

Analysis of Variance in Education, BER 545
Spring, 2008

Department of Educational Studies in Psychology, Research Methodology, and Counseling
Program: Educational Research
Credit Hours: 3
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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. In the past, students who have missed class found it difficult to understand the material and concepts of the course. When missing a class, students cannot ask questions about any clarification that is needed. I often receive e-mails from students asking questions that would have been answer had he/she been in class. For these reasons attendance is required. **If you are late to class, leave early, or miss a class, you are responsible for getting the notes from another student.** I do not do make-up lectures. Anyone who is absent 3 times (whatever the reason, including job responsibilities) will receive a letter grade deduction (10 points) for the course. Each absence over 3 will receive an additional 5 point deduction. You are responsible for all material discussed in class. Computer instruction on SPSS[®] is part of the course. 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. You can always fax an assignment, e-mail it, or give it to someone in class to turn in if you are not going to be in attendance.

ASSIGNMENTS WILL NOT BE TAKEN LATE!!!! Since assignments are assigned well in advance of the due date, you have ample time to complete the assignment. **WARNING!!!!** **POWER FAILURES, COMPUTER CRASHES, AND COMPUTER VIRUSES ARE NOT ACCEPTABLE EXCUSES FOR FAILING TO TURN IN AN ASSIGNMENT. ALSO, IF**

YOU E-MAIL 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. IF I HAVE NOT RECEIVED IT BEFORE CLASS IT IS CONSIDERED

LATE AND WILL NOT BE ACCEPTED. The final exam is given out the first night of class. There should be no excuses for turning it in late. Please do not ask for special consideration. Missed tests will **not** be made up. If you miss test 1 because of job responsibilities, an emergency, or any other acceptable* reason (including sports participation), you will take a comprehensive final on the night test 2 is scheduled. The grade made on the final will be the grade for both test 1 and test2. Since the comprehensive final is not the same test taken by the other students, any possible extra points added to test 1 or test 2 will not apply. Failure to take test 2 at the scheduled time will result in an "I" for the semester. A makeup test will be given at the convenience of the professor (usually at the beginning of the next semester). Please do not ask to take tests early. Tests dates are final. Please plan your schedule accordingly. Computer crashes and/or computer viruses are not an excuse. 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. Tests are from 6:00 to 9:00 PM on the scheduled date. If you are late, the test still ends at 9:00 PM. No extra time will be given.

***NOTE: In order to be allowed to take the comprehensive final due to missing test 1, I must be contacted prior to the missed test (phone, e-mail, or in person) with an acceptable reason (I reserve the right to determine if the reason is acceptable). If contacting me is not possible before, then you need to contact me within 24 hours after the test, otherwise you may receive a '0' for the missed test. Missing test 1 does not mean that you will automatically be allowed to take the comprehensive final. Be aware that going on vacation is not an acceptable reason. The same applies for missing test 2. I need to be contacted.**

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 process. Of course to do so before and/or after class is ok.

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

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/> . This applies to the take-home test problems and the final exam that are intended to be the **sole work of each student**.

Plagiarism: Plagiarism is the act of representing the words, data, works, ideas, computer program or output, or anything not generated by the student as his or her 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 being suspended from The University. For more information, refer to <http://registrar.ua.edu/policies/>.

Equal Treatment: 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 (at least one week) 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 require extra time for test taking, you must make arrangements with the Office of Disability Services to take the test in their offices (**before or during the actual test time**). The classroom test runs from 6:00 to 9:00 PM. Please do not come to the classroom to take the test, then realize that you need more time. The extra time will not be given. You must take the test in the Office of Disability Services.

RECOMMENDED TEXT (Do not buy unless you want to)

Green, S. B., & Salkind, N. J. (2008). *Using SPSS® for Windows and Macintosh: Analyzing and understanding data* (5th ed.). Upper Saddle River, NJ: Prentice Hall. ISBN: 0-13-1890255

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. Two tests
- E. Final Examination (7 SPSS® assignments)

EVALUATION		PERCENTAGES	
4 Test Problems @ 25 points	100 points**	90% - 100%	A
2 Tests @ 100 points	200 points	80% - 89%	B
Class points	25 points*	70% - 79%	C
Final Exam	175 points	60% - 69%	D
<hr/> Total		500 points	Below 60%
			F

Class Points

Class points are given at the discretion of the instructor. The points can be for participation, questions asked in class, reflective points, etc. In order to receive the points you must be in class. These points can not be made up if you miss a class in which they are given.

*If no class points are given during the semester, then the total possible points for the semester will be 475. I will inform you in class when I am taking class points.

****Test Problems**

Printouts are to be included with the test problems. You must have your name typed on the SPSS® printouts before printing by SPSS®. I will demonstrate this in class. Failure to do so will be a 3 point penalty.

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.

E Learning

Handouts for the class can be found on E Learning. 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 E Learning. If your E Learning is not working properly, it is your responsibility to find out why and get the problem corrected. Failure to access E Learning 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 E Learning. 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 day'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.** When e-mailing me, please send e-mails to agodfrey@bama.ua.edu. Please DO NOT use other e-mail addresses. Sending assignments via other e-mail addresses may result in you receiving a zero for

the assignment. I do not check other e-mail addresses. Your e-mail should have in the subject line BER 545T and your name (first and last) at the end of the e-mail. Please do not e-mail me for grades. I return the graded assignments and tests at 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. 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 as well.

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.

WARNING!!!! WHEN YOU TURN IN AN ASSIGNMENT MAKE SURE THAT YOU TURN IN EVERYTHING. FAILURE TO TURN IN ALL OF AN ASSIGNMENT WILL RESULT IN YOU MISSING THE POINTS DELEGATED FOR THAT PART. I WILL NOT ACCEPT MISSING PARTS AT A LATER DATE.

SEMESTER GRADE

The semester grade is final. There will be no changes except for cases of error in recording the grade and/or a mistake in grading on my part. If you fail to answer questions on the tests or on the assignments or do not turn in part of an assignment you will not be given a chance to redo. 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. Also, do not decide to turn in an assignment that you previously did not turn in after the due date. FINAL GRADE MEANS FINAL GRADE.

Projected Term Schedule

Class	Date	Topic	Assigned	Due
1	1/14	Introduction Review of SPSS® for Statistical Analyses t-test using SPSS® computer software (CP 1)	Review & Review Problems (RP) 1-11 HW 1	
2	1/21	Introduction to F-Statistic and Assumptions The Process of Analysis of Variance (CP 2 & 3) Practical Significance	HW 2, 3 TP 1	RP 1-11 HW 1
3	1/28	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 4, & 4B TP2	HW 2, 3
4	2/4	Orthogonal Comparison Procedure (CP 5) Scheffe' Procedure Review of Multiple Comparison Procedures Trend Analysis (CP 4C)	HW 5 HW 4C TP3	HW 4,4B TP1
5	2/11	Catch up and review		TP2 HW 5, 4C
6	2/18	Test 1		TP3
7	2/25	Two-way Factorial Designs (CP 6 & 7) Main and Simple Effects Interpretation of Interactions	HW 6 & 7 TP4	
8	3/3	Repeated Measures (Example 1)	Example 2	HW 6 & 7

Class	Date	Topic	Assigned	Due
9	3/10	Introduction to Three-way Factorial Design (CP 8)	HW8	Example 2 TP4
10	3/24	Nonparametric Analyses (Mann-Whitney and Kruskal Wallis) (CP 9)	HW9	HW 8
11	3/31	Regression (CP 10 & 11)	HW 10, 11	HW9
12	4/7	ANCOVA (CP 12)	HW 12	HW 10, 11
13	4/14	Catch up and review		HW 12 TP 5 extra credit
14	4/21	Test 2 (you may turn in the final exam, tonight, if you wish)		
15	4/28	Final Examination Due DUE BY 6:30 PM, 10% POINT REDUCTION IF LATE!!!!!! PROJECTS TURNED IN AFTER MAY 1 WILL NOT BE ACCEPTED!!!!!!		

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>