Hierarchical Linear Models II: Advanced Topics

Instructors

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Course Description

This is a second course in hierarchical linear models. Individuals who enroll should have taken the ICPSR course *Hierarchical Linear Models I: Introduction* or its equivalent. This course will consider several advanced topics. These include: 1) multivariate models for longitudinal data, with consideration of a variety of alternative covariance structures including compound symmetry, autoregressive structures, and heterogeneous level-1 variance; 2) embedding IRT measurement models in HLM; 3) generalized hierarchical linear models, including nonlinear models for binary, binomial, count, ordinal, and multinomial outcomes; 4) latent variable models, including random effects as latent variables and random coefficients as predictors; 5) matched models for cross-classified data; and 6) models for causal inference in multi-level research.

Required Reading


Sequence of Topics

Tuesday July 10

I. Multivariate linear models for change as hierarchical models

- Disaggregating within-person and between-person effects using a time-varying covariate:
  Compositional effects model (example from the National Youth Survey)
- The unrestricted model
- Compound symmetry model
- Autoregressive (AR1) models
- Time-varying level-1 variance
- A log-linear model for the level-1 variance

  Reading: HLM (2nd edition): Chapter 6
Sayer & Willett (1998)
Willett & Sayer (1994)

II. Item response models at Level-1: HLM as a measurement model (example from Arnett data)

Reading: HLM (2nd edition): Chapter 11

Doorenbos, Verbitsky, Given & Given (2005)
Raudenbush, Johnson, & Sampson (2003)

Wednesday July 11

I. Generalized hierarchical linear models

- Binary outcomes (example from Thailand survey data)
- A Bernoulli Model
- A Binomial Model
- Overdispersion at Level 1
- Counts (example from the National Youth Survey)
- Unit-Specific versus Population-Average Models
- Models for ordinal data (example from Teacher Commitment data)
- Models for multinomial data (example from NELS on post-secondary education)

Reading: HLM (2nd edition) Chapter 10

Rumberger (1995)

Thursday July 12

I. Latent Variable Models Within the Framework of HLM

- Estimating indirect and direct effects of latent variable (example from PHDCN)
- Random coefficients as predictors

Reading: HLM (2nd edition) Chapter 11


II. Cross-classified models within the framework of HLM
• Partitioning variance (example from Garner)
• Random intercept models
• Random coefficient models

Reading: HLM (2nd edition) Chapter 12

Suggested: Raudenbush (1993)
Garner & Raudenbush (1991)

Friday July 13

I. Causal inference for multilevel data: An introduction

• Introduction and brief overview
• Rubin’s causal model
• Causal effects of educational interventions: An application using grade retention
• Multi-level randomized experiments: Naïve analysis of ECLS-K data
• Selection bias and the propensity score
• Logistic regression and hierarchical logistic regression
• Propensity score estimation
• Propensity stratification, causal analysis with propensity adjustment
• Sensitivity analysis
• Final remarks

Reading: Hong & Raudenbush (2005)

Optional topics (if time permits):

• Extending the multivariate outcomes model to matched pairs (cross-sectional & longitudinal)
• Optimal design for hierarchical models (power analysis)
• Missing data models, multiple imputation within HLM, measurement error in explanatory variables
Selected References Organized by Topic

Generalized Linear Models with Random Effects


Multivariate Hierarchical Growth Models


Latent Variable and IRT Models


**Bayesian Methods for Hierarchical Models**


**Cross-classified Models**


**Models for Causal Inference**