

ERM 617: STATISTICAL METHODS IN EDUCATION

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Course Overview

This introductory course covers statistical concepts and methods that can be applied in educational research, behavioral research and other social science research. The course is intended to provide you with a conceptual understanding of basic statistical procedures for quantitatively exploring and understanding data in applied research. You will be expected to learn when, how and why to use these various procedures. Topics to be covered include: frequency distributions, graphical representations, measures of central tendency, variability, normal distributions, probability, sampling distributions, correlation, regression and hypothesis testing. You will also be expected to use the computing software package SPSS™ to carry out some of the analytical procedures required in your homework assignments and exams. Other calculations may require the use of either a statistical calculator or spreadsheet software (e.g., Microsoft Excel®). The statistical software is available on the UNCG network and can be accessed from most computing labs on campus. You cannot access SPSS on the University network from home.

Course Objectives

1. To learn statistical vocabulary and techniques that enable you to become statistically literate and make it possible for you to interpret and evaluate statistical methodology and results reported in educational and related social science research.
2. To understand the basic statistical concepts that will enable you to study more advanced statistical topics in future courses.
3. To learn how to report statistical findings.
4. To foster an appreciation and understanding of general procedures for formulating and testing research hypotheses.

Texts

Required text:

Howell, David C. (1999). *Fundamental Statistics for the Behavioral*, 4th Edition. Pacific Grove, CA: Duxbury Press.

Supplemental Texts

Morgan, S. E., Reichart, T. & Harrison, T. R. (2002) *From Numbers to Words*, Boston, MA: Allyn and Bacon. (This book guides you in translating your statistical results in text for reports, theses, and journal articles.)

Phillips, J. L. (1988). *How to Think About Statistics*. New York: W. H. Freeman & Company. (This book presents ways to think statistically and use statistical data, without focusing on statistical formula or the computation aspects of statistics.)

Vogt, W. P. (1999). *Dictionary of Statistics & Methodology*, 2nd Edition, Thousand Oaks, CA: SAGE Publications (This book is a great resource. It provides short, understandable descriptions of statistical terms. It really comes in handy when reading journal articles and technical reports.)

Course Requirements

Homework:

Homework assignments will consist mainly of problems from David Howell's textbook. Work must be turned in on the due date. Unless prior arrangements have been made with your professor, you will lose ONE point for each day your homework is handed in late.

Whenever possible, you should show all of your work and **HIGHLIGHT** your answers. **Make sure you put your name and exercise set number at the top of your paper.** Problems that are starred require you to do the problem by hand and also in SPSS. For problems done on the computer simply attach a copy of the output and highlight your answers. Homework will be graded and returned to you as quickly as possible.

Exams

There will be one midterm exam and one final exam. The exams are NOT cumulative. The exams will cover the materials presented in lectures, homework problems, and assigned readings.

Each exam will have two parts: a multiple-choice/short answer part and a problem-solving part. The multiple-choice/short answer part of the exam will be given in class.

The problem-solving part will be “take home” and will involve some computer (SPSS) work. The take-home part of the midterm and final exams will be passed out at the end of class and will be due the following Monday (no exceptions). Make-up exams will not be given. All exams will be graded and returned in class following the day they are handed in. **The UNCG Academic Integrity Policy will apply for all examinations.**

Prior to each exam students will receive a summary of the content the exam will cover and a practice exam. The answers to the practice exam will be provided and discussed at review sessions held prior to the in-class examination date. The review sessions will be held outside of our regular class time to go over the practice exam, homework, and any other questions students may have. Review sessions are NOT mandatory, but are strongly suggested.

Calculators

To do most of the exercise sets and exams you will need a hand calculator that has at least one memory location and that ideally does square roots, squares, and summation (Σ + key). Keep in mind that this course does not require sophisticated mathematics nor should you need a graphing or programmable calculator! Texas Instruments has many low cost calculators that can compute basic statistics such as standard deviations(F), factorial (x!), sums (E x). The TI-30Xa model is relatively simple to use. The TI-30X IIS model is somewhat more sophisticated and includes extended statistical capabilities.

Software

Statistical Package for the Social Sciences (SPSS) – Throughout the course you will be asked to do some of the exercises in SPSS. SPSS is a commonly used computer package that contains many powerful statistical analyses. It is available at all computer centers on the UNCG campus. Class notes will include an annotated handout illustrating exactly how to do various analyses in SPSS, including what you should see on the computer screen as you proceed through the analysis. Procedures will also be illustrated in class. If you plan on doing any numerical analyses for your thesis or dissertation, learning how to use SPSS is a must!

SPSS, Inc. (www.spss.com) offers several options for purchasing a licensed version of the software. The SPSS Graduate Pack 11.0 contains SPSS Base, SPSS Regression, and SPSS Advanced Statistics and is a useful purchase if you anticipate using SPSS beyond this course for your graduate research. The UNCG bookstore can order this package for you. SPSS also offers a lower-cost Student Version; this version has restricted capabilities but will be adequate for all computations in this course. The Student Version can be purchased at the UNCG Bookstore. You can also lease a full-featured version of SPSS from the UNCG Instructional Research and Computing (IRC) Department. Each SPSS module costs \$10 for a one-year lease. Visit the IRC website <http://www.uncg.edu/irc/spss/> for more information (click on “SPSS Lease Information”).

Grading

Your grade will be determined by your performance on your exams and your exercise sets using the following criteria. There will be 10 scored homework exercise sets, each worth 10 points, for a possible total of 100 points.

The total possible points for each exam are as follows:

Midterm	100 pts (50 pts. for in-class section, 50 pts. for take-home)
Final	100 pts (50 pts. for in-class section, 50 pts. for take-home)

Therefore, the total number of points possible is 300. Grades will be assigned as follows:

<u>Point Range</u>	<u>Grade</u>	<u>Point Range</u>	<u>Grade</u>
270-300	A	210-224	B-
255-269	A-	180-209	C
240-254	B+	0-179	F
225-239	B		

Lectures

Some handouts will be provided at the beginning of each lecture. In addition, copies of the lecture will be posted as "PDF documents" (requires Adobe Acrobat™ Reader) during the week following the lecture. Occasionally I will handout self-tests and excerpts from journal articles for you to read and answer questions. The purpose of these will be twofold. First, it provides a review of what was covered in class and will serve as a check to make sure you are understanding the material. Second, it will help you to see how the different concepts are discussed and presented in journals. These will be passed out at the end of a lecture and then we will go through them at the beginning of the next class and discuss them, (not to worry...I won't collect them). They are intended to serve as a check on your understanding and will provide a good review when studying for the exam.

Study Groups

I encourage you, if it is at all possible, to form your own study groups. Sharing questions and hearing others describe concepts will oftentimes facilitate studying. Explaining or teaching a concept to someone is the one of the best ways to realize what you know and what you don't know. Besides there is the old adage about "misery loves company". (Not that learning statistics is a miserable experience, right?)

Class attendance/reading

The lectures and in-class discussions will supplement, not duplicate, the material in your textbook. **Attendance is mandatory!** *It is also important for you to do the assigned reading BEFORE you come to class!* If you need to miss a class please let me know and I'll make

arrangements for you to receive the materials you missed. However, neither I, nor the course tutors, will not conduct make-up or individual lectures.

Asking questions

Whenever you are in doubt, ask the question. If something that is being covered is unclear, please do not be afraid to stop me and ask for clarification. Sometimes students avoid asking simply because they're lost and feel they don't even know how to phrase a question. All you need to do is just ask me to repeat or clarify and I will be happy to reword or give more examples so that you can understand the material better. Sometimes students think they "sort of" understand. However, it doesn't take long for a few "sort of" understands" to add up to "totally lost".

To further promote understanding, feel free to give me a slip of paper that you can fill out at the end of each class on which you can list anything that you didn't quite understand in the day's lecture and would like me to review and repeat at the beginning of the next class.

Evaluations

Although the summer session is short, halfway through the course I will ask you to evaluate the course and provide me with any suggestions about how the course can be improved. You will also be asked to formally evaluate the course on the last day of class.

Topics* and Readings (Howell textbook)

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|----|---|-------|
| 1. | Introduction: basic terminology, selecting statistical procedures, using computers | Ch. 1 |
| 2. | Basic Concepts: scales of measurement, variables, random sampling statistical notation | Ch. 2 |
| 3. | Displaying data: frequency polygons, stem-and-leaf displays, histograms, other graphical displays, SPSS | Ch. 3 |
| 4. | Measures of Central Tendency: mode, median, mean, advantages and disadvantages, SPSS | Ch. 4 |
| 5. | Measures of variability: range, average deviation, variance, standard deviation, boxplots, SPSS | Ch. 5 |
| 6. | The normal distribution: standard normal distribution, z-scores, determining probability | Ch. 6 |

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| 7. | Basic Concepts of Probability: basic terminology, discrete and continuous probability distributions | Ch. 7 |
| 8. | Correlation: Scatter diagrams, covariance, Pearson's correlation, Spearman's correlation, SPSS | Ch. 9 |
| 9. | Regression: regression line, prediction, standard error of estimate, SPSS regression analysis | Ch. 10 |
| 10. | Sampling distributions and hypothesis testing: null and alternative hypotheses, Type I and II errors | Ch. 8 |
| 11. | Hypothesis Testing Applied to Means: one sample - hypothesis testing with σ known (z-test); with σ unknown (t-test), confidence limits, SPSS | Ch. 12 |
| 12. | Hypothesis Testing Applied to Means: Two related samples - dependent t-test, SPSS; Hypothesis Testing Applied to Means: | Ch. 13 |
| 13. | Two Independent samples; assumptions, confidence limits; SPSS | Ch. 14 |
- * Note: some topics will require less time than anticipated, others more. We will make adjustments during the semester if necessary.

Exercise Sets

Note that problems with an asterisk (*) you must do by hand AND in SPSS. Assignments will be due AFTER the material has been covered in class. DO NOT GET BEHIND IN DOING YOUR ASSIGNMENTS!!!!

Exercise Set 1: Chapter 2 - Pages 25-27 2.1, 2.7, 2.8, 2.11, 2.12, 2.15, 2.17, 2.18, 2.19

Exercise Set 2: Chapter 3 - Pages 48-51 3.1, 3.2*, 3.5*, 3.9*, 3.10*, 3.11, 3.18, 3.19

Exercise Set 3: Chapter 4 - Pages 61-62 4.1*, 4.2, 4.4^a, 4.5^a, 4.6^a, 4.16^{a,b,c}, 4.17*
(a = use exactly 6 numbers in your data set)

Exercise Set 4: Chapter 5 - Pages 83-84 5.1*, 5.2*, 5.4, 5.5, 5.8, 5.11*, 5.15

Exercise Set 5: Chapter 6 - Pages 100-102 6.1, 6.3, 6.4, 6.5, 6.7, 6.10, 6.13

Exercise Set 6: Chapter 7 - Pages 116-117 7.2, 7.3, 7.8, 7.9, 7.15, 7.17, 7.19

Exercise Set 7: Chapter 9 - Pages 169-170 9.1*, 9.2*, 9.19*

Exercise Set 8: Chapter 10 – Page 192 10.1*, 10.2, 10.9, 10.14, The Special Problem

Exercise Set 9: Chapter 8 – Page 139 8.2, 8.3, 8.4, 8.5, 8.11

Exercise Set 10: Chapter 12 – Pages 244-245 12.1*, 12.2* 12.3, 12.8, 12.15*
Do 12.1 and 12.2 in SPSS only