Psychology 9542B. Multilevel Modeling (MLM) (Winter 2021)

COURSE OUTLINE

Instructor: Paul F. Tremblay
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Course OWL website: here
Format: Zoom meetings Tuesdays (1:30 – 3:00pm) beginning January 12
Asynchronous weekly prerecorded lectures (slides and videos posted weekly on OWL website)
Individual or group appointments: Please contact me to set online appointment to discuss course material or projects.

I. COURSE DESCRIPTION

This course serves as an introduction to theory, design, and application of multilevel modeling, and it is ideal for students who plan to do research with group level data (e.g., peer groups, teams in organization or sports, dyads such as couples or twins, surveys with clustered data, neighborhoods, and classrooms, and experiments with multiple stimuli such as words in linguistic studies) or multi-observation studies (e.g., daily diary studies, longitudinal designs, experimental designs with multiple repeated stimuli). Students should have some training in multiple regression and would benefit from experience in analysis of variance and structural equation modeling. Course topics include a review of traditional regression procedures, research design with multilevel structures, the basic two-level regression model (and extension to three-levels), methodological and statistical issues including power analyses, models with longitudinal data, models with dichotomous, categorical or count outcomes and structural equation models with multiple data levels and mediation.

My overall objective is to provide students with the necessary knowledge to apply MLM to research through hands-on individualized projects tailored to their research interests and needs. Students will have the opportunity to analyze their own data, to use large data sets provided in the course, or to conduct a simulation study. Mplus, Jamovi (linear models), and SPSS Mixed Models are used for demonstration in the course but students are free to work with other programs such as R (e.g., package lme4). Prerequisite: must have taken Psychology 9540 (Research Design) or equivalent course.

II. COURSE READINGS

Textbook (available for pdf download through online Western Library). The first two books are very similar except that they use different software packages and have one or two unique chapters.

Finch, W. H., Bolin, J. E., & Kelley. (2019). *Multilevel Modeling Using R. Second Edition*. New York: CRC Press.

Finch, W. H., Bolin, J. E. (2017). *Multilevel Modeling Using Mplus*. New York: CRC Press.
The following handbook is also available online at the Western Library. You can download individual chapters. See few recommended chapters in section on topics and schedule.

Humphrey S. E., & LeBreton, J. E. (Editors). (2019). *The Handbook of Multilevel Theory, Measurement, and Analysis*. American Psychological Association.

A few key articles (see lecture schedule) will also be used. See also course OWL website for more resources including software documents and data files.

III. METHOD OF EVALUATION

55%: Individual project. The individual project will consist of a study involving a multilevel data set and will include the data analysis, interpretation, a full manuscript report, and a presentation. I have collected a variety of secondary data sets that would be ideal for impressive secondary MLM projects. Alternatively, many students take this course because they are currently working or plan to work on a project with their own data. I have seen some of these course projects turn into published journal articles!

The main requirement is a multilevel design with observations at level-1 nested in a level-2 unit (e.g., students nested within classrooms, repeated observations nested within people). The second requirement is that you have at least one level-1 predictor and one level-2 predictor. The third requirement is that you use a model building approach in which you start with a simple intercept-only model and add your predictors in subsequent models. Note that for those using repeated measures, you have the option to model time using a latent growth modeling approach. If you want to do something different such as a Monte Carlo study or a confirmatory factor analysis/structural equation model combining level-1 and level-2 data please discuss your idea with me.

1. **Research idea (due Feb 9)**. Have your idea approved by me by Feb 9. No write-up necessary. The main goal is to decide on your design in general and your data set. You can discuss your idea with me in class, or by email, or we can set up a meeting.
2. **Research proposal (due Feb 23; 15%)**. A two-page max description of your project outlining your objectives, hypotheses, research design, description of data, and description of variables/measures.
3. **Presentation (March 30 or April 6; 15%)**. You will have 20 minutes (max) to do your presentation followed by a 5-10 min discussion. Two students will be assigned to comment and to ask questions first followed by questions from the rest of the class. You will be rated on the material in your slideshow (10%) as well your presentation itself (5%; ability to present and explain clearly). Your slides will be due the same day.
4. **Paper (due April 13, one week after the last class; 25%).** Your paper should generally be written as a manuscript for publication. Your introduction can be less elaborate than in publication manuscript, but you should include a rationale, objectives and hypotheses and a brief review of the literature. The text should be no longer than 20-25 double spaced pages and you should include tables and or figures. One good way to present your analyses is by using a table describing the models that you ran. See for example the tables in the Peugh (2010) article.

45%: 3 lab/assignments. You will have two weeks to complete an assignment (due at the beginning of class). These assignments will include data analysis, reporting, interpretation, discussion of results, and other questions. Late assignments include a 5% deduction per 24 hours, and assignments that are more than one week late will not be accepted for partial marks. I recognize the stressful situation we are in this semester. If you anticipate any problems meeting deadlines, please contact me prior to the due date.

Rules about working in groups. I am supportive of students working in 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, and to make decisions about plausible strategies.

IV. STATEMENT OF 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).

V. LECTURE SCHEDULE (and resources)

Jan 12. OVERVIEW

Ch 1. Linear Models (Finch…R or Mplus)

Huang, F. L. (2018). Multilevel modeling myths. *School Psychology Quarterly*, *33*, 492-499.

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.

Rose, R. A. (2018). Multilevel modeling in family violence research. *Journal of Family Violence*, *33*, 109-122.

Jan 19. THEORY I: INDIVIDUALS NESTED IN GROUPS

Ch 2. An Introduction to Multilevel Data Structure (Finch…R or Mplus)
Ch 3. Fitting Two-Level Models in R (Finch…R) or (Finch…Mplus)

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.

Pozzoli, T., Gini, G., & Vieno, A. (2012). Individual and class moral disengagement in bullying among elementary school children. *Aggressive Behavior*, *38*, 378-388.

Wang, Y-D, & Hsieh, H-H. (2012). Toward a better understanding of the link between ethical climate and job satisfaction: A multilevel analysis. *Journal of Business Ethics*, *105*, 535-545.

Jan 26. THEORY II: OBSERVATIONS NESTED WITHIN INDIVIDUALS - LONGITUDINAL

Ch 5. Longitudinal Data Analysis Using Multilevel Models (Finch…R) or Ch 6. (Finch…Mplus)

Hoffman, L., & Stawski, R. S. (2009). Persons as contexts: evaluating between-person and within-person effects in longitudinal analysis. *Research in Human Development*, *6*, 97-120.

McCrae, C. et al. (2008). Sleep and affect in older adults: using multilevel modeling to examine daily associations. *Journal of Sleep Research*, *17*, 42-53.

Quené, H., & van den Bergh, H. (2004). On multi-level modeling of data from repeated measures designs: a tutorial. *Speech Communication*, *43*, 103-121.

Siddique, J., Hedeker, D., & Gibbons, R. D. (2017). In B. Sobolev & C. Gatsonis (Eds.), *Methods in Health Services Research*, Health Services Research, doi: 10.1007/978-1-4939-6704-9_1-1

Feb 2. THEORY III: OBSERVATIONS NESTED WITHIN INDIVIDUALS – MULTIPLE STIMULI

Carson, R. J., & Beeson, C. M. L. (2013). Crossing language barriers: Using crossed random effects modelling in psycholinguistics research. *Tutorials in Quantitative Methods for Psychology*, *9*, 25-41.

Locker, L., Hoffman, L., & Bovaird, J. A. (2007). On the use of multilevel modeling as an alternative to items analysis in psycholinguistic research. *Behavior Research Methods*, *39*, 723-730.

Feb 9. ANALYSIS I: THE BASIC TWO-LEVEL MODEL (Individuals nested in groups)

Ch 3. Fitting Two-Level Models in R (Finch…R) or (Finch…Mplus)

Feb 23. ANALYSIS II: THE BASIC TWO-LEVEL MODEL (Longitudinal)

Ch 5. Longitudinal Data Analysis Using Multilevel Models (Finch…R) or Ch 6. (Finch…Mplus)

Mar 2. ANALYSIS III: THE BASIC TWO-LEVEL MODEL (Multiple stimuli and cross-classified designs)

Carson, R. J., & Beeson, C. M. L. (2013). Crossing language barriers: Using crossed random effects modelling in psycholinguistics research. *Tutorials in Quantitative Methods for Psychology*, *9*, 25-41.

Heck, R. H. (2009). Teacher effectiveness and student achievement. Investigating a multilevel cross-classified model. *Journal of Educational Administration*, *47*, 227-249.

Mar 9. ADVANCED ISSUES: Centering, Variance Explained, Three-Level Models

Ch 4. Three-Level and Higher Models (Finch…R) or Ch 5 (Finch…Mplus)

Enders, C. K., & Tofighi, D. (2007). Centering predictor variables in cross-sectional multilevel models: A new look at an old issue. *Psychological Methods*, *12*, 121-138.

LaHuis et al. (Ch 15). Explained variance measures for multilevel models. In Humphrey & LeBreton

Peugh, J. L. (2014). Conducting three-level cross-sectional analyses. *Journal of Early Adolescence*, *34*, 7-37.

Mar 16. ADVANCED ISSUES: Missing Data, Data Inspections, Monte Carlo Simulation of Power

Ch 6. Graphing Data in Multilevel Contexts (Finch…R only)
Ch 10. Advanced Issues in Multilevel Modeling (Finch…R only)

Arend, M. G., & Schäfer, T. (2019). Statistical power in two-level models: A tutorial based on Monte Carlo Simulation. *Psychological Methods*, *24*, 1-19.

Muthén, L. K., & Muthén, B. O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling*, *9*, 599-620.

Grund et al. (Ch 16). Missing data in multilevel research. In Humphrey & LeBreton
Scherbaum, C. A., & Pesner, E. (Ch 14). Power analysis for multilevel research. In Humphrey & LeBreton

Mar 23. ADVANCED ISSUES: I. Analyzing Dyad Models; II. Logistic Models

Ch 7. Brief Introduction to Generalized Linear Models (Finch…R or Mplus)
Ch 8. Multilevel Generalized Linear Models (Finch…R or Mplus)

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

Kenny, D. A., & Kashy, D. A. (2010). Dyadic data analysis using multilevel modeling. In J. J. Hox & J. K. Roberts (Eds.), *Handbook of Advances Multilevel Analysis* (pp.335-370). New York: Routledge.

Mar 30. MULTILEVEL CFA AND SEM; PRESENTATIONS

Ch 9. Multilevel Latent Variable Models in Mplus (Finch… Mplus only)

Dyer, N. G., Hanges, P. J., & Hall, R. J. (2005). Applying multilevel confirmatory factor analysis techniques to the study of leadership. *The Leadership Quarterly*, *16*, 149-167. doi:10.1016/j.leaqua.2004.09.009

Preacher, K. J. et al. (2010). A general multilevel SEM framework for assessing multilevel mediation. *Psychological Methods*, *15*, 209-233.

Apr 6. PRESENTATIONS