

LARRY B. CHRISTENSEN



EXPERIMENTAL EIGHTH EDITION METHODOLOGY



Experimental Methodology

EIGHTH EDITION

Larry B. Christensen

University of South Alabama

Allyn and Bacon

Boston | London | Toronto | Sydney | Tokyo | Singapore

Executive Editor: Rebecca Pascal
Series Editorial Assistant: Whitney Brown
Marketing Manager: Caroline Croley
Composition and Prepress Buyer: Linda Cox
Manufacturing Buyer: Megan Cochran
Cover Administrator: Linda Knowles
Editorial-Production Administrator: Mary Beth Finch
Editorial-Production Service: The Book Company
Text Designer: Lisa Devinish
Electronic Composition: Omegatype Typography, Inc.
Illustrator: EmSpace Artwork



Copyright © 2001, 1997, 1994, 1991, 1988, 1985, 1980, 1975 by Allyn & Bacon
A Pearson Education Company
Needham Heights, Massachusetts 02494

Internet: www.abacon.com

All rights reserved. No part of the material protected by this copyright notice may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without the written permission of the copyright owner.

Between the time website information is gathered and published, some sites may have closed. Also, the transcription of URLs can result in typographical errors. The publisher would appreciate notification where these occur so that they may be corrected in subsequent editions.

Library of Congress Cataloging-in-Publication Data

Christensen, Larry B., 1941-

Experimental methodology / Larry B. Christensen. -- 8th ed.

p. cm.

Includes bibliographical references and index.

ISBN 0-205-30832-5

1. Psychology, Experimental. 2. Psychology--Experiments. 3. Experimental design. I. Title.

BF181.C48 2001

150'.7'24--dc21

00-026668

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1 RRDV 05 04 03 02 01 00

■ Preface

Goals of the Textbook

It is with great pleasure that I present you with the eighth edition of *Experimental Methodology*. My goal in writing the first edition of this textbook was to provide an introduction to the basic principles of psychological research. I wanted to create a textbook that explained the key principles of the research process in as clear and straightforward a manner as possible, using examples to illustrate each of the various points. This goal has guided all the subsequent editions, including the current one. While the basic principles of psychological research tend to remain invariant over time, there are always some changes that take place over the years that necessitate a revision such as this one. In recent years these changes have been more dramatic than in the past. One of the most dramatic changes is the increased focus of attention on qualitative research methods such as ethnography. These research methods have had an increasing impact on psychological research. This impact has reached a point where students of psychology need at least an introduction to these methods. The other significant change is the advances that have taken place in computer technology, particularly the Internet. This communication process has changed not only the way we communicate with one another, it has also changed the way the research process is implemented, for example, in the way literature searches are currently conducted. An up-to-date research methods textbook must reflect these changes. I have attempted, in the current edition of this textbook, to incorporate these changes.

Organization of the Textbook

In presenting the basic principles of research, I have chosen to organize the textbook to follow the steps involved in the research process. The first chapter presents a discussion of the basic scientific method, including a discussion of its characteristics and objectives. The intent of this chapter is to orient students to science to give them a sense of the difference between information that is acquired through scientific inquiry versus nonscientific inquiry.

Following the discussion of the nature of science, the different research processes, quantitative and qualitative research, are introduced to provide students with an appreciation of both processes. A distinction is also made between experimental and nonexperimental quantitative research to ensure that students recognize the difference between these two research processes. Identification of a research question is then covered at some length, because students frequently have difficulty developing a good researchable idea.

Ethics of research, both human and animal, are discussed next, because consideration of ethical issues must be kept in mind in the designing of the study and the reporting of the results. Control issues are then discussed to give students an appreciation of the necessity of exercising control as well as information on how to implement the needed control. Actual design, both multiparticipant and single case, are presented to provide students with knowledge of the various approaches that can be used to test hypotheses. Following these chapters on design are chapters that focus attention on data collection and statistical analysis, as well as on communication of the research results in a research report.

Pedagogical Features

In each chapter I have incorporated a number of pedagogical features that are designed to improve the comprehension and understanding of the material presented. Each chapter begins with a set of learning objectives that should orient the student to the material in the chapter. A vignette, taken from events reported in magazines and newspapers, introduces the material to be presented in most chapters. These vignettes are included to not only enhance the interest in the material, but to also demonstrate the connection and value that exists between everyday life and good psychological research. Each chapter also highlights the important terms and concepts and includes marginal definitions to maximize the probability that students will acquire the appropriate definition of these terms and concepts. Study questions are spaced throughout the chapter to enhance the learning and retention of the material read. The end of each chapter concludes with a summary of the chapter material as well as a list of key concepts and terms. Most of the chapters also include World Wide Web addresses that relate to the material discussed in the chapter.

The Eighth Edition

The eighth edition retains the same format and goals of previous edition. However, a number of changes have been made in this edition that represent not only an updating of the material, but also changes that reflect the evolving nature of psychological research methods. These changes are as follows:

1. The vignettes introducing most chapters have been updated to include examples of current events. This alteration was considered important because many of the previous vignettes focused on events that took place some years ago and more current events should have more relevance to students.
2. Study questions are interspersed throughout each chapter rather than being placed at the end of the chapter as in previous editions. This alteration was incorporated based on the assumption that students would profit more from the study questions if they immediately followed the relevant material.
3. Chapter 2 was completely rewritten to reflect the current orientation to “nonexperiment research approaches,” particularly qualitative research. This chapter retains some of the material presented in previous editions, but adds material on the qualitative research approaches of ethnography, phenomenology, and case study.
4. In Chapter 4, attention was focused on conducting a literature review using electronic databases rather than doing a manual search using *Psychological Abstracts*. In addition to electronic databases, the use of the Internet is also discussed.
5. Many changes have been made in most chapters to eliminate material that was not viewed as necessary to the instruction of the basic principles of psychological research, such as reducing the discussion of deception in psychological research and the material on doing manual literature searches.
6. World Wide Web addresses have been added to most chapters. These addresses include material that can be used to supplement the material presented in each chapter. Including these addresses is somewhat risky because their longevity and accuracy is totally dependent on the person(s) maintaining the site. At the time this edition was prepared, these sites were functional and considered worthy of inclusion as supplemental resources. I cannot ensure that they will continue to be functional and accurate sites in the future.
7. All designs in Chapter 11 have been labeled “single-case,” which more accurately reflects these designs.

Acknowledgments

The eighth edition of *Experimental Methodology* is, as were previous editions, a product of the excellent input I have received from many colleagues and students. While I have not been able to incorporate all suggestions given to me, I can assure everyone that each suggestion was carefully considered and weighed. Without this continuous input the textbook would not be as well received as it is because the quality would not be there. I continue to encourage both faculty and students to continue to provide me with their candid comments—both positive and negative—as well as suggestions for alterations

and additions of material I may have omitted. I will take each suggestion seriously and will do my best to include your suggestions in the next edition. You can send your comments to me at the Department of Psychology, University of South Alabama, Mobile, AL 36688, or e-mail me at *lchrste@usamail.usouthal.edu*.

I would like to thank the professors who have reviewed this book and provided valuable input: Glenn Gamst, University of California-LaVerne; Robert Newby, Tarleton State University; and Bryan Auday, Gordon College.

Finally, I would like to thank the staff at Allyn & Bacon for their continued support and careful handling of the current edition. Special thanks go to my editor, Rebecca Pascal and to her assistant, Jill Jeffrey.

■ Contents

Preface | ix

CHAPTER 1	What Is Science? 1
	Learning Objectives 1
	Introduction 3
	Methods of Acquiring Knowledge 4
	Science 10
	Advantage of the Scientific Method 13
	Characteristics of the Scientific Approach 13
	Objectives of Science 18
	Basic Assumptions Underlying Science 20
	Method versus Technique 22
	The Role of Theory in Science 24
	The Role of the Scientist in Science 25
	<i>Summary 27</i>
	<i>Key Terms and Concepts 28</i>
CHAPTER 2	Nonexperimental Research Approaches 30
	Learning Objectives 30
	Introduction 32
	Nonexperimental Quantitative Research 33
	Qualitative Research 50
	<i>Summary 58</i>
	<i>Key Terms and Concepts 59</i>
CHAPTER 3	The Experimental Research Approach 60
	Learning Objectives 60
	Introduction 61

Causation	62
The Psychological Experiment	66
Experimental Research Settings	72
<i>Summary</i>	74
<i>Key Terms and Concepts</i>	75

CHAPTER 4

Problem Identification and Hypothesis Formation | 76

Learning Objectives	76
Introduction	78
Sources of Research Ideas	78
Gender Bias in Research Ideas	82
Ideas Not Capable of Scientific Investigation	83
Review of the Literature	83
Feasibility of the Study	93
Formulating the Research Problem	94
Formulating Hypotheses	95
<i>Summary</i>	98
<i>Key Terms and Concepts</i>	98

CHAPTER 5

Ethics | 100

Learning Objectives	100
Introduction	102
Research Ethics: What Are They?	103
Ethical Dilemmas	108
Development of the APA Code of Ethics	113
Ethical Principles	114
Issues Raised by the Code of Ethics	123
Ethics of Animal Research	134
<i>Summary</i>	141
<i>Key Terms and Concepts</i>	142

CHAPTER 6

Variables Used in Experimentation | 143

Learning Objectives	143
Introduction	144
Types of Variables	145
The Independent Variable	146
The Dependent Variable	160
<i>Summary</i>	168
<i>Key Terms and Concepts</i>	169

CHAPTER 7	Control in Experimentation 170 <ul style="list-style-type: none">Learning Objectives 170Introduction 171Control of Extraneous Variables 173Extraneous Variables to Be Controlled 174Research Participant and Experimenter Effects to Be Controlled 181Sequencing Effect to Be Controlled 191Additional Extraneous Variables to Be Held Constant 192<i>Summary</i> 193<i>Key Terms and Concepts</i> 194
CHAPTER 8	Techniques for Achieving Constancy 195 <ul style="list-style-type: none">Learning Objectives 195Introduction 197Randomization 197Matching 203Counterbalancing 212Control of Participant Effects 218Control of Experimenter Effects 223Likelihood of Achieving Control 228<i>Summary</i> 228<i>Key Terms and Concepts</i> 230
CHAPTER 9	Experimental Research Design 231 <ul style="list-style-type: none">Learning Objectives 231Introduction 233Faulty Research Design 234Requirements of True Research Designs 238Pretesting Participants 240True Research Designs 242Choice of a Research Design 256<i>Summary</i> 258<i>Key Terms and Concepts</i> 259
CHAPTER 10	Quasi-Experimental Designs 260 <ul style="list-style-type: none">Learning Objectives 260Introduction 262

Nonequivalent Control Group Design	263
Time-Series Design	271
<i>Summary</i>	276
<i>Key Terms and Concepts</i>	276

CHAPTER 11

Single-Case Research Designs | 260

Learning Objectives	277
Introduction	279
Single-Case Designs	281
A-B-A Design	282
Interaction Design	286
Multiple-Baseline Design	290
Changing-Criterion Design	294
Methodological Considerations in Using Single-Case Designs	296
Criteria for Evaluating Change	299
Rival Hypotheses	301
<i>Summary</i>	302
<i>Key Terms and Concepts</i>	303

CHAPTER 12

Data Collection | 304

Learning Objectives	304
Introduction	306
Research Participants	306
Sample Size	309
Apparatus	311
Instructions	314
Scheduling of Research Participants	314
Procedure	315
Institutional Approval	317
Data Collection	318
Consent to Participate	318
Debriefing, or Postexperimental Interview	320
<i>Summary</i>	323
<i>Key Terms and Concepts</i>	324

CHAPTER 13

Hypothesis Testing | 325

Learning Objectives	325
Introduction	327
Testing the Hypothesis	328
The Mean	329

Standard Deviation	330
Selection of a Statistical Test	332
Independent Samples <i>t</i> -Test	334
Significance Level	335
Analysis of Variance	338
Potential Errors in the Statistical Decision-Making Process	354
<i>Summary</i>	356
<i>Key Terms and Concepts</i>	357

CHAPTER 14**External Validity | 358**

Learning Objectives	358
Introduction	360
Population Validity	360
Ecological Validity	364
Temporal Validity	367
Relationship Between Internal and External Validity	370
Cautions in Evaluating the External Validity of Experiments	371
<i>Summary</i>	374
<i>Key Terms and Concepts</i>	375

CHAPTER 15**The Research Report | 376**

Learning Objectives	376
Introduction	377
The APA Format	379
Preparation of the Research Report	407

Appendixes | 419

References | 425

Index | 445

1

What Is Science?

LEARNING OBJECTIVES

- 1 To gain an understanding of the nature of the scientific method.
- 2 To understand how the scientific method differs from other methods of acquiring information.
- 3 To learn the unique characteristics of the scientific method and understand why each of these characteristics is necessary.
- 4 To understand the sort of characteristics that typify the person who is adept at pursuing the scientific enterprise.

On July 5, 1998, the Los Angeles Daily News ran an article under the headline "Handwriting Analyst Reads Human Nature." In this article Sheila Lowe, a handwriting analyst for 31 years, stated that "you are what you write." According to Ms. Lowe, handwriting always tells the truth because it is a projective behavior that reflects all of the experiences of a person's life. Lowe has gained considerable attention for her comments to the media on criminal and civil trials such as the O. J. Simpson trial and the JonBenet Ramsey murder case. She has even appeared on NBC's *Unsolved Mysteries*. When she analyzes handwriting, she states that she tries to focus on small details, such as how Ts are crossed, as well as the larger picture such as the arrangement and balance on the page and whether anything stands out. From a handwriting analysis of individuals such as Bill Clinton and Elvis Presley, she drew the following conclusions. "Bill Clinton is a combination of strength and flexibility. He can stand firm and build a consensus." Elvis Presley's handwriting indicated that he was in ill health and depressed.

Is there anything to handwriting analysis? Are you what you write, as claimed by Ms. Lowe? It would be wonderful if we could tell what a person was like just from analyzing a sample of an individual's handwriting. There are, however, many skeptics of handwriting analysis. Handwriting analysis has typically been scorned by scientists as something akin to fortune-telling and palm reading. In spite of this, some individuals and companies are turning to individuals such as Ms. Lowe to assist them in identifying desirable employees and in providing guidance in child rearing. Law enforcement agencies are employing her to assist in background investigations as are individuals involved in romantic entanglements. Ms. Lowe is even selling a computer program that analyzes handwriting because of the tremendous demand for her services.

There seems to be little question that there is an interest in handwriting analysis by different groups of individuals in areas of the country such as Southern California. The important question is whether handwriting analysis really does provide a window into the personality of an individual. Obviously many individuals think it does because they use it in making some very important decisions. But how do we know for sure? In order to determine if handwriting analysis can provide an accurate assessment of the personality of an individual, we must conduct a scientific study. You may wonder how something that seems as subjective as handwriting analysis can be scientifically investigated. Few people understand the nature of a scientific investigation or the need to conduct such an investigation in a situation like this. This lack of understanding may be because scientists are usually conceptualized as people in white coats who work in a laboratory, conducting experiments on complex theories that are far beyond the comprehension of the average individual. Handwriting analysis is something that most people have at least heard of, even if they don't understand how it is done. Actually studying the validity of something like handwriting analysis seems very mysterious. This is probably because the actual process by which scientists uncover the mysteries of the universe totally eludes most people. It is as if the scientific process were encompassed in a shroud of secrecy and could be revealed only to the scientist. Science, however, is not a mysterious phenomenon. Rather, it is a very

logical and rigorous method for attempting to gather facts. This chapter is designed to remove the mystery surrounding science and to acquaint you with the scientific process. This chapter will cover not only the meaning of science but also the unique characteristics that distinguish the scientific method from other methods of gathering information.

Introduction

In our daily lives, we continually encounter problems and questions relating to behavior. For example, one person may have a tremendous fear of taking tests. Others may have problems with alcoholism or drug abuse, or problems in their marriage. People who encounter such problems typically want to eliminate them but often lack the knowledge or ability to handle the problems themselves. Consequently, they seek out professionals, such as psychologists, to help them to remediate such difficulties.

Other people may enlist the assistance of professionals in understanding the behavior of others. For example, salespeople differ greatly in their ability to sell merchandise. One car salesperson may be capable of selling twice as many cars as another salesperson can. If the sales manager could discover why such differences in ability exist, he or she might be able to develop either better training programs or more effective criteria for selecting the sales force.

In an attempt to gain information about behavior, people turn to the field of psychology. As you should know by now, a great deal of information about the behavior of organisms has been accumulated. We have knowledge that enables us to treat disorders such as “test anxiety.” Similarly, we have identified many of the variables influencing persuasion and aggression. Although we know a great deal about the behavior of humans and infrahumans, there is still much to be learned. For example, we have an inadequate understanding of childhood autism and leadership ability. In order to learn more about such behaviors, we must engage in scientific research because this is the only way in which we can fill the gaps in our knowledge. However, the ability to understand and engage in the research process does not come easily; it is definitely not an ability that comes from taking introductory or abnormal psychology. These content courses give little insight into the way in which psychological facts and data are acquired. They state implicitly or explicitly that such facts and data have been acquired from scientific research, but the nature of the scientific research process itself remains elusive.

In order to learn about the scientific research process, one needs more direct instruction. The course in which you are now enrolled is aimed at providing you with information about the way in which the scientific research process is conducted. Some students may object that such a course is not necessary for their education because they have no intention of becoming research psychologists. But there are a number of very good reasons for all students to study experimental methodology. First, at some time in the future you may be asked to conduct a study (such as a community survey) on some

issue. Second, virtually all the material you are required to learn in your science courses is based on knowledge acquired from the scientific method, so you should be familiar with the method. Third, we are all continually bombarded by the results of scientific research, and we need experimental tools to determine which research outcomes are conclusive. For example, saccharin has been demonstrated to cause cancer in laboratory animals, yet there are many people who consume saccharin and do not contract cancer. You as a consumer must be able to resolve these discrepancies in order to decide whether or not you are going to eat foods containing saccharin.

Similarly, television commercials often present what appears to be a scientific test in order to convince us of the superiority of one product over another. Several years ago the manufacturers of Schlitz beer were concerned with the decline in the sales of their product. In an effort to reverse this decline, the company conducted a live “Challenge” on television in which devotees of another brand were challenged to see if they could distinguish their preferred brand from Schlitz. This live demonstration consistently showed that about 50 percent of these beer drinkers chose Schlitz over their preferred brand as the better tasting beer. On the surface, this challenge seems to reveal that Schlitz is an excellent beer because so many people chose it. If you had some knowledge of research design and statistics, however, you would be able to see that this contest did not prove anything about the superiority of Schlitz over other beers because the challenge was conducted on live television, in the midst of a lot of noise and commotion. Such distractions would minimize a person’s ability to distinguish one beer from another. If there were enough distractions that people could not distinguish one beer from another, they would probably select one beer about the same number of times as the other. This is exactly what happened, since Schlitz and the other brand were *each* picked by about 50 percent of the people. From this example, you can see that an understanding of the scientific research process induces a way of thinking that will enable you to evaluate critically the information with which you are confronted. Given that our society is constantly becoming more complex and we are having to rely more and more on scientific evidence, our ability to evaluate the evidence intelligently becomes increasingly important.

Methods of Acquiring Knowledge

There are many procedures by which we obtain information about a given phenomenon or situation. We acquire a great deal of information from the events we experience as we go through life. Experts also provide us with much information. Helmstadter (1970) has posited that there are at least six different approaches to acquiring knowledge, only one of which is the scientific method. In order to enable you to gain an appreciation of the rigor and accuracy that is achieved by the scientific method, we will begin by taking a look at the five unscientific approaches to acquiring knowledge and then

look at the scientific method. You should be able to see that each successive approach represents a more acceptable means of acquiring knowledge.

This does not mean that these unscientific approaches have no place in science. While they do not contribute to the accumulation of scientific knowledge they are used in the process of implementing the scientific method. When discussing each of these approaches I will also discuss how they are used when the scientific method is implemented.

Tenacity

Tenacity

A method of acquiring knowledge based on superstition or habit

The first approach can be labeled **tenacity**, defined in *Webster's Third New International Dictionary* as "the quality or state of holding fast." This approach to acquiring knowledge seems to boil down to the acquisition and persistence of superstitions, because superstitions represent beliefs that are reacted to as if they were fact. Habit, or what might be labeled the principle of longevity, also illustrates tenacity at work. Habit leads us to continue believing something we have always believed.

The principle of longevity can be seen in statements such as "You can't teach an old dog new tricks." In general, the more frequently we are exposed to such statements, the more we tend to believe them. Social psychologists have identified a similar process operating in attitude formation; they call it **mere exposure**. The more we are exposed to something or the more familiar it becomes, the more we like it. Politicians are very aware of this principle and discuss it in terms of name recognition. When running for office, a politician will plaster his or her name all over town, repeatedly exposing the public to it without ever mentioning campaign issues. This repeated exposure can engender in voters a more positive attitude toward the politician and a belief that he or she is the best candidate for the position.

Although tenacity is a method of acquiring knowledge, it has two problems that diminish its value. First, knowledge that is acquired through mere exposure may be inaccurate. Everyone has heard that old dogs can't learn new tricks, but in fact the elderly can and do learn. They may be more resistant, but they learn. Second, tenacity does not provide a mechanism for correcting erroneous superstitions and habits in the face of evidence to the contrary.

Tenacity does, however, permeate the scientific approach when a scientist persists in believing in an idea, a hypothesis, or the results of research in the face of criticism from colleagues. Garcia's (1981) research on conditioned taste aversion, for example, was severely criticized initially as being incompetently conducted and was rejected for publication. However, Garcia believed in his ideas and the quality of his research. His tenacity eventually led to the publication of his research and the demonstration of conditioned taste aversion as a robust psychological phenomenon.

Tenacity also operates in science when a favorite theory is maintained in the face of conflicting evidence or in the absence of much scientific evidence.

Mere exposure

The development of a positive attitude toward something as a function of increased familiarity with it