SPSS for Intermediate Statistics: Use and Interpretation

Second Edition
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SPSS for Intermediate Statistics: 
Use and Interpretation

Second Edition

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PREFACE

This book is designed to help students learn how to analyze and interpret research data with intermediate statistics. It is intended to be a supplemental text in an intermediate statistics course in the behavioral sciences or education and it can be used in conjunction with any mainstream text. We have found that the book makes SPSS for Windows easy to use so that it is not necessary to have a formal, instructional computer lab; you should be able to learn how to use SPSS on your own with this book. Access to the SPSS program and some familiarity with Windows is all that is required. Although SPSS for Windows is quite easy to use, there is such a wide variety of options and statistics that knowing which ones to use and how to interpret the printouts can be difficult, so this book is intended to help with these challenges.

SPSS 12 and Earlier Versions

We use SPSS 12 for Windows in this book, but, except for enhanced tables and graphics, there are only minor differences from versions 10 and 11. In fact, as far as the procedures demonstrated, in this book there are only a few major differences between versions 7 and 12. We also expect future Windows versions to be similar. You should not have much difficulty if you have access to SPSS versions 7 through 9. Our students have used this book, or earlier editions of it, with all of these versions of SPSS; both the procedures and outputs are quite similar.

Goals of This Book

This book demonstrates how to produce a variety of statistics that are usually included in intermediate statistics courses, plus some (e.g., reliability measures) that are useful for doing research. Our goal is to describe the use and interpretation of these statistics as much as possible in nontechnical, jargon-free language.

Helping you learn how to choose the appropriate statistics, interpret the outputs, and develop skills in writing about the meaning of the results are the main goals of this book.

Thus, we have included material on:
1) How the appropriate choice of a statistic is based on the design of the research.
2) How to use SPSS to answer research questions.
3) How to interpret SPSS outputs.
4) How to write about the outputs in the Results section of a paper.

This information will help you develop skills that cover a range of steps in the research process: design, data collection, data entry, data analysis, interpretation of outputs, and writing results. The modified high school and beyond data set (HSB) used in this book is similar to one you might have for a thesis, dissertation, or research project. Therefore, we think it can serve as a model for your analysis. The compact disk (CD) packaged with the book contains the HSB data file and several other data sets used for the extra problems at the end of each chapter. However, you will need to have access to or purchase the SPSS program. Partially to make the text more readable, we have chosen not to cite many references in the text; however, we have provided a short bibliography of some of the books and articles that we have found useful. We assume that most students will use this book in conjunction with a class that has a textbook; it will help you to read more about each statistic before doing the assignments. Our “For Further Reading” list should also help.

Our companion book, Morgan, Leech, Gloeckner, and Barrett (2004), SPSS for Introductory Statistics: Use and Interpretation, also published by Lawrence Erlbaum Associates, is on the “For Further Reading” list at the end of this book. We think that you will find it useful if you need to
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review how to do introductory statistics including the ones such as t tests, chi-square, and correlation.

Special Features

Several user friendly features of this book include:
1. The key SPSS windows that you see when performing the statistical analyses. This has been helpful to “visual learners.”
2. The complete outputs for the analyses that we have done so you can see what you will get, after some editing in SPSS to make the outputs fit better on the pages.
3. Callout boxes on the outputs that point out parts of the output to focus on and indicate what they mean.
4. For each output, a boxed interpretation section that will help you understand the output.
5. Specially developed flow charts and tables to help you select an appropriate inferential statistic and tell you how to interpret statistical significance and effect sizes (in Chapter 3). This chapter also provides an extended example of how to identify and write a research problem, several research questions, and a results paragraph for a t test and correlation.
6. For the statistics in chapters 4-10, an example of how to write about the output and make a table for a thesis, dissertation or research paper.
7. Interpretation questions that stimulate you to think about the information in the chapter and outputs.
8. Several extra SPSS problems at the end of each chapter for you to run with SPSS and discuss.
9. A Quick Reference Guide to SPSS (Appendix A) which provides information about many SPSS commands not discussed in the chapters.
10. Information (in Appendix B) on how to get started with SPSS.
11. A step by step guide to (Appendix C) making APA tables with MsWord.
12. Answers to the odd numbered interpretation questions (Appendix D).
13. Several data sets on a CD. These realistic data sets are packaged with the book to provide you with data to be used to solve the chapter problems and the extra problems at the end of each chapter.

Overview of the Chapters

Our approach in this book is to present how to use and interpret SPSS in the context of proceeding as if the HSB data were the actual data from your research project. However, before starting the SPSS assignments, we have three introductory chapters. The first chapter is an introduction and review of research design and how it would apply to analyzing the HSB data. In addition chapter includes a review of measurement and descriptive statistics. Chapter 2 discusses rules for coding data, exploratory data analysis (EDA), and assumptions. Much of what is done in this chapter involves preliminary analyses to get ready to answer the research questions that you might state in a report.

Chapter 3 provides a brief overview of research designs (between groups and within subjects). This chapter provides flowcharts and tables useful for selecting an appropriate statistic. Also included is an overview of how to interpret and write about the results of a basic inferential statistic. This section includes not only testing for statistical significance but also a discussion of effect size measures and guidelines for interpreting them.

Chapters 4-10 are designed to answer several research questions. Solving the problems in these chapters should give you a good idea of some of the intermediate statistics that can be computed with SPSS. Hopefully, seeing how the research questions and design lead naturally to the choice
of statistics will become apparent after using this book. In addition, it is our hope that interpreting what you get back from the computer will become more clear after doing these assignments, studying the outputs, answering the interpretation questions, and doing the extra SPSS problems.

Our Approach to Research Questions, Measurement, and Selection of Statistics
In Chapters 1 and 3, our approach is somewhat nontraditional because we have found that students have a great deal of difficulty with some aspects of research and statistics but not others. Most can learn formulas and “crunch” the numbers quite easily and accurately with a calculator or with a computer. However, many have trouble knowing what statistics to use and how to interpret the results. They do not seem to have a “big picture” or see how research design and measurement influence data analysis. Part of the problem is inconsistent terminology. For these reasons, we have tried to present a semantically consistent and coherent picture of how research design leads to three basic kinds of research questions (difference, associational, and descriptive) which, in turn, lead to three kinds or groups of statistics with the same names. We realize that these and other attempts to develop and utilize a consistent framework are both nontraditional and somewhat of an oversimplification. However, we think the framework and consistency pay off in terms of student understanding and ability to actually use statistics to answer their research questions. Instructors who are not persuaded that this framework is useful can skip Chapters 1 and 3 and still have a book that helps their students use and interpret SPSS.

Major Changes and Additions to This Edition
The following changes and additions are based on our experiences using the book with students, feedback from reviewers and other users, and the revisions in policy and best practice specified by the APA Task Force on Statistical Inference (1999) and the 5th Edition of the APA Publication Manual (2001).

1. **Effect size.** We discuss effect size in addition to statistical significance in the interpretation sections to be consistent with the requirements of the revised APA manual. Because SPSS does not provide effect sizes for all the demonstrated statistics, we often show how to estimate or compute them by hand.

2. **Writing about outputs.** We include examples of how to write about and make APA type tables from the information in SPSS outputs. We have found the step from interpretation to writing quite difficult for students so we now put more emphasis on writing.

3. **Assumptions.** When each statistic is introduced, we have a brief section about its assumptions and when it is appropriate to select that statistic for the problem or question at hand.

4. **Testing assumptions.** We have expanded emphasis on exploratory data analysis (EDA) and how to test assumptions.

5. **Quick Reference Guide for SPSS procedures.** We have condensed several of the appendixes of the first edition into the alphabetically organized Appendix A, which is somewhat like a glossary. It includes how to do basic statistics that are not included in this text, and procedures like print and save, which are tasks you will use several times and/or may already know. It also includes brief directions of how to do things like import a file from Excel or export to PowerPoint, do split files, and make 3-D figures.

6. **Extra SPSS problems.** We have developed additional extra problems, to give you more practice in running and interpreting SPSS.

7. **Reliability assessment.** We include a chapter on ways of assessing reliability including Cronbach’s alpha, Cohen’s kappa, and correlation. More emphasis on reliability and testing assumptions is consistent with our strategy of presenting SPSS procedures that students would use in an actual research project.

8. **Principal Components Analysis and Exploratory Factor Analysis.** We have added a section on exploratory factor analysis to increase students’ choices when using these types of analyses.
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9. Interpretation questions. We have added more interpretation questions to each chapter because we have found them useful for student understanding. We include the answers to the odd numbered questions in Appendix C for self-study.

Bullets, Arrows, Bold and Italics
To help you do the problems with SPSS, we have developed some conventions. We use bullets to indicate actions in SPSS Windows that you will take. For example:

- Highlight gender and math achievement.
- Click on the arrow to move the variables into the right hand box.
- Click on Options to get Fig 2.16.
- Check Mean, Std Deviation, Minimum, and Maximum.
- Click on Continue.

Note that the words in italics are variable names and words in bold are words that you will see in the SPSS Windows and utilize to produce the desired output. In the text they are spelled and capitalized as you see them in the Windows. Bold is also used to identify key terms when they are introduced, defined, or important to understanding.

The words you will see in the pull down menus are given in bold with arrows between them. For example:

- Select Analyze => Descriptive Statistics => Frequencies
  (This means pull down the Analyze menu, then slide your cursor down to Descriptive Statistics and over to Frequencies and click.)

Occasionally, we have used underlines to emphasize critical points or commands.

Acknowledgements
This SPSS book is consistent with and could be used as a supplement for Gliner and Morgan, (2000) Research Methods in Applied Settings: An Integrated Approach to Design and Analysis, also published by Erlbaum. In fact, some sections of chapters 1 and 3 have been only slightly modified from that text. For this we thank Jeff Gliner, the first author of that book. Although Orlando Griego is not an author on this revision of our SPSS book, it still shows the imprint of his student writing style.

We would like to acknowledge the assistance of the many students in our education and human development classes who have used earlier versions of this book and provided helpful suggestions for improvement. We could not have completed the task or made it look so good without our technology consultant, Don Quick, our word processors, Linda White and Catherine Lamana, and several capable work study students including Rae Russell, Katie Jones, Erica Snyder, and Jennifer Musser. Jikyeong Kang, Bill Sears, LaVon Blaes, Mei-Huei Tsay and Sheridan Green assisted with classes and the development of materials for the DOS and earlier Windows versions of the assignments. Laura Jensen, Lisa Vogel, Don Quick, James Lyall, Joan Anderson, and Yasmine Andrews helped with writing or editing parts of the manuscript or earlier editions. Jeff Gliner, Jerry Vaske, Jim zumBrunnen, Laura Goodwin, David MacPhee, Gene Gloeckner, James O. Benedict, Barry Cohen, John Ruscio, Tim Urdan, and Steve Knotek provided reviews and suggestions for improving the text. Joan Clay and Don Quick wrote helpful appendices for this edition. Bob Fetch and Ray Yang provided helpful feedback on the readability
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