Multilevel Modeling with HLM and SPSS
ICPSR Summer Program in Quantitative Methods of Social Research
June 29 - July 2, 2020

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COURSE DESCRIPTION

Multilevel models (MLM), also known as hierarchical linear models (HLM) and mixed effects models, are widely used across a range of disciplines including sociology, psychology, political science, education, economics, and public health. They provide a conceptual framework and a flexible set of analytic tools to study a variety of social, political, and developmental processes. In this workshop, we will teach in parallel the use of both the HLM and SPSS software packages to fit two- and three-level multilevel models, focusing on both linear and nonlinear outcomes. We will demonstrate the new features of the HLM 8 program, which include analysis of missing data through multiple imputation of both dependent and independent variables, and the use of fixed intercept models with random effects.

In MLM, one set of applications focuses on data in which persons are clustered within social contexts, such as couples, families, schools, neighborhoods, or organizations. A second set of applications concerns individual growth or change over time, where time series or longitudinal data are clustered within persons. A third set of applications involves a combination of the two: persons changing over time who are also nested within organizational contexts. Participants will be exposed to a wide variety of hands-on examples, with emphasis on computing practice and interpretation and reporting of results. Topics include an introduction to the basic two-level model for continuous outcomes, assessment of fit, checking model assumptions, single and multiparameter hypothesis testing, the extension to three-level models, and nonlinear models for binary and count outcomes. Although the workshop will focus on practice with SPSS and HLM, syntax for other statistical software packages (Mplus, R, Stata, and SAS) will be provided to participants as needed.

Course Website: TBD (all lecture materials, in class computing worksheets, and syntax will be made available to workshop participants.

Suggested Textbook:

SEQUENCE OF TOPICS

Monday

I. An Introduction and Brief History

* Methodological criticism of past treatment of hierarchical data
  - problems in the measurement of organizational effects
  - problems in the measurement of change

II. The logic of the 2-level multilevel model illustrated by an application to the study of individual change over time: National Youth Survey (NYS) data

* Modeling change over time for one individual: The Level 1 model
* Modeling change over time for J individuals: The Level 2 model

III In-class computing: An Introduction to the HLM Computer Program and SPSS MIXED syntax

* Data input and creating the MDM file; NYS data
* Graphing

IV. Applications to repeated measures: NYS data

* Polynomial models
* Studying correlates of growth
* Model comparison tests using deviance statistics
* Piecewise modeling

Reading: Raudenbush & Bryk: Chapters 1, 2, 6

Tuesday

I. Time-varying covariates and group-mean centering

II. Assessing Model Fit

* Proportional reduction of variance (PRV)
* Multiparameter hypothesis testing (contrasts for simple slopes)

III. In-class computing: Adding predictors, calculating PRV, & testing contrasts: nys1 data

IV. Assessing distributional assumptions via residual analysis

* Level-1 assumptions: Creating and using the level-1 residual file
* Level-2 assumptions: Creating and using the level-2 residual file
* working with Empirical Bayes coefficients (posterior predictions)
Wednesday

I. An application of the 2-level model to organizational research: High School and Beyond

II. Random Intercept Models
* One-way ANOVA with random effects
* Group means as outcomes

III. Centering
* The contextual effects model

IV. Random Slope Models
* One-way ANCOVA with random effects
* Random coefficients regression
* Cross-level model with intercepts and slopes as outcomes

V. In-class computer lab: Intercept and slope models with HSB data

Reading: Raudenbush & Bryk, Chapters 4, 5

Thursday

I. Introduction to Non-Linear Models for Binary and Count Data

* Binary outcomes: Thailand example
* Count outcomes: Ansell drinks example

II. In-class computer lab: Practice with Thai or Ansell data

Reading: Raudenbush & Bryk, Chapters 10, 11

III. Introduction to the Three-Level Model: Chicago Schools Data

* The level-1 model
* The level-2 model
* The level-3 model

IV. In-class computer lab: 3-level models using Chicago Schools and Sustaining Effects Data

Reading: Raudenbush & Bryk: Chapter 9
Selected References Organized by Topic

School Effectiveness Applications


Neighborhood Effects Applications


Individual Growth Modeling Applications


Accelerated Longitudinal Designs


Meta-Analysis


Measurement Models


Binary & Count Outcomes


Multiple Informant/Multiple Outcomes Applications


**Three Level Models**