



Course	Research Methods in Behavioral and Brain Sciences—Part 1, PSYC 6312.002, HCS 6312.002, ACN 6312.002
Professor	Robert A. Ackerman, Ph.D.
Term	Fall 2016
Meetings	JO 3.209, Tuesdays and Thursdays from 10:00am-11:15am

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General Course Information

Restrictions Students are assumed to have taken an introductory undergraduate course in statistics. They should be familiar with general concepts and definitions (e.g., descriptive vs. inferential statistics, independent and dependent variables), distributions (e.g., standard normal distribution, t-distribution), measures of central tendency and variability, the central limit theorem, one-sample z-tests, one-sample t-tests, independent groups t-test, and correlated groups t-test. Because this course will include a large data analysis component, students must also have access to SPSS.

Course Description This course aims to familiarize students with how to use Analysis of Variance (ANOVA) techniques to analyze data from experimental and non-experimental research. We will cover single-factor designs, planned comparisons and post-hoc tests, Type I and II errors, power, multiple factor designs, breaking down interaction effects, repeated measures designs, and mixed designs. We will also spend a good deal of time learning how to compute relevant effect sizes for different analyses.

Students will demonstrate:

Learning Objectives

1. Knowledge of basic topics within Null-Hypothesis Significance Testing (NHST), including how to accurately interpret a p-value, Type I and Type II errors, and power.
2. Knowledge of basic topics within estimation, including effect sizes and confidence intervals.
3. Knowledge of basic topics within ANOVA, including the F ratio, between and within-groups designs, factorial designs, and mixed designs.
4. An ability to conduct basic and more advanced ANOVAs, including the single-factor between-subjects and within-subjects designs, 2-way between-subjects factorial, and mixed designs.
5. An ability to break down interaction effects in ANOVA.
6. An ability to estimate appropriate effect sizes for relevant designs.
7. An ability to write up different forms of analyses in APA style.

Students' achievement of these objectives will be evaluated through a combination of homework assignments and exams.

Keppel, G., & Wickens, T. D. (2004). Design and Analysis: A Researcher's Handbook (4th Edition). Prentice Hall, ISBN: 0-1351-5941-5

**Required
Texts**

Cumming, G. (2012). Understanding the new statistics: Effect sizes, confidence intervals, and meta-analysis. New York: Routledge. ISBN-10: 041587968X

The course E-learning website can be accessed through this link:

<https://elearning.utdallas.edu/webapps/portal/frameset.jsp>

(I will be posting all course materials on e-learning. **You will need to print out copies of the outputs and other materials to bring to class each day.**)

Computer

We will be using the SPSS program for data analyses. I will show examples in class using both the drop-down menu approach and syntax. It is very important that you have access to this program, and so your first homework assignment-to be completed by Friday-is to locate a computer that has SPSS installed on it that you can use for homework in this class. If you want to purchase SPSS for your own computer, you can buy it from the UTD tech store. Be sure to buy SPSS Statistics Premium Graduate Pack for version 21 or higher (it should cost you around \$100-\$120). If you do not want to buy your own copy of SPSS, it is installed on several UTD computer labs (e.g., GR 3.206 Statistics Lab).

**Course
Requirements**

Data Analysis Assignments. Homework will be assigned in class. Assignments should be completed individually. Also, examples of write-ups discussed in class are NOT TO BE USED as templates for the assignments—this is plagiarism and will not be tolerated. In most cases you will have one week to complete each assignment (I will note due dates in class for each assignment.) Completed homework will be collected in class and will be scored out of a possible 10 points. One point will be deducted for each day that an assignment is late (assignments will not be accepted after 5 days). Scores on these assignments will count for 20% of your final grade.

Exams. Grades will also be based on a midterm exam (40%) and a final exam (40%). As an initial guess (i.e., it is subject to change) the in-class midterm exam will be given on Tuesday, October 11. The date, time, and location of the final exam will be announced in class.

The following scheme will be used to provide you with a grade:

**Grading
Criteria**

Percentage of Total Points Earned	Letter Grade
90-100%	A
87-89%	B+
83-86%	B
80-82%	B-
77-79%	C+
73-76%	C
70-72%	C-
67-69%	D+
63-66%	D
60-62%	D-
Below 60%	F

Materials for this course were adapted from a course taught by Dr. Deborah A. Kashy.

**Instructor
Expectations**

Because the material in this course is more or less cumulative, it is imperative that you stay alert during class and keep up with the readings and assignments. It is easy to fall behind, but very difficult to catch up. I also expect you all to be respectful towards one another.

Late Work

One point will be deducted for each day that a homework assignment is late (assignments will not be accepted after 5 days).

**Student
Conduct and
Discipline**

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD printed publication, *A to Z Guide*, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Series 50000, Board of Regents, The University of Texas System*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391) and online at <http://www.utdallas.edu/judicialaffairs/UTDJudicialAffairs-HOPV.html>

A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

**Academic
Integrity**

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic Dishonesty, any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.

Email Use

The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's U.T. Dallas email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at U.T. Dallas provides a method for students to have their U.T. Dallas mail forwarded to other accounts.

**Withdrawal
from Class**

The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.

**Student
Grievance**

Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the

Procedures university's *Handbook of Operating Procedures*.

In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the dean will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.

Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.

**Incomplete
Grades**

As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of **F**.

**AccessAbility
Services**

The goal of the Office of Student AccessAbility Services is to provide students with disabilities equal educational opportunities. The Office of Student AccessAbility Services provides students with a documented letter to present to the faculty members to verify that the student has a disability and needs accommodations. This letter should be presented to the instructor in each course at the beginning of the semester and accommodations needed should be discussed at that time. It is the student's responsibility to notify his or her professors of the need for accommodation. If accommodations are granted for testing accommodations, the student should remind the instructor five days before the exam of any testing accommodations that will be needed. The Office of Student AccessAbility Services is located in Room 3.200 in the Student Services Building. Office hours are Monday – Thursday, 8:00 a.m. to 6:00 p.m., and Friday 8:00 a.m. to 5:00 p.m. You may reach the Office of Student AccessAbility Services at (972) 883-2098. Guidelines for documentation are located on the Office of Student AccessAbility Services website at: <http://www.utdallas.edu/studentaccess/guidelines/>

**Religious
Holy Days**

The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.

The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.

If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of TEC 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.

Course Schedule

Note: This schedule is tentative and subject to change. Changes will be noted in class. Note also that the reading assignment should be completed before class on the day it is assigned. KW = Keppel & Wickens (2004).

Date	Topic	Reading Assignment
Aug 23	Introduction to course Data exploration	Raykov & Marcoulides (2008)- Chapter 3
Aug 25	Introduction to SPSS	
Aug 30	Review of material prior to ANOVA	KW: Chapters 1,2
Sep 1	Review of material prior to ANOVA (continued)	
Sep 6	Introduction to ANOVA	KW: Chapter 3
Sep 8	Introduction to ANOVA (continued)	
Sep 13	Confidence intervals	Cumming (2012)-pp. 75-117 (optional to read Chapter 2 and beginning of Chapter 3)
Sep 15	Introduction to effect sizes for ANOVA	Grissom & Kim (2012)-Chapter 6
Sep 20	Cohen's d and confidence intervals	Cumming (2012)-Chapter 11
Sep 22	ω^2 and confidence intervals	Kelley (2007)
Sep 27	Power, effect size, and sample size	KW: Chapter 8
Sep 29	Accuracy-of-parameter estimation	Cumming (2012)-Chapter 13
Oct 4	The linear model and ANOVA assumptions	KW: Chapter 7
Oct 6	The linear model and ANOVA assumptions (continued)	
Oct 11	Midterm Exam	
Oct 13	Dealing with assumption violations (e.g., non-parametric alternatives)	
Oct 18	Comparisons among means	KW: Chapters 4.1-4.3, 6 Cumming (2012)-Chapter 6
Oct 20	Comparisons among means (continued)	
Oct 25	Introduction to factorial ANOVA	KW: Chapter 10
Oct 27	NO CLASS	
Nov 1	Two-factor Between-Subjects ANOVA	KW: Chapter 11

Nov 3	Breaking down the interaction	KW: Chapter 12
Nov 8	Effect sizes for factorial designs	Grissom & Kim (2012)-Chapter 7 (pp. 205-230) Cumming (2012)-Chapter 15 (pp. 411-424)
Nov 10	Three-factor ANOVA & breaking down the 3-way interaction	KW: Chapters 21, 22
Nov 15	Unequal sample sizes in factorial ANOVA	KW: Chapter 14
Nov 17	Single-factor within-subjects designs	KW: Chapters 16, 17
Nov 22	NO CLASS: Fall Break	
Nov 24	NO CLASS: Fall Break	
Nov 29	Two-factor within-subjects design	KW: Chapter 18
Dec 1	Effect sizes for factorial within-subjects designs	Grissom & Kim (2012)-Chapter 7 (pp. 230-239)
Dec 6	Mixed Designs	KW: Chapters 19, 20

Below is a list of topics that you should be familiar with from your undergraduate statistics course. Hopefully each of you will look at the list and feel reasonably comfortable with the topics. Perhaps for some of you, a brief perusal of your undergraduate statistics text and notes might help to rekindle the knowledge. Unfortunately, there may be some of you that look at this list and panic. You may never have had this material or it may have been very long ago.

The problem is twofold. First, we already have far too much to do in this course. Second, a brief review tends to be boring and useless to students who are comfortable with the material, but is far too fast and overwhelming for students who are uncomfortable.

All of you should go home today and look through your undergraduate statistics books to be sure that you are really familiar with the listed material. If you do not have a book, I should be able to find one that you can use on a temporary basis. Note that I don't expect you to memorize formulas – just to be familiar with the statistics, what they tell you, what assumptions are necessary, and so on.

Topics from undergraduate statistics that I assume you know (formulas need not be memorized – just know how to use them if you need to):

General Concepts & Definitions you should know

- Descriptive Statistics vs Inferential Statistics
- Population vs Sample
- Random Sampling
- Representative Sample
- Independent and Dependent variables
- Experimental research
 - manipulate the independent variable,
 - random assignment
- Observational research
- Confounding variables
- Qualitative versus Quantitative measurement

Distributions

The Normal Distribution - characteristics of it

The Standard Normal Distribution = the Normal distribution with $\mu = 0$ and $\sigma = 1$

The t-distribution and how it relates to the Normal distribution

Measures of Central Tendency

Mean, Mode, Median

- What each of these measures tell you (how to interpret them)
- characteristics of each, i.e.,
 - is it a stable measure from sample to sample?
 - is it sensitive to outliers?
 - can there be more than one?

Measures of variability

Range - What it is and properties of it

Sum of Squares

Variance

Standard Deviation

- What it is, how you compute it, and what it tells you

Inferential Statistics

You should be able to explain/define:

Population and sample, and the difference between them

Sampling error - why it occurs and its importance

The sampling distribution of the mean

The Central Limit Theorem and its importance to inferential statistics

The standard error of the means

One Sample z-test.

You should be able to

- understand how the Central Limit Theorem relates to the z-test
- understand the role of the standard error of the means in this test
- state the null & alternative hypotheses being tested
- conduct the test
- state your conclusions about the test both in terms of the null hypothesis and in terms of the research question being addressed in the problem

One Sample t-test.

You should be able to

- recognize that the question is a one-sample t-test problem versus a one-sample z-test problem (i.e., the comparison μ is known but the true population σ is unknown so it must be estimated)
- state the null & alternative hypotheses being tested
- conduct the test
- state your conclusions about the test both in terms of the null hypothesis and in terms of the research question being addressed in the problem
- explain the relationship between the degrees of freedom and the shape of the t-distribution

Independent Groups t-test

You should be able to

- recognize that the question is an independent groups t-test problem (versus a one-sample problem or a correlated groups problem)
- state the null & alternative hypotheses being tested
- conduct the test

- state your conclusions about the test both in terms of the null hypothesis and in terms of the research question being addressed in the problem

Correlated Groups t-test.

You should be able to

- recognize that the question is a correlated groups t-test problem
(versus a one-sample problem or an independent groups problem)
- state the null & alternative hypotheses being tested
- conduct the test
- state your conclusions about the test both in terms of the null hypothesis and in terms of the research question being addressed in the problem

You should also know

- what within subjects (= repeated measures) designs are
- what matched pairs designs are
- advantages and disadvantages of within subjects and matched pairs designs