Introduction to Multilevel Modeling

Multilevel modeling (MLM; also known as hierarchical linear modeling or linear mixed effects modeling) is widely used to analyze nested data structures in a variety of fields, including psychology, education, biology, and organizational research. Common examples of such structures include datasets in which students are nested within classrooms, patients are nested within clinicians, and repeated measures are nested within individuals. MLM provides an intuitive framework by which researchers can accommodate the dependency of observations within the same cluster (e.g., similarity of students within the same class) and simultaneously examine predictors at each level (e.g., student-level characteristics as well as classroom-level characteristics).

This course provides an introduction to multilevel modeling, with a focus on its application within the social, education, health, and business sciences. Participants will learn fundamental statistical principles underlying multilevel modeling, a variety of techniques and methods that can be used in many different research contexts, and how to appropriately specify models and interpret results in practice.

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Learning Objectives

Upon completing this course, you will

- be able to extend the basic concepts of multiple linear regression analysis in single-level data contexts to multilevel modeling in nested data contexts.

- understand the motivation behind multilevel modeling, when it is appropriate to use in practice, and how it relates to alternative approaches for accommodating nested data structures.

- know how to make informed choices when specifying and evaluating a model, or a series of models, in practice

- be able to implement multilevel modeling in a wide variety of data contexts, including cross-sectional and longitudinal data, data with two-level vs. higher-level structures, and data with purely hierarchical vs. cross-classified nesting

- understand the basic ideas behind more advanced techniques (e.g., multilevel structural equation modeling) that extend the standard multilevel modeling framework

Who Will Benefit

This course will be helpful for researchers in any field—including psychology, sociology, education, business, human development, social work, public health, communication and others that rely on social science methodology—who want to understand learn how to apply multilevel models to their research with widely-used software. Learners will ideally be comfortable with multiple linear regression analysis, though this topic will be briefly reviewed at the beginning of the workshop. Participants will also ideally have some familiarity with running analyses using some type of statistical software (e.g., R, SPSS, SAS, STATA), but proficiency with any software will not be assumed.
Summary

In this course, you will learn about the underlying principles and the practical applications of multilevel modeling. The topics covered include

- Review of single-level regression
- Overview of nested data structures and methods to accommodate them
- Distinguishing between fixed and random effects
- Fitting and interpreting random intercept and random slope models
- Centering choices and implications for model results
- Model specification, estimation, and evaluation
- Conducting multivariate tests
- Engaging in model selection
- Conducting power analyses and determining appropriate sample size
- Longitudinal models and alternative error structures
- Three-level (and higher-level) models
- Cross-classified models

Time Commitment and Course Delivery

The course will be delivered in person at the University of Calgary's downtown campus (906 8th Avenue SW, Calgary, Alberta, Canada). The course meets from November 18-19, 9am – 5pm.
Computing

The course will focus on multilevel modeling as a framework that can be applied using a variety of software, rather than focusing exclusively on a single one. Because this is a hands-on course, learners are encouraged to bring a laptop to class with a copy of R installed, along with the following packages: lme4, nlme, and lmerTest. Most of provided materials and examples will involve R code, but time with also be devoted to discussing how the same analyses can be implemented in other software, such as SPSS, SAS, and STATA.

Faculty

**DR. JASON RIGHTS, PHD**

Dr. Rights received a Ph.D. in Quantitative Methods from the Department of Psychology and Human Development at Vanderbilt University. He is currently an Assistant Professor of Quantitative Methods in the Department of Psychology at the University of British Columbia. His primary research focus is on addressing methodological complexities and developing statistical methods for multilevel/hierarchical data contexts (e.g., patients nested within clinicians, students nested within schools, or repeated measures nested within individuals). Specifically, he has recently been involved in several lines of research: (1) developing R-squared measures and methods for multilevel models; (2) addressing unappreciated consequences of conflating level-specific effects in analysis of multilevel data; (3) delineating relationships between multilevel models and other commonly used models, such as mixture models; and (4) advancing model selection and comparison methods for latent variable models. To aid researchers in applying his work, he develops software, primarily in R, that is openly available for public use. More detail about Dr. Rights and his work can be found at https://psych.ubc.ca/profile/jason-rights/

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