Chapter 1: Introduction to Statistics

**Chapter Outline**

1.1 The Use of Statistics in Science

1.2 Descriptive and Inferential Statistics

1.3 Research Methods and Statistics

1.4 Scales of Measurement

1.5 Types of Variables for Which Data Are Measured

1.6 Research in Focus: Evaluating Data and Scales of Measurement

1.7 SPSS in Focus: Entering and Defining Variables

Chapter Summary Organized by Learning Objectives

Key Terms

End-of-Chapter Problems

Factual Problems

Concepts and Application Problems

Problems in Research

**Learning Objectives (Chapter 1)**

After reading this chapter, you should be able to:

1. Distinguish between descriptive and inferential statistics.

2. Explain how samples and populations, as well as a sample statistic and population parameter, differ.

3. Describe three research methods commonly used in behavioral science.

4. State the four scales of measurement and provide an example for each.

5. Distinguish between variables that are qualitative and quantitative.

6. Distinguish between variables that are discrete or continuous.

7. Enter data into SPSS both by placing each group in separate columns and each group in a single column (coding is required).

*A suggestion for meeting learning objectives.* This book has been written as a teachable reference. You will find that the sections and chapters in this book are loaded with practical research examples and illustrations that can be easily incorporated into your lectures. An advantage of teaching from content in the textbook is that it will increase how often students reference and read the textbook. So incorporating the many examples and illustrations from the textbook into your lectures should have a positive effect on the readings many students complete. This is just something to keep in mind as you prepare your lectures.

**Lecture Suggestions (in Support of the Learning Objectives)**

Learning Objectives 1–2 Suggestions. Refer to Section 1.2 for these learning objectives. Also, you might want to include the following exercise:

For smaller classes, ask all students in your class to tell you their age (or any other variable you find appropriate). Make sure you let them know they can refuse to participate. To make students more comfortable, be the first volunteer to write down your age. Once you have written every student’s age, compute the average. While the mean is Chapter 3 material, most students are familiar with averages (so use that term, and not the mean). Let students know that this is the average age for the POPULATION of students in your class. Explain that the average age is a parameter (a characteristic of the population of all students in your class).

Once you have done this, ask the students to split up into groups. The number and size of the groups depends on the number of students enrolled in your class. As a rule of thumb, make sure that at least three to four students are in each group. Ask each group to write down the age of each group member on a piece of paper. Once they complete this, ask one student in each group to tell you the average age in their group. To organize this exercise, write each group average below the population average and draw a line connecting these averages to the population average. Once all group averages have been recorded, explain to the students that each group was a SAMPLE and that the average age in each group was a statistic.

Obviously, the sample averages will not be the same as the population average age. This is a good opportunity to engage students. Explain that the mean in a sample is an estimate of the mean in the population. Talk about why samples are used, why researchers care about populations, and how inferential statistics are largely used to determine how well sample statistics estimate parameters in the population. This is a great way to engage multiple learning styles to illustrate this difficult learning objective to students and link it with the principles of decision making and research.

Learning Objective 3 Suggestions. Section 1.3 is a great reference for meeting this learning objective. This section works through research problems and gives students a context for research design, measurement, and statistics.

Research design this early in the semester tends to be intimidating to students. You may consider drawing a simple analogy to a game. In class, explain to students that board games have many pieces, and to play a game, you have to follow the rules for how to use the game pieces on the board. In a similar way, statistics are the game pieces, and the rules for how to use them are written in research design. The three research methods explain the rules for obtaining data scientifically. Once data have been obtained scientifically, we can then apply statistical analyses to describe and interpret the data we collected. This analogy has worked well with students. To further illustrate the requirements of an experiment, you might consider discussing Example 1.2. It might also be beneficial to ask students how the experiment could be changed to be considered a quasi-experimental method and correlational method.

Learning Objectives 4–6 Suggestions. Section 1.4 gives many examples of each scale of measurement. Use these examples in your lectures. The book even introduces interval scales without going on and on about temperature, which is an overused example in many other books. Also, Section 1.5 gives a comprehensive overview of Learning Objectives 5 and 6. The Research in Focus section (Section 1.6) provides a great example to help make sense of how these learning objectives are related in the context of science. Also, Table 1.3 lists 20 variables and specifies the type of data they represent in terms of scales of measurement, discrete/continuous values, and qualitative/quantitative information. Using this example in class will be very helpful to students.

Learning Objective 7 Suggestions. This learning objective is taught in Section 1.7. Refer to the template for SPSS given for this chapter. This template is designed to complement any lab assignment you want to give (even one not from the book) for entering data using SPSS.

*Additional suggestion*. Many professors prefer to teach summation notation as part of their introduction to statistics. This material is covered in Section A11 of Appendix A. Learning Check 7 is included in the appendix for students to review what they have learned. Also, the last 16 review questions in Appendix A are given for summation notation. It may help to do the odd-numbered problems in class (only answers for even-numbered problems are given in the textbook).

**Identifying Variables Exercise**

Below is a list of examples that are typical of research conducted in behavioral science. For the following list of examples, identify the dependent variable and independent (or quasi-independent) variable.

1. A researcher tests whether cocaine use increases impulsive behavior in a sample of cocaine-dependent and cocaine-inexperienced mice.

2. A professor tests whether students perform better on a multiple-choice or fill-in-the-blank test format.

3. A researcher tests whether smoking by parents influences children’s attitudes toward smoking behavior.

4. A social scientist tests whether attitudes toward morality differ based on political affiliation (Democrat or Republican).

5. A health researcher tests whether the number of calories in a meal changes liking for that meal among a sample of adults.

6. A neuroscientist measures whether levels of dopamine (a chemical messenger) in the brain are altered by the size of a reward.

7. A student tests whether tutoring from a remedial tutor improves performance on a standardized exam.

8. A researcher tests whether the type of distraction during recall (auditory or visual) influences the number of words participants are able to recall from a list.

9. A cultural researcher tests whether individuals from different cultures share or differ in the belief that dreams have meaning.

10. A psychologist tests whether employee satisfaction is different among employees working different shifts (day or night shifts).

**Answers to the Identifying Variables Exercise**

1. Cocaine use (independent variable) is presumed to increase impulsive behavior (dependent variable).

2. The test format (independent variable) is presumed to cause differences in preference (dependent variable).

3. Parent smoking (quasi-independent variable) is related to differences in child attitudes toward smoking behavior (dependent variable).

4. Political affiliation (quasi-independent variable) is related to differences in attitudes toward morality (dependent variable).

5. The number of calories in a meal (independent variable) is presumed to cause differences in liking for that meal (dependent variable).

6. The size of a reward (independent variable) is presumed to cause changes in the levels of dopamine in the brain (dependent variable).

7. Receiving tutoring from a remedial tutor (independent variable) is presumed to cause improved performance on standardized exams (dependent variable).

8. Different types of distraction (independent variable) are presumed to cause different levels of recall (dependent variable).

9. Being from a different culture (quasi-independent variable) is related to different beliefs about whether dreams have meaning (dependent variable).

10. Working different shifts (quasi-independent variable) is presumed to cause different levels of employee satisfaction (dependent variable).