Designing and Conducting Research in Education

Clifford J. Drew
University of Utah

Michael L. Hardman
University of Utah

John L. Hosp
University of Utah

Sage Publications
Brief Table of Contents

Preface xvii

PART I. OVERVIEW OF RESEARCH 1
Chapter 1: The Foundations of Research 3
Chapter 2: The Research Process 29
Chapter 3: Ethical Issues in Conducting Research 55
Chapter 4: Participant Selection and Assignment 81
Chapter 5: Measures and Instruments 109

PART II. RESEARCH METHODS AND DESIGNS 135
Chapter 6: Quantitative Research Methodologies 137
Chapter 7: Designing Nonexperimental Research 165
Chapter 8: Introduction to Qualitative Research and Mixed-Method Designs 183
Chapter 9: Research Design Pitfalls 209

PART III. DATA ANALYSIS AND RESULTS INTERPRETATION 241
Chapter 10: Statistics Choices 243
Chapter 11: Data Tabulation 259
Chapter 12: Descriptive Statistics 287
Chapter 13: Inferential Statistics 305
Chapter 14: Analyzing Qualitative Data 335
Chapter 15: Interpreting Results 355

Appendix: Table of Random Numbers 370
Glossary 375
References 387
Index 000
About the Authors 000

First Proof not final
Contents

Preface xvii

PART I. OVERVIEW OF RESEARCH 1

Chapter 1: The Foundations of Research 3

Chapter Objectives 4
Perspectives of Educational Research 5
Research and the Consumer 5
  Distinguishable Differences in Research for the Consumer 6
  Research as Information and Its Implications 7
Research and the Professional 8
  Keeping Current With Research 10
Defining Ways of Conducting Research 10
  The “Ivory Tower” Research 11
  Basic Versus Applied Research 11
  Action Versus Theoretical Research 12
Research in Action 13
  Personalized Approach 12
Foundations of Research 15
  Four Ways of Knowing or Fixing Belief 15
    Tenacity 15
    Authority 16
    A Priori 16
    Method of Science 16
Inductive and Deductive Reasoning 17
Differences Between Experimental Science and Common Sense 17
  Theoretical Structures and Concepts 17
  Theory Development and Testing 18
  Concept of Control 18
  Relationships Among Phenomena 18
  Explanations of Phenomena 18
Research Types and Methods in Brief 19
Quantitative Research 20
  Experimental Research 20
  Nonexperimental Research 20
Qualitative Research 21
  Mixed Methods 21
The Research Process 21
  Selecting a Research Topic 22
  Distilling the Topic Into Research Question Format 23
  Moving From the Question and Hypothesis to the Design 24
  Using the Research in Data-Based Decision Making 24
Chapter 2: The Research Process

Chapter Objectives
Finding a Topic to Investigate
The Process of Discovering an Idea
Reading Published Articles
Reading Literature Reviews
Replicating Previous Studies
Student Research Ideas and Educational Objectives
Objectives for a Thesis
Steps in the Scientific Method
Distilling the Idea or Problem
Types of Questions
Research in Action
Operational Definition
Formulating a Specific Research Question
Building Your Case
Hypotheses
Design and Implementation of the Study Plan
Reliability of Data
Simulation 2.1
Data Collection
Important Considerations When Collecting Data
An Essential Rule for Data Collection
Anticipating Contingencies in the Study
Data Analysis
Interpretation From Results
Why It Happened, and What It Means
Meaningful Interpretation
Chapter Summary
Key Terms
Student Study Site
Simulation Feedback 2.1

Chapter 3: Ethical Issues in Conducting Research

Chapter Objectives
Ensuring the Protection of Human Participants
Consent
Capacity
Information
Voluntariness
Research in Action
Harm
Potential Hazards to Participants
Determining the Degree of Harm
Chapter 5: Measures and Instruments

Chapter Objectives
Selection and Definition of a Criterion Measure
Features of Criterion Measures
Reliability
Research in Action
Validity
Direct Measurement
Characteristics of Alternative Measures
Measure Communication Value
Measure Sensitivity
Comments on Criterion Measures
Simulation 5.1
Instruments or Tasks
Participant Reactivity to Tasks
Multiple Task Effects
Types of Instruments Used in Research
Task Performance Range
The Questionnaire's Purpose and Design
Constructing the Questionnaire
Pitfalls to Avoid in Question Writing
Using Observation as an Instrument
Observation Protocols
Protocol Formats
Comments
Chapter Summary
Key Terms
Student Study Site
Simulation Feedback 5.1

PART II. RESEARCH METHODS AND DESIGNS

Chapter 6: Quantitative Research Methodologies

Chapter Objectives
Defining Quantitative Research
Characteristics of Experimental Studies
Controlling or Manipulating Contaminating Factors
Criterion Measures
Quasi and True Experiments: Approaches to Group Experimentation
Basic Experimental Design Formats
Time Series or Single-Subject Experimental Designs
Important Elements in Single-Subject Research
Data Stability
Determining Baseline
Types of Single-Subject Designs
PART III. DATA ANALYSIS AND RESULTS INTERPRETATION

Chapter 10: Statistics Choices
Chapter Objectives
Statistics: What and Why
  What Are Statistics?
  Why Statistics Are Important
  Categories of Statistical Techniques
  Descriptive Studies
  Inferential Studies
The Decision Tree: Moving From the Question to the Analysis
  Decision One: What Type of Question?
  Decision Two and Thereafter
    Descriptive Question
    Difference Question
    Relationship Question
Simulation 10.1
The Importance of Data Type in Selecting Statistics
  Properties of Numbers
    Identity
    Order
    Additivity
  Types of Data
    Nominal Data
    Ordinal Data
Research in Action
  Interval Data
  Ratio Data
  Using Different Statistics for Each Data Type
Simulation 10.2
Summary
Key Terms
Student Study Site
Simulation Feedback 10.1
Simulation Feedback 10.2

Chapter 11: Data Tabulation
Chapter Objectives
Aggregating Data
  Ranks
Research in Action
  Grouping
    Intervals
Simulation 11.1
  Common Content
Tables

First Proof not final
This book is designed for use in the very first course in educational research, which may involve students at any level and is frequently offered at both the undergraduate or beginning graduate levels depending on the student’s program. The purpose of this book is to provide a first step into the world of research, for consumers of research and also for students who will be actively involved in conducting research. The material presented here can serve as an initial conceptual framework for students without a background in research. From this beginning, students may then either proceed to more advanced work or end their study of research methods with a general working knowledge of what research involves.

This book reflects some very strong beliefs held by the authors. One basic belief is that the study of research methods and their use is surrounded by a number of academic myths. Further, we believe that if you strip away these myths, research methods are not difficult. Some of the academic myths related to research methods include the notions that research is synonymous with statistics, that studying research methods is too difficult for some students, and that research is reserved for a chosen few. We do not subscribe to these beliefs, and over 75 years of combined experience teaching research methods supports our position. Even when we do discuss statistics, our emphasis is on selecting the correct analysis rather than computation. Another academic myth is that research has little to do with our daily lives. We do not subscribe to this belief either, and we find many applications in our daily lives. One final belief has been particularly important to us in teaching this material over the years. We believe this is fun content, and that viewpoint has seemingly been appreciated by our students.

**Toolbox of Educational Research**

The world of educational research has experienced a number of important developments over the past few decades, and this book emphasizes those changes. In particular, you will find examinations of quantitative, qualitative, and mixed-method research approaches, which have emerged as vital components in the toolbox of educational research. As methodologists, we believe strongly in multiple research methods and approaches. The basic design of an investigation represents the foundation on which successful research is built, irrespective of methodology or approach employed. We have used this same philosophy in presenting action research through all the steps, from a research question to interpreting results. We describe action research studies in each chapter, taking the student through various challenges presented by environmental circumstances often encountered in field settings.
PEDAGOGICAL FEATURES

Research Design Simulations

As instructors, we believe in practice, which is why you will find problem simulations at the end of each chapter that are helpful as students move through the material. These simulations address each step in the research process, from the idea stage through implementation and results interpretation. In the very early parts of the book, students are asked to develop research ideas into researchable questions. They are then given research questions for which they develop designs, and the process moves forward through selecting appropriate statistics and interpreting results. These simulations have been field tested on students over many years.

The simulations may be used in a variety of fashions, depending on the instructor’s preference. They may be effectively used in class sessions for both individual and small-group participation. It seems to be more effective to complete the relevant simulations immediately after reading a given section than to wait until the entire chapter is read. These points in the text are “flagged” with instructions to the reader regarding which simulation is appropriate and where it may be found. Each simulation is accompanied by simulation feedback at the end of the chapter. Usually it is helpful for a student to read this feedback immediately after completing a given problem. The feedback provides a check on the student’s performance for that problem and is useful before proceeding to the next simulation or further reading. In addition, throughout the book, readers will find terms that are printed in boldface, which means their definitions can be found in the glossary at the back of the book.

Research in Action

Research in Action boxes are included in each chapter to highlight ways that research is integrated into every educator’s life. Each box starts off with a list of “key points in the chapter reflected in this box” that ties the chapter to the boxed material. Next, each box includes “objectives to learn from this box” to help students understand the purpose of the boxed material. Each box also includes two scenarios that describe student experiences with research. The boxes end with a “Think About This” section that reflects on what has been learned from the research scenarios. Overall, these boxes are a great resource to help students understand how they might encounter and use research in their everyday life.

ORGANIZATION OF THE TEXT

The way this book is organized reflects our belief in terms of how educational research should be taught; we begin with a background on research and then walk students through the research process from beginning to end.

Part I provides basic background information about research—what it is, why it is important, and an overview of the fundamental steps in the process. Chapter 1 does this by defining research, dispelling misconceptions, discussing why research is important, and providing an overview on the foundations of research. Chapter 2 describes the research process from beginning to end. Chapters 3 and 4 lay the groundwork for ethical issues, participant selection, and participant involvement. In Chapter 5, background is provided on the steps to follow in helping select and develop ways of collecting measures. The research overview in the first five chapters reflects the view of an outsider looking into the research process and experiencing this new world for the first time.
Part II examines a variety of research designs as well as major issues often encountered in planning and implementing studies. Chapter 6 begins with quantitative methodologies, moves on to discuss experimental variables, criterion measures, single subject and group designs, and then concludes with the importance of planning ahead for data analysis. Chapter 7 focuses on non-experimental studies, beginning with survey research and moves to observation as a data collection approach. Chapter 8 discusses qualitative and mixed-method approaches. Chapter 9 explores the pitfalls encountered in research designs. This part of the book continues emphasizing pre-implementation planning in order to maximize the strength of research designs and minimize contaminating influences.

Part III completes the research process by exploring statistics, data tabulation, and analysis and interpretation of results. Chapter 10 begins with a discussion of what statistics are and why we use them. Chapter 11 discusses the various components of data aggregation and tabulation as well as how and when to use tables and graphs. Chapter 12 discusses descriptive statistics including central tendency and dispersion. Chapter 13 moves ahead to inferential statistics and Chapter 14 examines the analysis of qualitative data. Chapter 15 completes the last leg of the research loop with a focus on interpreting results.

The remainder of the book includes an appendix with a random numbers table and a glossary. Together these chapters provide all of the necessary information needed to complete a course in educational research.

SUPPLEMENTAL MATERIALS

Designing and Conducting Research in Education comes with a variety of supplements designed with both faculty and students in mind.

Instructor’s Resource CD-ROM

This CD offers the instructor a variety of resources that supplement the book material, including sample syllabi, teaching tips, PowerPoint® lecture slides, lecture outlines, classroom activities, additional simulations, media resources, and more. Also included is an electronic Test Bank, which consists of 20–30 multiple choice questions with answers and page references, 10–15 true/false questions, as well as 10–15 short answer and 5–10 essay questions for each chapter. Instructors can create, deliver, and customize tests and study guides using Brownstone’s Diploma test bank software.

Web-Based Student Study Site

www.sagepub.com/drewstudy

This Web-based student study site provides a variety of additional resources to enhance students’ understanding of the book content and take their learning one step further. The site includes comprehensive study materials, such as chapter objectives, e-flash cards, practice tests, and more. Also included are special features, such as How to Read a Research Article, Learning from Journal Articles, Expanding on “Research in Action,” and a variety of educational research web resources.
Acknowledgments

We are indebted to many whose wisdom and frustrations have contributed to the conceptualization of this volume. It is always risky to name specific individuals since some will undoubtedly be overlooked. Such practices are, however customary and appropriate despite the risk. First and foremost are our students, who have helped us learn to teach about research, served as primary impetus for the book, and also served as the research participants as we tried out new material or new simulations. Sincere appreciation is also extended to our colleagues who read portions of the manuscript and made suggestions. We are particularly grateful to our reviewers,

James E. Barr, Nicholls State University
Sheryl Boris-Schacter, Lesley University
Nancy Brown, Oakland University
Yvonne N. Bui, University of San Francisco
MaryAnn Byrnes, University of Massachusetts Boston
A. Keith Dils, King’s College
Debbie L. Hahs-Vaughn, University of Central Florida
Dwight Hare, Mississippi State University
Steven A. Harris, Tarleton State University
Douglas Hermond, Prairie View A&M University
Shouping Hu, Florida State University
John A. Huss, Northern Kentucky University
Jenifer Moore, National Center for Rural Early Childhood Learning Initiatives
Alfred P. Rovai, Regent University
Joan P. Sebastian, National University
Wayne H. Slater, University of Maryland
Patience Sowa, Rockhurst College
Hersh C. Waxman, University of Houston
Cherng-Jyh Yen, The George Washington University

They provided invaluable feedback and suggestions that helped guide our work.

Clifford J. Drew
Michael L. Hardman
John L. Hosp
Part I

OVERVIEW OF RESEARCH

Part I provides basic background information about research—what it is, why it is important, and what the fundamental steps are in the process. Chapter 1 begins with a definition of research, dispelling a number of misconceptions about the process and those who conduct it. These points are combined with discussions of why research is important in the lives of both consumers as well as professionals in education. The rationale for conducting a study is also examined. The overview on foundations of research concludes with an examination of how research and science fit with other “methods of knowing,” general descriptions of the different types of research, and how to proceed in selecting a research topic and molding it into a research question.

Chapter 2 describes the research process from beginning to end. The discussion explores where to find research ideas and how to identify them from readings, previous studies, and daily life. The scientific method is discussed, from the perspective of how research ideas become focused and molded into specific research questions, the types of questions studied, and how these steps proceed into planning the research design. The chapter continues with steps on how to implement a study, including collecting data, ensuring reliability, analyzing the results, and drawing implications for practice- and data-based decision making.

Chapters 3 and 4 lay the groundwork for locating and protecting research study participants. Ethical considerations, informed consent, and protecting participants from harm are extremely important in conducting educational research. Investigations involving children present a number of particularly challenging issues in conducting research to improve education. Ethical issues must be balanced with the significance and need for the study in moving forward with participant selection. In Chapter 5, these steps are followed by the basic process of selecting and developing ways of collecting data. The process of defining and selecting criterion measures is discussed with careful attention to data reliability and validity. Selecting a measure is examined in terms of how sensitive it is and how well it communicates the purpose of the research. Challenges presented by various measures and instruments are discussed as well as how to avoid specific problems. The discussion concludes with the development of instruments to collect data, including questionnaires as well as observation protocols.

The research overview in each of the five chapters in this section emphasizes the view of an outsider looking into the research process and experiencing this new world for the first time. The discussion on developing research topics, questions, and plans for implementing studies de-emphasizes the use of jargon and focuses on why research is important and how the beginning researcher can get started. This is the point of departure for education students who may either choose to actively engage in the process or become consumers of research themselves.
1

The Foundations of Research

Chapter Outline

Chapter Objectives
Perspectives of Educational Research
  Research and the Consumer
    Distinguishable Differences in Research for the Consumer
  Research as Information and Its Implications
  About Simulations
  Simulation 1.1
  Research and the Professional
    Keeping Current With Research
Defining Ways of Conducting Research
  The "Ivory Tower" Research
  Basic Versus Applied Research
  Action Versus Theoretical Research
  Research in Action
  Personalized Approach
Foundations of Research
  Four Ways of Knowing or Fixing Belief
    Tenacity
    Authority
    A Priori
    Method of Science
  Inductive and Deductive Reasoning
  Differences Between Experimental Science and Common Sense
  Theoretical Structures and Concepts
  Theory Development and Testing

Concept of Control
  Relationships Among Phenomena
  Explanations of Phenomena
  Research Types and Methods in Brief
  Simulation 1.2
Quantitative Research
  Experimental Research
  Nonexperimental Research
Qualitative Research
  Mixed Methods

The Research Process
  Selecting a Research Topic
  Distilling the Topic Into Research
    Question Format
  Moving From the Question and Hypothesis to the Design
  Using the Research in Data-Based Decision Making

Chapter Summary

Key Terms

Student Study Site

Simulation Feedback 1.1

Simulation Feedback 1.2
Research means different things to different people. A layperson’s view of research may be limited to descriptions seen in advertisements and on television (which are really marketing and may not involve research at all). Likewise, if you ask six different scientists what research is, you may receive six different answers. Some may respond with very lofty and complex-sounding definitions. Others might be somewhat more casual in their responses, using more commonplace terms.

Students often find it difficult to determine a clear and useful definition of research. Many research courses begin with a discussion of some particular focused content. Unfortunately, that content often focuses on a limited part of the research process, such as statistics, and does not place it in the context of the world around us. Some might think that the definition of research is supposed to become self-evident as the discussion progresses. Perhaps an instructor assumes that you already know what research is and that your purpose in taking the course, or reading a research text, is to become thoroughly familiar with details of the process. Before going any further, let us examine this basic question: what is research?

Research is a systematic way of asking questions, a systematic method of inquiry. The purpose of research is to obtain knowledge or information that pertains to some question. The question may be simple (such as, “Which of these teaching methods is most effective?”) or it may be more complicated. The emphasis of this definition is the term systematic. There are many ways of asking questions and obtaining information. Research is a method that attempts to undertake this task in a systematic fashion to obtain objective and unbiased information. The definition of research presented above is simple. There are many descriptive characteristics involved in different types of research that we will see throughout this book. At the outset, however, a general definition will serve quite well.

The term research has traditionally generated a variety of misconceptions on the part of those not involved. To students, it sometimes seems like a shroud of secrecy has been placed over the act of research, either purposefully or by accident. The net outcome of this situation is a general lack of information concerning what goes on in a research laboratory, the nature of the research process, and what research results mean. All of this tends to generate a mystique and suspicion of the whole process on
the part of lay and student populations. The process of conducting research is anything but mystical, and it certainly is not mechanistic. This will become increasingly clear as you progress further into the content of this book.

Research has typically been an anxiety-producing topic for students. In fact, the most consistent description of what research is may be found among students. From a student perspective—particularly the beginning student—research generates a certain amount of mental anguish, perhaps even outright fear. To many students, research is basically an academic hurdle to be conquered but has little relevance to the “real world” we live in (see Box 1.1 for an illustration of this). In addition, for many students, research is synonymous with statistics, and that implies mathematics. These perceptions are unfortunate misconceptions that must be corrected to better understand the research process. For example, it is critical to understand from the outset that research is much more than statistics. Statistical analysis represents only one step in the overall research process. The statistics used in research would be better viewed as tools, like the way an automobile mechanic uses screwdrivers and wrenches. The mechanic’s tools are of little value if there is no clear understanding of how a car works. Likewise, the researcher who does not know how to initiate the logical process of asking questions will have little meaningful use for statistical or other scholarly tools. Some research tools involve no statistics whatsoever.

### PERSPECTIVES OF EDUCATIONAL RESEARCH

This discussion of research began with some brief attention to what research is and is not. We also began with a general definition of research as a systematic method of inquiry. It is important at this point to examine why the study of research design is useful. The purpose of this section is to address that question from two perspectives: that of the consumer and the professional.

#### Research and the Consumer

In discussing issues related to the importance of studying research, we initially focus on the consumer perspective. This view provides one of the most compelling rationales available for becoming familiar with the research process. We are consumers of research in nearly every facet of our daily lives—clearly, research does relate to the real world.

Almost daily, the news media reports the results of drug research and product recalls on medicine and many other consumer products because of faulty research. In some cases, research results suggest a risk to consumers; in others, the results simply indicate that there is no positive effect. We also hear many reports about
government requirements related to education, such as the No Child Left Behind (NCLB) Act and fluid requirements for educational curriculum related to science such as teaching evolution. Both of these latter topics are high profile and attract national attention. Many research outcomes have educational impacts in some very practical ways. For example, we know a lot more about the effectiveness of various instructional techniques in reading, math, and other academic content areas than we did 30 years ago. We know that the direct and explicit teaching of letters and words, as well as syntactic, phonetic, and semantic analysis improves literacy program effectiveness for children with intellectual disabilities. This approach is known as direct instruction and emerged prominently in research literature within the last 30 years (Hardman, Drew, & Egan, 2006; Katims, 2000).

Science and research produce new knowledge on a daily basis (e.g., effects of implementing educational programs for young children), and that new knowledge provides society with more choices. Providing more choices is a strong, consumer-oriented rationale for research, but the consumer must be equipped to take advantage of new options (Jones & Kottler, 2006). In most cases, the individual consumer will need to interpret the research results and be able to determine what those results mean for his or her life.

**Distinguishable Differences in Research for the Consumer**

It is important for us to be able to distinguish between a sales pitch and research evidence. Product advertising in the media often resorts to assertions about research, with subtle and not-so-subtle claims that scientific studies have proved the superior effectiveness of whatever product is being sold. While some might be truthful, there are many such statements that are simply advertising claims cloaked in a research covering to enhance appeal. Lay research consumers can see through such statements with some basic knowledge about the research process and make personal decisions about claims of scientific support. One indicator of a marketing exaggeration is when the narrative says that something was proved; scientists will almost never use the term proved.

Students of research quickly become quite cynical concerning the manner in which research is used and misused to manipulate consumers. A few examples make this point clear. Some of the worst offenders in terms of misusing research are the people who develop and present advertising on television. It seems that one technique of selling a product on television is rather simple: Employ an unknown actor, put that individual in a white coat behind a desk (with rows of books on the wall), and the product to be sold suddenly appears scientifically credible. If the advertisement is a bit more aggressive, the actor may also tell some sort of research story to drive the point home. The story may begin like this: “At a famous research center in the East . . .” One example of this type of selling is a commercial in which a well-known toothpaste was claimed to be “unsurpassed in the prevention of cavities when compared to the other leading brands of toothpaste.” The wording of this line is carefully drafted and important. The implication is that this brand (Brand X) is more effective in preventing cavities. However, that is not what was said. The term unsurpassed specifically means that the other leading brands were not any better than Brand X. Most likely there was no difference between them. Certainly, if Brand X was really more effective, the advertisers would emphatically say so.

Parents are immediately thrust into the role of educational consumers as their children approach school age. They may be faced with decisions about whether early school experiences are productive for their children. Digging through the research literature is a cumbersome process to determine preschool effectiveness, and even reports about the topic that appear in the media can be challenging to understand. It is worthwhile to know some general research methods information to help figure out what is being said. What does a positive correlation between participation and later academic performance mean? What does a comparison between two approaches to
early childhood education tell us? These are the types of consumer questions that are floating around out there. They are also circumstances where knowing about how research is conducted is very helpful to understand what is being reported.

**Research as Information and Its Implications**

Lay consumers are inundated on a daily basis with what appears to be research information and its implications. Without some knowledge of the research process, they are at the mercy of those who present the information. Laws requiring truthful advertising will not help people make intelligent decisions. On a personal level, it is your child who is about to go off to preschool. You are the one who has to make a consumer decision about the nature of preschool experience that you think is best for your child. It is important for you, as lay consumers, to have enough background about research methods to make intelligent judgments regarding claims that are supposedly based on research. It is important to have enough information to know what research generally says about preschool experiences. It also may be worth knowing why some people are raising such a fuss about NCLB; after all, doesn’t that law relate to all children receiving what they deserve? Read over the “About Simulations” piece and complete Simulation 1.1 at the end of this chapter to see if the implied cause of the results makes sense.

**About Simulations**

*Topic:* What simulations are and how to approach them

*Background statement:* This class may be an unusual one for many of you. For one thing, some of you may be frightened about this content and anything that has to do with the word “research.” Many students don’t know what research is but are pretty certain that they aren’t smart enough to understand it, let alone conduct research. You will survive it, and later you will wonder what all the mystery was about. Although there are terms in research that are not common in the lay world, for the most part, research can be explained in common English.

As you proceed through this content, there will be points when you are instructed to complete what we call “simulations.” At that point you should take a few minutes to work on the simulation. The notion is that the material presented simulates, or mimics, problems that have just been covered, either in the text or as an in-class topic. These are not math problems because this material does not involve math. Basically you are asked to write out responses (in the space identified as “your response”). You can work individually or in small groups, whichever suits your own temperament and how your instructor wants it done. In many cases, we encourage students to work together on these because the group work seems to have great instructional value and it certainly is more fun. When you are finished (or totally frustrated and cannot go further), turn to the written feedback for that simulation. Each simulation has written feedback, with the same number, in the feedback section of each chapter. Your instructor may circulate among you as you are working on your simulations. This is done to be helpful, not snoopy.

The simulations are all important to complete, so don’t just blow them off as something that is not helpful. In our 40 years of experience, the simulations are the element of this course that has been consistently rated as excellent and useful by the students in our classes. Have fun with this material. If this is your first step into research methods, that may sound like a strange statement, but just relax a bit and enjoy this experience.

*Your response:* This is the area in a simulation where you write your response to the task presented.
The perspective of a research consumer is also relevant to most professionals. Professionals often encounter situations similar to those confronting lay consumers. The content may be different since, as a professional, you are consuming work-related items or services, rather than weight-loss pills or another lay-oriented product. However, because professional consumers have to select from an array of competing products, they still need to be familiar with the research process. Once again, a few examples illuminate this point, some also involving the news media.

One serious illustration of the misuse of research information occurs regularly in schools across the United States. Headlines scream that a state’s third graders performed 2 points below (or 10 points above) the national average on this year’s standardized reading test. The story often attributes the blame or credit for these scores, whether explicitly or implicitly, to the teaching staff. In fact, there may be a variety of influences that are likely to be contributing to these scores. For example, it may be that a local high-tech scientific firm moved its design plant, thereby relocating most of its scientists to another community. If the children of these scientists (who tend to perform better academically) represent a significant group in the school’s population, these results may be misattributed. Your task is to determine how best to address this issue.


**Research and the Professional**

The perspective of a research consumer is also relevant to most professionals. Professionals often encounter situations similar to those confronting lay consumers. The content may be different since, as a professional, you are consuming work-related items or services, rather than weight-loss pills or another lay-oriented product. However, because professional consumers have to select from an array of competing products, they still need to be familiar with the research process. Once again, a few examples illuminate this point, some also involving the news media.

One serious illustration of the misuse of research information occurs regularly in schools across the United States. Headlines scream that a state’s third graders performed 2 points below (or 10 points above) the national average on this year’s standardized reading test. The story often attributes the blame or credit for these scores, whether explicitly or implicitly, to the teaching staff. In fact, there may be a variety of influences that are likely to be contributing to these scores. For example, it may be that a local high-tech scientific firm moved its design plant, thereby relocating most of its scientists to another community. If the children of these scientists (who tend to perform better academically) represent a significant group in the school’s population, these results may be misattributed. Your task is to determine how best to address this issue.

enrollment, schoolwide average performance could easily decline by two points because these children are no longer there.

Another practical example of research in education relates to the question of how important the principal is in a school. This is an interesting question because some cynics inside and outside the profession occasionally claim that educational administrators, such as principals, are on the frivolous side of the budget and we should divert all of the administrative budget directly into the classroom. Teaching effectiveness is the number one influential factor in student learning. However, research indicates that the second most important influence is school leadership—that is, principal effectiveness (Leithwood, Louis, Anderson, & Wahlstrom, 2004; Mazzeo, 2003). So it might not make a lot of sense to take educational administrators out of the school environment. Furthermore, other research also suggests that we do know something about preparing both effective teachers and principals (Davis, Darling-Hammond, LaPointe, & Meyerson, 2005; Natalicio & Pacheco, 2005). These are examples of how research can address practical questions for professionals in education and are examples of applied research—that is, research that addresses questions with some clear application rather than testing a theory.

Most professional practitioners deliver service in one form or another on a daily basis. Counselors interact with clients, educators teach students, psychologists use tests to evaluate individuals, and so on. Knowing this raises product selection questions: Why does a professional select a particular technique, strategy, or measurement instrument? Which counseling method, teaching procedure, or test should be used and why? Test selection questions are not easily or simply answered. This is particularly true since professional consumers receive a variety of sales pitches, often resembling the television advertisements we all see. Everyone wants you to use their test, or their instructional package or process. There are limited consumer safeguards, and the professional consumer still has the basic responsibility of evaluating the manner in which a procedure, technique, or test instrument was developed and the degree to which it fits a particular need (e.g., American Psychological Association, 2005; Jones & Kottler, 2006). Clearly some methods have been developed on a very sound basis with a solid research foundation, whereas others have not.

The selection of instructional materials presents an interesting consumer dilemma. In some cases, committees appointed as “State Textbook Commissions” or some such body make statewide decisions. These committees may develop a list of approved textbooks or instructional materials. While the criteria for selection may be well articulated, there are some circumstances where the selection of instructional materials is based more on marketing effectiveness than on research evidence. Some book or material selections may be made on the basis of secondhand information from others. Perhaps a teacher casually indicates that a particular material is “good.” The basis for the “good” rating may remain unspecified, or there may be a careful assessment regarding developmental level, for example. It may be that the individual making the recommendation mentions that “the material is based on research that indicates this type of instructional materials engages students more actively than some others, which leads to better academic achievement.” However, this is not a typical basis for such a suggestion. Further investigation concerning the research results and the technical soundness of such research (if it actually exists) is even less typical. The immediate pressure of teaching or other duties often precludes such investigation.

This all begins to sound very much like the sales proposition involving that infamous “research center in the East.” In fact, there are more similarities than many professionals would like to admit (teachers are certainly not the only professional consumers involved). Professional practitioners (administrators, psychologists, supervisors, technology managers) often find themselves inundated with salespeople and advertisements expounding the virtues of a wide variety of products. The marketing process for professional products has the same goal as in any other arena—selling. The same tactics are often used, and a substantial number of professional consumers are ill-equipped to evaluate or question the “research” claims used to sell these products.
Professional research consumers need to examine workplace products carefully as they make selections. If the circumstance involves teaching young children, do the materials appear appropriate for the developmental age of the children being taught? What does the early childhood research suggest about teaching techniques that are effective with this age of children? What does the research suggest about using objects that they can manipulate as they are learning basic arithmetic skills? Are the instructional products sequenced in a manner that is appropriate for their developmental level? There are many variations on questions that should be asked about the research literature as professional consumers. In many cases, it is important to know some basic information about how research is conducted in order to evaluate products.

**Keeping Current With Research**

There is no intent here to suggest that everyone has to become a practicing researcher, gathering data through surveys or experiments. We do contend, however, that some understanding of the research process is important to be an intelligent consumer in your role as a professional just as it is for laypeople. Certainly many decisions do not require an awareness of the scientific method. There are many times, however, when it would be most helpful to be able to question some of the claims made by people who are selling a message that is presumably based on research. It is difficult to imagine how one can intelligently keep current in the professional literature without an understanding of the research process. It is clear in most fields that a person cannot succeed as a professional without reading the relevant literature and making some thoughtful judgments. Most professionals have long since learned that they should not accept everything they read without question.

There are a variety of means used by most professionals to keep current on developments in their fields. Almost without fail they subscribe to or review authoritative publications (e.g., journals, monographs, annually published compendiums, Web sites of professional organizations). These sources either present or summarize research results and trends in their fields. Increasingly, electronic bulletin boards and other online publications provide summaries of the latest information and debates in the field. Part of the challenge with these sources is filtering through opinions and unfounded assertions versus other information that is based on solid investigation that has passed the test of review. Some information available on the Web is no more substantiated than casual hallway conversation. Other information has undergone the evaluations and quality tests of what we call “blind reviews” (pre-publication evaluation of the study and its methodology by qualified scientists who are “blind” regarding who wrote the manuscript). It is important to have this latter filter to provide some confidence regarding the source of information—well-planned investigation versus an assertion without supporting evidence.

**Defining Ways of Conducting Research**

It is worthwhile to briefly discuss why research is conducted and examine the perspective of some who become researchers. The reasons for conducting research are as varied as the people who are involved. Some will suggest very grand and glorious motivations such as solving the ills of society. Others might be much more personal and indicate that research is just plain fun. Neither of these extremes should be ignored; they are both genuine and powerful reasons for conducting research. Research is conducted to describe what is, why it is, and to determine how a particular event happens (Black, 2001; Joseph, 2004; Sapsford & Jupp, 2004). Research is also undertaken to test the usefulness of a treatment for some social or educational problem. Research may be undertaken to gather data on the effectiveness of a reading
program, perhaps comparing it to another program offered by another vendor. Other examples of research might study how well a treatment works to help students who have difficulty attending to a task (Carradice, Beail, & Shankland, 2003; Gelfand & Drew, 2003; O’Donnell, 2004).

The “Ivory Tower” Research

The previous points indicate that research is conducted to solve problems, to expand knowledge, and to increase understanding. These examples also include topics that have very practical utility. Both lay and professional groups commonly accept these reasons. However, the comment concerning “research is fun” raises a completely different justification that is not generally discussed. Some would claim that the amusement of an investigator is not an adequate rationale for conducting research. Such justification sounds too frivolous and all too much like the “ivory tower.” This type of argument represents a way of thinking that demands that all research must directly relate to the immediate solution of a practical problem. However, it ignores the fact that many problems cannot be immediately and effectively solved until a foundation of basic knowledge exists. Often the development of such a body of knowledge is only possible through the accumulative investigations of many researchers who may well be studying questions that seem removed from the practical, “real world.”

The demand that every piece of research be immediately and obviously relevant also ignores the history of solutions to immediate problems that have resulted because some researcher was indulging a curiosity many years before. It is not uncommon to find answers that may be theoretically interesting but will not find their way into application until problems arise at a later time. From our point of view, indulging an investigator’s curiosity is a very good reason for conducting research. The benefits from a practical perspective may not be immediate, but such immediacy is less important than a more reasoned outcome later that ultimately leads to more effective decisions. Box 1.2 sketches one researcher’s work that would not have been undertaken, and almost wasn’t, if the test was immediate practicality.

Basic Versus Applied Research

The previous discussion also relates to a debate regarding basic versus applied and theoretical versus action research. Some would contend that the application(s) of basic research are too remote to be engaged in by investigators in service-delivery

BOX 1.2 Basic Research and Application

Genetic targeting was developed in the early 1980s and allows manipulation of an individual gene. Mario Capecchi, the scientist involved, had to “bootleg” the investigations, performing the experiments on the side as he was doing his other research. Funding agencies were not convinced that targeting a specific gene was possible and were unclear what you would do with the process (this latter being the practical importance question). However, genetic targeting is now used commonly in battles against certain diseases. It permits removal of a particular gene, which can then be replaced by another that has very specific characteristics. One use of this process is the ability to “turn on” certain types of biological conditions. Some examples are more well known because they receive attention in the popular press, such as various forms of cancer. Thus, a line of investigation that was once considered of questionable practicality and even questionable possibility is now employed in thousands of laboratories around the world as scientists study diseases of many types.

professions like education. Those on the other end of the continuum assert that applied research is of lesser worth because it is hampered by the many challenges and “messiness” of life (and therefore is not really research). This is a popular argument in some circles, although not one in which we wish to engage. Basic research involves investigation of questions that are interesting but may have no application at the present time, like Capecchi’s initial experiments in Box 1.2. This is sometimes called pure research, but that term connotes a value judgment that is not particularly helpful (as compared with impure research?). Research that is considered applied research moves along the continuum with the intent of the results being put into use rather immediately. For example, determining the amount of instructional time allocated for reading in a classroom provides an example of applied research. Some evidence suggests that the amount of time allotted to reading during a day is surprisingly small (Edmonds & Briggs, 2003; Foorman & Schatschneider, 2003). This could suggest that simply providing more time for reading might improve that skill.

Action Versus Theoretical Research

Action research is closely allied to the applied end of the continuum and is undertaken to determine results related to a specific action or decision (Hendricks, 2006; Schmuck, 2005). Action research is often undertaken by teachers to determine the effectiveness of a specific teaching intervention in a particular setting. The example presented above involving reading time allocation might lead to an action research study. Identifying a meager amount of time being allocated to reading could be considered identifying a problem. An action research intervention study might investigate whether or not providing more time actually enhances reading skills. A further intervention might study how much student engagement in reading (as manipulated by the teacher) would change reading skills. Both of these examples might be categorized as action research and together would reflect a systematic inquiry into classroom practices (Mertler, 2006). Both studies emerge from theories about the amount of practice and the level of engagement that is important for skill acquisition or improvement. Both address practical questions that may have rather immediate implications for the way a teacher operates his or her classroom. Such research provides considerable practical benefit for teachers. The Research in Action box presents two action research studies for you to examine.

Discussions concerning applied versus basic or theoretical versus action research are confusing because the issues have been argued as both method issues and value judgments. This is unfortunate because a great deal of time and energy has been spent on the debate itself. Essentially, the argument can be reduced to the value judgment issue regarding whether or not a requirement of immediate applicability should be a determiner of the value of research. If conducted carefully, the methodology is the same; only the content and setting differ. The task here, however, is to explore technically sound research designs, not debate value judgment issues. There is good reason to conduct both basic and applied research. There is no reason for conducting research that is unsound, regardless of the topic.

Personalized Approach

We are strong advocates of a wide array of reasons for conducting research. Most active researchers seem to be motivated by a variety of reasons for undertaking investigations. This places the question of “Why conduct research?” on a very personal level, which seems quite appropriate. We have already noted that research is fun (not discounting the fact that it is also work). It is most certainly a pleasure to obtain an answer to a question that one has, regardless of whether curiosity, theory, or immediate social problems that motivate the research. There is tremendous personal satisfaction in gathering your own data. Not only is it satisfying to determine whether a teacher-initiated intervention results in student learning, it is also gratifying when
you can share those findings with other teachers such as the many teacher-oriented action research Web sites (Mertler, 2006). In addition to feeling good about your own teaching, you can potentially help others with similar questions.

As the years have passed, we have begun to appreciate other personal benefits of conducting research. One important part of the process is writing. The expression of thoughts, ideas, and findings, in writing, is one of the most demanding tasks a person can undertake. It requires a completeness and clarity of communication that is not involved in routine conversation. Spoken communication, even in formal circumstances, often includes nonverbal gesturing to accentuate, provide emphasis, and complete thoughts that are only partially expressed by the actual words. Most people do not even notice these behaviors since they are so accustomed to both using and experiencing them. Although nonverbal aids may be acceptable in verbal communication, writing does not permit such luxuries. Consequently, it is challenging for most people to write clearly. Despite the struggle, a great deal of satisfaction accompanies completion of the writing.

**Research in Action**

**Key points in the chapter reflected in this box:**

- The research ideas will be generally identified.
- The method of science is examined as one way of knowing information among others.

**Objectives to learn from this box:**

- Understand how action research ideas begin in a field setting and emerge from the problems or questions in that setting.
- Reflect on how action researchers choose among different ways of thinking about their beliefs.

**Scenario 1: Student Engagement in Reading**

Emily is a teacher and researcher who has always been interested in how to engage students in the material they encounter in school. She thinks that students who are engaged in a topic will learn more easily and master the content better than students who are not engaged. She views this as a very practical problem, one of how to actively involve her students in the topics she is teaching. She believes this involvement or engagement has a very beneficial effect on her students’ learning. For her, it is an action research possibility because it can directly translate into something she can implement in a classroom.

Emily’s idea for research is to demonstrate how student engagement enhances students’ motivation for school topics. Her area of particular interest involves how students learn to read and how to improve their reading performance. Combining these two interests, Emily has found some literature that seems related to her ideas (Guthrie & Cox, 1998). She begins to investigate the articles of John Guthrie and his associates and starts thinking about how to study student engagement and reading.

Although Emily firmly believes in engagement, she has some options in how she develops her ideas. She could continue to assert her belief strongly without any further investigation on her part, or she could reference the writings of Dr. Guthrie and be satisfied with that approach. Another approach would be to systematically investigate the topic of engagement and its effect on reading instruction. These options involve
three different ways of knowing something or establishing a belief (tenacity, authority, and the method of science). She decides to follow the method of science, which will lead her down a path of actually conducting some research. As she proceeds, she will think through the differences between a commonsense view of the topic and one that involves scientific methods (including the concept of control). She will also make some choices regarding which types of research methods might be used effectively.

**Think about this:** How does the action research topic of reading engagement emerge from the classroom setting? How is the method of science different from other ways of knowing about the influence of student engagement in reading?

**SOURCES:** This action research scenario is roughly based on the work of John Guthrie at the University of Maryland and Emily Anderson Swan at the University of Utah (Guthrie & Anderson, 1999; Swan, 2003).

---

### Scenario 2: Student Self-Esteem

Daniel is interested in self-esteem, learning disabilities, and diverse students. This is a broad range of topics and he has ideas about all of them. He believes that having learning disabilities influences self-esteem. He also thinks that there are cultural matters that influence students’ self-esteem. Daniel has some options regarding his beliefs about these topics. As a teacher, he sees his students with learning disabilities on a daily basis. He observes their self-esteem as being pretty low. These students often express themselves in ways that lead Daniel to think they don’t have very high self-concepts, and they often behave in ways that reflect this same low personal evaluation of themselves. Often this seems related to their learning disability.

Daniel also has some Latino students with learning disabilities. They seem to also have low self-esteem, too, but there appear to be differences between his Latino students and those that are Caucasian. Daniel thinks that it is wrong to just say that all students with learning disabilities have similarly low self-esteem. It appears to him that both Latino and Caucasian students with learning disabilities have low self-esteem but that there are important differences between the two groups of students. Daniel has firmly and vocally expressed his view about these differences, but some of his coworkers challenge him. They seem to believe that a low self-esteem is similar for all children. Daniel begins to read the scientific literature in two areas: self-esteem related to students with disabilities and self-esteem related to students with different ethnic backgrounds.

Daniel has found the method of tenacity to be unsatisfactory because simply expressing his belief strongly is not convincing to his coworkers, and their questions trigger his own curiosity. He is a little frustrated by his reading because he finds that there are few studies comparing minority and Caucasian students in terms of self-esteem. He also finds there are some measurement issues regarding self-esteem itself. Everyone globally and grandly asserts that it is important, but they are a bit vague on what self-esteem is and how to measure it. Reference to authority in terms of the published literature doesn’t provide clear direction. Daniel believes that he can learn something about self-esteem in his Latino students that is different from his Caucasian students. He also thinks that he can learn something that will help him work with both groups of students differently and more effectively as a teacher. He decides he will conduct a study on the self-esteem of Latino and Caucasian students with learning disabilities to at least see if he can identify differences that might be useful to him in his teaching efforts.

**Think about this:** How does the action research topic of differences in self-esteem emerge from Daniel’s classroom setting? How is the method of science different from other ways of knowing about the influence of ethnicity differences on self-esteem?

The entire research process, from designing a study to writing the report, can be one of the most growth-producing experiences available. Each step requires the exercise of disciplined thought balanced with an appropriate dose of creativity. Conducting research has many similarities to other creative acts. You can nearly feel the mental growth when a study is completed. For us, this is a very compelling, personal reason for conducting research and one that is more powerful than any of the lofty justifications typically offered.

**FOUNDATIONS OF RESEARCH**

Research is part of our daily life whether we are conscious of its presence or not. Each of us as individuals may not be actively engaged in what most would consider research, but most of us are consumers of scientific investigations in our daily lives. This is easy to see if we use technology in our work, such as using hydraulic pressure principles if we are operating earth-moving equipment. It is less obvious in the context of how we think. However, research is based on some ways of thinking and certain methods of establishing beliefs. This section will briefly examine certain approaches to formulating beliefs and show how they relate to science.

The purpose of research is to obtain knowledge or information. Research is a systematic method of asking questions, involving the scientific method, and inquiring about phenomena (Hart, 2003; Middleton & Brown, 2006). Both the scientific method and other systematic research traditions are somewhat different from the way people generally conduct their daily lives. This section discusses the placement of research, and therefore science, in relation to various methods of knowing about the world.

**Four Ways of Knowing or Fixing Belief**

There are a variety of ways of knowing something or fixing belief that are relevant to much of the research conducted today (Goodwin, 2005; Wacome, 2003). Four of these methods of knowing include tenacity, authority, a priori, and science. Each approach involves a different set of characteristics and sources of information. In addition, each of these methods is used to a greater or lesser degree by different groups of people as they pursue knowledge (Jupp, 2006). The different ways of establishing belief are useful in placing research in perspective with regard to other approaches to inquiry.

**Tenacity**

If a person uses tenacity as a method of knowing a fact, then that fact is thought to be true because “it has always been true.” This approach comes from the idea that an individual holds tenaciously to existing beliefs. If something is known by the method of tenacity, essentially a closed system exists—meaning no new information is put into the system. In fact, the very nature of tenacity may prompt the individual to hold to a belief even in the face of nonsupportive evidence (Evans, 2002). People often become so accustomed to ordinary life events that they selectively ignore information that contradicts previously held beliefs (perhaps the students in Box 1.1 are an example). Certainly there are circumstances in education where tenacity is used, even though most of us would like to think that what we do is based on scientific evidence. For example, the academic or school year has been established to be about the same time of the year in most geographic locations for a very long time. Originally, it may have followed that schedule in order to allow older schoolchildren to help with
harvesting crops. When educators began to suggest operating schools on a year-round basis to better use facilities, they encountered significant resistance. Although many students were no longer involved in agriculture, tenacity was a strong support base for not changing the academic schedule.

**Authority**

Another approach to knowing or fixing belief—authority—cites an eminent person or entity as the source of knowledge. If a well-known individual or an “expert” (an authority) states that something is the case, then it is so (at least according to some people). The authority’s declaration relieves the believer from going elsewhere to obtain information. The method of authority is not definitively a “bad” method of knowing. Much depends on the authoritative source and on the way in which the believer uses the method. If it is used totally in a nonthinking, closed-system fashion, there are obvious weaknesses. Used in this manner, no consideration is given to nonsupportive or conflicting evidence. When this is the case, the progress of knowledge and ideas is painfully slow and depends totally on the progress of the authority.

**A Priori**

A third way of knowing or fixing belief is called the a priori method. A priori, by definition, refers to “before the fact” and is primarily based on intuitive knowledge. In subscribing to the a priori method, something is known before information is gathered or even in the absence of experiential data. Usually the a priori approach is logical or in harmony with reason. The reasoning can be a weakness, however. Unless the information system is open to data gleaned from experience (experimentation or observation), an error of logic may begin a line of reasoning that is characterized by progressive errors.

**Method of Science**

The fourth method of knowing is called the method of science. The method of science is different from the other three ways of fixing belief. External experience through observation is the foundation of this method. The method of science has a built-in self-correction factor, which distinguishes it rather dramatically from the other ways of knowing. This self-corrective factor is operative because the system is open and public. A scientist’s work is public not only in terms of end products (published results), but also in the means by which those ends were obtained. In their publications, researchers must describe the procedures, materials, and participants. Investigators must explain and demonstrate the logic used to reach the conclusion in their publications. This ensures that future investigators have the opportunity to learn from those before them. Independent replication operates the self-correction factor of science, and all knowledge must remain open to eventual change or correction if new data come to light. This discussion also highlights the importance of publishing by researchers. Without rigorously reviewed publications, researchers wouldn’t be able to demonstrate their investigations to others.

Research has its foundation in the method of science. However, one has only to read a research article to observe great variation within the method of science and the use of at least segments of two other methods of knowing. Certainly reference to authority is operative in research—investigators are continually citing the work of others. This use of the method of authority, however, is different from using authorities solely as a closed system in which conflicting evidence is not acknowledged. Furthermore, research openly challenges authority when evidence is not in agreement. Research also uses basic components of the a priori method of knowing—logic and reason. Again, the way in which logic and reason are used in research is
considerably different from the use of the a priori method as the sole source of knowledge. Researchers are required to clearly demonstrate the path of reasoning by which conclusions are reached in their writing. If the logic is faulty or conflicts with observed evidence, it is challenged by the method of science. By virtue of its public nature, science can effectively use portions of the other methods of knowing and avoid pitfalls inherent in them. Refereed review of scientific research by peers capitalizes on the virtues of these qualities.

**Inductive and Deductive Reasoning**

Reasoning and logic represent vital components of the research process, as noted above. If these elements are absent, the research process is weakened and jeopardized so severely as to render it useless. Without the input of reasoning, knowledge would not progress at all since the relationship of one idea to another, or of data to an idea, is based on this essential element.

Two distinctive types of reasoning are involved in the broad spectrum of research efforts—deductive and inductive reasoning. *Deductive reasoning* uses logic that moves from the general to the specific. Statements initiated from a general idea, model, or theory characterize deductive reasoning, and from these statements something is inferred about a specific case (“If the [general] theory is correct, then I should be able to observe this [specific] behavior in children.”). *Inductive reasoning*, on the other hand, reflects the reverse type of logic. Inductive reasoning uses logic that is launched from a specific case or occurrence and moves to inferences about the general (“If a [specific] behavior occurs, then this [general] theory is supported.”).

Both types of reasoning are used in behavioral research. Examples of deductive reasoning may be found in introductory statements of research articles. Deductive reasoning is being used when researchers examine a general theory, model, or body of knowledge about teaching and hypothesize a specific behavior they expect to observe when they apply this in a classroom. Inductive reasoning often drives exploratory, qualitative inquiry; where theory is lacking or just developing; when the area of study is new; or when controlled, experimental research has suggested behavioral patterns exist that the researcher would like to examine in natural settings. Inductive reasoning is also the primary means by which data generalization is accomplished. When a researcher is writing the discussion section of a research article, the discussion is mostly based on data collected. From the data (specific observations), inferences are drawn about the general theory or model reviewed in the introduction. Generalizations may be made about a population (general) from the participants’ performance (specific).

**Differences Between Experimental Science and Common Sense**

There are several distinctions between science and common sense that are useful in placing the scientific method in the context of daily life. There is a general theme that threads its way through the differences. Science is characterized by a more systematic approach to problems than common sense, and it always leaves the door open for new approaches or knowledge that may change beliefs about truth or reality (Goodwin, 2005; Wacome, 2003).

**Theoretical Structures and Concepts**

There is a distinct difference between science and common sense in the use of theoretical structures and concepts. Science *systematically constructs theories and
conceptual schemes, uses them, and submits them to repeated tests—the scientist is never certain. A person who operates primarily on a commonsense basis often does not use theory and concepts in the same fashion. Often theories and concepts are applied loosely and not systematically. Explanations of events may not be supported by logic relating that explanation to a conceptual scheme. They may not even relate to accurate data about the events.

**Theory Development and Testing**

A second difference, closely related to the first, speaks to the issue of theory development and testing. The method of science systematically generates and tests theories, hypotheses, and ideas. The term systematic here again becomes the key. If a given theory is presumed to work under conditions X, Y, and Z, science demands the systematic examination of events under conditions X, Y, and Z. A commonsense approach to testing, on the other hand, tends to be much less concerned with systematically testing an idea under all relevant conditions. *Selection bias* frequently enters into the choice of situations in which the theory is tested and the viewing of test results. Often an idea such as “all republicans are conservative” is tested unintentionally under conditions that ensure support for a preconceived notion. Information that does not support the hypothesis may be discounted or ignored and not included as a part of the test. Proverbial “in-law” stories exemplify this type of information bias.

**Concept of Control**

A third difference between science and common sense involves the concept of control. This concept will become a central focus in later chapters on experimental designs. Here again, a systematic approach is preeminent. All science arose from the observation of naturally occurring events. Education and the social and behavioral sciences cannot always control natural processes in existing groups, cultures, or settings. Experimental science relies on the concept of control, which essentially involves eliminating possible influential variables except the one being tested. Common sense, in contrast, may operate in such a loose fashion that several factors are allowed to vary at once. This may mean that any one of two or three influences might have generated the results observed, in addition to the one being studied. Under such circumstances, scientists would probably throw up their hands and view the data as uninterpretable, certainly not attributing the results to any one influence. From the less systematic framework of common sense, interpretation may suggest a result caused by one influence, which, since two or three are operating, may be in error.

**Relationships Among Phenomena**

A fourth distinction between science and common sense involves the interest level concerning relationships among phenomena. The layperson is frequently interested in relationships among phenomena in a somewhat loose and unsystematic fashion. Interest is primarily generated when there is great personal relevance involved. In contrast, *the scientist becomes almost obsessed with the relationships among phenomena, whether personally relevant or not*. There seems to be a continual question-asking process in operation (e.g., “I wonder if this material would be more effective if...” or “I wonder if that behavior is influenced by...”).

**Explanations of Phenomena**

The fifth difference between science and common sense relates to explanations of phenomena. *Explanations of events that flow from the method of science tend to be*
stated in terms of the observable, the logical, and the empirically testable (Berthold, Hakala, & Goff, 2003; Thomas & Rosqvist, 2003). A commonsense explanation, on the other hand, frequently involves reference to metaphysical influences. Metaphysical explanations cannot be tested. Such statements as “Working hard is good for one’s moral character” and “Suffering builds character” are metaphysical statements.

There is certainly a conceivable continuum between the science method and common sense. The primary factors that seem to be involved are concepts of systematic inquiry, logic, objectivity, and observable phenomena. Read over Simulation 1.2 at the end of this chapter to see how you would outline the differences between science and common sense.

**Simulation**

*Simulation 1.2*

* Topic: Science and common sense

*Background statement:* You are a graduate student at Southeastern Unified College (SUC). One of the faculty has become ill, and you are substituting as the instructor in the introductory research class. In your first lecture, you are going to be discussing the differences between science and common sense. What five points will you emphasize? Give examples of each.

*Your response:*

**Research Types and Methods in Brief**

Research projects begin with a question, as we saw in Figure 1.1. The research question then leads to a planning process where the scientist maps out a plan (often called a design) for the study that will gather information and answer the research question. The steps between a research question and interpreting the information are characterized by various activities and procedures aimed at the process of gathering data systematically and objectively. These place certain requirements on the information-gathering process to eliminate or minimize bias and errors in answering the research question.

As a researcher plans the study, he or she may use a number of different approaches to design. Different approaches or methods have various features as part of their procedural protocol and are often labeled by elements of those features (e.g., quantitative studies gather information in numbers or quantities; qualitative studies use a narrative to describe situations). We will briefly outline different research methods below. Each method may be used with different research questions, and in some cases the choice of design is made based on the comfort level and background of the investigator.
Quantitative Research

Studies using quantitative methods collect data in the form of numbers. In this approach to research, the occurrences of behaviors are counted, correct answers or errors are counted, and other types of measures are recorded in terms of quantity. Quantitative research tends to be planned and details specified rather extensively before a study begins. The research question or questions are specified in detail. Operational steps of how the study is to be carried out are typically specified and gathered into an itemized operational guide or protocol for actually conducting the study. Often the plan or design of the study is arranged to control outside influences. The plan for the study will also include a description of the participants and how they are to be sampled, what testing or data collection instruments are used, and what specific procedures are employed to gather the data.

Data analysis for quantitative research also has a long history of using statistical tools, and those components are also planned and specified before the study begins. This type of analysis leads to explanations that are divided into parts—for example, the interpretation of a participant’s behavior in class may focus on a very limited set of stimuli rather than a global explanation of the broad context of the whole classroom. This interpretation might suggest that a particular child’s attention to spelling materials is controlled by the visual stimuli on the paper, as opposed to a broader description of classroom stimuli like his or her classmate’s behavior, noise level, lighting, and so on.

From this thumbnail sketch, it is clear that researchers using quantitative methods make detailed plans before the study begins. This is worth noting because when we examine qualitative research, we will find that some elements are intentionally left undefined. There are also some subtypes that need to be mentioned because they have descriptive labels you will often encounter: experimental and nonexperimental research.

Experimental Research

Imposing or manipulating certain conditions in order to see how participants respond characterizes experimental research. For example, suppose we were interested in the effectiveness of a particular method of teaching arithmetic. An investigator using experimental research methods would be inclined to impose the intervention (teaching method) on a group of children and measure how well they learn math. The experimenter will prefer to define all the procedures, data collection processes, and study protocols in advance, adopting many of the broader elements outlined for quantitative methods. The researcher will also tend to sample a group of children and is likely to count the number of correct responses on an arithmetic test. This counting of the children’s correct responses is the investigator’s approach to determining how much they learned. The experimenter will typically use the elements of research methods described for quantitative methods above, as well as manipulate or impose the intervention or treatment.

Nonexperimental Research

Nonexperimental research methods are distinguished from experiments in that they do not impose a treatment or intervention to see how participants respond. Nonexperimental studies are more characterized by gathering data as it occurs or exists in a natural environment. For example, surveys or questionnaires are typically viewed as being used in nonexperimental studies. This type of research typically asks the participant (the person completing the questionnaire) to respond to survey questions when and where they encounter the questionnaire. This may be in the person’s office, on the Web, in his or her kitchen, or some other setting, but is characterized by data collection in that situation rather than manipulating a set of conditions to see how participants respond.
The data collected may be in the form of numbers or a narrative, depending on the nature of the question and the preference of the researcher. For example, the survey may ask respondents how old they are, which would likely result in numbers. They may be asked to express how well they approve of their schools and the education their children are receiving, which could result in responses on a 1 to 5 scale—also numerical information. However, respondents may also be asked to write a short narrative reflecting their feelings about a political question, which would result in data in the form of words and would be treated differently than the numbers in the analysis.

Nonexperimental quantitative studies tend to also be planned in detail ahead of time. For example, the survey researcher will always draft and revise a questionnaire multiple times in order to get the wording just right. Because nonexperimental research may collect data in narrative form and also study participants in their natural environments, these studies have elements of qualitative as well as quantitative methods. This is a characteristic we see emphasized in mixed methods.

**Qualitative Research**

Qualitative research methods may outline the broad scope of a study but may not specify as much operational detail. Qualitative researchers tend not to tamper with natural settings where the data are to be collected. Some qualitative researchers may decide to let hypotheses and definitions emerge as the study proceeds. The data collected might lead a researcher down a path of investigation that was not anticipated before the study began. Researchers seek validity or accuracy by obtaining information from multiple sources—a process known as triangulation. Triangulation means that the investigator may, for example, ask for descriptions of an event from two different people and also see how the event is described in official records by the government. This process is the researcher’s attempt to ask what the story is from multiple sources, not just one source, thereby trying to find out what really happened. Data are recorded in terms of narrative descriptions, not numbers. Researchers using qualitative methods will describe what else is going on rather than controlling it, trying not to tamper with the natural setting they are studying. When presenting the results, researchers using qualitative methods will tell the story in narrative form, describing the whole setting and broad scope of the study.

**Mixed Methods**

Mixed method studies employ elements from more than one approach, often capitalizing on the strengths of each process. Investigations using mixed method research may count participants’ correct responses (quantitative) and also collect narrative descriptions of some behaviors or information (qualitative) in order to construct a data set that more completely answers the research question. For example, using mixed methods the researcher may count the children’s correct responses to arithmetic problems (numbers—quantitative) and then also ask them how they felt about having to do the arithmetic (words—qualitative). This allows the researcher to learn information and draw inferences that could not be achieved by using a single type of protocol. Mixed method research approaches provide the potential for substantial strengths that the component approaches cannot achieve when used singly.

**The Research Process**

Reference has been made to the research process, although thus far only certain portions of it have been described. As a whole, the research process can be conceptualized in a circular or closed-loop fashion in the manner illustrated in Figure 1.1. The
process begins with the research question or problem. The research problem is then developed into more focused questions, which lead to hypotheses in the form of very specific statements that characterize each and every comparison or relationship being studied. From the hypotheses, the study is designed or planned in detail with very specific written statements of what the questions are and what procedures will be used to collect data to answer those questions.

At this point, the investigation is ready to be implemented, which begins with data collection. This is the component where the researcher gathers information through a questionnaire, testing children or observing in a classroom. Once the data are collected, they need to be analyzed to determine what the results indicate. This is then followed by an interpretation of the results regarding the research question(s) (inference about what the results mean). The inference or interpretation may lead to new questions, discussion about any theory that might have prompted the study, and some interpretation about what the results mean for practical applications. This simple description of the research process includes many different components, and it mirrors the general structure of this book.

Selecting a Research Topic

A research topic or idea may emerge from theoretical dilemmas presented by other studies, a practical problem needing solution, or the curiosity of the individual undertaking the study. For example, a teacher might identify a research topic about how much instructional time should be allocated for reading each day. Such a topic might address the teacher’s problem of how to manage time, combined with a need or desire to raise student reading skills and test scores. In this case, the general topic is an applied research question and one that could easily lead to action research. That is, a study of the topic could result in an action by the teacher such as rearranging his or her instructional time to focus additional time on reading. Given the nature of this topic, the next step is to develop specific research questions from the topic, and those questions will then lead to the hypothesis or hypotheses.
Distilling the Topic Into Research Question Format

Distilling the topic or idea into research question format means moving from the general topic to a specific question or questions. In our example above, the curiosity about instructional time for reading may lead to several possible research questions. In one case, the teacher-researcher may first want to know how much time is currently allotted for reading instruction.

This would logically lead to a descriptive research question—that is, simply asking for a description of what is currently allotted. Such a question would then suggest that the teacher-researcher record the number of minutes each day allotted to reading instruction. Referring to Figure 1.1, the research process might move past hypotheses directly to study design. This is acceptable since in this situation we don't have particular hypotheses in mind, merely a description of what currently is the case. The design or plan for the study would likely involve a research assistant recording the numbers of minutes each day that are allotted to reading instruction, while the teacher continues his or her daily routine in a normal fashion (without making any changes). Recording time might continue over a week or over any specified period of time that the researcher believes represents what is normally done.

Another approach might lead to a difference question, which might ask, “Is there a difference in the amount of instructional time allocated to reading as compared to math, science, or any other specified topics of interest?” In this situation, the teacher-researcher is still obtaining a general description of his or her instructional day, but the amount of time is recorded for each subject area. This type of research question is a difference question that involves comparisons. The minutes are recorded for each content area over a week’s period (or whatever period has been specified). In this study, there may be some hypotheses and they may indicate that, “There is no expected difference in the number of instructional minutes allotted to math as compared to reading” (or math vs. reading vs. science). This is called a null hypothesis because it predicts no difference.

Notice how the research question format is much more specific and detailed than the research idea or topic. Distilling research topics into research questions involves becoming much more detailed. A proper research question should be sufficiently specific that it leads the researcher to the hypotheses and logically to how the study is implemented. In both examples, the distillation is a logical progression.

In the case of quantitative research and all experimental designs, the research topic must be distilled into a very specific question, which will then lead to a hypothesis or several hypotheses. Research addressing immediate practical problems is often called action research, because it is prompted by an immediate action or decision that needs to be made. This is the type of study example suggested above. In addition to the previous examples, such studies might investigate questions like which of two or three teaching techniques shows greater improvements in achievement scores (such as on a criterion-referenced test). These circumstances will involve a very specific question or questions and lead to hypotheses and then to detailed operational steps for data collection in the design phase.

Qualitative research often explores naturally occurring events or processes, which is different from the experiment mentioned above where the researcher tries out two or three different teaching protocols. Because qualitative studies may emphasize studying events as they naturally occur, some of the detail about what goes on is less prescribed. However, although the specific activities may be less prescribed or prearranged, the research must be consistent with general questions about how and why things occur. Qualitative studies must also be designed (planned) in a manner that will avoid potential difficulties and permit the researcher to answer the question. The research design is critically important and involves rigorous and meticulous planning.
Moving From the Question and Hypothesis to the Design

The next stage continues to represent a logical flow, and it leads to the design or plan for the study. In both the descriptive and the difference questions above, the next step is simply to specify how the study is to be implemented. This design process will again become quite specific and detailed. It is the road map or study protocol and involves specifying how the data are to be collected and under what conditions. This is the next step in Figure 1.1. Let’s take our difference question example and develop a design statement.

In this study, our hypothesis stated that there was no difference in the amount of instructional time allocated to math, reading, and science. In order to obtain an accurate set of data, several items are important. One involves the teacher not changing what he or she is normally doing. The research question and hypothesis must be fairly tested by gathering data under routine and normal circumstances. It is recommended that there be an observer or research partner who records the data. This allows the teacher to continue teaching normally. It is also important for the observer to be able to distinguish between the content areas so he or she will be able to record the minutes allocated to each content area accurately. This often means that very precise statements need to be developed ahead of time that describe markers or characteristics of instructional time for each topic. The more detailed these statements are, the easier it will be to achieve accurate and reliable data collection. These statements become the design or plan for study implementation.

Planning will include the operational steps of actually conducting the study and recording data. This is followed by the many steps involved in executing the investigation with data being collected and then analyzed. Once this is done, the results must be interpreted in terms of the research question that completes the loop. If executed properly, the question should be answered or at least a first step should be taken toward achieving this end.

Using the Research in Data-Based Decision Making

The final steps in closing the loop of Figure 1.1 show several points that involve inference from results, the emergence of new questions, and interpretation of the data. Interpreting the data will result in a discussion about whether the study supported earlier findings in literature that was reviewed as the study was begun. The new questions may lead to further studies to achieve greater clarification or following some new line of investigation that might have surfaced. Interpretation of the meaning of results may also lead to using the research outcomes for data-based decisions, which is often the purpose of action research. In our earlier example on instructional time, the teacher-researcher may find that the amount of instructional time allotted for reading does differ from that of math and science and that reading has been receiving less time. This might lead our teacher-researcher to recheck the literature, which suggests that academic achievement measures do seem to be enhanced if they are given more instructional time. The next step may be to revise his or her time allocation between content areas in order to find additional time for reading instruction. This provides an example of an instructional decision that might be made based on data from a piece of action research. Making decisions about instruction is a very important benefit for educational practitioners and one of the appealing features of action research.

The discussion above presents a simple view of the overall research process. As is always the case, the devil is found in the details. A variety of challenges may surface at each step and many specific points have been omitted here. These will be discussed in greater depth throughout this book. What has been examined, however, is the research process as a whole. Many characterizations of research have been guilty
of focusing on one portion or emphasizing one step to the exclusion of others. Such a limited perspective frequently gives laypeople and beginning students an inaccurate view of what is really involved in research. Creating such perspectives (knowingly or unknowingly) has generated many misconceptions and often contributed to unfavorable opinions about research. We hope that this book will serve to inform as well as correct misconceptions in cases when that is appropriate.

A simple working definition of research is a systematic way of asking questions. Some of the misconceptions about research include terms like mechanistic, mystical, and others. In reality, research is often not conducted in a laboratory and is not mechanistic, nor is it mystical.

Research is important to consumers because we receive information daily about products we use and much of that information is derived from research. It is important to distinguish between research and marketing.

Research is important to professionals because they are consumers of research and are often involved in making decisions based on information from research.

Research is conducted for many different reasons ranging from solving basic theoretical problems to making decisions about which reading program to use for specific children in the classroom.

The different ways of knowing about something range from tenacity—something is true because it has always been true—to the method of science, which involves collecting data on questions in a systematic and open manner.

Deductive reasoning involves logic that progresses from general ideas to specific cases, whereas inductive reasoning starts with a specific case or observation and progresses to more general ideas.

Science systematically uses, tests, and constructs theories and concepts, whereas common sense may use them selectively and not systematically under all conditions. Science tries to control all influences except the one under study, while common sense may allow multiple influences to operate in addition to the one under study.

Quantitative research involves collecting data in the form of numbers and planning studies in specific operational details, often manipulating the environment to determine what happens. Qualitative research means collecting data in narrative formats, tends to leave the environment in a natural format, and may leave many details of the study undefined at the beginning. Mixed method research employs elements from both quantitative and qualitative procedures.

A research topic may surface from reading or a daily dilemma. The topic may be general and will be molded into a specific research question.

Results from research can often be used to make decisions about matters in daily life, such as how much time should be allotted to teaching math or science or what happens to academic achievement when more time is given to a content area which may then lead to the decision to allot more instructional time to the topic.
**Key Terms**

**Action research.** Research undertaken to determine results related to a specific action or decision. Action research is often conducted by teachers to determine the effectiveness of a specific teaching intervention in a particular setting.

**Applied research.** Research involving studies that address questions with some clear application rather than testing a theory.

**Basic research.** Basic research involves investigation of questions that are interesting but may have no application at the present time.

**A priori method of knowing.** Refers to things that are known “before the fact” and is primarily based on intuitive knowledge. In subscribing to the a priori method, something is known before information is gathered or even in the absence of experiential data.

**Authority method of knowing.** This method of knowing or fixing belief cites an eminent person or entity as the source of knowledge. It is based on the idea that if a well-known authority states that something is the case, then it must be so.

**Concept of control.** The process of holding all possible influences constant except the experimental variable, which is what is being studied. For example, if the researcher is comparing the effectiveness of Reading Programs A and B, the reading programs should be the only factor that is different between the groups. All other influences (such as intelligence or age) should be equivalent.

**Experimental research.** Imposing or manipulating certain conditions in order to see how participants respond characterizes experimental research. An investigator using experimental research methods would be inclined to impose an intervention, such as a teaching method, on a group of children and measure how well they learn math.

**Mixed-method research.** Mixed-method studies employ elements from more than one approach to research, often capitalizing on the strengths of each procedure. Investigations using mixed method research may use both quantitative and qualitative methods.

**Nonexperimental research.** Nonexperimental research methods are distinguished from experiments in that they do not impose a treatment or intervention to see how participants respond. Nonexperimental studies are more characterized by gathering data as it occurs or exists in a natural environment.

**Qualitative research.** Research that involves collecting data in the form of words or a narrative that describes the topic under study and emphasizes collecting data in natural settings.

**Quantitative research.** Studies using quantitative methods collect data in the form of numbers. In this approach to research, the occurrences of behaviors are counted, correct answers or errors are counted, and other types of measures are recorded in terms of quantity.

**Research question.** A focused and often detailed statement of the research topic to be studied. The three types of research questions often studied in education are descriptive, difference, and relationship.

**Science method of knowing.** The method of science as a way of knowing is based on external experience through observation. Data are collected about a topic to determine the existence of a phenomenon.

**Tenacity method of knowing.** This method involves thinking that something is true because “it has always been true.” This perspective comes from the idea that an individual holds tenaciously to existing beliefs.
The companion Web site for Designing and Conducting Research in Education
www.sagepub.com/drewstudy

Supplement your review of this chapter by going to the companion Web site to take one of the practice quizzes, use the flashcards to study key terms, and check out the many other study aids you’ll find there. You’ll even find some research articles from the SAGE Full-Text Collection and a step-by-step guide that will show you how to read an educational research article.

Simulation Feedback

Simulation Feedback 1.1

Neither Janet nor Andrew should jump to the conclusion that he or she is correct and the other position is incorrect based on this research evidence. Research results accumulate over a period of time. This particular study indicated that preschool children have some capacity to deal with symbolic math concepts, perhaps more than was thought before. However, this is just one piece of evidence. Many studies have been performed, each with a slightly different specific research question, and the accumulated evidence will perhaps answer the questions of these well-meaning parents. Research evidence accumulates somewhat like the way a complex jigsaw puzzle is assembled—after many pieces are fit into place, the picture begins to emerge.

This research reported that preschool children are able to perform some mathematics at an age that surprises many of us. The study Janet found indicated that the children probably can handle the curriculum (assuming it is presented in an appropriate manner). Like many areas of study, there are some related questions that haven’t been posed yet, such as, “Will this type of curriculum presented this early help Ben, or might it be detrimental?” Addressing these questions would involve additional studies with research questions like the following (insert your own child’s name in place of Ben’s): “What are the effects of introducing math concepts to preschool children?” “Are these effects beneficial or detrimental to Ben’s development?” “Is such exposure likely to enhance Ben’s ability to do math later?” “Will this early exposure make him more afraid of math when he gets older (or less afraid)?” Each of these could be the research question for one or more studies, and each might help fill in the puzzle with an additional piece of information. All assembled, they may tell parents a lot about preschool curriculum that involves math.

As a research consumer, you will be best served by examining an accumulation of research results on any topic. Each study will likely have results that are fairly focused on a narrow topic. The narrow focus is necessary for a quality investigation, as we will see. As we proceed, you will become more familiar with this focused approach and you will begin to feel more comfortable as a consumer of research.
Simulatio Feedback

Simulation Feedback 1.2

Probably the quickest way of providing feedback in this simulation is to refer to sections of this chapter regarding the differences between science and common sense. Certainly you will want to discuss how theories and the development and testing of them relate to both common sense and science. It will be extremely important to examine the concept of control and how it is central to science but less so in commonsense discussions. Finally, you will probably discuss differences between science and commonsense approaches to examining different phenomena and their relationships, and explanations about them.