

Research Methods and Analysis for User Studies

USC Viterbi School of Engineering

Syllabus

Term: Fall 2024

Units: 4

Time: 8:00-11:20 Mondays

Location: OHE 122

Instructor: Dr. Gale Lucas

Office Hours: arranged by appointment only via email

Office hours location: Zoom meeting room <https://usc.zoom.us/j/8697807131>

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Catalogue Course Description

Introduction to research methods and data analysis techniques for human subjects research. Topics include experimental research design, correlational research, data analysis, ensuring validity and ethics.

Expanded Course Description

This course will teach data science students to properly design and analyze human subjects research. The course will enable students to:

- Acquire solid understanding of research methods that will enable students to design experiments and correlational research
- Determine the proper statistical analyses appropriate for testing research questions
- Understand the ethical issues that are relevant to designing experiments and correlational research

The course is intended for students in data science, so no prior experience with user studies, research methods, or basic statistical analysis (i.e., null hypothesis significance testing) is expected. The course topics will be particularly relevant to students interested in human-computer interaction, social robotics/agents, and the like. This class will include two quizzes and a three-part project.

Learning Objectives

After completing this course, students will be able to:

- describe the scientific methods and provide examples of its application
- explain how null hypothesis testing works and the logic and assumptions that it hinges on
- determine if a study is experimental or correlational and evaluate conclusions drawn from it accordingly
- choose the appropriate research design for their research questions, while considering both validity and ethics
- plan and evaluate choices in determining the specific design of an experiment, while considering both validity and practical factors
- select the appropriate statistical tests, for a research question, given the research design adopted

- run the statistical test using available software and understand the output
- write up and interpret the results of the statistical tests
- conduct a power analysis to determine the likelihood of finding a significant result if there is an effect

Prerequisite(s): none

Co-Requisite (s): none

Required Readings

Chrisinger, D., & Brodsky, L. (2023). Because Data Can't Speak for Itself: A Practical Guide to Telling Persuasive Policy Stories. JHU Press.

Required Software

All students will need to obtain access to a program for running basic statistical tests (e.g., R (https://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/R/R-Manual/R-Manual_print.html), SPSS, SAS etc.), as well as G*Power to run power analysis (<https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower.html>). SPSS is available to USC students through this website: <https://itservices.usc.edu/stats/spss/order/> including how to get the code and download SPSS.

Description and Assessment of Class Project

The class includes a project that will be developed by the students in 3 separate stages, getting feedback from the instructor at each stage. The purpose of the class project is for you to conduct and analyze a user study. In the iterative stages of the project, participants will lay out their research question, operationalize their variables, choose their research design, identify the population they are going to sample from (and how they will recruit the participants), determine their sample size, create an online experiment or correlational research (using survey monkey, google forms, qualtrics, etc.), distribute the study to be completed by participants from their sample, continue planned recruitment efforts until the target sample size is reached, analyze their data, and report and interpret the analyses.

Students will get approval from the instructor for running their design (class projects are conducted for educational purposes and not as research, and thus, do not require IRB approval). Students conducting the research for educational purposes in this course may use their social networks to recruit participants to complete their study. However, it is optional for students to complete the study as research, and therefore it may be published in an academic venue. Such students will need to obtain IRB approval and use a subject pool (e.g., psychology) or crowdsourcing (e.g., MTurk); students taking this option need to identify themselves to the instructor on the first day of class, and will work with them to submit the protocol to IRB and obtain access to the subject pool.

Working as a group is allowed, but individual submissions must be made for each assignment. Participants can work together to create the content for their project reports, however, they need to submit individually. That is, while using others' work (outside your group), chatGPT, etc. is considered cheating, students may have as much overlap as they wish within the group; this is allowed for the project. There is no restriction on group size other than there must be more than one group in the class.

Project example: An example project is to conduct an experiment, specifically between subjects AB testing for the design, to test whether need to belong had an effect on positive mood. Participants were randomly assigned to A (heighten need to belong) or B (satiated need to belong), and then positive mood was measured using 6 face valid items asking the extent to which the participant currently felt happy, good, pleasant, elated, joyful, and peaceful on a 1 (not at all) to 7 (very much) scale: see https://usc.qualtrics.com/jfe/form/SV_0e71c1XgPENUvXf.

Project reports: The project will be documented with 3 written reports (see schedule below) that documents the motivation for the project, methodology, results, and conclusions. The main text of each report will typically be 3-4 pages; the details of what is required for each report is provided in an "assignment" document for each report, posted on Blackboard.

Project timeline and submission: The due date for each report are listed in the Course Schedule, and available on Blackboard in the submission portal. These assignments are due at 11:59pm on the due date and *must* be submitted in Blackboard. Project assignments can be accepted up to 1 week late, however, the student *must* request a late submission ahead of time, and the assignment will be graded at 20% less than the possible points for the assignment. After one week, the assignment will not be graded. Exceptions to this “one week/planned/20% less” rule will only be made with a note from a professional: for illness or family caregiving due to illness, religious observances, USC athletic event.

Rubric: The details of what is required for each report is provided in an “assignment” document for each report, posted on Blackboard. *Follow the instructions carefully.* The project reports will be graded on completeness in answering each of the questions in each section. Students must answer all questions completely and clearly. For example, students must state their research question clearly, and it must align with the IV(s) and DV(s), including how they will be operationalized, and must select the correct statistical analysis to analyze these variables, as well as provide the correct explanation for why it's the right test. Likewise, it will be graded on completeness of the description of the study, their dataset, their pre-processing and analysis steps, as well as the extent to which students are able to clearly interpret their findings, including identifying obvious limitations of their study. How correctly it is written in APA format will also be considered for all questions that require it. The appendices will be graded based on the number of updates they missed (i.e., if they point out all parts that require updates, they will receive full credit; but points will be deducted for any necessary corrections that were missed), and all required screen shots will also likewise be counted, as per the assignment document(s).

Grades

Project: There will be a three-part project spread throughout the course (see description above).

Quizzes: Two quizzes will cover all of the material up to that point. That is, the midterm covers everything up to the midterm, and the final is cumulative for the entire course.

Grading Schema:

Project part 1:	26%
Project part 2:	26%
Project part 3:	39%
Midterm quiz:	4.5%
Final quiz:	4.5%
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Total	100%

Class Schedule

Week	Topic	Assignments	Reading
Week 1	Introduction	Assigned: Project part 1	#1-3 & fwd
Week 2	NO CLASS		
Week 3	Analysis: Logic and probability for statistics		#4-6
Week 4	Analysis: Basic statistical tests		#7-9
Week 5	User study design: Experiments		#10-12
Week 6	User study design: Correlational research		#13-15
Week 7	User study design: Validity		#16-18
Week 8	Midterm Quiz	Midterm Quiz	
Week 9	Analysis: Regression	Due: Project part 1 Assigned: Project part 2	#19-21
Week 10	Analysis: Regression		#22-25
Week 11	Analysis: Statistical power		#26-29

	User study design: Research Ethics		
Week 12	NO CLASS	Due: Project part 2 Assigned: Project part 3	
Week 13	Data analysis for project		#30-32
Week 14	WORK IN GROUPS ON #3 ON OWN		
Week 15	Final Quiz	Final quiz	

Academic Conduct and Support Systems

LLMs

The course uses quizzes as learning checks/feedback on understanding. So the percent of the total grade is 35 points for each quiz (out of 770). The remainder of the total class points (700/770) will be the project. If you are found to be using an LLM, you will fail the entire class for refusing to focus on learning. Please focus on learning so you can make progress towards the objective of the class (see above).

Honor Code

In response to recommendations made by the Academic Integrity Task Force to the Dean, the USC Viterbi School of Engineering now has an Honor Code. The code was developed by viterbi students and is as follows

Engineering enables and empowers our ambitions and is integral to our identities. In the Viterbi community, accountability is reflected in all our endeavors.

Engineering+ Integrity.

Engineering+ Responsibility.

Engineering+ Community.

Think good. Do better. Be great.

These are the pillars we stand upon as we address the challenges of society and enrich lives.

During your time here at Viterbi, please know that academic and personal resources are available to help:

- The student-driven and student-written Honor Code is here: <http://viterbi.usc.edu/academics/integrity/>.
- An introductory video is posted at <https://myviterbi.usc.edu/> under the link "Academic Integrity Introduction" and serves as a reminder of the school's emphasis in maintaining a high level of academic integrity.
- Master's and PhD students can contact the GAPP office in OHE 106 (<https://gapp.usc.edu/>) for other helpful resources.
- The Viterbi Academic and Resource Center (VARC) (<http://viterbi.usc.edu/students/undergrad/varc>) has a variety of services available.

Academic Integrity

The Viterbi School takes academic integrity violations seriously. Most of the violations that have been reported in the past fall into four categories: unauthorized collaboration, plagiarism, code sharing, and cheating on an exam. Specifically:

- Unauthorized collaboration - Unauthorized collaboration on a project, homework or other assignment. (section 11.14.B) All quizzes must be completed individually. Students that collaborate on quizzes will be referred to the Academic Integrity Coordinator.
- Plagiarism - presenting someone else's ideas as your own, either verbatim or recast in your own words - is a serious academic offense with serious consequences.
- Code sharing - Obtaining for oneself or providing for another person a solution to problem, without the knowledge and expressed consent of the instructor. (section 11.14.A)
- Cheating in an exam - this may involve a number of violations, such as looking at class notes during the exam, looking at other student's exam, "texting" with other students during the exam. See the section titled Two Exams for a list of specific violations.

Please note that that these are only the basic violations that we have encountered in the past, and there are many more. Please familiarize yourself with the discussion of plagiarism in SCampus in Section B.11.00, Behavior

Violating University Standards and Appropriate Sanctions available at <https://scampus.usc.edu/b/11-00-behavior-violating-university-standards-and-appropriate-sanctions/>.

All academic integrity violations will be referred to the Academic Integrity Coordinator of the Viterbi School of Engineering. The process for adjudicating these cases is available in SCampus, Part B, Section 13.

Other Misconduct

Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>. Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity <http://equity.usc.edu/> or to the Department of Public Safety <http://capsnet.usc.edu/departments/departments-public-safety/online-forms/contact-us>. This is important for the safety whole USC community. Another member of the university community - such as a friend, classmate, advisor, or faculty member - can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute <http://dornsife.usc.edu/ali> which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information <http://emergency.usc.edu/> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Diversity

The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. The instructors encourage and support the efforts of all of our students to contribute freely and enthusiastically. As members of an academic community, it is our shared responsibility to cultivate a climate where all students and individuals are valued and where both they and their ideas are treated with respect, regardless of their differences, visible or invisible.

Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. - 5:00 p.m., Monday through Friday. Website and contact information for DSP: http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html, (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX), ability@usc.edu.

Emergency Preparedness/Course Continuity in a Crisis

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.