Rutgers University
Graduate School of Applied and Professional Psychology
Advanced Statistics and Research Design
Spring 2025

Professor: Timothy Cleary
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Student Hours: Monday – 2:00-3:30 (and by appointment)

Class Meeting Location and Time:

Wednesdays, 8:45am to 11:30am
Smithers building: 200

Course Description

This course is designed to provide students with experience conducting and interpreting multiple regression analyses and understanding more advanced statistical topics (e.g., moderation, mediation, power). This course will also provide students with an overview of common research designs and methodologies, along with the issues about the threats to valid inference and interpretation of research results. Finally, the course addresses psychometrics and measurement issues in psychology and considers how culture and race may play a role in statistical analyses and interpretation. The material presented in this course will provide the necessary knowledge and skills for critically analyzing and evaluating research.

Profession-wide Competencies and Discipline-Specific Knowledge

School Psychology Profession-Wide Competency (SP-PWC) Elements

1.1: Critically evaluates and synthesizes the research literature to formulate research questions and hypotheses.
1.2*: Designs studies and applies principles of scientific method to generate new knowledge.
1.3: Critically interprets and applies empirical findings to address problems, make decisions, and enhance the social, behavioral, and/or academic functioning of children and youth.
* Note: Students will not be expected to explicitly design as specific research, but they will learn how to apply research design principles to guide and evaluate research

Learning Objectives

At the end of this course, students will be able to:

1) define, describe, and/or interpret a broad array of multiple regression principles and metrics including ordinary least squares, R, R^2, beta coefficients, partial and semi-partial correlations
2) demonstrate knowledge of key factors influencing multiple regression results (e.g., sample size, restriction of range, outliers, order of PV entry)
3) use SPSS or other relevant statistical software to run and analyze multiple regression results
4) demonstrate basic knowledge of advance regression techniques (e.g., mediation, moderation)
5) demonstrate knowledge of measurement theory and concepts related to test reliability
6) demonstrate knowledge of the broad array of validity concepts related to research design and measurement
7) discuss and explain similarities and distinctions among quantitative research designs

8) critique and evaluate empirical research in terms of the rationale, methods, statistical analyses, and conclusions

Assessment of Learning Objectives

Student competencies in attaining course objectives will be evaluated using course exams, homework assignments, and/other course-related projects.

Assignments and Examinations

Overview of Assignments & Exams

1. **CITI training modules** on ethics in human subjects research (required, but not graded).
2. **Homework Assignments** targeting regression analyses (10%)
3. **Exam #1:** Correlation and Regression (40%)
4. **Practice article critiques:** (7%)
5. **Exam #2:** Article Critique (35%)
6. **Class participation:** (8%)

A = 90–100
B+ = 86-89
B = 80-85
C = 70-79
F = < 70

CITI Training

Each student must send me proof that s/he 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). Please send me the CITI certificate showing you have satisfied this course requirement. If you ***have not completed*** this training, please visit: https://orra.rutgers.edu/citi. This training typically takes a couple of hours to complete, and you do not have to do it in a single session. After completing the course, please email me the CITI certificate to satisfy this course requirement.

Homework Assignments in Statistical Analysis (10%)

Several homework assignments involving regression analysis will be assigned during the first six weeks of the semester. The primary purposes of the exercises are to (1) provide opportunities to extend and expand knowledge of statistical concepts taught in class, and (2) provide opportunities to use SPSS to examine regression-related questions. These assignments will be evaluated for completion, not accuracy. An exercise will be scored as "complete" if adequate efforts have been made to answer all questions thoroughly; exercises turned in without thorough responses to each question will be scored as "incomplete" (0 points). I will review and provide feedback for **late homework assignments (no more than 2 days) but students will only receive half credit.** I will not review assignments over 2 days late, and students will receive no credit for that assignment. Students will be provided an "Answer Key" for each homework assignment and are expected to use that key to evaluate their responses.

Examination #1: Multiple Regression and Related concepts (in-person test) (40%)

This in-person exam will be a "limited" open book addressing all statistics-related material covered in the first half of the course. It will extend prior knowledge of concepts and skills obtained from the Fall Statistics course at GSAPP. The specific format for the exam will be communicated during the semester. It will be administered in person during an approximately 3-hour block of time.

Practice Article Critique (7%)

Students will be asked to perform several "partial" critiques of empirical articles, and at least 1 "full" article critiques during the second half of the semester. Like the statistics homework assignments, these critiques will be evaluated for completion only. Completion will be determined by the adequacy of efforts made to answer all questions thoroughly; exercises turned in without thorough responses to each question will be scored as "incomplete" (0 points). Late assignments will be accepted **(no more than 2 days), but students will only receive half credit.** Any assignment handed in more than two days late will receive 0 points. Specific details regarding the content and structure of the critiques will be shared and practiced during class. Students will be provided an "Answer Key" for each homework assignment and are expected to use that key to evaluate their responses.

Examination #2: Article Critique Exam (online test) (35%)

This in-person exam will be a "limited" open book and will mirror the comprehensive exam procedures for the research question. Students will be provided a 3-hour timeframe to complete the exam. The critique should incorporate research methodology and design principles introduced during the second half of the course (validity, nature of design, adequacy of measures, rationale for study, etc.) 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) analyses and interpretations of results, and (4) the overall conclusions and sophistication of the student and corresponding findings. A rubric with more detailed instructions for these critiques will be placed in the "Assignments" tab in CANVAS.

Class Participation (8%)

At the doctoral level, students are expected to regularly participate in small group activities, class discussions, and other activities related to the lessons' objectives. Students are also expected to attend all in-person classes (see Attendance below).

Course Policies and Expectations

Important Notice: The faculty and staff at Rutgers are committed to your success. Successful students 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.

1. 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 with more than one absence or who are tardy multiple times are subject to losing points for their participation grade. Students are responsible for all missed lectures or assignments and are expected to take the necessary steps for

learning, such as getting notes from classmates or asking classmates to record the class with the instructor's permission.

2. Professional behavior – All students are expected to display appropriate professional behavior. Examples of desired behaviors include: (a) treating others with respect and dignity, (b) contacting the instructor with any personal concerns or issues and addressing such concerns appropriately and respectfully, (c) using technology ONLY for educational and class-related purposes, 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 are subject to having their grades lowered over and above that considered for the participation grade.

3. Assignments - students are required to complete all assignments (e.g., homework, and practice critiques) 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 the submission of assignments on time.

4. Accommodation procedures for persons with disabilities - Rutgers University welcomes students with disabilities into all the University's educational programs. To receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office where they 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 Accommodation. 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).

5. 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 I may make appropriate changes to my records.**

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

7. **Use of AI**: Unless otherwise indicated in this syllabus, assignment directions, or other course activities, all work submitted in this course must be the student's own and created without the aid of impermissible technologies, materials, or collaborations. While spelling and grammatical technologies (e.g., Grammarly) are permissible, students **cannot** use AI technologies for exams, article critiques, or answering homework questions. AI technology is permissible for refining one's understanding of concepts taught in class or helping students brainstorm ideas regarding applying course concepts.

Required Books

Meyers, Lawrence S., Gamst, G., & Guarino, A. J. (2017). *Applied multivariate research: Design & interpretation* (3rd ed). Sage. ISBN: 978-1-5063-2976-5.

Kitsantas, A., Cleary, T. J., DiBenedetto, M. K., & Hiller, S. E. (2024). *Essentials of research methods for educators*. Sage. ****Please note:** I will be purchasing this book for the class. You will receive an access code to Sage Vantage.

Highly Recommended Books

Keith, T. Z. (2019). *Multiple Regression and Beyond* (3rd ed.). Routledge/Taylor & Francis Group.
McMillan, J., & Schumacher, S. (2014). *Research in education: Evidence-based inquiry* (7th ed.). Pearson.

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education (Eds.). (2014). *Standards for educational and psychological testing*. American Educational Research Association.

Required Articles or Chapters

**Ansley, B. M., Houchins, D. E., Varjas, K., Roach, A., Patterson, D., & Hendrick, R. (2021). The impact of an online stress intervention on burnout and teacher efficacy. *Teaching and Teacher Education, 98*, Article 103251 https://doi.org/10.1016/j.tate.2020.103251

**Bui, Y., & Fagan, Y. (2013). The effects of an integrated reading comprehension strategy: A culturally responsive teaching approach for fifth-grade students' reading comprehension. *Preventing School Failure*, *57*(2), 59–69. https://doi.org/10.1080/1045988X.2012.664581

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

Castillo, W., & Gilborn, D. (2022). *How to "QuantCrit": Practices and questions for education data researchers and users*. (EdWorkingPaper No. 22-546). Retrieved from Annenberg Institute at Brown University. https://doi.org/10.26300/v5kh-dd65.

**Cleary, T. J., & Kitsantas, A. (2017). Motivation and self-regulated learning influences on middle school mathematics achievement. *School Psychology Review*, *46*(1), 88-107. https://doi.org/10.1080/02796015.2017.12087607

**Cleary, T. J., Velardi, B., & Schnaidman, B. (2017). Effects of the Self-Regulation Empowerment Program on middle school students' strategic skills, self-efficacy, and mathematics achievement. *Journal of School Psychology*, *64*, 28-42. http://doi:10.1016/j.jsp.2017.04.004

**Cleary, T. J., & Zimmerman, B. J. (2001). Self-regulation differences during athletic practice by experts, non-experts, and novices. *Journal of Applied Sport Psychology, 13*(2), 185-206. http://doi:10.1080/104132001753149883

Cohen, J. (1992) A power primer. *Psychological Bulletin*, 112, 155-159.

Drost, E. A. (2011). Validity and reliability in social science research. *Education Research and Perspectives, 38(1)*,105-123.

Dunn, T. J., Baguley, T., and Brundsen, V. (2014). From alpha to omega: A practical solution to the pervasive problem of internal consistency estimation. *British Journal of Psychology, 105*, 399-412.

Fagley (1985). Applied statistical power analysis and the interpretation of nonsignificant results by research consumers. *Journal of Counseling Psychology*, 32, 391-396.

**Fuchs et al. (2021). A quasi-experimental evaluation of two versions of first grade PAKS: One with and one without repeated reading. *Exceptional Children, 87(2)*, 141-162.

**Hartley et al (2015). Comparative study of bullying victimization among students in general and special education. *Exceptional Children, 81(2)*, 176-193

**Hoogeveen et al. (2012). Social-emotional characteristics of gifted accelerated and non-accelerated students in the Netherlands. British Journal of Educational Psychology, 82(4), 585-605.

**Huk et al. (2019). Predicting teacher burnout as a function of school characteristics and irrational beliefs. *Psychology in the Schools, 56(5)*, 792-808.

**Kremer & Kremer (2019). Bullying victimization and disability status are associated with television watching in adolescence. *Journal of Child and Family Studies, 28(12)*, 3479-3486.

McDaniel, S. C., Houchins, D. E., & Robinson, C. (2016). The effects of Check, Connect, and Expect on behavioral and academic growth. *Journal of Emotional & Behavioral Disorders*, *24*(1), 42–53. https://doi.org/10.1177/1063426615573262

Maxwell, S. E. (2000) Sample size and multiple regression analysis, *Psychological Methods, 5(4), 434-458*.

Streiner, D. L. (2003). Starting at the beginning: An introduction to coefficient alpha and internal consistency. *Journal of Personality Assessment, 80(1),* 99-103.

**** Articles assigned for the article critique practice and discussion**

Additional resources or supplemental books

Students are **not required** to purchase these texts, as readings will not be assigned from these throughout the semester. However, these resources might prove to be extremely useful for future quantitative work.

Kazdin, A.E. (1998). *Research design in clinical psychology* (3rd/4th ed. 2002). Allyn & Bacon.

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

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Allyn & Bacon.

Statistical Software

SPSS will be emphasized in this course. Although other software is available (see below for informational purposes), we will be focusing exclusively on SPSS regarding homework assignments. Students are free to use other statistical software if that better aligns with their skillset or preferences. The expectations for all assignments are the same regardless of software that is used.

Course Schedule

Week	Topics Covered	Class Readings/	Assignment Due
1 **Jan 22**	**Key objectives**: REVIEWING/EXPANDING ON CORRELATION CONCEPTS (1) Overview of design of course/review syllabus (2) Overview of correlation – focus on covariation and pattern principles (3) Understand statistical significance and correlation (multiple approaches)	*Required readings* (1) Meyers et al (2017); **Ch. 1 (pp.20-25); 4a (pp. 124-138).** (2) Kitsantas et al. (2024) – **Ch. 12 (LO 12.1; LO 12.7)**	**Homework #1** – Due Monday **Jan 27th** 12am (midnight) ** ***Use Life Satisfaction dataset***
2 **Jan 29**	**Key objectives**: KEY ISSUES IN SIMPLE LINEAR REGRESSSION (1) Practice quiz/HW review (2) Review of Simple Linear Regression (equate to Pearson r) (3) Discuss ordinary least square rule (4) Review SPSS regression output – what do the results mean? - discuss R and R^2 - F-table results - sum of squares (Total, regression, residual) - introduction to the meaning of Beta coefficients (5) Brief into MLR (time permitting)	*Required readings* (1) Meyers et al (2017); **Chs 4a (pp. 139-148); 4b (pp. 149-156); Ch 5 (pp.158-164; 168-174; 180-183)** *Supplemental* (1) Keith (2019); **Ch 1 (pp.3-12); Chs. 2 (pp.31-38); Ch 3 (50-53)**	**Homework #2** – Due Monday **Feb 3rd** 12am (midnight) ** ***Use Depression dataset***
3 **Feb 5**	**Key objectives**: KEY CONCEPTS IN MULTIPLE LINEAR REGRESSION (1) Introduce two and three predictor regression models (2) Review SPSS output - dissecting the meaning of R^2, and its relation to r, semi-partial and Beta - consider two key MLR questions (model, predictors) (3) Differentiate shared and unique variance (Ballantine) (4) Discuss importance of descriptive statistics (5) Problems with multi-collinearity	*Required readings* (1) Meyers et al (2017); **Ch 3 (generally review); Chs 5a (pp. re-read 157-174; 176-178; 189-190); 5b (review SPSS procedures)** *Supplemental* (1) Keith (2019); **Chs. 2 (re-read pp.31-36; 41-42) and 3 (pp.44-47); Ch. 10 (pp.216-221)**	**Homework #3** – Due Monday **Feb 10th** 12am (midnight) ** ***Use Expanded Life Satisfaction dataset***

4 **Feb 12**	**Key objectives**: APPLICATIONS OF BETA AND TYPES OF MR (1) Expand applications of unstandardized vs standardized beta (2) Introducing four predictor regression models – "more of the same" (3) Examine three types of MR (simultaneous (standard), sequential (hierarchical), stepwise (backward, forward)	*Required readings* (1) Meyers et al (2017); **Chs 5a (re-read pp. 180-184; 185-189); 5b (review SPSS procedures); 6a (pp. 205-208); 6b (pp. 231-238)** *Supplemental* (1) Keith (2019); **Ch. 2 (re-read pp., 31-41); Ch. 4 (review pp.57-64); Chapter 5 (ignore stepwise)**	**Homework #4** – Due Monday **Feb 17th** 12am (midnight) ** ***Use Depression dataset***
5 **Feb 19** **Hybrid class (NASP)**	**Key objectives:** ADVANCED ISSUES – CATEGORICAL VARIABLES AND MODERATION (1) Review of hybrid lecture (2) Introduction to categorical PV's (3) Moderation (1 categorical; 1 continuous PV)	*Required readings* (1) Meyers et al (2017); **Ch 6a (pp. 213-220; 220-230 (mediation))** *Supplemental* **(1) Keith (2019); **Ch 6 (pp.108-116); Ch. '[p;'7 (pp.129-141)**	**Homework #5** – Due Monday **Feb 24th** 12am (midnight) ** ***Use Disaster dataset***
6 **Feb 26**	**Key objectives**: POWER AND EFFECT SIZE (1) Continue moderation/mediation lecture (if needed) (2) Brief example of mediation (time permitted) (3) Power analysis and effect sizes	*Required readings* (1) Meyers et al (2017); **Chs 1 (pp. 20-30)** (2) Keith (2019); **Ch 4 (pp. 62-63); Ch.10(pp. 216-221)** (3) Cohen (1992) *Supplemental readings* (1) Fagley (1985) **(focus on the arguments made about underpowered studies)** (2) Maxwell (2000) **(very technical but a good foundation)**	**Partial Article critique #1 (Practice)** Due Monday **March 3** 12am (midnight) Lenger and Gordon (2019)
7 **March 5**	**Key objectives**: REVIEW FOR TEST AND OVERVIEW OF SCIENTIFIC METHOD AND DESIGN (1) Review Study Guide – questions about concepts (2) QuantCrit (3) Role of research design in the research process and the importance of validity	*Required readings* (1) Study Guide (2) Kitsantas et al. (2024) – **Ch 1 (Intro; LO 1.1-1.2); Ch 3 (Intro; LO 3.2, 3.3, 3.5)** (3) Castillo and Gillborn (2022)	
8 **March 12**	**In Person Exam #1**		**Exam #1 (statistics)**

	Details of exam)		
Mar 19	SPRING BREAK – NO CLASS		
9-10 **Mar 26** **April 2**	**<u>Key objectives</u>**: SAMPLING AND MEASUREMENT (1) Classical test theory (2) Reliability of test scores (alpha; test-retest) (3) Construct validation (4) Sampling procedures (characteristics of sample) (5) Practice critique of articles (Mathers & Walker, 1999; Lenger & Gordon, 2019)	*<u>Required readings</u>* (1) Kitsantas et al (2024) – **Ch 3 (LO 3.5); Ch 10 (Intro; LO 10.1-10.2; 10.4-10.7); Ch 16 (Intro; LO 16.2)** (2) AERA (2014) – Testing Standards - **Chs. 1 (pp. 11-22), 2 (pp. 33-40); and 4 (pp. 75-84)** (3) Meyers et al (2017); **Ch 10a (pp. 20-30)** *<u>Supplemental readings</u>* (1) Drost (2011) – excellent supplement to key validity and reliability concepts (2) Dunn (2014) – addresses the issue of alpha vs omega (technical difference but trend is toward omega0029 (3) Streiner (2003) **(4) Lenger and Gordon (2019) **(5) Mathers and Walker (1999)	**Partial Article critique #2 (Practice)** Due Monday **March 31st** 12am (midnight) Lenger and Gordon (2019)
11 **April 9**	**<u>Key objectives</u>**: NON-EXPERIMENTAL DESIGNS (1) Review Key Research Design Principles (2) Discussion and interpretation of descriptive/survey, correlational, and ex post facto (comparative) designs (3) Practice critiques of articles	*<u>Required readings</u>* Kitsantas et al. (2024) – **Ch 4 (Intro; LO 4.1-4.4);** *<u>Supplemental readings</u>* (look at design/stats only) (1) Huk et al. (2019) **(Correlational)** (2) Cleary & Kitsantas (2017) **(Correlational)** (3) Hartley et al (2015) **(Comparative)** (4) Cleary & Zimmerman (2001) **(Comparative)**	**Partial Article critique #3 (Practice)** Due Monday **April 7th** 12am (midnight) Lenger and Gordon (2019)
12 & 13 **April 16 and 23**	**<u>Key objectives</u>**: EXPERIMENTAL DESIGNS (1) Finish non-experimental designs (if needed) (2) Importance of internal validity (3) Discussion and interpretation of true experiments (RCT) and quasi-experiments (4) Practice critique of articles	*<u>Required readings</u>* (1) Kitsantas et al (2024) – **Ch 3 (LO 3.5); Ch.5 (Intro; LO 5.1-5.5)** *<u>Supplemental readings</u>* (1) Campbell & Stanley (1963) – **pp. 6-16** (2) Bui et al (2013) **(QUASI - Nonequivalent PP design)**	**Full Article critique #1 (Practice)** Due Monday **April 21st -** 12am (midnight) Benson et al (2020)

		(3 Fuchs et al. (2021) - **(QUASI - Nonequivalent PP design)** (4) McDaniels et al (2016) **(QUASI - Single group interrupted time series)** (5) Ansley et al (2021) **(TRUE -Pretest-posttest)** (6) Cleary et al (2017) **(TRUE - Pretest-postest)**	
14 **Apr 30**	**<u>Key objectives</u>**: ARTICLE CRITIQUE PRACTICE (1) Review of comprehensive exam structure - key topics of research (sample, effect size/stat significance, design, theory and rationale) (2) Review practice article critique #1 (3) Group exercise to review 1 additional article	(1) Kitsantas et al (2024) – **Ch 15 (Intro; LO 15.3-15.4); Ch. 16 (Intro; LO 16.2)** (2) Additional critique handouts	
15 **May 7th**	**<u>Exam #2</u>** - Details of exam will be TBD	TBD	**Exam #2 (article critique)**