Western University
Psychology
PSY 9552B
Regression and Factor Analysis Methods
Winter 2026
Tue 1:00pm-4pm

Enrollment Restrictions

Enrollment in this course is restricted to graduate students in Psychology as well as any student in another program (pending class size) who has obtained special permission to enroll in this course from the course instructor as well as the Graduate Chair (or equivalent) from the student's home program.

Instructor and Information

Instructor: Paul F. Tremblay
Office: SSC 6336
Office Phone: (519) 661-2111 x85644
Office Hours: by appointment
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Teaching Assistant: Megan Lindloff

Course Description

This course covers various regression-based procedures that fall within the general linear model as well as an introduction to generalized linear model methods such as logistic, multinomial, ordinal and poisson regression. Within multiple linear regression, we cover moderation and non-experimental design in depth including concepts of causality and methods of statistical control. We consider limitations of traditional mediation designs and improved methods. The course includes demonstrations of the parallels between regression methods and both ANOVA and ANCOVA, and also introduces multilevel modeling. Also covered are factor analytic methods including exploratory and confirmatory approaches in the context of test construction and validation. The course work consists entirely of lab assignments that provide hands-on training in generating hypotheses and designs, conducting power analyses and analyzing data, interpreting and reporting results. Demonstrations are provided using various software (e.g., R, Jamovi, JASP, Mplus, and SPSS).

Course Format

Lectures in person

Course Learning Outcomes/Objectives

Upon completion of this course, students should be able to:

1. Design, conduct power analyses, analyze and report studies using regression approaches.
2. Test for moderation (i.e., interactions) and report using up-to-date methods.
3. Critically evaluate the limitations of traditional mediation methods and apply the new guidelines.
4. Design, analyze, and interpret the two basic designs in multilevel modeling (people within groups, and repeated observations within people).
5. Analyze, interpret, and report exploratory and confirmatory factor analyses.

Course Materials

The following textbooks are optional and can serve as secondary resources. They will be available online through our Western library and can be accessed through the OWL course page. You will be able to download sections in pdf.

Darlington, R. B., & Hayes, A. F. (2016). *Regression Analysis and Linear Models: Concepts, Applications, and Implementation*. Guilford.

Hahs-Vaughn, D. L. & Lomax, R. G. (2020). *An introduction to statistical concepts. Fourth Edition*. Routledge.

A list of supplementary articles and book chapters (available electronically through the library system or in the OWL course website) are listed below by lecture topics. These are additional resources that may serve you beyond this course in your own research. I will discuss most of these in my lecture material.

Methods of Evaluation

The course work consists entirely of **6 equally weighted (~16.5% each)** lab assignments provided every two weeks starting Jan 13. You will have two weeks to complete each assignment. These assignments provide hands-on training by having you generate hypotheses, analyze data, interpret and report results, write mini research proposals, or evaluate published research. My lectures and demonstrations include presentations in R (and the related Jamovi software) and SPSS. Students are allowed to work in any software package or programming language of their choice including any not mentioned above (e.g., SAS, Stata, Python or MATLAB).

Assignment reports will typically consist of a two double-spaced page write-up including a short method section, results section including tables and/or figures, interpretation and discussion of results, answers to specific questions, and an appendix with analysis output.

Late assignments will receive a 5% deduction per 24 hours. Assignments that are more than one week late will not be accepted for partial marks unless you have contacted me to request an extension. All assignments must be completed to pass the course.

You are expected to attend most lectures. Missing two lectures requires informing me of each additional absence. Otherwise, I will contact your supervisor to enquire about your frequent absences.

Rules about working in groups. I am supportive of students working in pairs or groups to conduct the analyses and discuss the assignments. However, you are required to write your own report with no duplication from your colleagues' work. The assignments will often require you to choose a subset of variables, to make decisions about plausible strategies, or to describe research ideas from your own area of interest. Also, some questions will ask you to design your own hypothetical research designs. As a result, it is unlikely that two students will work with the exact same material.

Assignment	Due date	Topic
Lab1	Jan 27	Bivariate regression
Lab2	Feb 10	Multiple regression
Lab3	Mar 3	Moderation
Lab4	Mar 17	Mediation
Lab5	Mar 31	Multilevel modeling
Lab6	Apr 14	Factor analysis and CFA

Assignments are provided two weeks before the due date.

Course Timeline

Week	Date		Suggested chapters from two books*
1	Jan 6	Measures of Association and their Inferential Tests	[H&L 8,10]
2	Jan 13	Bivariate Linear Regression	[D&H 2][H&L 17]
3	Jan 20	Multiple Correlation – Statistical Control Methods	[D&H 1,3] [H&L 18]
4	Jan 27	Multiple Regression (MR)	[D&H 3,4,5,8,16] [H&L 18]
5	Feb 3	Categorical Predictors in MR, similarity to ANOVA	[D&H 9,10]
6	Feb 10	Moderation in MR	[D&H 13,12,14] [H&L 20]
	Spring R		
7	Feb 24	Mediation in MR and Extensions	[D&H 15] [H&L 20]
8	Mar 3	Logistic Regression and Other Regression Models	[D&H 18] [H&L 19]
9	Mar 10	Multilevel Modeling-I – Subjects Within Groups	
10	Mar 17	Multilevel Modeling-II – Repeated Observations	
11	Mar 24	Factor Analysis	
12	Mar 31	Confirmatory Factor Analysis part 1	
13	Apr 7	Confirmatory Factor Analysis part 2	

* D&H: Darlington & Hayes (2016); H&L: Hahs-Vaughn & Lomax (2020)

Additional resources for lecture topics

Jan 6.
Bishara, A. J., & Hittner, J. B. (2012). Testing the significance of a correlation with nonnormal data: Comparison of Pearson, Spearman, transformation and resampling approaches. *Psychological Methods*, *17*, 399-417.

de Winter, J. C. F., Gosling, S. D., & Potter, J. (2016). Comparing the Pearson and Spearman correlation coefficients across distributions and sample sizes: A tutorial using simulations and empirical data. *Psychological Methods*, *21*, 273-290. http://dx.doi.org/10.1037/met0000079

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149-1160. doi:10.3758/BRM.41.4.1149

McHugh, M. L. (2013). The chi-square test of independence. *Biochemica Medica*, *23*, 143-149. http://dx.doi.org/10.11613/BM.2013.018

Jan 13.
See book chapters

Jan 20.
Becker, T. E. (2005). Potential problems in the statistical control of variables in organizational research: A qualitative analysis with recommendations. *Organizational Research Methods*, *8*, 274-289. doi: 10.1177/1094428105278021

Rohrer, J. M. (2018). Thinking clearly about correlations and causation: Graphical causal models for observational research. *Advances in Methods and Practices in Psychological Science, 1*, 27-42. DOI: 10.1177/2515245917745629

Jan 27.
Hoyt, W. T., Leierer, S., & Millington, M. J. (2006). Analysis and interpretation of findings using multiple regression techniques. *Rehabilitation Counseling Bulletin*, *49*, 223-233.

Williams, M. N., Gomez Grajales, C. A., & Kurkiewicz, D. (2013). Assumptions of multiple regression. Correcting two misconceptions. *Practical Assessment, Research & Evaluation*, *18(11)*. Available online: https://pareonline.net/getvn.asp?v=18&n=11.

Feb 3.
See book chapters

Feb 10.
Hayes, A. F., & Rockwood, N. J., (2017). Regression based statistical mediation and moderation analysis in clinical research: Observations, recommendations and implementation. *Behaviour Research and Therapy*, 98, 39-57. http://dx.doi.org/10.1016/j.brat.2016.11.001

Murphy, K. R., & Russell, C. J. (2017). Mend it or end it: Redirecting the search for interactions in the organizational sciences. *Organizational Research Methods*, *20*, 549-573. doi: 10.1177/1094428115625322

Feb 24.
Hayes, A. F., & Rockwood, N. J., (2017). Regression based statistical mediation and moderation analysis in clinical research: Observations, recommendations and implementation. *Behaviour Research and Therapy*, 98, 39-57. http://dx.doi.org/10.1016/j.brat.2016.11.001

Hayes, A. F., & Rockwood, N. J. (2020). Conditional process analysis: concepts, computation, and advances in the modeling of the contingencies of mechanisms. *American Behaviorist Scientist*, 64(1), 19-54. DOI: 10.1177/0002764219859633

Kline, R. B. (2015) The Mediation myth. *Basic and Applied Social Psychology*, *37*, 202-213. doi:

10.1080/01973533.2015.1049349

Schoemann, A. M., Boulton, A. J., & Short, S. D. (2017). Determining power and sample size for simple and complex mediation models. *Social Psychological and Personality Science*, *8*, 379-386. DOI: 10.1177/1948550617715068

Mar 3.

Coxe, S., West, S. G., Aiken L. S. (2009). The analysis of count data: A gentle introduction to poisson regression and its alternatives. *Journal of Personality Assessment*, *91*, 121-136. doi: 10.1080/00223890802634175

Huang, F. L., & Moon, T. R. (2013). What are the odds of that? A primer on understanding logistic regression. *Gifted Child Quarterly*, *57*, 197-204. doi: 10.1177/0016986213490022

Mar 10.

Kahn, J. H. (2011). Multilevel modeling: Overview and applications to research in counseling psychology. *Journal of Counseling Psychology*, *58*, 257-271.

Nezlek, J. B. (2008). An introduction to multilevel modeling for social and personality psychology. *Social and Personality Psychology Compass*, 2(2), 842-860.

Peugh, J. L. (2010). A practical guide to multilevel modeling. *Journal of School Psychology*, *48*, 85-112. doi:10.1016/j.jsp.2009.09.002

Brown, V. A. (2021). An introduction to linear mixed-effects modeling in R. Advances in Methods and Practices in Psychological Science, 4, 1-19. doi: 10.1177/2515245920960351

Mar 17.

Kahn, J. H. (2011). Multilevel modeling: Overview and applications to research in counseling psychology. *Journal of Counseling Psychology*, *58*, 257-271.

Muradoglu, M., Cimpian, J. R., & Cimpian, A. (2023). Mixed-effects models for cognitive development researchers. *Journal of Cognition and Development*, *24*, 307-340. https://doi.org/10.1080/15248372.2023.2176856

Peugh, J. L. (2010). A practical guide to multilevel modeling. *Journal of School Psychology*, *48*, 85-112. doi:10.1016/j.jsp.2009.09.002

Mar 24.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, *4*, 272-299. doi: 10.1037//1082-989X.4.3.272

Watkins, M. W. (2018). Exploratory factor analysis: A guide to best practice. *Journal of Black Psychology*, *44*, 219-246. doi: 10.1177/0095798418771807

Mar 31 and Apr 7.

Kline, R. B. (2013). Exploratory and confirmatory factor analysis. In Y. Petscher, C. Schatsschneider, & D. L. Compton (Eds.), *Applied quantitative analysis in the social sciences* (pp. 171–207). Routledge.

Weston, R. & Gore Jr, P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist*, *34*, 719-751. doi: 10.1177/0011000006286345

Whitley, B. E., & Kite, M. E. (2018). *Principles of Research in Behavioral Science*. Fourth Edition. NY: Routledge. See chapter 12: Factor analysis, path analysis, and structural equation modeling.

Statement on Academic Offences

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Health/Wellness Services

Students who are in emotional/mental distress should refer to Mental Health Support at https://www.uwo.ca/health/psych/index.html for a complete list of options about how to obtain help.

Accessible Education (AE)

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program.

Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are strongly encouraged to register with Accessible Education Western (AEW), a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AEW and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.

Statement on Gender-Based and Sexual Violence

Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts at the following website: https://www.uwo.ca/health/student_support/survivor_support/get-help.html To connect with a case manager or set up an appointment, please contact support@uwo.ca

Statement on the Use of Generative Artificial Intelligence (AI)

You are allowed to use AI to assist you with generating code/script/syntax for statistical analysis procedures. However, you are not allowed to AI to run the analyses for you. All assignments require your individual analysis outputs. You are also not permitted to use AI to write your report. If you are

using AI for researching sources of information, you are responsible to ensure that the information and references are accurate.