The first theme was to connect readers with a more comprehensive introduction to design and analysis for quantitative research by highlighting the assumptions for parametric testing in a new feature, *Testing the Assumptions of Parametric Testing*. This feature

balances the coverage of this final analysis step in quantitative research by (1) making students aware of the assumptions, (2) connecting readers to where in the book they can learn about nonparametric alternatives to this testing, and (3) providing students with a more balanced perspective for choosing appropriate statistical analyses to analyze quantitative data.

Another theme in the writing of the third edition was that the figures, tables, and writing were revised to improve clarity throughout. Many revisions were specifically based on feedback from instructors and students, such as updating the example for distinguishing between basic and applied research, adding more examples to clarify between types of validity and reliability, pulling apart the sections on basic and control time series designs, expanding the section on writing valid and reliable survey items, and updating many examples for the experimental designs. Changes included revising figures and tables, in addition to revising and adding new content throughout to build strong writing around the content being presented, as per feedback from students and instructors.

The third theme that arose was updating scholarship throughout. As disciplines in the behavioral sciences advance, it is important to link hypothesis methodology to current examples to help students (1) realize the value and real-world application of research design in the behavioral sciences and (2) connect students to examples in research that they can relate to their own experiences and interests. The scholarship was updated throughout with over 130 new references added to reflect updated scholarship and perspectives, while also removing many references that are relatively outdated. The scholarship was updated both in the text and in the end-of-chapter problems to bolster student learning throughout the book.

In addition, many other changes were made to reflect recent advances or changes in the field. For example, SPSS version 25 made updates that changed not only the views but, in some cases, changed the selection options required to analyze data, which has not been the case for quite some time. Those changes are reflected in this third edition, both in the chapters and in Appendix B. In addition to highlighting the assumptions for parametric testing with quantitative methodologies, the qualitative sections were likewise revised to incorporate a strong focus on the holistic perspective of these methodologies and the general nature of conducting and interpreting such studies in the social behavioral sciences.

Additional changes in the book include learning objectives that were updated throughout and learning objective summaries that were revised with those corresponding changes. Examples were added and revised as needed to further clarify the examples in chapters and make the writing more concise where appropriate. The end-of-chapter pedagogy was revised and updated to include new content where needed. If end-of-chapter materials were revised, then the corresponding answer key was also updated. Overall, the changes allow for a more comprehensive presentation of the material and scholarship based on years of feedback from colleagues, instructors, and students.

Supplements

Visit **edge.sagepub.com/priviteramethods3e** for a complete set of ancillary resources, including:

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- Editable, chapter-specific **PowerPoint® slides** offer complete flexibility for creating a multimedia presentation for the course
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- An **Instructor's Manual** provides chapter-by-chapter lecture notes, discussion questions, class activities, and more to ease preparation for lectures and class discussions
- **SPSS in Focus Screencasts** that accompany each SPSS in Focus section from the book show you how to use SPSS step-by-step
- **Answer keys** for all problems featured in the book and in the SPSS Workbook assist in grading student work
- EXCLUSIVE! Access to full-text **SAGE journal articles** that have been carefully selected to support and expand on the concepts presented in each chapter to encourage students to think critically
- **Multimedia content** includes videos that appeal to students with different learning styles
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- Mobile-friendly **eFlashcards** strengthen understanding of key terms and concepts
- **Web resources** are included for further research and insights
- **Multimedia content** includes audio and video resources that appeal to students with different learning styles
- EXCLUSIVE! Access to full-text **SAGE journal articles** that have been carefully selected to support and expand on the concepts presented in each chapter

Thank you for choosing *Research Methods for the Behavioral Sciences*, and best wishes for a successful semester.

Gregory J. Privitera
St. Bonaventure, New York

• To the Student—How to Use SPSS With This Book •

The Statistical Package for the Social Sciences (SPSS), acquired by IBM in January 2010, is an innovative statistical computer program used to compute most statistics taught in this book. This preface provides you with an overview to familiarize you with how to open, view, and understand this software. The screenshots in this book show SPSS version 25.0 for the PC. Still, even if you use a Mac or different version, the figures and instructions should provide an effective guide for helping you use this statistical software (with some minor differences, of course). SPSS will be introduced throughout this book, so it will be worthwhile to read this preface before moving into future discussions of SPSS. Included in this preface is a general introduction to familiarize you with this software.

Understanding this software is especially important for those interested in research careers because it is the most widely used statistical program in the social and behavioral sciences. For students who will be working through a research project this semester, knowing how to enter, analyze, and interpret statistics using SPSS is instrumental to your success. The SPSS in this book is an essential complement to your reading and work because it will help you better understand and interpret the output from SPSS software.

P.1 Overview of SPSS: What Are You Looking At?

When you open SPSS, you will see a window that looks similar to an Excel spreadsheet. (In many ways, you will enter and view the data similar to that in Microsoft Excel.) At the bottom of the window, you will see two tabs as shown in Figure P.1. The **Data View** tab is open by default. The **Variable View** tab to the right of it is used to view and define the variables being studied.

Data View

The Data View screen includes a **menu bar** (located at the top of the screen), which displays the following commands that perform most functions that SPSS provides: **File**, **Edit**, **View**, **Data**, **Transform**, **Analyze**, **Graphs**, **Utilities**, **Extensions**, **Window**, and **Help**. Each command will be introduced as needed in each chapter in the SPSS in Focus sections.

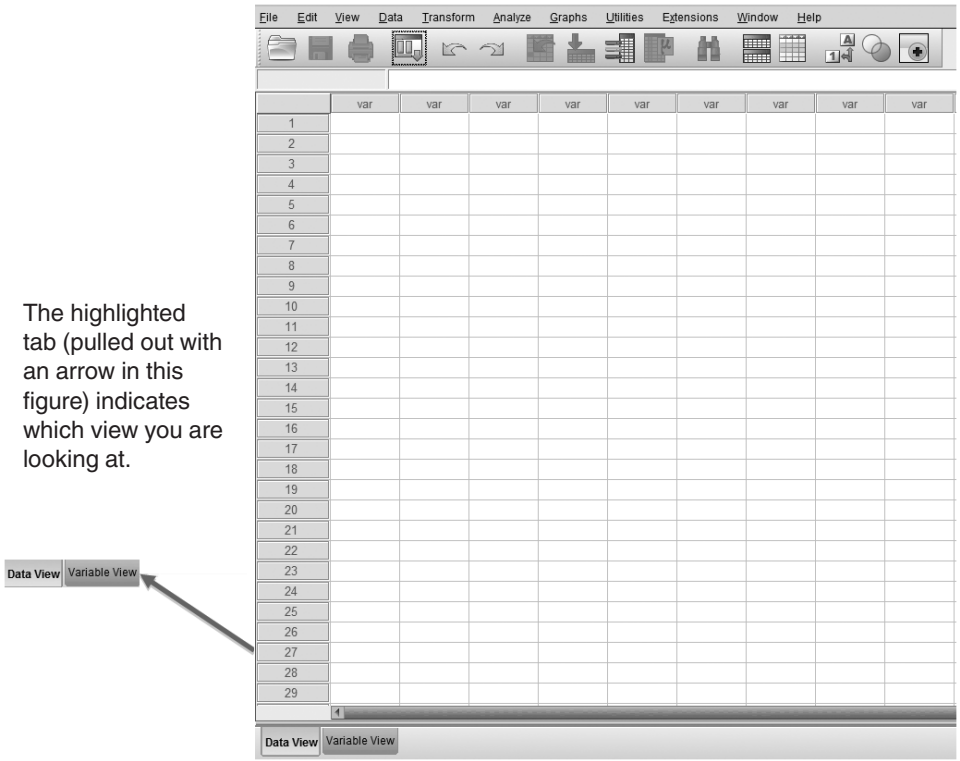
Below the menu bar is where you will find the **toolbar**, which includes a row of icons that perform various functions. We will use some of these icons, whereas others are beyond the scope of this book. The purpose and function of each icon will be introduced as needed in each chapter (again, in the SPSS in Focus sections).

Within the spreadsheet, there are **cells** organized in columns and rows. The rows are labeled numerically from 1, whereas each column is labeled *var*. Each column will be used to identify your variables, so *var* is short for *variable*. To label your variables with something other than *var,* you need to access the Variable View tab—this is a unique feature to SPSS.

Variable View

When you click the Variable View tab, a new screen appears. Some features remain the same. For example, the menu bar and toolbar remain at the top of your screen. What changes is

FIGURE P.1 ● Default Data View in SPSS



the spreadsheet—notice that the rows are still labeled numerically beginning with 1 but the labels across the columns have changed. There are 11 columns in this view, as shown in Figure P.2: **Name**, **Type**, **Width**, **Decimals**, **Label**, **Values**, **Missing**, **Columns**, **Align**, **Measure**, and **Role**. We will describe each column in this section.

Name. In this column, you enter the names of your variables (but no spaces are allowed). Each row identifies a single variable. Also, once you name a variable, the columns label in the Data View will change. For example, while in Variable View, enter the word *stats* in the first cell of this column. Now click on the Data View tab at the bottom left. Notice that the

FIGURE P.2 ● Variable View Page With 11 Columns

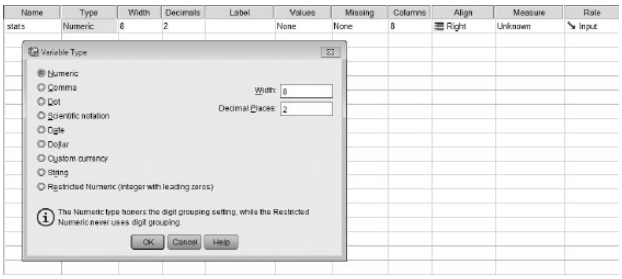
	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1											
2											
3											
4											
5											

Each column allows you to label and characterize variables.

label for column 1 has now changed from *var* to *stats*. Also, notice that once you enter a name for a variable, the row is suddenly filled in with words and numbers. Do not worry; this is supposed to happen.

Type. This cell identifies the type of variable you are defining. When you click in the box, a small gray box with three dots appears. Click on the gray box and a dialog box appears, as shown in Figure P.3. By default, the variable type selected is numeric. This is because your variable will almost always be numeric, so we usually just leave this cell alone.

FIGURE P.3 ● Variable Type Dialog Box



The dialog box shown here appears by clicking the small gray box with three dots in the Type column. This allows you to define the type of variable being measured.

Width. The Width column is used to identify the largest number or longest string of your variable. For example, grade point average would have a width of 4: one digit to the left of the decimal, one space for the decimal, and two digits to the right. The default width is 8. So if none of your variables are longer than 8 digits, you can just leave this alone. Otherwise, when you click in the box, you would select the up and down arrows that appear to the right of the cell to change the width.

Decimals. This cell allows you to identify the number of places beyond the decimal point in your variables. Like the Width cell, when you click in the decimal box, you can select the up and down arrows that appear to the right of the cell to change the decimals. If you enter whole numbers, for example, you would simply set this to 0.

Label. The Label column allows you to label any variable whose meaning is not clear. For example, we can label the variable name *stats* as *statistics* in the label column, as shown in Figure P.4. This clarifies the meaning of the *stats* variable name.

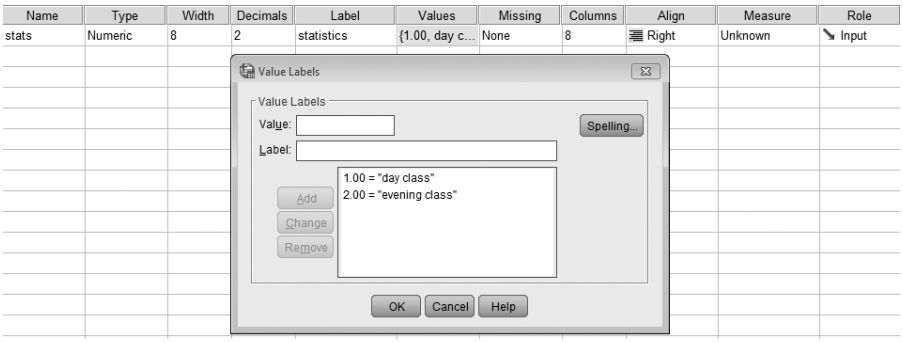
FIGURE P.4 ● Column for Labeling Variables

Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
stats	Numeric	8	2	statistics	None	None	8	Right	Unknown	Input

In this example, we labeled the variable name stats as statistics in the Label column.

Values. This column allows you to identify the levels of your variable. This is especially useful for coded data. Nominal data are often coded numerically in SPSS because SPSS recognizes numeric values. For example, sex could be coded as 1 (*male*) and 2 (*female*); seasons could be coded as 1 (*spring*), 2 (*summer*), 3 (*fall*), and 4 (*winter*).

FIGURE P.5 ● Value Labels Dialog Box



The dialog box shown here appears by clicking the small gray box with three dots in the Values column. This function allows you to code data that are not numeric.

Click on the small gray box with three dots to display a dialog box where we can label the variable, as shown in Figure P.5. To illustrate, we will label *day class* as 1 and *evening class* as 2 for our *stats* variable. To do this, enter *1* in the value box and *day class* in the label box, then click the **add** option. Follow these same instructions for the *evening class* label. When both labels have been entered, click **OK** to finish.

Missing. It is at times the case that some data researchers collect are missing. In these cases, you can enter a value that, when entered, means the data are missing. *99* is a common value used to represent missing data. To enter this value, click on the small gray box with three dots that appears to the right of the cell when you click in it. In the dialog box, it is most common to click on the second open circle and enter a *99* in the first cell. When this has been entered, click **OK** to finish. Now, whenever you enter *99* for that variable in the Data View spreadsheet, SPSS will recognize it as missing data.

Columns. The Columns column lets you identify how much room to allow for your data and labels. For example, the *stats* label is 5 letters long. If you go to the Data View spreadsheet, you will see *stats* as the column label. If you wrote *researchcourse* in the name column, then this would be too long because the column's default value is only 8. You can click the up and down arrows to increase or decrease how much room to allow for your column name label.

Align. The Align column allows you to choose where to align the data you enter. You can change this by selecting the dropdown menu that appears after clicking in the cell. The alignment options are right, left, and center. By default, numeric values are aligned to the right, and string values are aligned to the left.

Measure. This column allows you to select the scale of measurement for the variable (scales of measurement are introduced in Chapter 4). By default, variables are unknown until you select the scale of measurement in the dropdown menu that appears after clicking in the

cell. The options in the dropdown menu are *scale* (refers to interval or ratio data), *ordinal*, and *nominal*. When you select a scale of measurement, an icon will be added next to the name of your variable in the data view tab: a ruler for scale, a histogram for interval, and three circles for nominal. In this book, scales of measurement are introduced in Chapter 4.

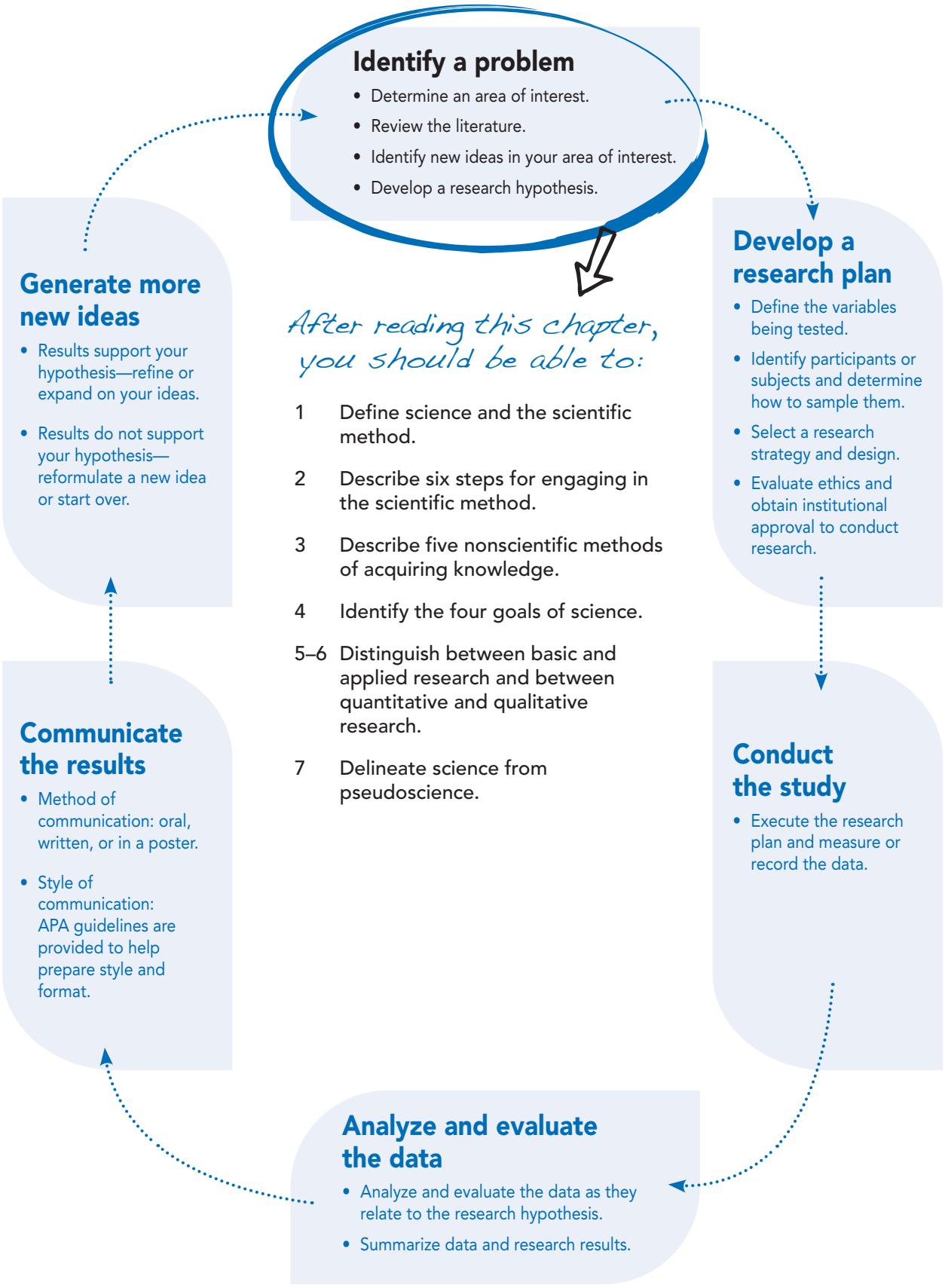
Role. The Role column has a dropdown menu that allows you to choose the following commands: input, target, both (input and target), none, partition, or split. Each of these options in the dropdown menu generally allows you to organize the entry and appearance of data in the Data View tab. Although each option is valuable, these are generally needed for data sets that we will not work with in this book.

P.2 Preview of SPSS in Focus

This book is unique in that you will learn how to use SPSS in the context of the research designs that require its use (this instruction is provided in the SPSS in Focus sections in many chapters). Most research methods textbooks omit this information, include it in an appendix separate from the main chapters in the book, or include it in ancillary materials that often are not included with course content. The reason SPSS is included in this book is simple: Most researchers use some kind of statistical software to analyze data, and in the social and behavioral sciences, the most common statistical software utilized by researchers is SPSS. So, this textbook brings research methods to the 21st century, giving you both the theoretical and the applicable instruction needed to understand how, when, and why to analyze data using appropriate technologies.

SECTION I

Scientific Inquiry


Identify a problem
• Determine an area of interest.
• Review the literature.
• Identify new ideas in your area of interest.
• Develop a research hypothesis.
Develop a research plan
• Define the variables being tested.
• Identify participants or subjects and determine how to sample them.
• Select a research strategy and design.
• Evaluate ethics and obtain institutional approval to conduct research.
Conduct the study
• Execute the research plan and measure or record the data.
Analyze and evaluate the data
• Analyze and evaluate the data as they relate to the research hypothesis.
• Summarize data and research results.
Communicate the results
• Method of communication: oral, written, or in a poster.
• Style of communication: APA guidelines are provided to help prepare style and format.
Generate more new ideas
• Results support your hypothesis—refine or expand on your ideas.
• Results do not support your hypothesis—reformulate a new idea or start over.
After reading this chapter, you should be able to:
1 Define science and the scientific method.
2 Describe six steps for engaging in the scientific method.
3 Describe five nonscientific methods of acquiring knowledge.
4 Identify the four goals of science.
5–6 Distinguish between basic and applied research and between quantitative and qualitative research.
7 Delineate science from pseudoscience.

1

Introduction to Scientific Thinking

Are you curious about the world around you? Do you think that seeing is believing? When something seems too good to be true, are you critical of the claims? If you answered yes to any of these questions, the next step in your quest for knowledge is to learn about the methods used to understand events and behaviors—specifically, the methods used by scientists. Much of what you think you know is based on the methods that scientists use to answer questions.

For example, on a typical morning you may eat breakfast because it is "the most important meal of the day." If you drive to school, you may put away your cell phone because "it is unsafe to use cell phones while driving." At school you may attend an exam review session because "students are twice as likely to do well if they attend the session." In your downtime you may watch commercials or read articles that make sensational claims like "scientifically tested" and "clinically proven." At night you may get your "recommended 8 hours of sleep" so that you have the energy you need to start a new day. All of these decisions and experiences are related in one way or another to the science of human behavior.

This book reveals the scientific process, which will allow you to be a more critical consumer of knowledge, inasmuch as you will be able to critically review the methods that lead to the claims you come across each day. Understanding the various strengths and limitations of using science can empower you to make educated decisions and confidently negotiate the many supposed truths in nature. The idea here is that you do not need to be a scientist to appreciate what you learn in this book. *Science* is all around you—for this reason, being a critical consumer of the information you come across each day is useful and necessary across professions.

1.1 Science as a Method of Knowing

Science is the acquisition of knowledge through observation, evaluation, interpretation, and theoretical explanation.

The **scientific method**, or **research method**, is a set of systematic techniques used to acquire, modify, and integrate knowledge concerning observable and measurable phenomena.

This book is a formal introduction to the scientific method. **Science** is one way of knowing about the world. The word *science* comes from the Latin *scientia*, meaning knowledge. From a broad view, science is any systematic method of acquiring knowledge apart from ignorance. From a stricter view, though, science is specifically the acquisition of knowledge using the **scientific method**, also called the **research method**.

To use the scientific method we make observations that can be measured. An observation can be direct or indirect. For example, we can directly observe the number of students enrolled in a school from one academic year to another. We can also observe how well a student at a school performs on a test by counting the number of correct answers on the test. However, learning, for example, cannot be directly observed. We cannot "see" learning. Instead, we can indirectly observe learning by administering tests of knowledge before and after instruction or by recording the number of correct responses when applying the knowledge to a new situation. In both cases, we indirectly observe learning by defining how we structured our observations to "see" learning. Likewise, consider many other commonly studied behaviors, such as love, resilience, creativity, and loyalty; all of these behaviors must be defined in terms of how we structured our observations to indirectly observe them. Hence, we can make direct observations or we can make indirect observations by defining how we precisely measure a given behavior.

The scientific method requires the use of systematic techniques, many of which are introduced and discussed in this book. Each method or design comes with a specific set of assumptions and rules that make it *scientific*. Think of this as a game. A game, such as a card game or sport, only makes sense if players follow the rules. The rules, in essence, define the game. The scientific method is very much the same. It is defined by rules that scientists must follow, and this book is largely written to identify those rules for engaging in science. To begin this chapter, we introduce the scientific method and then introduce other nonscientific ways of knowing to distinguish them from the scientific method.

Science is one way of knowing about the world by making use of the scientific method to acquire knowledge.

Learning Check 1 ✓

1. Define the scientific method.
2. Engaging in the scientific method is like a game. Explain.

Answers:

1. The scientific method is a set of systematic techniques used to acquire, modify, and integrate knowledge concerning observable and measurable phenomena; 2. Science is defined by rules that all scientists must follow in the same way that all players must follow rules defined for a game or sport.

1.2 The Scientific Method

To engage in the scientific method, we need to organize the process we use to acquire knowledge. This section provides an overview of this process. The remainder of this book elaborates on the details of this process. The scientific method is composed of six general steps, which are shown in Figure 1.1. The steps are the following:

Identify a problem

Develop a research plan

Conduct the study

Analyze and evaluate the data

Communicate the results

Generate more new ideas

Step 1: Identify a Problem

The research process begins when you identify the problem to be investigated, or a problem that can be resolved in some way by making observations. For example, prior work has shown a surprising relationship that the more young adults use alcohol, the more they engage in exercise behavior (French, Popovici, & Maclean, 2009; Leasure, Neighbors, Henderson, & Young, 2015). From this prior work, Abrantes, Scalco, O'Donnell, Minami, and Read (2017) evaluated possible reasons why this relationship exists among college students. For example, Abrantes et al. tested whether students who drink more also exercise more to compensate for the calories consumed from drinking alcohol. They investigated this problem by observing students and recording their exercise and drinking patterns and their reasons for alcohol use.

In Step 1, we determine what to observe in a way that will allow us to answer questions about the problem we are investigating. In the behavioral sciences, we often investigate problems related to human behavior (e.g., drug abuse; diet and health factors; social, moral, political views), animal behavior (e.g., mating, predation, conditioning, foraging), or processes and mechanisms of behavior (e.g., cognition, learning and memory, consciousness, perceptions). Step 1 is discussed in greater detail in Chapter 2.

(1) Determine an Area of Interest.

The scientific process can take anywhere from a few days to a few years to complete, so it is important to select a topic of research that interests you. Certainly, you can identify one or more human behaviors that interest you.

(2) Review the Literature.

The literature refers to the full database of scientific articles, most of which are now accessible using online search engines. Reviewing the scientific literature is important because it allows you to identify what is known and what can still be learned about the behavior of interest to you. It will be difficult to identify a problem without first reviewing the literature.

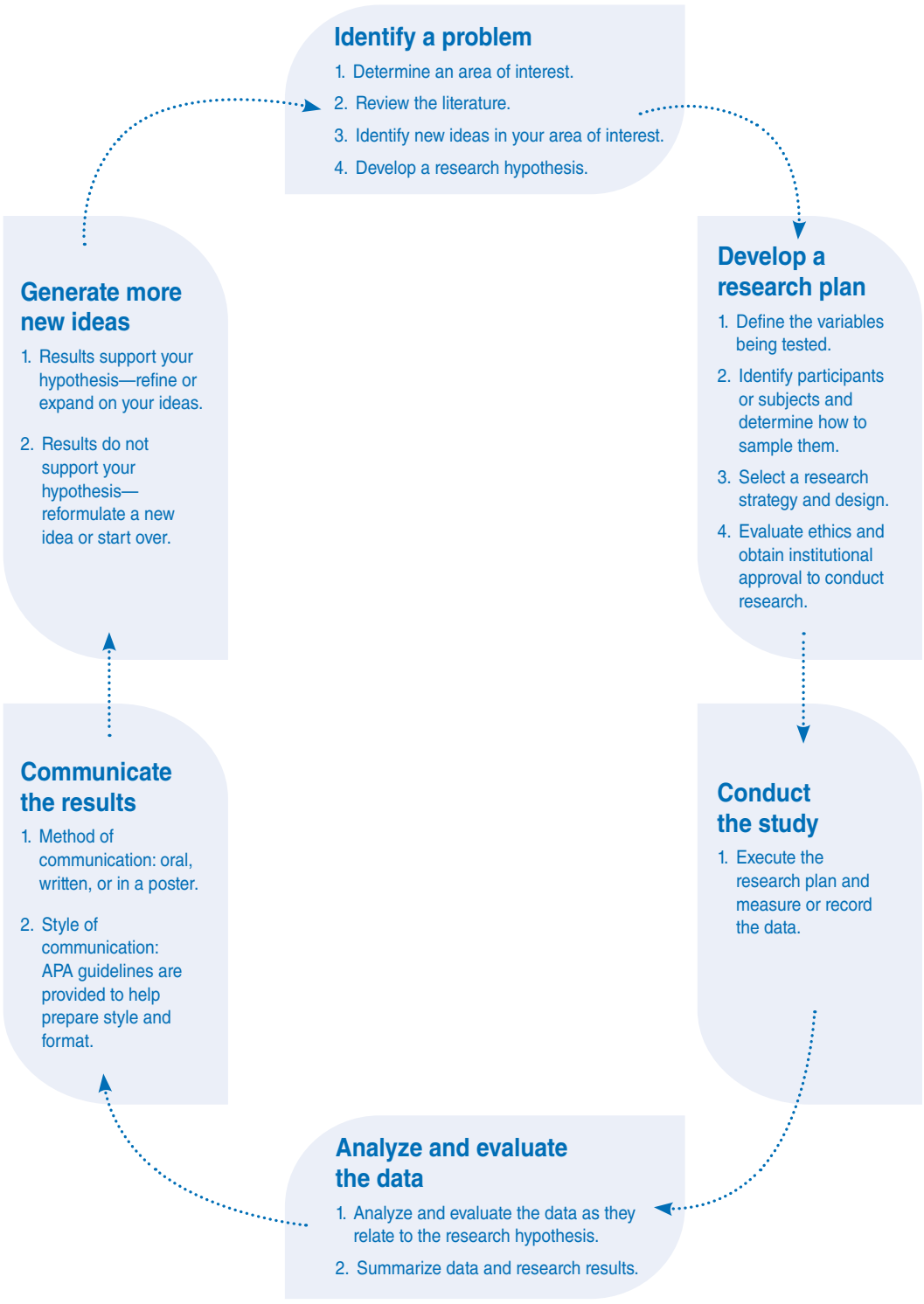
(3) Identify New Ideas in Your Area of Interest.

Reviewing the literature allows you to identify new ideas that can be tested using the scientific method. The new ideas can then be restated as predictions or expectations based on what is known. For example, below are two outcomes identified in a literature review. From these outcomes we then identify a new (or *novel*) idea that is given as a statement of prediction, called a **research hypothesis**:

A **research hypothesis** or **hypothesis** is a specific, testable claim or prediction about what you expect to observe given a set of circumstances.

Scientific Outcome 1: Toy premiums linked to food purchases, such as free toys or collectables, enhance food purchases among children (Jenkin, Madhvani, Signal, & Bowers, 2014).

FIGURE 1.1 ● The Six Steps of the Scientific Method



Scientific Outcome 2: Offering "meal plus free toy" deals to children is associated with a greater frequency of eating fast foods (Emond, Bernhardt, Gilbert-Diamond, Li, & Sargent, 2016).

Research hypothesis: Offering "meal plus free toy" deals for healthier meal options to young children will increase the percentage of children choosing healthier meals.

(4) Develop a Research Hypothesis.

The research hypothesis is a specific, testable claim or prediction about what you expect to observe given a set of circumstances. We identified the research hypothesis that offering "meal plus free toy" deals for healthier meal options to young children will increase the percentage of children choosing healthier meals. This hypothesis is similar to one tested by Dixon, Niven, Scully, and Wakefield (2017), which we will revisit at the end of this section. Note that the research hypothesis we stated is derived from findings in the previous literature. It is important, particularly in science, to build upon (not simply repeat) previous knowledge. Reviewing the literature allows us to identify what we know and build upon that to state research hypotheses that can generate new knowledge.

Step 2: Develop a Research Plan

Once a research hypothesis is stated, we need a plan to test that hypothesis. The development of a *research plan*, or a strategy for testing a research hypothesis, is needed to be able to complete Steps 3 and 4 of the scientific process. The chapters in Sections II, III, and IV of this book discuss Steps 2 to 4 in greater detail. Here, we develop a research plan so that we can determine whether our hypothesis is likely to be correct or incorrect.

(1) Define the Variables Being Tested.

A **variable**, or any value that can change or vary across observations, is typically measured as a number in science. The initial task in developing a research plan is to define or *operationalize* each variable stated in a research hypothesis in terms of how each variable is measured. The resulting definition is called an **operational definition**. For example, we can define the variable identified in the research hypothesis we developed: Offering "meal plus free toy" deals for healthier meal options to young children will increase the percentage of children choosing healthier meals.

A **variable** is any value or characteristic that can change or vary from one person to another or from one situation to another.

An **operational definition** is a description of some observable event in terms of the specific process or manner by which it was observed or measured.

In our research hypothesis, we state that the percentage of choices for a healthier meal option will increase if a "meal plus toy" deal is offered. The term *choice*, however, is a decision made when given two or more options. We need to measure this phenomenon in such a way that it is numeric and others could also observe or measure choice in the same way. How we measure *choice* will be the operational definition we use. For our prediction, we have operationalized choice as a percentage: the *percentage* of children choosing a healthier food option with versus without offering a "meal plus toy" deal.

We could define or operationalize *choice* in other ways, such as a count (i.e., the number of healthier food options chosen). However, in our study, we define this as a percentage (of children choosing a healthier food option). We typically state one operational definition for a variable. In our example, then, we define *choice* as a percentage. The critical part of stating operational definitions is to disclose *how* exactly we objectively measured a behavior numerically, such that another researcher could replicate our measurements. The operational definition we use can often influence the type of study we conduct in Step 3.

To make a testable claim, or hypothesis, it is appropriate to then develop a plan to test that claim.

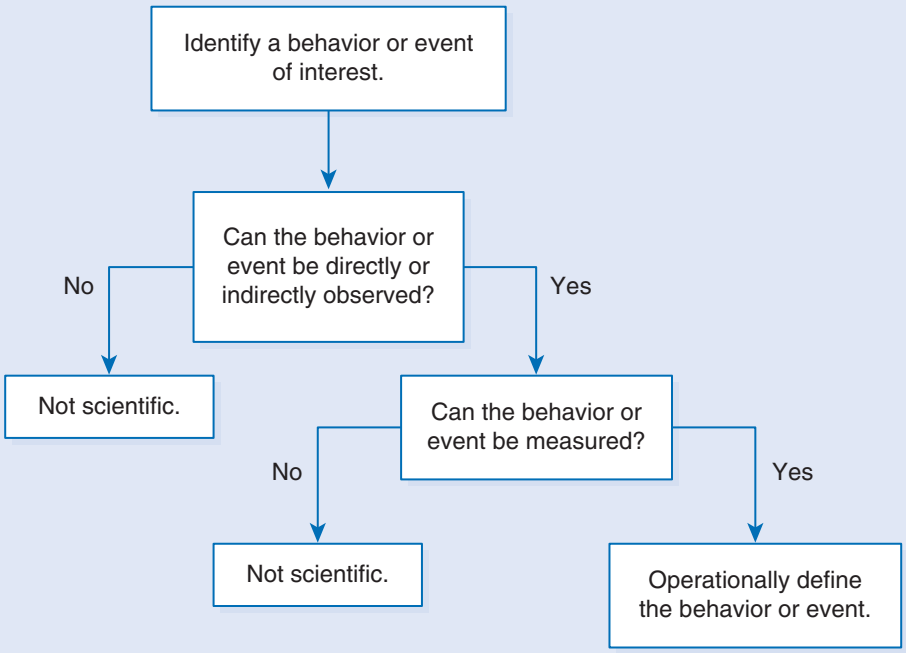
To operationally define a variable, you define it in terms of how you will measure it.

MAKING SENSE—OBSERVATION AS A CRITERION FOR "SCIENTIFIC"

In science, only observable behaviors and events can be tested using the scientific method. Figure 1.2 shows the steps to determine whether a phenomenon can be tested using the scientific method. Notice in the figure that we must be able to observe and measure behaviors and events. Behaviors and events of interest (such as *choice* for a meal) must be observable because we must make observations to conduct the study (Step 3). Behaviors and events must be measurable because we must analyze the observations we make in a study (Step 4)—and to analyze observations, we must have defined the specific way in which we measured those observations.

The scientific method provides a systematic way to test the claims of researchers by limiting science to only phenomena that can be observed and measured. In this way, we can ensure that the behaviors and events we study truly exist and can be observed or measured by others in the same way we observed them by defining our observations operationally.

FIGURE 1.2 ● A Decision Tree for Identifying Scientific Variables



A behavior or event must be observable and measurable to be tested using the scientific method.

(2) Identify Participants or Subjects and Determine How to Sample Them.

A **population** is a set of *all* individuals, items, or data of interest about which scientists will generalize.

Next we need to consider the population of interest, which is the group that is the subject of our hypothesis. A **population** can be any group of interest. In our research hypothesis, we identify young children. We should define further what *young children* refers to here. In our example, let us define the age range as preteen between the ages of 5 and 12 years (school-aged), which is the typical age of children observed in such studies. The population of interest to us, then, is school-aged children between the ages of 5 and 12 years.

Of course, we cannot readily observe every 5- to 12-year-old child. For this reason, we need to identify a sample of 5- to 12-year-old children whom we will actually observe or have access to study in our study. A **sample** is a subset or portion of individuals selected from the larger group of interest. Observing samples instead of entire populations is more realistic and more economical—it generally requires less time, less money, and fewer resources than observing an entire population. Concomitantly, most scientific research is conducted with samples and not populations. There are many strategies used to appropriately select samples, as is introduced in Chapter 5.

A **sample** is a set of *selected* individuals, items, or data taken from a population of interest.

(3) Select a Research Strategy and Design.

After defining the variables and determining the type of sample for the research study, we need a plan to test the research hypothesis. The plan we use will largely depend on how we defined the variable being measured. For our example, let us develop a research plan for our operational definition of *choice*: The percentage of children choosing a healthier food option with versus without offering a "meal plus toy" deal. Figure 1.3 illustrates the research plan using this operational definition. To structure a study to test our hypothesis, we need to compare choices for healthier meals that offer versus do not offer a toy deal.

Using Operational Definition 2, we predict that a higher percentage of children will choose a healthier meal compared to a less healthy meal if the healthier meal includes a toy deal offer. To test this prediction, we set up a two-group design in which we record the number of children choosing a healthier or less healthy meal in one group that offers no toy deal for either meal (Group No Toy Deal) and in another group where the healthier meal option offers a toy deal (Group Healthier Meal Plus Toy Deal). We then compare the percentage of children choosing the healthier meal with versus without the toy deal offer. Selecting an appropriate research strategy and design is important; nearly half of the chapters in this book (Chapters 6 to 12) are devoted to describing this step.

FIGURE 1.3 ● Developing a Research Plan to Test the Hypothesis

Research Plan
(measuring the percentage of choices made)

Young children are shown two meal options: one that does and one that does not offer a toy deal for the healthier meal. The groups, measurements, and prediction for the hypothesis being tested are summarized below.

Groups:	*No Toy Deal Group*: Children choose between a healthier and less healthy meal where both meals do not offer a toy deal.	*Healthier Meal Plus Toy Deal Group*: Children choose between a healthier and less healthy meal where only the healthier meal offers a toy deal.
Measurements:	Operational definition for *choice*: The percent of children choosing a healthier food option with versus without offering a "meal plus toy" deal.	
Prediction from research hypothesis:	A higher percentage of children will choose a healthier meal compared to a less healthy meal if the healthier meal offers a "meal plus toy" deal.	

A research plan with two groups using *percentages* as the operational definition for choice. The type of research design we implement influences how the dependent variable will be defined and measured.