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ESSENTIALS OF STATISTICS FOR THE BEHAVIORAL SCIENCES

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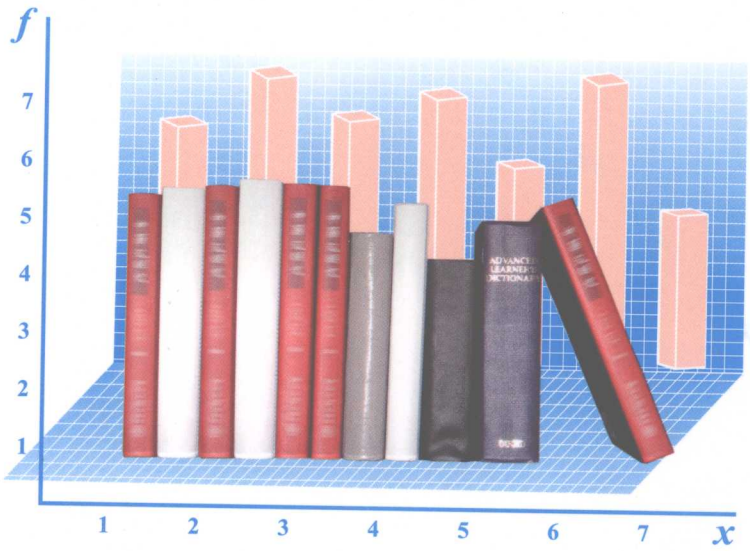
第 6 版



〔美〕弗雷德里克·格雷维特（Frederick J. Gravetter）
拉里·沃尔诺（Larry B. Wallnau）
著

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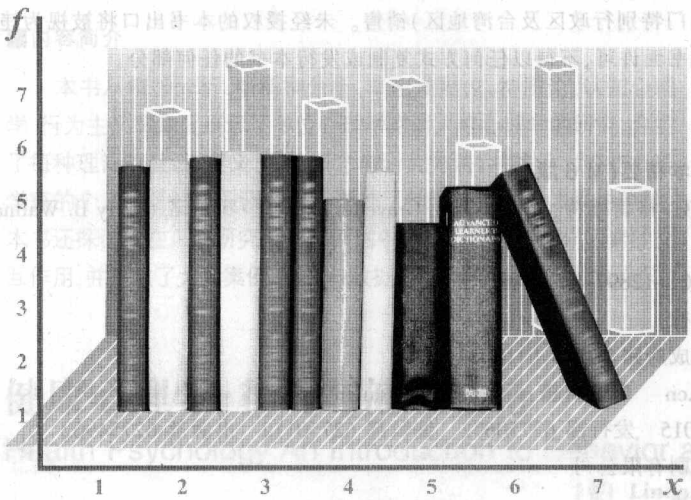

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培文书系心理学影印系列旨在面向心理学领域的师生和广大心理科学的从业者和爱好者，推介国外心理学领域的英文原版专著和教材，使我国读者能够接触到原汁原味的第一手资料。

需要重申的是，作者本人的有些观点和结论尚需商榷，有些甚至是不可取的，为此提请读者加以甄别。书中的观点均不代表出版社观点。

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2008 年 1 月

Preface

Many students in the behavioral sciences view the required statistics course as an intimidating obstacle that has been placed in the middle of an otherwise interesting curriculum. They want to learn about human behavior—not about math and science. As a result, the statistics course is seen as irrelevant to their education and career goals. However, as long as the behavioral sciences are founded in science, knowledge of statistics will be necessary. Statistical procedures provide researchers with objective and systematic methods for describing and interpreting their research results. Scientific research is the system that we use to gather information, and statistics are the tools that we use to distill the information into sensible and justified conclusions. The goal of this book is not only to teach the methods of statistics, but also to convey the basic principles of objectivity and logic that are essential for science and valuable for decision making in everyday life.

Those of you who are familiar with previous editions of *Essentials of Statistics for the Behavioral Sciences* will notice that some changes have been made. These changes are summarized in the section entitled "To the Instructor." In revising this text, our students have been foremost in our minds. Over the years, they have provided honest and useful feedback. Their hard work and perseverance has made our writing and teaching most rewarding. We sincerely thank them. Students who are using this edition should please read the section of the preface entitled "To the Student."

ANCILLARIES

Ancillaries for this edition include the following:

- *WebAssign:* New to this edition, WebAssign allows instructors to assign additional homework and study problems to students so they can get even more practice on the most difficult concepts. Guided problems lead students through exercises step-by-step and get students back on track when they make a mistake.
- *Study Guide:* Contains a chapter overview, learning objectives, new terms and concepts, new formulas, step-by-step procedures for problem solving, study hints and cautions, a self-test, and review for each chapter. The Study Guide contains answers for the self-test questions.
- *Book Companion Website:* Additional, free study resources are available online at the book companion website. Practice and reinforce statistical concepts using the Statistics Workshops, chapter quizzes, chapter objectives, interactive flash cards, Web links, and more! Visit http://www.thomsonedu.com/psychology/gravetter.
- *Instructor's Manual with Test Bank:* Contains chapter outlines, annotated learning objectives, lecture suggestions, test items, and solutions to all end-of-chapter problems in the text. Test items are also available as a Word download or for ExamView computerized test bank software.
- *Transparency CD-ROM:* About 90 tables and figures taken directly from the text are available for instructors in PowerPoint.
- *JoinIn Student Response System:* Turn your classroom into an interactive experience with JoinIn polls and quizzes that allow students to respond with "clicker" keypads.

ACKNOWLEDGMENTS

It takes a lot of good, hard-working people to produce a book. Our friends at Wadsworth have made enormous contributions to this textbook. We thank our director, Marcus Boggs; our new editor, Erik Evans; assistant editor, Gina Kessler; editorial assistant, Christina Ganim; development editor, Kirk Bomont; technology project manager, Lauren Keyes; content project manager, Mary Noel; accuracy checker, Sudhir Goel; creative director, Vernon Boes; marketing manager, Karin Sandberg; marketing communications manager, Linda Yip; and marketing assistant, Melanie Cregger.

Reviewers play a very important role in the development of a manuscript. Accordingly, we offer our appreciation to the following colleagues for their assistance with the sixth edition: Noreen Dulin, Vanguard University of South Carolina; David J. Falcone, LaSalle University; Kristin Cotter Mena, University of Houston; Mark Vosvick, University of North Texas; Helga Walz, University of Baltimore; Todd Wiebers, Henderson State University. We would like to thank those who offered their insight on previous editions as well: Delbert Brodie, St. Thomas University; Deborah Carroll, Southern Connecticut State University; Michael Emond, Laurentian University; Jim Evans, Louisiana State University Shreveport; Joel Freund, University of Arkansas; Margarita Garcia-Estevez, Montclair State University; Roberto R. Heredia, Texas A&M University; Scott Hershberger, California State University, Long Beach; Charles Huffman, James Madison University; John Johanson, Winona State University; Mark Johnson, University of Maryland; Katheryn McGuthry, Reinhardt College; Kathryn Oleson, Reed College; Donald Saucier, University of Kentucky; and Richard Wielkiewicz, College of Saint Benedict.

TO THE INSTRUCTOR

Those of you familiar with the previous edition of *Statistics for the Behavioral Sciences* will notice a number of changes in the sixth edition. A new appendix (Appendix D) contains a general introduction to the statistics program SPSS®. In addition, at the end of each chapter for which an SPSS® analysis is feasible, there is a step-by-step set of instructions describing how to enter data, how to run the analysis, and what to look for in the output. Also, all end-of-chapter problem sets have been revised.

The following are examples of the specific and noteworthy revisions:

Chapter 1 More emphasis is placed on data structures and their relationship to statistical techniques and less emphasis on research methodology. Examples have been added to illustrate the different scales of measurement.

Chapter 3 New text acknowledges that most examples of computing the median are based on continuous variables and notes that some of the conventions involving the median can change if a discrete variable is involved.

Chapter 4 Greater emphasis is placed on the definition and concept of variance and standard deviation rather than the computation. Also, the section on degrees of freedom for sample variance has been expanded.

Chapter 5 A new section demonstrates and explains examples of z-score problems other than transforming back and forth between X-scores and z-scores. Also, a new section describes how z-scores can be used with sample data, rather than presenting z-scores exclusively in the context of population distributions.

Chapter 7 Expanded discussion of how the standard deviation and the sample size combine to determine the value of the standard error. Also, a new figure shows how standard error is related to sample size.

Chapter 8 The section on statistical power has been expanded, including a new figure to illustrate the relationship between sample size and power. Also, a new section discusses the different factors that influence the outcome of a hypothesis test (the size of the mean difference, the sample size, and the variability of the scores).

Chapter 9 The section on Cohen's *d* has been revised to clarify that we are now using sample values to obtain an estimate of Cohen's *d* (which is defined in terms of population parameters). Also a discussion has been added on how sample size and sample variance influence the hypothesis test.

Chapter 10 A new section discusses the interpretation of the standard error for a sample mean difference. Also, a new box describes an alternative to using pooled variance to compute the standard error for the independent-measures *t* statistic that eliminates the need for the homogeneity of variance assumption.

Chapter 11 A new section discusses order effects and time-related factors that are potential problems related exclusively to repeated-measures designs.

Chapter 12 The section on the interpretation of a confidence interval has been expanded.

Chapter 13 Increased emphasis is placed on the concepts of analysis of variance rather than the computations.

Chapter 14 New sections demonstrate measures of effect size for both the repeated-measures and the two-factor analysis of variance.

Chapter 15 The phi-coefficient has been added as one more example of a special application of correlation. Also, the presentation of regression has been expanded to include a new section on analysis of regression as an alternative method for evaluating the significance of a relationship.

TO THE STUDENT

A primary goal of this book is to make the task of learning statistics as easy and painless as possible. Among other things, you will notice that the book provides you with a number of opportunities to practice the techniques you will be learning in the form of learning checks, examples, demonstrations, and end-of-chapter problems. We encourage you to take advantage of these opportunities. Read the text rather than just memorize the formulas. We have taken care to present each statistical procedure in a conceptual context that explains why the procedure was developed and when it should be used. If you read this material and gain an understanding of the basic concepts underlying a statistical formula, you will find that learning the formula and how to use it will be much easier. In the following section, "Study Hints," we provide advice that we give our own students. Ask your instructor for advice as well; we are sure that other instructors will have ideas of their own.

Over the years, the students in our classes and other students using our book have given us valuable feedback. If you have any suggestions or comments about this book, you can write to either Professor Frederick Gravetter or Professor Emeritus Larry Wallnau at the Department of Psychology, SUNY College at Brockport, 350 New Campus Drive, Brockport, New York 14420. You can also contact Professor Gravetter directly at fgravett@brockport.edu.

Study Hints You may find some of these tips helpful, as our own students have reported.

- The key to success in a statistics course is to keep up with the material. Each new topic builds on previous topics. If you have learned the previous material,

then the new topic is just one small step forward. Without the proper background, however, the new topic can be a complete mystery. If you find that you are falling behind, get help immediately.

- You will learn (and remember) much more if you study for short periods several times per week rather than try to condense all of your studying into one long session. For example, it is far more effective to study half an hour every night than to have a single $3\frac{1}{2}$-hour study session once a week. We cannot even work on *writing* this book without frequent rest breaks.
- Do some work before class. Keep a little ahead of the instructor by reading the appropriate sections before they are presented in class. Although you may not fully understand what you read, you will have a general idea of the topic, which will make the lecture easier to follow. Also, you can identify material that is particularly confusing and then be sure the topic is clarified in class.
- Pay attention and think during class. Although this advice seems obvious, often it is not practiced. Many students spend so much time trying to write down every example presented or every word spoken by the instructor that they do not actually understand and process what is being said. Check with your instructor—there may not be a need to copy every example presented in class, especially if there are many examples like it in the text. Sometimes, we tell our students to put their pens and pencils down for a moment and just listen.
- Test yourself regularly. Do not wait until the end of the chapter or the end of the week to check your knowledge. After each lecture, work some of the end-of-chapter problems, and do the Learning Checks. Review the Demonstration Problems, and be sure you can define the Key Terms. If you are having trouble, get your questions answered *immediately* (reread the section, go to your instructor, or ask questions in class). By doing so, you will be able to move ahead to new material.
- Do not kid yourself! Avoid denial. Many students observe their instructor solve problems in class and think to themselves, "This looks easy, I understand it." Do you really understand it? Can you really do the problem on your own without having to leaf through the pages of a chapter? Although there is nothing wrong with using examples in the text as models for solving problems, you should try working a problem with your book closed to test your level of mastery.
- We realize that many students are embarassed to ask for help. It is our biggest challenge as instructors. You must find a way to overcome this aversion. Perhaps contacting the instructor directly would be a good starting point, if asking questions in class is too anxiety-provoking. You could be pleasantly surprised to find that your instructor does not yell, scold, or bite! Also, your instructor might know of another student who can offer assistance. Peer tutoring can be very helpful.

Frederick J Gravetter
Larry B. Wallnau

About the Authors

Frederick J Gravetter is a Professor of Psychology at the State University of New York College at Brockport. Dr. Gravetter has taught at Brockport since the early 1970s, specializing in statistics, experimental design, and cognitive psychology. He received his bachelor's degree in mathematics from M.I.T. and his Ph.D. in psychology from Duke University. In addition to publishing this textbook and several research articles, Dr. Gravetter co-authored *Research Methods for the Behavioral Sciences* and *Statistics for the Behavioral Sciences*.

Nicki and Fred

Larry B. Wallnau is Professor Emeritus of Psychology at the State University of New York College at Brockport. While teaching at Brockport, he published numerous research articles, primarily on the behavioral effects of psychotropic drugs. With Dr. Gravetter, he co-authored *Statistics for the Behavioral Sciences*. He also has provided editorial consulting for numerous publishers and journals. He routinely gives lectures and demonstrations on service dogs for those with disabilities.

Ed Berns

Ben and Larry

简明目录

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