

Analysis of Variance in Education, BER 545
Summer, 2007

Department of Educational Studies in Psychology, Research Methodology, and Counseling
Program: Educational Research

Credit Hours: 3

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Office: Gadsden Center, Gadsden, Alabama

Office Hours (June): Tuesday, Wednesday 10:00-11:45

Office Hours (July): Monday, 3:00- 4:30, Tuesday, Wednesday 10:00-11:45, 1:30-4:30

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CATALOGUE DESCRIPTION

Three hours. Topics include sampling, review of elementary statistics, one-way and two-way analysis of variance, multiple comparison procedures, and non-parametric procedures.

Prerequisite: BER 540 or equivalent.

CONCEPTUAL FRAMEWORK

Preparation of Professionals as Reflective Practitioners and Ethical Decision Makers:

Experiences in academic programs are devoted to developing individuals' understanding of *knowledge construction, learning, pedagogy, and responsible professional practice in the contexts of education*. The University of Alabama's College of Education seeks to prepare professionals who value and demonstrate *reflective practice and ethical decision making through respecting diversity, honoring difference, and promoting social justice*.

KNOWLEDGE BASE

BER 545 addresses knowledge construction, responsible professional practice, reflective practice, and ethical decision making.

COURSE OVERVIEW

This course communicates a conceptual understanding of ANOVA (Analysis of Variance). This course examines measures of relationship through linear regression and multiple regression.

Different models of ANOVA are discussed as well as basic nonparametric statistics. The use of statistical software (SPSS®) is used to present a better understanding of the topic.

The following is a content outline of the course.

- A. Review of basic statistics
 1. measures of central tendency
 2. measures of variability
 3. the normal distribution
 4. the Central Limit Theorem
 5. sampling distributions

6. the z distribution
 7. the t distribution
 8. the F distribution
 9. tests of hypotheses
 10. Statistical vs. practical significance
- B. One-way Analysis of Variance
1. conceptualization
 2. assumptions
 3. testing of assumptions
 4. calculation procedures
 5. interpreting results (statistical and practical significance)
 6. computer analysis
- C. Multiple Comparison and Other Followup Procedures
1. concept of experiment-wise vs. hypothesis-wise error rate.
 2. preplanned procedures (a priori)
 - a. least significant difference procedure
 - b. orthogonal comparisons
 3. post hoc procedures
 - a. Tukey's Honestly Significant Difference (HSD)
 - b. Newman-Kuels Test
 - c. Scheffe's Method
 - d. Dunnett's Test (post hoc applications)
 4. trend analysis (both a priori and post hoc applications)
- D. The Factorial Experiment
1. two-way design
 2. three-way design (conceptual explanation and interpretation)
 3. concepts, assumptions, and tests of assumptions
 4. computation and interpretation
 5. computer analysis
 6. follow-up procedures
 7. two-way when one factor is a repeated measure
- E. Other
1. Linear regression
 2. Multiple regression
 3. ANCOVA

COURSE OBJECTIVES

After successful completion of this course, the student will be able to:

1. apply and interpret correctly the concepts from elementary inferential statistics in a decision-making process with an emphasis on hypothesis testing.
2. analyze data using a completely randomized design including tests of the assumptions, computation of the statistics, appropriate follow-up procedures, and use the results in a decision-making process.
3. apply appropriately and interpret correctly preplanned and post hoc multiple comparison procedures.
4. analyze a set of data using factorial (two-way) and repeated measures designs including tests of the assumptions, computation of the statistics, follow-up procedures, and an interpretation of the results.
5. determine an appropriate analysis for a set of data from among those covered in class.
6. perform the analyses in the class using Statistical Package for the Social Sciences (SPSS[®]) computer software.

COURSE METHODS

The course will be taught by the lecture method utilizing the overhead and whiteboard. Students will have hands on work in the computer lab on the use of SPSS[®] in ANOVA.

ATTENDANCE AND MAKE-UP POLICY

Past experience has been that diligent work on non-graded assignments pays dividends on graded assignments such as test problems, quizzes, and the final examination. Students are expected to attend all regularly scheduled classes. When you register for a class you are taking the responsibility for all class requirements. Missing one class is the same as missing 1 ½ weeks during a regular semester. Anyone who misses 2 classes (whatever the reason, including job responsibilities) will receive a letter grade deduction (10 points) for the course. Each additional absence over 2 will be a 5 point grade deduction. You are responsible for all material discussed in class. If you are late to class, leave early, or miss a class, you are responsible for getting the notes from another student. Computer instruction on SPSS[®] is part of the course. We will spend class time in the computer lab. All test problems and the final exam are computer assignments. You are responsible for the content of any missed computer instruction session. I will not conduct makeup computer instruction sessions. Individual test problems may **not** be made up or turned in late. However, they can be turned in early. **WRITTEN ASSIGNMENTS ARE TO BE TURNED IN ON TIME!** Being absent from class is not an acceptable excuse. You have a schedule of all due dates. Since assignments are assigned at least two classes prior to the due date, you have ample time to complete the assignment by the due date. If you plan to be absent, you can turn in the assignment early, have someone in class turn it in, or e-mail it or fax it **BEFORE CLASS. IF YOU E-MAIL OR FAX AN ASSIGNMENT (MUST BE DONE BEFORE CLASS) I WILL ACKNOWLEDGE RECEIPT OF THE ASSIGNMENT. IF YOU DO NOT HEAR BACK FROM ME, THEN I DID NOT RECEIVE THE ASSIGNMENT. PLEASE RESEND IT IMMEDIATELY. MAKE SURE THAT YOU**

HAVE THE CORRECT E-MAIL ADDRESS OR FAX NUMBER. IF I HAVE NOT RECEIVED IT BEFORE CLASS IT IS CONSIDERED LATE AND WILL NOT BE ACCEPTED. PLEASE E-MAIL ME IF YOU ARE FAXING ANYTHING. THE E-MAIL SHOULD BE SENT PRIOR TO THE FAX SO I WILL BE LOOKING FOR IT.

REMEMBER, ASSIGNMENTS WILL NOT BE TAKEN LATE!!! If assignments are not turned in on time you will receive a “zero” for the assignment. Please do not ask for special consideration. **WARNING!! POWER FAILURES, COMPUTER CRASHES, AND COMPUTER VIRUSES ARE NOT ACCEPTABLE EXCUSES FOR FAILING TO TURN IN AN ASSIGNMENT. THERE ARE SEVERAL COMPUTER LABS AVAILABLE FOR YOUR USE.** Missed quizzes will **not** be made up. However, a make-up test problem and quiz will be given at the end of the term that may be substituted for a missing score or replace the lowest score for students who have turned in all previous test problems, or taken all quizzes. Quizzes will not be rescheduled due to trips, vacations, etc. Please plan your schedule accordingly. The final exam is given out the first night of class. There should be no excuses for turning it in late. Always make back-up copies. If you misplace or lose copies of the test problems and/or final exam, please see me. **Do not** make a copy from a fellow student.

Remember: Yes, the lectures are optional. Graduation is also optional. Anon.

Also, poor planning on your part does not constitute an emergency on my part.

CELL PHONES

Please turn off cell phones and pagers during class. If you are expecting an important call, set the phone to vibrate and sit near the door so you can leave the classroom to answer your call. Please do not answer nor talk on the cell phone in the classroom while class is in progress. Of course to do so before and/or after class is ok.

UNIVERSITY POLICIES

Academic Misconduct: Academic misconduct by students includes all acts of dishonesty in any academically related matter and any knowing or intentional help or attempt to help, or conspiracy to help, another student commit an act of academic dishonesty. The Academic Misconduct Disciplinary Policy will be followed in the event of academic misconduct. Please refer to <http://registrar.ua.edu/policies/> for the revised *Codes of Conduct*.

Plagiarism is the act of representing the words, data, works, ideas, computer program or output, or anything not generated by the student, as one’s own. Plagiarism may be inadvertent or purposeful; however, plagiarism is not a question of intent. All suspected incidences of plagiarism must be reported by the course instructor to the Assistant Dean of the College of Education. Plagiarism is considered a serious act of academic misconduct and may result in a student receiving an F in the course and suspension from The University. For more information, see <http://facultysenate.ua.edu/handbook/append-c.html>

WARNING!!!! ALL TEST PROBLEMS AND THE FINAL EXAM ARE TO BE YOUR OWN WORK. THESE ASSIGNMENTS ARE TO BE DONE BY YOU AND YOU

ALONE. IT IS OK TO GET HELP WITH THE HOMEWORK, BUT WHEN YOU DO THE GRADED ASSIGNMENTS, NO!!!!!! IF I SUSPECT THAT THE ASSIGNMENT IS NOT ENTIRELY YOUR WORK, I WILL EXERCISE THE ACADEMIC MISCONDUCT POLICY AND REFER THE WORK TO THE ASSISTANT DEAN OF THE COLLEGE OF EDUCATION.

Statement of Equal Treatment and Disabilities: The instructor and students in this course will act with integrity and strive to engage in equitable verbal and non-verbal behavior with respect to differences arising from age, gender, race, physical ability, and religious preferences.

Reasonable Accommodations: To request disability accommodations, please contact the Office of Disability Services at 205-348-7966. It is located at 133 B Martha Parham Drive. After initial arrangements are made with that office, please contact me for any course accommodations that may be necessary. It will be necessary to provide me with written notification from the Office of Disability Services. You are not protected under applicable disability laws until I am given the official letter **AND** we talk about the accommodations that are being requested (this talk will not occur minutes before class starts or during break). Please note that accommodations are not retroactive. Also, you are still expected to meet the requirements of the course. Students in need of reasonable accommodations relative to class attendance or arrival, course requirements, or related aspects of performance are to initiate such requests with the instructor prior to their anticipated need. Such requests will be accommodated within constraints of fairness and timeliness with regard for all other students enrolled for the course. If your accommodations involve extra time for test taking, you must speak with me at least one week prior to the date. The test will run from 5:00 to 9:30 PM. If you need extra time, you must come **BEFORE** 5:00. I will not stay past 9:30 PM.

RECOMMENDED TEXT

Green, S. B., & Salkind, N. J. (2005). *Using SPSS® for Windows and MacIntosh: Analyzing and understanding data* (4th ed.). Upper Saddle River, NJ: Prentice Hall. ISBN: 0-13-146597-X **OR**

If you would like a copy of the student version of SPSS, order this book:

Green, S. B., & Salkind, N. J. (2005). *Using SPSS® for Windows and MacIntosh: Analyzing and understanding data: With SPSS® Student Version 13.0 for Windows* (4th ed.). Upper Saddle River, NJ: Prentice Hall. ISBN: 0-13-2188260*

*Note this is the student version of SPSS®. It does not contain data analysis for repeated measures.

REQUIREMENTS

- A. Weekly homework assignments including data analyses using a computer
- B. Class participation including reading
- C. Four take home test problems involving computer data analyses plus an optional makeup
- D. Four quizzes plus an optional makeup
- E. Final Examination (7 SPSS® assignments)

EVALUATION

4 Test Problems @ 25 points	100 points
4 quizzes @ 25 points	100 points
Final Exam	<u>175 points</u>
Total	375 points

Grades

All grades are final. If you fail to answer questions on the quizzes or on the assignments or do not turn in part of an assignment you will not be given a chance to redo. The semester grade is FINAL. There will be no changes in grades except for cases of error in recording the grade and/or a mistake in grading on my part. Please do not ask to redo an assignment or ask for extra credit assignments in order to elevate a grade. This is not fair to the other students in the class.

WebCT

Handouts for the class can be found on WebCT. These handouts can be either Word documents, PDF files, and/or PowerPoint presentations. You are expected to download the appropriate handouts prior to each class. **PLEASE DO NOT COME TO CLASS WITHOUT THE APPROPRIATE MATERIAL.** I do not bring extra copies to class. You will also find a copy of the syllabus on WebCT. If your WebCT is not working properly, it is your responsibility to find out why and get the problem corrected. Failure to get on WebCT is not an excuse for failure to turn in an assignment on time. There will be no extensions. You can ask someone in class to make extra copies of the material for you if you are having problems with WebCT. **DO NOT** ask me to make copies.

E-MAIL

I will use Bamamail for communication purposes. I suggest if you have your e-mail forwarded from Bamamail that you change it back to Bamamail as there are sometimes as much as a 2 week delay in receiving forwarded messages. This causes a problem when I send an e-mail before class giving important information for that night's class. Also, I occasionally send revised assignments or other important information through e-mail. Please check your e-mail, daily. It is also recommended to check e-mail just before class. Failure to check e-mail is not a valid excuse for missed messages. It is your responsibility to make sure that the accounts are working properly. **I will not resend e-mails.** Please do not use WebCT to e-mail me. When e-mailing me please identify which class you are in. The way to do this is in the subject line put "BER 545." Also, please put your name (first and last) at the end of the message. Please do not e-mail me for grades. I return the graded assignments and quizzes the next class meeting. Please wait until then for your grade. If you miss class, ask at the next class meeting in attendance. Also, if you miss class, please do not send me e-mails asking for the information that was discussed in the missed class. That information should be in the notes that you get from another student and/or on WebCT. I reiterate, ATTENDANCE IS IMPORTANT.

ALL GRADED ASSIGNMENTS

Since assignments are to be graded, students are expected to work on the assignments INDEPENDENTLY. Questions concerning the assignments should be directed to the instructor. I reserve the right to give a zero for the assignment or refer the student to the Assistant Dean of the College of Education if I suspect dishonesty. **I DO NOT PREGRADE ASSIGNMENTS.** If you

send me an assignment by e-mail or give me an assignment to look over before it is due, I will grade the assignment accordingly. It is not fair to the other students in the class to ask me to pregrade. Please ask questions concerning your assignments in class so that other students can benefit.

All assignments that are turned in to me for grading must be word processed, not hand written. The only exception is the calculations for orthogonality. The calculations may be hand written. Also, when turning in an assignment, please attach the test problem and/or exam problem to the **front** of the assignment. You must also provide me with the computer printouts with your name on the printouts printed by the printer.

Projected Term Schedule

Class	Date	Topic	Assigned	Due
1	6/4	Introduction Review of SPSS® for Statistical Analyses t-test using SPSS® computer software (CP 1)	Review & Review Problems (RP) 1-11 HW 1	
2	6/11	Introduction to F-Statistic and Assumptions The Process of Analysis of Variance (CP 2 & 3) Practical Significance Multiple Comparison Procedures (CP 4) Least Significant Difference Procedure Dunn's Procedure (Bonferroni) Tukey HSD Procedure Student-Newman-Kuels Procedure Dunnett's Procedure Unequal n ANOVA and followups (CP 4B)	HW 2, 3, 4, & 4B TP 1 Chapter 13 Chapter 14	RP 1-11 HW 1 Q1
3	6/18	Orthogonal Comparison Procedure (CP 5) Scheffe' Procedure Review of Multiple Comparison Procedures Trend Analysis (CP 4) Multiple Comparisons with SPSS®	HW 5 HW 4C TP 2 & 3 Chapter 14	HW 2,3,4,4B TP 1 Q2
4	6/25	Two-way Factorial Designs (CP 6 & 7) Main and Simple Effects Interpretation of Interactions	HW 6 & 7 Chapters 15 & 17	HW 4C & 5 TP 2 Q3

Class	Date	Topic	Assigned	Due
5	7/2	Repeated Measures Introduction to Three-way Factorial Design (CP 8)	HW 8 & 9 TP 4 & 5 Chapters 13 & 15	HW 6 & 7 TP 3 Q4
6	7/9	Nonparametric Analyses (Mann-Whitney and Kruskal Wallis) (CP 9) Regression (CP 10 & 11)	Chapters 11, & 12 HW 10, 11	TP 4 HW 8
7	7/16	ANCOVA (CP 12)	HW 12	HW 9, 10, 11
8	7/23	Catch up and review		HW 12 TP 5, Q5
9	7/30	Final Examination Due DUE AT 5:00 PM, 10% POINT REDUCTION IF LATE!!!!!! I WILL NOT TAKE AFTER JULY 30		

Internet Resources

There are many statistical resources on the Internet. I would like to point out just one at this point, but it is hot linked to numerous others. It is an interactive textbook by David M. Lane. Its URL is:

<<http://www.davidmlane.com/hyperstat/index.html>