Instructor's Resource Manual to Accompany

Behavioral Statistics in Action

THIRD EDITION

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Section 1:
Course Development Aids

Course Organization

Course Topics

Since most experienced instructors have already decided the topics they wish to emphasize and deemphasize in their statistics course, topic coverage is mentioned here more for the new instructors teaching statistics.

The selection and emphasis of topics will differ depending on the length of the course, skills of the students, and if this course is part of a sequence. The minimum coverage of topics in an introductory course includes frequency distributions, graphing, central tendency, variation, standard scores, the normal curve, correlation, regression, *t* test, and one-way analysis of variance. Thus, some portions of Chapters 2 and 3 (frequency distributions and graphs), Chapter 14 (two-way analysis of variance), and Chapter 15 (non-parametric tests) may be deemphasized.

Course Syllabus

The syllabus is a formal statement about the content of the course, and the policies, procedures, tests, and assignments that will apply. It is both informative and a promise of what material will be covered (and not covered) in the course. Below is an example of a course syllabus. The assignment schedule is based on a 16-week semester with class meetings two days a week. Instructors teaching on a quarter system or shorter semester may find it necessary to reduce the material covered.

Introduction to Statistics
Course Syllabus – Fall XXXX

Instructor's Name
Email Address
Office Location and Phone

Course and Section
Course Room and Time

Office Hours

Text Website: http:// www.mhhe.com/vernoy3
Instructor's Website: http:// XXXXXXXX

Course Prerequisite:
The prerequisite for Introduction to Statistics is Intermediate Algebra or two years of high school algebra. Students must satisfy this prerequisite. *Sorry, there are no exceptions.*

Course Description and Goals**:**
This course introduces psychology and behavioral science majors to descriptive and inferential statistics. These methods are essential to the understanding, interpretation, and performance of scientific research, as well as, becoming critical consumers of information. Topics covered in this course are listed on the attached course assignment page. Throughout this course, students will be challenged to critically examine statistical evidence and the findings reported in both the popular press and scholarly journals.

Upon completion of this course students should understand the fundamental concepts in descriptive and inferential statistics, calculate the appropriate statistical tests for basic research designs, critically evaluate statistical information in the media, and be prepared for a more advanced course in statistical methods.

Required Text and Calculator:

Text:
Vernoy, M., & Kyle, D. (2002). *Behavioral Statistics in Action (3rd ed.).* San Francisco, CA: McGraw-Hill.

Calculator:
A hand calculator is required to complete in-class problems, homework assignments, quizzes, and examinations. A simple calculator that adds, subtracts, divides, multiplies, squares, and takes square roots is all that is necessary. It is not necessary to spend a lot of money on a calculator that also does complete statistical calculations since you will be required to show your work on all assignments. The cost of the calculator should be about $25.00 or less.

Course Format:
The course format is designed to enhance mastery of course material through the use of experimental exercises, in-class computational problems, computerized demonstrations, and videos, in addition to lectures and class/group discussions. The content of lectures, Internet assignments, and class activities correspond to the material presented in the course text.

Evaluation:
Class Participation. Participation in class activities and demonstrations are expected of all students. When students are involved in the class and material, it promotes a collaborative-learning environment.

Homework: Homework problems and study questions are assigned every week. There are four sets of homework problems (see assignment schedule attached). Homework sets are due the week before each exam and must be turned in at the start of class on the due date. You should make an extra copy of each homework set. Solution sets will be available to pick up on the due dates so you can compare your work to the written solutions. *Homework sets turned in late will not be accepted.*

Students are strongly encouraged to work the study problems that are available in the Online Learning Center for the course text (see website address above).

Quizzes: There will be a quiz almost every week. Except for the first quiz, the quizzes contain questions on both previous and new course materials. Typically, the quiz will take about 15 minutes at the start of each class. *There are no make-up quizzes***,** however, the *lowest* quiz score will be dropped. Thus, you may miss one quiz without it affecting your grade.

Exams: There are four exams (three midterms and one final). Examinations are comprehensive and will be a combination of multiple-choice, essay, and computational problems. Students must use their own calculators during the exam and will not be allowed to share equipment. Just as a precaution, it is a good idea to have an extra calculator on exam days. *There will be no make-up exams unless you have a documented and verifiable medical problem or emergency*.

Grading:

Course grades will be determined by the percentage of total points earned on various class components earned throughout the semester as follows:

Class participation	XX points
Homework problem sets	XX points
Quizzes	XXX points
Regular exam (3 X XX pts)	XXX points
Final exam	XXX points
Total points possible	XXX points

Academic Honesty:

Academic honesty protects the integrity of higher education. As such, all student work whether written papers, oral presentations, homework assignments, or exams must be their own work. All students should consult the College Catalog and read the policy on plagiarizing (using other's work and claiming it as their own) and/or cheating on exams. This is an important policy and it is strictly enforced in this class.

Special Adaptive Needs

Special testing and note-taking arrangements are available for eligible students through the Adaptive Services Center on campus. Students can either visit the Center's office on campus office or contact Adaptive Services by calling XXX-XXXX or hearing impaired XXX-XXXX to determine their eligibility for special accommodations. Once eligibility is determined, students are

given Adaptive Services testing request/forms. Please bring these forms to me as soon as possible. I will gladly make every effort to accommodate students with special needs.

Plan Success

I know that many students have math/statistics anxiety and/or have heard horror stories about the difficulty of statistics. From the first day of class forward, I will do my part to help reduce this anxiety, but you must do your part too. To do your part, come to class regularly with a willingness to learn and work, do the homework problems, ask questions *(use the eye-blink code*), and follow the tips for success listed below. Many of my former students report they never thought they would be fond of statistics and were pleased to find they actually liked statistics.

Tips for Success:

1) Attend every class.
2) Review the material frequently.
3) Do the review and calculation problems in the Online Learning Center.
4) Do the Internet exercises and visit recommended web links in the Online Learning Center.
5) Study in groups or teams and take turns teaching each other.
6) Discuss the use of statistics with colleagues.
7) Keep notebooks organized and rewrite notes to make them more legible and organized (this is also an excellent review).
8) See me during office hours if you are confused and/or have difficulties. I am here to help.

Course Assignment Schedule

Week	Day	Topic	Reading	Homework	Due Dates
1	M	Welcome!			
	W	Introduction to Stats	Chapter 1		
2	M	Frequencies	Chapter 2	Chapter 1	
	W	Graphs	Chapter 3	Chapter 2	
3	M	Central Tendency	Chapter 4	Chapter 3	
	W	Methods of Dispersion	Chapter 5	Chapter 4	
4	M	Scaled/Standard Scores	Chapter 6	Chapter 5	HW Set 1
	W	Review		Chapter 6	
5	M	Exam 1			
	W	Normal Curve	Chapter 7		
6	M	Correlation	Chapter 8	Chapter 7	
	W	Correlation	Chapter 8		
7	M	Regression	Chapter 9	Chapter 8	
	W	Review			HW Set 2
8	M	Exam 2			
	W	Probability Theory	Chapter 10		
9	M	Probability Theory	Chapter 10	Chapter 10	
	W	Experimental Design	Chapter 11		

10	M	Experimental Design	Chapter 11	Chapter 11	
	W	*t*-tests	Chapter 12		
11	M	*t*-tests	Chapter 12		
	W	*t*-tests	Chapter 12	Chapter 12	HW Set 3
12	M	Review			
	W	Exam 3			
13	M	One-Way ANOVA	Chapter 13		
	W	One-Way ANOVA	Chapter 13	Chapter 13	
14	M	Two-Way ANOVA	Chapter 14		
	W	Two-Way ANOVA	Chapter 14		
15	M	Two-Way ANOVA	Chapter 14	Chapter 14	HW Set 4
	W	Review			
16	M	Final Exam (Day, Time)			
(Course assignments are subject to change as deemed necessary by the instructor.)					

Instructional Videos

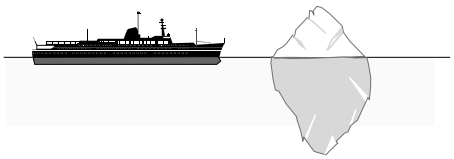
There are several video series available to use in statistics instruction. The following list includes a description of these videos, pertinent acquisition information, and useful websites.

- ***Against All Odds: Inside Statistics*.** This is a series of 26 half-hour programs produced by the Consortium for Mathematics and Its Applications and Chedd-Angier for the Annenberg/Corporation for Public Broadcasting Project. It is available through Annenberg/CPB and you may call 1-800-LEARNER for information.

  The timings and key content of the vignettes for each video in the series was prepared by Gordon Smyth, University of Queensland and are extremely useful for integrating key video segments into course lectures. This information is available at http://www.maths.uq.oz.au/~gks/class/aao.html.

- ***Statistics: Decisions Through Data*.** This is a set of 21 modules, 5 hours total, prepared by the Consortium for Mathematics and its Applications and Chedd-Angier for the National Science Foundation and draws on the location segments of *Against All Odds*. It is available from COMAP. Call 1-800-77-COMAP.

"First Day" Activities: Breaking the Ice (or Cracking the Iceberg)



Activity 1: Mental Aerobics

The first class meeting is usually a time to get acquainted, set the participation tone, and establish the goals of the course. Students are usually nervous the first day of *any* class, but they are *especially* nervous the first day of a statistics class. After introducing yourself and greeting the students and before discussing the syllabus and other class information, the mental aerobic activity (Handout 0.1) get students moving about the room and reduces their tension. In classes of 35 to 40 students, 10 minutes should be ample time to complete the task. Use this exercise to get students in a team spirit and offer everyone two points extra credit if the entire class completes the exercise (with correct answers) within the 10-minute period. Tell them they can share answers, move around the class, and even yell answers across the room, etc. This creates a fun-filled atmosphere students enjoy. Not only does this reduce tension and anxiety, but it also sets the tone for an active and collaborative classroom environment in the future.

Answers to Handout 0.1: (1) 88 piano keys; (2) 9 planets in the solar system; (3) 1 wheel on a unicycle; (4) 29 days in February in a leap year; (5) 200 dollars for passing go in monopoly; (6) 1001 Arabian Nights; (7) 26 letters of the alphabet; (8) 12 signs of the zodiac; (9) 90 degrees in a right angle; (10) 24 hours in a day; (11) 4 quarts in a gallon; (12) 40 days and nights of the great flood; (13) 32 degrees Fahrenheit at which water freezes; (14) 7 wonders of the world; (15) 60 seconds in a minute; (16) 8 sides on a stop sign; (17) 18 holes in a golf course; (18) 2 jokers in a deck of cards; (19) 3 blind mice see how they run; (20) 101 Dalmatians.

Tips to Reduce Statistics Anxiety

Statistics professors often mention that many students enter their classes fearful from negative views, beliefs, and expectations about statistics. For some students, this anxiety hinders their learning and

results in poor performance in the course. Their belief that statistics is a highly technical and heavy-duty math class can cause them to generalize previous math experiences to statistics. On top of this, many students tend to feel forced to endure the class and believe statistical knowledge has little personal benefit unless they plan to enter the research arena. The role of negative affect, beliefs, and attitude in the learning of statistics as reviewed in Gal and Ginsberg's (1994) article (see abstract below) highlights the need to find ways to dispel misconceptions and overgeneralizations and thereby reduce "statistics" apprehension as much as possible.

Activity 1: "Straight Stat-Talk"

This activity addresses students' apprehensions by exposing their preconceived ideas about a statistics class. Secondly, it also reveals what meaning or value learning statistics has for them. This gives professors an opportunity to clarify misconceptions and emphasize the academic, practical, and personal benefits for learning statistics. Thus, the goal of this activity is to reduce statistics anxiety.

Ask students to respond to the following three questions (see Handout 0.2): 1) Why is a statistics course required for psychology majors? 2) What types of activities and assignments do you expect to do in a statistics class? 3) How will learning statistics be useful to you? Encourage the class to express their true feelings and beliefs by emphasizing anonymity. Allow students 15 minutes to complete the questions before collecting the handouts. Review and discuss the responses by general category. Usually there are just a few overarching categories for each question. Often, I can respond to most of their misconceptions by explaining that statistics is not heavily weighted in mathematical rules and operations and that it involves learning conceptual relationships and "real life" mathematics. To address the motivational aspects for learning statistics, offer several examples of the need for statistical knowledge and the benefits. One example you may want to use is the opening vignette in Chapter 4.

In closing this exercise, you may want to share your feelings as a student in your first statistics class. It always surprises students when they hear what their professors felt "day one" of statistics.

Activity 2: "Stat-Talk Feedback"

This activity relates to Activity 1 and can be done either in class or as a homework assignment. To encourage students to give feedback about their experience in Activity 1, ask students to complete the sentences in Handout 0.3 anonymously. Collect and redistribute the completed handouts. Have students, one at a time, read aloud the first completed sentence. Proceed around the class. Then continue the next

round with sentence two and so forth. This exercise gives students an opportunity to hear how others experienced Activity 1. Most often they are surprised their concerns and apprehension were not unique. Moreover, they report some relief in knowing the class is much different than expected and less apprehensive about the course.

Two Strategies to Reduce Anxiety

Some may consider my strategies to reduce anxiety in class and during exams rather unorthodox. While this may be the case, I shared these strategies here because students' comments on both course and teacher evaluations indicate they were helpful. In addition, students have talked to me personally and expressed their appreciation.

"The Eye-Blink Code"

Since some students are reluctant to ask questions in class for a variety of reasons, I developed an "eye-blink code" to allow students to quietly communicate with me during lectures and demonstrations. It works like this. During lectures and/or demonstrations, I survey the understanding of the class a number of times before moving forward with new or additional course material. As I quickly glance up and down the rows, students use the "eye-blink code" to communicate difficulty understanding the material by blinking both eyes using the following code: 1 time = *I almost understand*, 2 times = *I don't understand*, and 3 times = *I haven't got a clue*. These responses help me to decide whether to move forward with new materials or not. Most often a different example or slightly different explanation is all that is needed to clarify the concept and help a student. Many of my students have told me this communication code helped them feel less anxious in class and also more comfortable asking for help during office hours.

Exam "Suckers"

Examinations are stressful enough to most students, but statistics exams seem to be extra stressful. Several years ago, I read about someone giving lollipops to their students during exams to help reduce stress. Having little to lose, I tried it and it seemed to work. Students reported feeling more relaxed and able to concentrate on the exam. Even though this could easily be personal bias and/or an expectancy effect, I have continued this practice for several years and

students continue to report feeling more at ease. Although this is only anecdotal evidence, some professors may also wish to try this strategy in their classes too.

Statistics Anxiety – Reference Resources:

Professors wanting to explore statistics anxiety further may find Gal & Ginsberg's (1994) comprehensive review article helpful. The abstract is shown below and the full-text article is available online at http://www.amstat.org/publications/jse/v2n2/gal.html.

The Role of Beliefs and Attitudes in Learning Statistics: Towards an Assessment Framework

Iddo Gal & Lynda Ginsburg
University of Pennsylvania

While many teachers of statistics are likely to focus on transmitting knowledge, many students are likely to have trouble with statistics due to non-cognitive factors, such as negative attitudes or beliefs towards statistics. Such factors can impede learning of statistics, or hinder the extent to which students will develop useful statistical intuitions and apply what they have learned outside the classroom. This paper reviews the role of affect and attitudes in the learning of statistics, critiques current instruments for assessing attitudes and beliefs of students, and explores assessment methods teachers can use to gauge students' dispositions regarding statistics.[1]

[1]Printed with permission. Gal, I., & Ginsberg, L. (1994). The role of beliefs and attitudes in learning statistics: Towards an assessment framework. *Journal of Statistics Education* v.2, (2).

Resource Articles on Statistics Anxiety

Bradley, D. R., & Wygant, C. R. (1998). Male and female differences in anxiety about statistics are not reflected in performance*. Psychological Reports, 82*, 245-246.

Elmes, Sylvia (2000*). Questioning in statistics*. Paper presented at the Effective Teaching and Learning in University Conference, sponsored by the Teaching and Education Development Institute, Queensland, Australia. Available online: http://www.tedi.uq.edu.au/conferences/teach_conference00/abstractsA-H.html#Elmes

Gal, I., & Ginsberg, L. (1994). The role of beliefs and attitudes in learning statistics: Towards an assessment framework. *Journal of Statistics Education* v.2, (2). Available online http://www.amstat.org/publications/jse/v2n2/gal.html

Potthast, M. (1999). Outcomes of using small-group cooperative learning experiences in introductory statistics courses. *College Student Journal. 33*, 34-42.

Roberts, D. M., & Reese, C. M. (1987). A comparison of two scales measuring attitudes towards statistics. *Educational and Psychological Measurement, 40,* 235-238.

Wise, S. L. (1985). The development and validation of a scale measuring attitudes towards statistics. *Educational and Psychological Measurement, 45,* 401-405.

Zettle, R. D., & Raines, S. J. (2000). The relationship of trait and test anxiety with mathematics anxiety. *College Student Journal, 34*, 246-259.

References:

McKeachie, W. J. (1994). *Teaching tips: Strategies, research, and theory for college and university teachers*. D. C. Heath and Company: Lexington, MA.

Handout 0.1

Mental Aerobics

Try this mental exercise and fill in the missing words.

1. 88 P_____ K_____
2. 9 P_____ in the S_____ S _____
3. 1 W _____ on a U _____
4. 29 D _____ in F _____ in a L _____ Y _____
5. 200 D _____ for P _____ G _____ in M _____
6. 1001 A _____ N _____
7. 26 L _____ of the A _____
8. 12 S _____ of the Z _____
9. 90 D _____ in a R _____ A _____
10. 24 H _____ in a D _____
11. 4 Q _____ in a G _____
12. 40 D _____ and N _____ of the G _____ F _____
13. 32 D _____ F _____ at which W _____ F _____
14. 7 W _____ of the W _____
15. 60 S _____ in a M _____
16. 8 S _____ on a S _____ S _____
17. 18 H _____ in a G _____ C _____
18. 2 J _____ in a D _____ of C _____
19. 3 B _____ M _____ (S _____ H _____ T _____ R _____)
20. 101 D _____

Handout 0.2

STRAIGHT STAT-TALK

Answer each of the following questions. Do not put your name on this questionnaire. Your answers are anonymous so please answer as truthfully as possible.

1. Why is statistics a required course for psychology majors?

2. What types of activities and assignments do you expect to do in a statistics class?

3. How will learning statistics be useful to you?

Handout 0.3

"STAT-TALK" EXPERIENCE

Complete the following sentences based on your experience from the "Straight Stat-Talk" activity. Your answers are anonymous, so feel free to be as candid as possible.

1. I learned that

2. I am surprised that

3. I am disappointed that

4. I am pleased that

Section 2:

Learning Objectives, Key Terms, Lecture and Demonstration Ideas, Active-Learning Activities, and Additional Assignments

Chapter 1: An Introduction to Statistics

"Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write." *H.G. Wells*

Learning Objectives

Upon completion of this chapter, students should know

- The rules of rounding numbers.
- The role of and the difference between null and research hypotheses.
- The function of and how to differentiate between independent, dependent, and extraneous variables.
- To identify and differentiate between the four scales of measurement.
- To identify and explain the relationship of a sample to a population.
- The difference between parameters and estimates.

Key Terms

Terms are listed in the order they appear in the chapter.

Statistics is a branch of applied mathematics that uses numbers to describe and analyze data collected by research scientists.

A scientific **hypothesis** is a possible explanation for the behavior that will be studied that is stated in the form of a prediction. It is based on gathered facts and theories from previous studies. It must be testable and stated in a way that it can be falsified.

Null hypothesis is one of the two mutually exclusive hypotheses that predicts there will be no relationship or change in behavior(s) among the group(s) being measured.

Research hypothesis is one of the two mutually exclusive hypotheses that predicts there will be a relationship or change in the behavior(s) measured.
Variables are events or qualities that can assume more than one value, such as gender that has the value of male and the value of female.

Independent variable is the factor in an experiment that is selected, manipulated, and/or controlled by the experimenter and is intended to be the cause of changes or differences (if any) in the dependent variable.

Dependent variable is the behavior exhibited by participants in an experiment that is measured and collected for statistical analysis. Changes in participants' behavior depend on the influence of the independent variable.

Extraneous variable is any variable that can vary along with the independent variable. Researchers must hold it constant (keep it from varying) because they won't know for sure whether it was the independent variable(s) or extraneous variables that caused or didn't cause changes or differences in the dependent variable.

Population is all the members of a specified group. Its size can be very small, extremely large, or may not be known depending on how the particular group of interest is defined.

Sample is a small and relatively representative group that was selected from a population.

Parameters are statistics that describe population values.

Estimates are statistics collected from samples and used to describe population values.

Nominal scale of measurement is the simplest form of measurement and is used when the dependent variable is qualitative and categorizes data based on the name of some physical or psychological quality or characteristic rather than a numerical score.

Ordinal scale of measurement is the simplest quantitative scale used to measure the dependent variable. Data are ranked in some order such as, highest to lowest, biggest to smallest, most important to least important, etc but not does measure the extent or how much difference there is between measures.

Interval scale of measurement is a quantitative scale used to measure the dependent variable. Data indicate relative ranks and the degrees of difference between scores but the zero point on this scale is not meaningful.

Ratio scale of measurement is the quantitative scale that has all the properties of nominal, ordinal, interval data and a meaningful zero point on the scale. Zero on this scale means the absence of something and makes ratio comparisons possible.

Lecture and Demonstration Ideas

Students coming into a statistics class often do not know what to expect. Some may view statistics as a nightmare of a math course and others may think it has to do with a mixture of experimental methodology, volumes of data, and monstrous formulas. One question at the tip of most of their tongues is…

Why do I need to know statistics? Many, if not most, students believe a statistics course should be required only for those who plan a career in psychological research. Use one or more of the following suggestions to help convince students that statistical knowledge is important in all specialty areas of psychology, other academic fields, and their personal lives.

a. Handout 1-A is useful to dispel mistaken beliefs that some subfields of psychology do not use statistics. Discussion of the different subfields of psychology illustrates that statistics are not used only by researchers but all fields of psychology. Afterwards, challenge students to name any career that does not use statistical knowledge in some fashion.

b. To start students on the path to becoming critical consumers of information, ask them to bring popular press articles to class. The articles should report behavioral news and include some mention of statistics. Make transparencies of these articles and evaluate one each week. This evaluation practice allows students to learn, apply, and fine-tune their critical thinking skills. Moreover, they witness the applied benefits of statistical knowledge in their personal life, become familiar with common sources of bias, general methodology issues, and interpretation problems.

Using Key Concepts: To illustrate the null and research hypotheses, independent, dependent, and extraneous variables, and the distinction between population and samples, use the research example summarized below (Kagan, Kagan (Klein), & Watson (1995). The full-text article is available online through APA PsycINFO. If the class did the Stress Reduction Program Activity (see Activity 1 below), move the discussion into the area of job stress and this research study. You may wish to give students a brief overview of this research and then return to the study to identify and explain the following: null hypothesis, research hypothesis, independent variable, dependent variable, extraneous variable, sample, and population. This is also a good opportunity to point out the different measurement scales used in the study. Handout 1-B is a worksheet for this lecture.

Research Example: For some people, work-related stress is more stressful than anything else in their lives, even divorce and death. The degree a job/career is centrally important to one's life and/or the types of occupation itself are important factors that relate to job stress levels. Some occupations and jobs within that occupation are more stressful than others. For example, emergency medical workers regularly deal with trauma in an unpredictable work environment. This and issues make these employees more vulnerable to job-related stress than other careers. Job stress, especially high levels, can result in headaches, sleep-disorders, emotional disturbances, anxiety issues, exhaustion, and other behaviors. Thus, effective stress-reduction strategies are important. Kagan, Kagan (Klein), and Watson (1995) conducted a three-year field study examining three types of a stress reduction intervention among a population of 373 employees in the emergency medical service (e.g., paramedics, emergency medical technicians, dispatchers, etc.) of a municipal fire department. Participants were randomly allocated to participate in one of three psychoeducation interventions: (1) training to control physiological reactions through muscle relaxation training, mediation, and exercise, (2) training to increase confidence and abilities to change others through assertiveness training, human relations training, hostage negotiation, and suicide prevention, and (3) interpersonal awareness training to increase self-awareness of cognitive and affective responses to events through insight therapy, affect therapy, and other stress management techniques. The results of their study demonstrated reduction in stress measures such as depression scores, anxiety, job strain, and emotional exhaustion.

Scales of Measurement: The visual summary (Transparency 1-2) for the scales of measurement may be a useful visual lecture aid. One way to generate interest and demonstrate the differences between measurement scales is to ask students to imagine they just agreed to go out on a blind date to help a friend. What questions would he/she ask about the date? Since students want a lot of information about a blind date, this demonstration gives them a chance to experience the differences in the measurement precision of the four scales. Examples of questions might be: "Is (George/Jane) attractive?" "Suppose George (Jane), Jim (Joan), Fred (Flossy), and Ned (Nelda) were in a room, how would you put them in order of their attractiveness?" "How attractive is George (Jane)?" 1 = not attractive, 7 = very attractive "If George (Jane) lived in our state, how many women (men) do you know that would try to date him (her)?

Scales of Measurement Examples

Temperature: Frequently students have difficulty correctly distinguishing between interval and ratio measures usually because of misconceptions about "the absence of a meaningful zero." A student might believe that weight is interval scale because it is not possible for anyone to weigh zero pounds. Clearing up this misconception will save students many problems later in the course. Usually temperature measurements are mentioned during scale discussion since both degrees Fahrenheit and Celsius are interval scales of measurement and involve negative temperatures. The Kelvin scale is the only temperature scale with a true zero. Degrees are not mentioned with its use. In case students ask, here are the conversion formulas for these measures. Degree Celsius = (F° - 32°) ÷ 1.8, Degree F = 1.8 x C° + 32, and Kelvin = C°+ 273. Ask students if the temperature was 35 degrees Fahrenheit in Alaska and 70 degrees Fahrenheit in Arizona, would the climate in Arizona be twice as warm as Alaska? Since Fahrenheit is interval scale, this type of ratio comparison should not be done. This comparison requires a conversion from degrees Fahrenheit to the Kelvin scale. The Kelvin conversions for the Alaska and Arizona example are shown below. You may want to put these on the board to illustrate the difference between interval and ratio scales.

Arizona

Temperature Conversion: 70 degrees Fahrenheit = 21.11 degrees Celsius

21.11 degrees Celsius = 294.11 Kelvin

Alaska

35 degrees Fahrenheit = 1.66 degrees Celsius

1.66 degrees Celsius = 274.67 Kelvin

More Examples:

Nominal Scale- gender, hair color, marital status, political party, presence of a cold, college major, social security number, state of residence, zip code, student identification number, phone number.

Ordinal Scale- military rank (general, colonel, major), letter grade on an exam, year in college (freshman, sophomore, junior), job classification (supervisor, vice-president, president), college degrees (Ph.D., M.S., M.A., BS., B.A., and A.A.), academic classification (professor, associate professor, assistant professor), medical condition (critical, guarded, serious, satisfactory), and my all-time favorite example**,** the scales of measurement itself (nominal, ordinal, interval, ratio).

Interval Scale - IQ scores, personal traits or states, such as shyness, stress, measured on a 5-pt, 7-pt., etc. scale, temperature, emotional intelligence scores, etc.

Ratio Scale – amount of money in the bank, weight in pounds, height, number correct on an exam, reaction time, number of pages in a book, number of children in the family, distance in inches between two people or points, the loudness of noise, the cost of your book, etc.

The Need to Know Statistics. Invite a guest speaker from an "applied " field of psychology such as, clinical psychologist, school psychologist, community psychologist, forensic psychologist or human services to discuss the use of statistics in their professional work.

Instructional Video. *Against All Odds: Inside Statistics.* Program One, "What is Statistics?" This 30-minute video provides a background of the evolution of the field of statistics. If you are pressed for time, the first 14 minutes include an introduction into the use of statistics with T. Amabile's study on creativity (4 minutes) and another example using statistics to make decisions and *Domino's Pizza*. This video is produced by the Consortium for Mathematics and Its Applications and Chedd-Angier (1989). Available through Annenberg/CPB.

Active-Learning Activities

The Importance of Statistics in Careers and Life

The following activity is designed to help students understand that statistical knowledge is required in all careers and not just research-oriented careers. Secondly, this activity helps students understand the importance of being a critical consumer of all forms of information ranging from popular media to academic journals.

Stress Reduction Program

Stress is one of the more prevalent health issues discussed in both popular and academic press these days. A certain amount of stress is normal but too much stress can lead to health problems including ulcers, back pain, migraines, high blood pressure, and insomnia. High levels of stress are related to an increased vulnerability for life-threatening

conditions such as infections, heart disease and cancer. To handle stress, many people use methods that may be more damaging than the stress itself including alcohol, drugs, cigarettes, and food.

Tell students you fast-forwarded time and now they are practicing clinical psychologists. Because an increasing number of their clients suffer from stress-related psychological problems or disorders, a stress reduction program needs to be started in their clinical practice. Ask students, either individually or in small groups, to generate a list of different treatments they might use in their program. Write these suggestions on the board and then explore the basis of their selections using the questions listed below. In addition to treatment effectiveness and outcome evaluations, you may want to briefly discuss the importance of reliability, validity, and research methods. This may also lead to discussion about professional ethics as well. Often, students fail to realize the extent they rely on statistics to make decisions and the importance of statistical knowledge in both their professional and personal lives.

1. Suppose a client asked why a stress reduction program was recommended in the first place. What evidence would students use to defend their recommendation?
2. How did students compare or classify the effectiveness of one treatment to another when they made their selections?
3. Would some areas of treatment be more important than others? What information would they use to prioritize areas of the program as most and/or least important to clients?
4. How could the effectiveness of the stress-reduction program be evaluated?
5. Would it be ethical to recommend a treatment without some evidence it works? How might they argue it wouldn't harm clients?

Evaluating Popular Films and Learning Measurement Scales

Students find examples, demonstrations, and assignments more interesting when real data are used. Designing a class survey is a good opportunity to gather real data and give students practice identifying and using the different measurement scales. Have your students design a "Comedy Film Evaluation" survey. Most students see films quite frequently and they know the topic (a good feeling in statistics). Ask the class for film suggestions and select a film or two that everyone in the class has seen. Have students work in small groups and generate at least four evaluation questions that will collect each of the four forms of data. You may want the groups to share their questions and let other students try to

identify the measurement scale. As I mentioned earlier, students have difficulty differentiating between interval and ratio measurement scales and this activity will give you an opportunity to detect misconceptions.

Students can easily survey two or three students on campus between one class meeting and the next. This will gather sufficient data for lecture examples, demonstrations, and assignments throughout the course.

Additional Assignments

Assignment 1. The Social Issues Research Center (SIRC) is an independent, non-profit organization that conducts research on social and lifestyle issues and monitors global sociocultural trends. The SIRC promotes debates on issues based on evidence rather than dogma. Their website has a searchable archive and many articles discussing the use and sometimes inappropriate use of certain statistics in the popular press and studies. Ask students to visit this website, search for an article discussing the use of statistics, evaluate the article, and write a one-page reaction paper.
Web URL: http://www.sirc.org

Assignment 2. Schaeffer and Lee's (2000) article, "A Case for Undergraduate Statistics" is an excellent reading assignment that explains the importance of studying statistics not only in their field of study but other areas of their lives. There are application stories illustrating the use of statistics by geneticists, biostaticians, and the business industry, such as quality control. Ask students to read this article and find additional applications of statistics in other applied fields.
Web URL: http://www.amstat.org/meetings/jsm/2000/usei/case.html

References:

Kagan, N. I., Kagan (Klein), H., & Watson, M. G. (1995). Stress reduction in the workplace: The effectiveness of psychoeducational programs. *Journal of Counseling Psychology, 42,* 71-78.

Handout 1-A

Psychologists and Statistics

There are many different career fields in psychology or related to psychology. Twenty such fields are listed below. According to your beliefs, to what extent do the following psychologists or professionals use statistical knowledge in their work? Write the number that most closely matches your belief in the blank box to the right of each career field.

1	2	3	4	5
RARELY OR NONE OF THE TIME	A LITTLE OF THE TIME	SOMETIMES	GOOD PART OF THE TIME	MOST OR ALL OF THE TIME

1. Cognitive Psychologist		11. Neuropsychologist	
2. Marriage & Family Therapist		12. Comparative Psychologist	
3. Developmental Psychologist		13. Community Psychologist	
4. Social Psychologist		14. Counseling Psychologist	
5. Political Psychologist		15. Social Worker	
6. Forensic Psychologist		16. School Psychologist	
7. Media Psychologist		17. Physiological Psychologist	
8. Experimental Psychologist		18. Traffic Psychologist	
9. Health Psychologist		19. Rehabilitation Psychologists	
10. Military Psychologist		20. Consumer Psychologist	

Handout 1-B

Stress Reduction Intervention Study

Kagan, Kagan (Klein), and Watson (1995) conducted a three-year field study examining three types of a stress reduction intervention among a population of 373 employees in the emergency medical service (e.g., paramedics, emergency medical technicians, dispatchers, etc.) of a municipal fire department. Participants were randomly allocated to participate in one of three psychoeducation interventions: (1) training to control physiological reactions through muscle relaxation training, mediation, and exercise, (2) training to increase confidence and abilities to change others through assertiveness training, human relations training, hostage negotiation, and suicide prevention, and (3) interpersonal awareness training to increase self-awareness of cognitive and affective responses to events through insight therapy, affect therapy, and other stress management techniques. The results of their study demonstrated reduction in stress measures such as depression scores, anxiety, job strain, and emotional exhaustion.

Hypotheses:

1. Null hypothesis

2. Research hypothesis

Participants:

1. Sample or Population

Variables:

1. Independent variable

2. Dependent variable

Transparency 1-2.

Scales of Measurement

Visual Summary