ERSH 8310
Applied Analysis of Variance Methods in Education
Fall, 2005

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Texts: (K) Keppel, G. & Wickens, T. D. (2004). Design and Analysis: A Researcher's Handbook. (Fourth Edition) New Jersey: Pearson.
(HC) Huck, W. W.,(2003). Reading Statistics and Research 4th ed. Reading, MA: Longman.
(GSA) Green, S. B., Salkind, N. J., & Akey, T. M. Using SPSS for Windows: Analyzing and Understanding Data. New Jersey: Prentice Hall.
(INS) Instructor Notes and Problem sets available at Bel Jean.

THIS COURSE SYLLABUS PROVIDES A GENERAL PLAN FOR THE COURSE; DEVIATIONS MAY BE NECESSARY.

ERSH8310 is a WEBct course. Every student is expected to have an ARCHES account and be familiar with WEBct. This course syllabus, review questions, additional problem sets, useful WEB sites, grades, a calendar of events, and a bulletin board for discussions will be maintained throughout the semester. You are encouraged to check the WEB site frequently for updated materials, discussion postings, and calendar listings. Suggestions for improving the course WEB site are greatly appreciated.

All students are expected to abide by the UGA student honor code: ***"I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others."*** The UGA policy on academic honesty states: Academic honesty means performing all academic work without plagiarism, cheating, lying, tampering, stealing, receiving unauthorized or illegitimate assistance from any other person, or using any source of information that is not common knowledge. The full version of A Culture of Honesty may be found at: http://www.uga.edu/ovpi.

Course Outline

Unit	Topic	Readings	Session
I	Review Statistical Hypothesis Testing		1-4
	A. Comparing two populations	H ch 5,6,7,	
	a. t-test statistic	8,9,11	
	b. errors in inference	K ch 1	
	c. effect size	GSA Lesson 23	
	d. statistical power		
	e. confidence interval	INS pp. 2-32, 180-186	
	f. assumptions	Computer 1 p. 247	
II	Analysis of Variance		5-9
	A. Single factor	H ch 12, 13	
	a. ANOVA summary	K ch 2-4,6 and 8	
	b. Identifying specific differences	GSA Lesson 24	
	c. assumptions	INS pp. 33-71, 187-195	
	d. statistical sample size/power	Computer 2 pp. 248-249	
	e. structural model		
Test 1 on Units I and II		September 26	10

Unit	Topic	Readings	Session
III	Analysis of Variance		
	A. Two Factors	H ch 14	11-17
	a. structural model	K ch 10-12	
	b. sample size/power	GSA Lesson 25	
	c. ANOVA summary table		
	d. assumptions	INS pp. 72-108, 196-207	
	e. effect size	Computer 3 pp. 250-251	
	f. contrasts		
	g. interaction		
	h. simple effects		
	i. identifying specific differences		
Test 2 on Unit III		October 24	18

Unit	Topic	Readings	Session
IV	Analysis of Covariance		19-24
	A. Overview	H ch 18	
	B. Structural model	K p. 311-330	
	C. ANCOVA summary table	GSA Lesson 26	
	a. equality of regression slopes	INS pp.126-154, 211-222	
	b. relationship between covariate and dependent measure	Computer 5 pp. 254-255	
	c. treatment effects		
	d. identifying specific differences		
	D. Compared with Gain scores		
Test 3 on Unit IV		November 16	25
V	Repeated Measures Design		26-27
	A. related samples t-test	H ch 16	
	B. ANOVA summary table	K ch 16, 17	
	C. assumptions	GSA Lesson 28	
	D. sample size/power		
	F. identifying specific differences	INS pp. 155-169, 223-230	
		Computer 6 p. 256	
VI	Mixed Model Design		28-29
	A. ANOVA summary table	HC ch 17	
	B. assumptions	K ch 19-20	
	C. identifying specific differences	INS pp. 170-179, 231-246	
		pp. 257-258	
	FINAL REVIEW		30

The final exam will be comprehensive, but Units V and VI will be emphasized. **December 12 5:00-8:00pm**

Grading

Three tests and a final exam are planned for the material presented in this class. It is anticipated that each test will consist of 30 points and the final exam will consist of 50 points. The major objectives for each of the Units are presented below. All tests will be administered in class and will be closed book and notes. Students may use a calculator, special tables distributed for the class and one 8 1/2 by 11 inch pages of summary notes for the first test, two pages of notes for the second test, three pages of notes for the third test and five pages of notes will be permitted for the final exam.

For grading purposes, the lowest score among the first three exams will be dropped. Final grades will be based on the sum of the top two scores among the first three tests plus the final exam score. Make-up exams will not be possible. If a student is unable to take an exam when it is scheduled that exam will be scored as a 0 and dropped from grading consideration.

In addition, students will be required to complete four out of seven computer assignments made during the semester and submit them by a designated date. Dates when assignments will be due will be announced as the semester progresses. Generally students will have approximately one week to complete the assignment after the procedure is presented in class. Late papers will not be accepted without sufficient justification. Each assignment will require the student to analyze/interpret the results of a research study and answer several questions regarding the results. **THE COMPUTER OUTPUT MUST BE SUBMITTED ALONG WITH THE ANSWERS TO THE QUESTIONS**. Each assignment will be graded on a five point scale. If more then four computer assignments are submitted to the instructor, the four highest scored assignments will be counted toward the grade. If a student submits more than four computer problems and earns at least four points for each problem, two additional bonus points for each problem will be awarded (a total of 6 bonus points). **Students may work on the computer programs in teams but all interpretation and written work on the assignments must be completed by the student alone.**

Final grades will be assigned based on the percent of the possible points earned during the semester. Grades will be assigned as follows:

Percent of Points		Earned Grade
85-100	=	A
70- 84	=	B
60- 69	=	C
50- 59	=	D
Below 50	=	F

UNIT OBJECTIVES

UNIT I

1. Given a small data set and summary calculations determine the

standard error of the statistic of interest (sample mean, difference between means).

2. Define and interpret the meaning of a Type I error, Type II error and statistical power.

3. Describe the interrelationship between Type I, Type II errors and statistical power.

4. Given a research context and summary data identify the appropriate critical value for the test statistic for a specific hypothesis and confidence interval.

5. Given a computed t-statistic estimate the p-value

UNIT II

1. Given summary calculations (i.e., SS, MS F) complete an ANOVA summary table and interpret the results in terms of the hypothesis tested.

2. Given descriptive statistics(i.e., sample means, standard deviations, variances), compute the ANOVA summary table and F-ratio

3. Given the results reported in an ANOVA summary table or descriptive statistics, identify specific differences using the Bonferroni procedure.

4. Develop confidence intervals for specific contrasts of interest.

5. Describe the effect on the Type I error rate when data assumptions are violated

6. Given a research problem identify appropriate procedures for increasing statistical power and reducing Type II errors.

7. Calculate statistical power for a specific research study.

8. Determine the necessary sample size needed to answer a specific research question with reasonable statistical power.

9. Given a description of a research study and a computer printout or facsimile interpret the results of the analysis and draw appropriate conclusions.

UNIT III

1. Given a research problem and summary calculations for a study involving two independent variables, complete the analysis and interpret the results.

2. Given the results of a research study involving two independent variables provide an appropriate interpretation of

the results.

3. Given summary calculations test hypotheses for specific contrasts and provide interval estimates for differences between specific populations

4. Estimate the minimum sample size needed to test main effects or an interaction for a factorial ANOVA.

5. Given a specific research context estimate the statistical power for detecting main effects in a factorial ANOVA

6. Given a description of a research study and a computer printout or facsimile interpret the results of the analysis and draw appropriate conclusions.

7. Interpret the results for an interaction effect as well as suggesting appropriate follow-up analyses.

8. Illustrate the meaning of an interaction, simple effect and main effect by numerical examples or graphs

9. Given a description of a research study and a computer printout or facsimile interpret the results of the analysis and draw appropriate conclusions.

Unit IV

1. Given a description of a research study and the data analysis results as reported on a computer output or facsimile interpret the results completely and draw conclusions supported by the data. Data analysis strategies which might be reported include:

    a. ANOVA for gain scores
    b. analysis of covariance

2. Given the results of analysis of covariance correctly interpret the meaning and significance for the following tests

    a. equality of regression slopes
    b. relationship between the covariance and dependent variable
    c. treatment effect including confidence intervals

Unit V

1. Given descriptive data complete the ANOVA summary table

2. Describe the effect of violating the assumption of sphericity.

3. Determine the necessary sample size for a repeated measures design.

4. Determine appropriate tests for specific contrasts of interest to a researcher.

5. Given a computer printout or facsimile interpret the results of the analysis.

Unit VI

1. Given a description of a research study and summary calculations for a mixed model design

    a. complete an ANOVA summary table
    b. given a research question determine which F-ratio is relevant for the question
    c. test specific hypotheses of interest through contrast analyses

2. Given a computer printout or facsimile interpret the results of the analysis.

Summary Objectives

1. Given a description of a research study and a research question, suggest an analysis procedure that will answer the question. All such questions will be answerable using one or more of the following:
   a. independent samples t-test
   b. statistical techniques for analyzing one-way design
      1. F-ratio
      2. multiple comparison procedures
   c. statistical techniques for analyzing two-way designs
      1. main effects
      2. interaction
      3. simple effects
      4. multiple comparison procedures
   d. analysis of covariance
   e. gain score analysis of variance
   f. repeated measures ANOVA
   g. mixed model ANOVA

2. Given a description of a research design, a research problem and a computer printout or facsimile or results relevant to the question, interpret the meaning of the results for the research question. The interpretation will involve:
   a. statement of a null and alternative hypothesis
   b. statement of the calculated and critical value of a test statistic
   c. construction of a confidence interval
   d. implications of a, b and c for the research question

3. Given a description of a research study and question identify the most appropriate procedure to analyze the data set and answer the researcher's question.

4. Given a description of a research study and question identify which hypothesis test or test statistic (e.g., main effect, interaction, simple effect, contrast analysis) will answer the research question.

5. Given the ANOVA summary table interpret the results in relation to the researcher's question.

6. Identify statistical data assumptions required for the ANOVA for repeated measures mixed model, simple linear regression and analysis of covariance. Describe the effect violations of data assumptions have on the validity of the ANOVA F-test.