Rutgers University Graduate School of Applied and Professional Psychology

Advanced Statistics and Research Design

Spring 2024

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Student Hours: by appointment

Class Meeting Location and Time: Mondays, 8:45am to 11am

Course Goal and Objectives

The primary goal of this course is to help students build upon basic knowledge of quantitative analysis using correlational and regression methods. Students will also gain proficiency in critical consumption and evaluation of quantitative research through exposure to foundational concepts in scientific methodology, study designs, and psychological measurement. This course will include lectures and lab sessions.

Primary Learning Objectives:

1. To learn about how **psychological measures** are constructed and tested in research.
2. To know a range of **research methods** to draw and generalize valid causal inferences.
3. To understand and implement techniques of **data analysis** to evaluate and report intervention efficacy and effectiveness. The techniques of data analysis will include: indices of association, general and generalized linear modeling, and advanced extensions of linear regression techniques

Readings

Required Textbooks and Journal Articles

Keith, T. Z. (2019). *Multiple Regression and Beyond* (3rd ed.). Routledge/Taylor & Francis Group.

Suggested Texts

Students are not required to purchase these texts, and readings will not necessarily be assigned from these throughout the semester. However, these might prove to be extremely useful references for future quantitative work and will be introduced during the course.

Campbell, D. T., & Stanley, J. C. (1963*). Experimental and quasi-experimental designs for research*. Houghton Mifflin Company.

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Holt, Rinehart and Winston, 6277 Sea Harbor Drive, Orlando, FL 32887.

Drost, E.A. (2011) Validity and Reliability in Social Science Research. *Education Research and Perspectives*, 38, 105- 123.

Dunn, T. J., Baguley, T., & Brunsden, V. (2014). From Alpha to Omega: A Practical Solution to the Pervasive Problem of Internal Consistency Estimation. *British Journal of Psychology*, 105, 399-412.

Gelman, A., & Hill, J. (2006). *Data analysis using regression and multilevel/hierarchical models*. Cambridge university press.

Howell, D. C. (2009). *Statistical methods for psychology*. Cengage Learning.

Judd, C.M. and Kenny, D.A. (1981) Process Analysis: Estimating Mediation in Treatment Evaluations. *Evaluation Review*, 5, 602-619.

Kaplan, R. (1987). Validity in Environment/Behavior Research. Environment and Behavior 4(19): 495-500.

Kratochwill, T. R. (2015). Single-case research design and analysis: An overview. *In Single-case Research Design and Analysis (Psychology Revivals*) (pp. 13-26). Routledge.

Pedhazur, E. J., & Schmelkin, L. P. (2013). *Measurement, design, and analysis: An integrated approach*. Psychology Press.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 1). Sage.

Schlomer G. L., Bauman S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology*, 57(1):1–10.

Spokas, M., Rodebaugh, T., & Heinberg, R. (2008). Therapy Outcome. In D. McKay (Ed.), *Handbook of research methods in abnormal and clinical psychology*. California: Sage Publications.

Williams, B., Onsman, A., & Brown, T. (2010). Exploratory Factor Analysis: A Five-Step Guide for Novices. *Australasian Journal of Paramedicine*, 8, 1-13.

Recommended Software

Although SPSS is an industry standard it is by no means the only available option for statistical computing. I created the list below for anyone who, by interest or need, would like to find something with different features or greater accessibility (e.g., lower price).

R: This is a widely used platform for statistical computing. There is no graphic user interface in the base version, and all analysis or data management is written in R syntax. This program is available for free download, as are hundreds of add-ons created and maintained by statisticians and researchers worldwide. Some of these add-ons are graphic user interfaces meant to shorten the learning curve for new users. If you plan to learn to use R, I highly recommend downloading "R Studio"—there's a free version. Contact me if you would like to have any reference materials.

JASP: This is a standalone program that is based on R but requires no knowledge of R syntax or programming in general. Also available for free download. You can accomplish essentially all analyses covered in this class using JASP. It was designed for statistics teaching but is also useful for research. The output is much cleaner than that which is provided by SPSS, and often in APA format.

PSPP: This is a completely free program designed to closely emulate SPSS, but without several of the corporate features. Usable from a terminal (text-based) or from a graphical user interface. I have not used this, but believe it provides output quite similar to that of SPSS.

jamovi: A newer program I believe to be a spin-off from JASP; developed by three former JASP developers. It has a few more bells and whistles than JASP, including a better user interface.

Assignment, Examinations and Grades

Grades in this course will be assigned based on assignment completion and test performance.

1. CITI training modules on ethics in human subjects research (required, but not graded).
2. Weekly Homework Exercises in Statistical Analysis (20%)
3. Exam #1: Correlation and Regression (30%).
4. Group Research Project (5%).
5. Practice article critique: (10%)
6. Exam #2: Research Design and Article Critique (30%)
7. Class participation: (5%)

Final course grades will be rounded to the nearest whole number (e.g., an 89.5 would be rounded to a 90, or an 89.4 would be an 89). Grading will follow Rutgers' criteria: 100-90 A; 89-85 B+; 84-80 B; 79-75 C+; 74-70 C; 69-60 D; 59-0 F

CITI Training

Each student must send me proof that s/he successfully completed the CITI training modules before the end of this semester. Although no points are associated with this assignment, any student who does not submit proof of completing this training will receive an "Incomplete" for the final grade in the course.

If you have already completed this training, and your certification is still valid (it is good for three years), just send me the PDF you received from CITI once you completed this training and you will have satisfied this course requirement.

If you have not completed this training, please visit: Collaborative Institutional Training Initiative (CITI) | Rutgers Research. This training can be completed in a few hours, and you do not have to do it in a single session. When you are finished CITI will send you a PDF, which you should send to me to satisfy this course requirement.

Weekly Homework /Exercises (n = 5): Due approximately weekly.

Several homework exercises will be assigned throughout the semester, with most of them assigned in the first half of the course. Note that grades for these exercises are only given for completion, not for accuracy. The purpose for these assignments is to ensure that students practice concepts and skills from class independently, and can receive feedback based on their performance. As such, these are regarded as formative assessments for grading purposes and accuracy will not be scored—just completion. An exercise will be scored as "complete" if adequate efforts have been made to answer all items thoroughly; exercises turned in without thorough responses to each item will be scored as "incomplete" (0 points).

Exercises and corresponding datasets will be uploaded to a CANVAS Module labeled "Homework Exercises". Students must submit the completed exercises to CANVAS by the due date to receive credit (see Assignment tab)

Examination #1: Correlation and Regression – 3/04/2024

This test will cover all material covered in the first half of the course and may require knowledge of concepts and skills from your Fall, 2023 statistics course. This exam will be open-book and open-notes and will be completed online (via Canvas) during an approximately 3-hour block of time.

Group Research Project: Due 04/08/2024

Students will divide into groups (approximately four groups) to analyze a dataset provided by the instructor. A detailed description of this project is provided on the Sakai page for this class in the "Assignments" folder under "Resources". In addition to providing you with more practice in quantitative analysis, this assignment will begin to help you integrate thinking about analytic assumptions, procedures, and interpretations with thinking about scientific rationale and research design (major themes for the second half of this course). Each group will: • fully screen, clean, and analyze the provided data set, then interpret the results; • develop a presentation (use Powerpoint or Google Docs); • present your findings in class (can present as a group or select one presenter from the team).

Article Critiques (n = 2):

Students will complete two separate critiques of quantitative research to put into practice the concepts and skills introduced during lectures in the second half of the course (after we complete exam. #1). In each critique, students must critically evaluate (1) the rationale for the conduct of the study (2) the research and analytic methods used (3) interpretations of results, and (4) implications for practice and research in psychology. You will identify two quantitative studies; at least one of which much present the results of a treatment study. Both studies must be approved by me before you begin writing your critiques. The written critiques should be between 2 and 5 pages long (double spaced), although I am much more concerned with coherence critical thinking, and completeness than overall page length or word count. A rubric with more detailed instructions for these critiques will be placed in the "Assignments" tab in CANVAS.

Examination #2: Measurement, Design, & Analysis

This exam, as with exam #1, will be open-book and open-note, and will be open on Canvas for a specified window of time. Students will be provided with 3 hours to complete this exam (unless otherwise specified). The focus of this exam will be to provide a formal critique of a quantitative research article. The critique should incorporate research methodology and design principles introduced during the second half of the course as well as statistical concepts and knowledge addressed in the first half of the class (and potentially other stats courses). In critiquing an article, students must critically evaluate (1) the rationale for the conduct of the study (2) the research and analytic methods used (3) interpretations of results, and (4) implications for practice and research in psychology. A rubric with more detailed instructions for these critiques will be placed in the "Assignments" tab in CANVAS.

Course Policies and Expectations

Important Notice: The faculty and staff at Rutgers are committed to your success. Students who are successful tend to seek out resources that enable them to excel academically, maintain their health and wellness, prepare for future careers, navigate college life and finances, and connect with the RU community. Resources that can help you succeed and connect with the Rutgers community can be found at success.rutgers.edu, and nearly all services and resources that are typically provided in-person are now available remotely.

Attendance

Consistent with university and GSAPP guidelines, our program requires that students take their courses in person (as opposed to virtual or online). Students are expected to be punctual and attend all classes. If an absence needs to occur, regardless of the reason, students should inform the instructor prior to the class session. As per departmental guidelines, students who do not attend class in person are considered absent. Students are permitted one excused absence without penalty. Students who have more than one absence are subject to losing points for their participation grade. Students are individually responsible for all assignments or coursework for missed classes, which includes but not limited to getting notes from classmates or asking classmates to record the class with the instructor's permission.

Professional behavior

All students are expected to display appropriate professional behavior. Examples of desired behaviors include: (a) treating others with respect and dignity, (b) bringing any personal concerns or issues in an appropriate and respectful way to the instructor, (c) using technology for educational and class-related purposes only, such as using computers for reviewing or taking notes or viewing PowerPoint slides. Examples of inappropriate uses of technology include but are not limited to surfing the internet, texting, reading/sending emails, and texting or using one's phone for matters unrelated to class. Students should inform the instructor if there is an emergency that may require the use of their phone or related device. Students who engage in inappropriate use of technology or who engage in other unprofessional behaviors during class time or in relation to course activities are subject to having their grades lowered over and above that considered for the participation grade.

Assignments

Students are required to complete all assignments (i.e., homework, practice critique) on time, as indicated on the course schedule. Students are encouraged to contact the instructor well in advance of the due date if extenuating circumstances arise that prevent submission of assignments on time.

Accommodation procedures for persons with disabilities

Rutgers University welcomes students with disabilities into all the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: https://ods.rutgers.edu/students/documentation-guidelines. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodation with them as early in your courses as possible. To begin this process, please complete the Registration form(https://webapps.rutgers.edu/student-ods/forms/registration).

Names and Pronouns

Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Respect for Diversity

It is my intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a resource, strength, and benefit. It is my intent to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture. Your suggestions are encouraged and appreciated.

Tentative Course Schedule

Week	Date	Topics Covered	Readings	Assignment Due
1	22-Jan	Data, correlation and simple linear regression.	Schlomer et al. (2010), Keith, Appendix B	CITI training Due Fridy 01/27 5pm
2	29-Jan	Simple Linear Regression	Keith (2019); Ch. 1&2	Homework #1 – Due Friday 02/02 5pm
3	5-Feb	Multiple Regression	Keith (2019); Ch. 3&4	Homework #2 – Due Friday 02/09 5pm
4	12-Feb	Modelling with categorical predictors, & model selection strategies	Keith (2019); Ch. 5&6	Homework #3 – Due Friday 02/16 5pm
5	19-Feb	Moderation in MR	Keith (2019); Ch.7	
6	26-Feb	Logistic Regression	Keith (2019); Ch.10	Homework #4 – Due Friday 03/01 5pm
7	4-Mar	**Exam #1** Details of exam (time/online process) will be TBD		
8	11-Mar	**SPRING BREAK – NO CLASS**		
9	18-Mar	Psychological Measurement: • Classical test theory & modern test theory • Construct validation • Instrument development	Murphy & Davidshofer (1991);	
10	25-Mar	Procedures to evaluate psychometric properties of test scores • Internal consistency & reliability • MTMM; Analysis of factor structure	Williams et al. (2010). Intro & Guide to EFA; Dunn, Baguley, & Brundsen (2014)	
11	1-Apr	Psychometrics & the use of psychological tests: • Screening, Diagnosis, & Measurement of Change		Homework #5 – Due Friday 04/05 5pm
12	8-Apr	Science and the scientific method, and four types of validity. Critical consumption of quantitative psychological research	Judd & Kenny (1981); Kaplan (1987); Drost (2011); APA JARS & MARS	Group Research Project

13	15-Apr	Treatment outcome research • RCTs and other forms of group designs	Spokas (2008)	Practice Article Critique #1 Due
14	22-Apr	Single Case Designs (SCD)		
15	29-Apr	Treatment outcome research, cont. • Effect Sizes • Quasi-experimental designs	Cook (2008)	Practice Article Critique #2 Due
16	6-May	**Exam #2** - Details of exam (time/online process) will be TBD		