

Spring 2020  
**Educ/Psy 6600: Statistical Foundations**  
**Sarah Schwartz**

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**Office Location:** EDUC 455  
**Office Hours:** by appointment

**Lecture Location:** EDUC 130  
**Lecture Hours:** M & W 4:30 – 5:45 pm

## Course Purpose

Research Design & Analysis I is designed to provide the student with a **practical, applied approach** to the application of fundamental behavioral and educational research design and statistical principles. Students will learn how to differentiate and appropriately select the best statistical methods for use in various research designs and analytical problems.

This course will mostly focus on **basic statistical techniques** and **several forms of the ANOVA model**, which can be used by themselves or serve as building blocks for more advanced techniques in other courses. Students will also learn how to:

- 1) Use the R statistical programming environment (via the R Studio IDE) to analyze data and
- 2) Interpret and communicate the results of analyses (including creating reproducible research reports with R Markdown).

## Prerequisites

- ❑ Prior/concurrent EDUC/PSY 6570 'Introduction to Educational & Psychological Research'
- ❑ Passing the EDUC/PSY 6600 pretest (70% or better)

## Course Structure

This is a lecture and applied skills course. Students will be expected to demonstrate their learning via *classroom participation, assignments, and examinations*. The purpose of class lectures is to elaborate on interesting or difficult material presented in the text, conduct skill-building exercises and demonstrations, and to provide a forum for discussion.

## Required Materials

- Cohen, B. H. (2008). **Explaining Psychological Statistics** (4th Ed.). New York: Wiley.
- **eBook** *Encyclopedia of Quant Methods in R* (free online at <https://cehs-research.github.io/eBooks/> )
- **Canvas** (my.usu.edu) Please check Canvas frequently for course updates, assignments, & grades
- **R, R Studio, & TeX** software (all free to download online, instructions will be given)
- **G\*Power** software (free for PC or Mac at [www.gpower.hhu.de](http://www.gpower.hhu.de) )
- Scientific or statistical **calculator** (may be a graphic calculator, but NOT a cell phone, iPod, ect.)

*Note: it is advantageous to bring a laptop to class, but not required.*

## Preparation & Attendance

The nature of this course **requires** regular class attendance and participation. The student is therefore expected to read assigned chapters **BEFORE** each class session in order to be prepared for classroom activities and discussion (see 'Summaries' below). Please note that this is a 3-credit course in a 7-week period, requiring an average of approximately **18 HOURS of time outside of class EVERY WEEK** devoted to reading and homework for students who are adequately prepared for this course. Students should **not miss class lectures** as some material covered in class will not be covered in the text. All information covered in the text and lectures is fair game for examination questions. The instructor encourages all students who have or anticipate attendance difficulties to discuss these issues with them as soon as possible.

## Grade Components

### I. Chapter Summaries

20% of grade

By design, in person meetings (i.e. 'lectures') are to enhance your understanding and experience with statistical concepts, rather than present them the FIRST time (**this is not an introductory course**). It is of utmost importance that students read the material **PRIOR** to the designated lecture, as well as read through the associated homework assignment. This ensures class time may be more valuably spent on answering higher level questions and preparing students for assignments, but more importantly for their conducting their own research. To facilitate this, a chapter **summary or outline** of the assigned readings is due on the day the material is covered in class, **before** the lecture time begins.

A skeleton will be provided for typing your notes into an **R Notebook using R markdown**. Alternatively, students may choose to type notes in a standard word processor, like Microsoft Word. **Tables, formulas, pictures, and examples 'may' be included** as each student finds appropriate. Each of the EIGHTEEN chapter's summaries will be turned in electronically by **3:30 am** on the due date posted in **CANVAS (knitted .pdf or word format only, no .Rmd or other formats accepted)**. Summaries will be reviewed and assigned full credit/no-credit. The lowest 2 scores will be dropped.

Each student must compose his or her own work. Summaries must NOT be a copy of the lecture slides or notes. Summaries maybe added to and printed out for use during examinations. Please note, copied summaries (either from posted lecture notes or from students of previous semesters), summaries that violate page specifications, or late summaries will not receive any credit.

### II. Unit Homework Assignments

30% of grade

SEVEN equally weighted unit assignments form the basis for learning the practice of statistics at the level required by this course. The units are outlined on the course schedule (chapters are from Cohen's 4<sup>th</sup> edition text). Details regarding what is required for each assignment will be available on Canvas. Assignments require the manipulation or analysis of data and communication of results (complete sentences, too). Most, if not all, assignments will also require analysis in R. Additional reading of provided articles may be required, too.

All assignments are REQUIRED: NO scores will be dropped. Students may work together, however each student must turn in his or her own work, **not photocopies or identical replicates**. Assignments are due by **11:59pm** on the due date (see Canvas). Details on what is required to be turned in will be posted on canvas.

Rubrics will be used for grading. Half of the points are earned for **completion** and half for **correctness** (based on a subset of problems chosen for grading). Skipped portions of an assignment may result in loss of points for **BOTH** completeness **AND** correctness. Late assignments turned in within 24 hours of the due date will receive **half** the score earned. No points will be awarded thereafter. The lowest 2 scores will be dropped.

### III. Examinations

30% of grade

FIVE equally weighted examinations will be given during this course. Examinations will be offered via the **Proctorio** for a maximum duration of 2 hours anytime on the day scheduled. Examinations will cover all material discussed in class AND in the readings (which are not necessarily one and the same). No code or syntax will be required on exams, however partial output may be included, and students will be expected to interpret the results and communicate the meaning correctly.

All formulas needed will be provided on examinations (unless noted during examination reviews). Applicable statistical tables will also be provided (Appendix A of Cohen's textbook). Calculators may be used, but not any electronic device that may transmit/receive, such as cell phones, ipods, tables, ect.

All exams are REQUIRED: NO scores will be dropped. Examinations may consist of definitions, multiple choice questions, computations, output interpretations, and short-answer essays. Student may use their own printed chapter summaries, homework, and other notes during examinations.

Please make every effort not to miss the final examination as it cannot be rescheduled unless there is documented evidence for the reason of absence (e.g., serious illness, accident, court). In the event of an emergency the student must contact the instructor immediately and BEFORE the examination.

\* No exam is not truly comprehensive; HOWEVER, all prior material is fair game on every exam. \*

### IV. Final Project

20% of grade

Application of analyses covered in the course is required in the form of a final project. Your final project is a **journal article style report** consisting of at least one method from each unit. More information will be provided on Canvas. It will be graded with:

- 10% - Short introduction highlighting the research questions (one paragraph).
- 35% - Methods section highlighting how those research questions were addressed with at least one method from each unit.
- 35% - Results section showing the results of the methods with their corresponding interpretations, assumption checks, etc.
- 10% - Short discussion putting the results in context of the research questions (one paragraph).
- 10% - Appendix of code and output for transparency and reproducibility.

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The standard grade breakdown used by Utah State University will be followed to assign the student a letter grade. The final percentage will be determined by a weighted average of the student's percentages earned in each of the three areas.

A 93-100%	B+ 87-89%	C+ 77-79%	D 60-69%
A- 90-92%	B 83-86%	C 73-76%	F < 60%
	B- 80-82%	C- 70-72%	

## Changes in Assignments and Schedule

The instructor reserves the right to make changes to this syllabus at any time. Changes will be announced in class and posted on Canvas. The included schedule and all deadlines are extremely tentative and will be adjusted as needed.

## Students Needing Assistance with the English Language

Several assignments in this course require English composition. If you feel you need assistance, please visit the USU Writing Center. They have tutors available to help: <http://writingcenter.usu.edu>.

## Academic Integrity - "The Honor System"

Each student has the right and duty to pursue his or her academic experience free of dishonesty. The Honor System is designed to establish the higher level of conduct expected and required of all Utah State University students.

The Honor Pledge: To enhance the learning environment at Utah State University and to develop student academic integrity, each student agrees to the following Honor Pledge: "I pledge, on my honor, to conduct myself with the foremost level of academic integrity." A student who lives by the Honor Pledge is a student who does more than not cheat, falsify, or plagiarize. A student who lives by the Honor Pledge:

- Espouses academic integrity as an underlying and essential principle of the Utah State University community;
- Understands that each act of academic dishonesty devalues every degree that is awarded by this institution;
- Is a welcomed and valued member of Utah State University.

## Plagiarism

Plagiarism includes knowingly "representing, by paraphrase or direct quotation, the published or unpublished work of another person as one's own in any academic exercise or activity without full and clear acknowledgment. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials." The penalties for plagiarism are severe. They include warning or reprimand, grade adjustment, probation, suspension, expulsion, withholding of transcripts, denial or revocation of degrees, and referral to psychological counseling.

## Sexual Harassment

Sexual harassment is defined by the Affirmative Action/Equal Employment Opportunity Commission as any "unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature." If you feel you are a victim of sexual harassment, you may talk to or file a complaint with the Affirmative Action/Equal Employment Opportunity Office located in Old Main, Room 161, or call the AA/EEO Office at 797-1266

## Students with Disabilities

Qualified students with disabilities may be eligible for reasonable accommodations. If a student has a disability that will likely require some accommodation by the instructor, the student must contact the instructor and document the disability through the Disability Resource Center (797-2444 voice, 797-0740 TTY, or toll free at 1-800-259-2966; Room 101 of the University Inn), preferably during the first week of the course. Any request for special consideration relating to attendance, pedagogy, taking of examinations, etc., must be discussed with and approved by the instructor. In cooperation with the Disability Resource Center, course materials can be provided in alternative format, large print, audio, diskette, or Braille."

## Withdrawal Policy and "I" Grade Policy

Students are required to complete all courses for which they are registered by the end of the semester. In some cases, a student may be unable to complete all of the coursework because of extenuating circumstances, but not due to poor performance or to retain financial aid. In such cases an 'I' will be submitted as the grade for the semester. The term 'extenuating' circumstances includes:

- (1) incapacitating illness which prevents a student from attending classes for a minimum period of two weeks,
- (2) a death in the immediate family,
- (3) financial responsibilities requiring a student to alter a work schedule to secure employment,
- (4) change in work schedule as required by an employer, or
- (5) other emergencies deemed appropriate by the instructor.

## Free Advice

Many of you will learn to appreciate, and may even develop a deep interest in, statistical analysis over the course of our semester together. I hope that you do as the skills you will acquire in this course will benefit you in many ways. You will see that statistical methods are tools in the social scientist's toolkit, which will help you to better interpret and understand the applied research of your given field and will be of great value to you in conducting your own research.

However, I understand that many of you are somewhat "mathephobic". Although statistics is a branch of mathematics, in this applied course we keep the level of mathematics to a minimum – arithmetic and high school algebra. So, please do not let a fear of mathematics prevent you from excelling in this course. Some of you may also fear work on the computer. The practice of modern statistics relies almost exclusively on computer software. I believe that learning a statistical computing language or syntax is key to the learning of statistics. However, you should expect some frustration as you begin to use the statistical software in this course, but as you gain experience you will come to appreciate the power of statistical software as a tool for discovery. So, be patient with yourself and the material, it comes naturally to very few.

A final word of warning: Beware technology misbehaving near deadlines. All summaries and assignments are to be turned in before the strict deadlines. Additionally, most assignments require some use of R or other software to complete them. It never ceases to amaze me how computers seem to sense when you are in a time crunch since they seem to not play nice every time I procrastinate. Work ahead as much as possible.

Date	Day	Chapter	Topic Covered in Class	Unit
6-Jan	Mon	0	Syllabus, Textbook, APA Style, & Journal Articles	1 Preparatory Topics and Exploratory Analysis
8-Jan	Wed	R	Ihno's Dataset, R/R Studio Basics, & Data Manipulation	
	--	1	Variables, Scales, Rounding, & Summation	
13-Jan	Mon	2	Exploration of Data with Plots	
15-Jan	Wed	3	Summarizing Data with Descriptive Statistics	
20-Jan	Mon	Martin Luther King, Jr. Day		
22-Jan	Wed	4	Standardized Scores & The Normal Distribution	
27-Jan	Mon	EXAM 1		
29-Jan	Wed	5	Intro to Hypothesis Testing: 1 Sample z-test	2 Foundations of Inference: 1-2 Sample Mean Differences
3-Feb	Mon	6	Confidence Interval Estimation: The t Distribution	
5-Feb	Wed	7	Independent Samples t-Test for Means	
10-Feb	Mon	8	Statistical Power & Effect Size	
12-Feb	Wed	9	Linear Correlation	
17-Feb	Mon	President's Day		
19-Feb	Wed	10	Linear Regression	
24-Feb	Mon	11	Matched t-Test	
26-Feb	Wed	EXAM 2		
--Spring Break--				
9-Mar	Mon	12	1-way Independent Groups ANOVA	3 ANOVA without Repeated Measures
11-Mar	Wed			
16-Mar	Mon	13	Multiple Comparisons	
18-Mar	Wed			
23-Mar	Mon	14	2-way ANOVA	
25-Mar	Wed			
30-Mar	Mon	EXAM 3		
1-Apr	Wed	15	Repeated Measures ANOVA	4 ANOVA with Repeated Measures
6-Apr	Mon			
8-Apr	Wed	16	2-way Mixed Design ANOVA	
13-Apr	Mon			
15-Apr	Wed	EXAM 4		
20-Apr	Mon	19	The Binomial Distribution	5 Categorical Data
		20	Chi-Squared Tests	
27-Apr	Mon	4:30-6:20 pm ← EXAM 5 "final"		