

**Western University**  
**Psychology**  
**PSY 9552B**  
**Regression and Factor Analysis Methods**  
**Winter 2023**  
**SSC XXXX, Wed 9:00am-12noon**

**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  
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Office Phone: (519) 661-2111 x85644  
Office Hours: by appointment  
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Teaching Assistant	TBD
Email	TBD

**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 textbook is optional and can serve as a secondary resource. It 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.

Hahs-Vaughn, D. L. & Lomax, R. G. (2020). *An introduction to statistical concepts. Fourth Edition.* Routledge. 978-1138650558

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 18. 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.

*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	Feb 1	Bivariate regression
Lab2	Feb 15	Multiple regression
Lab3	Mar 8	Moderation
Lab4	Mar 22	Mediation
Lab5	Apr 5	Multilevel modeling
Lab6	Apr 17	Factor analysis

Assignments are provided two weeks before the due date.

### Course Timeline

Week	Date		Suggested chapters from Hahs-Vaughn & Lomax (2020)
1	Jan 11	Measures of Association and their Inferential Tests	8, 10
2	Jan 18	Bivariate Linear Regression	17
3	Jan 25	Multiple Correlation – Statistical Control Methods	18
4	Feb 1	Multiple Regression (MR)	18
5	Feb 8	Categorical Predictors in MR, similarity to ANOVA	
6	Feb 15	Moderation in MR	20
7	Spring R		
8	Mar 1	Mediation in MR and Extensions	20
9	Mar 8	Logistic Regression and Other Regression Models	19
10	Mar 15	Multilevel Modeling-I – Subjects Within Groups	
11	Mar 22	Multilevel Modeling-II – Observations within Individuals	
12	Mar 29	Factor Analysis	
13	Apr 5	Confirmatory Factor Analysis	

Additional resources for lecture topics (list may be slightly updated before start of course)

#### Jan 11.

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 18.

Ernst, A. F., & Albers, C. J. (2017), Regression assumptions in clinical psychology research practice—a systematic review of common misconceptions. *PeerJ*, 5:e3323. DOI 10.7717/peerj.3323

Jan 25.

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

Feb 1.

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

Hoyt, W. T., Imel, Z. E., & Chan, F. (2008). Multiple regression and correlation techniques: Recent controversies and best practices. *Rehabilitation Psychology*, 53, 321-339. doi: 10.1037/a0013021

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 8.

Ch 9, 10 in Darlington, R. B., & Hayes, A. F. (2016). *Regression Analysis and Linear Models: Concepts, Applications, and Implementation*. Guilford Publications.

Feb 15.

Hayes, A. F., & Rockwood, N. J., (2016). Regression based statistical mediation and moderation analysis in clinical research: Observations, recommendations and implementation. *Behaviour Research and Therapy*, 1-19. <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

Mar 1.

Hayes, A. F., & Rockwood, N. J., (2016). Regression based statistical mediation and moderation analysis in clinical research: Observations, recommendations and implementation. *Behaviour Research and Therapy*, 1-19. <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 8.

- 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 15.

- 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
- Plouffe, R. A., & Tremblay, P. F. (2017). The relationship between income and life satisfaction: Does religiosity play a role? *Personality and Individual Differences, 109*, 67-71.

#### Mar 22.

- Kahn, J. H. (2011). Multilevel modeling: Overview and applications to research in counseling psychology. *Journal of Counseling Psychology, 58*, 257-271.
- 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
- Pila, E., Gilchrist, J. D., Kowalski, K. C., & Sabiston, C. M. (2022). Self-compassion and body-related self-conscious emotions: Examining within- and between-person variation among adolescent girls in sport. *Psychology of Sport & Exercise, 58*, 102083.

#### Mar 29.

- 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

#### Apr 5.

- Kline, R. B. (2013). Exploratory and confirmatory factor analysis. In Y. Petscher, C. Schattschneider, & 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](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf)

## **Health/Wellness Services**

Students who are in emotional/mental distress should refer to Mental Health@Western <http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help.

## **Accessible Education Western (AEW)**

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.