Application of Hierarchical Linear Models in Behavioral and Social Research

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Course Description

The fundamental phenomenon of interest in educational research is the growth in knowledge and skills of individual students. Two facts – that children’s growth is typically the object of inquiry and that such growth occurs in organizational settings – correspond to two of the most troublesome and persistent methodological problems in the social sciences: the measurement of change and the assessment of multi-level effects (also referred to as the unit of analysis problem). Although these two methodological problems have distinct, long-standing, and non-overlapping literatures, these problems, in fact, share a common cause – the inadequacy of traditional statistical techniques for the modeling of hierarchy.

A satisfactory solution to measuring change and assessing multilevel effects has been developed using hierarchical linear models. This course will consider the statistical foundations of hierarchical linear models and focus on their application in behavioral and social research.

Students will learn:

1. To formulate multi-level research problems in terms of hierarchical linear model (HLM).
2. To pose and to test hypotheses about the parameters of the HLM and to provide a meaningful, substantive interpretation of its results.
3. To examine critically the application of HLM to particular problems in light of its statistical assumptions.

The course is organized around our text on hierarchical linear models and will operate in a quasi-workshop format. Participants are expected to read assigned chapters prior to class. Class time will be spent on clarifying ideas, discussing student questions and “real time” data analyses. Students will conduct data analyses using common data sets and also have an opportunity to undertake an analysis project of their own choosing. The course is designed to meet once a week for about 3 hours. Approximately half of the time is spent on introducing new ideas and the remaining time in a data analysis workshop format.
Schedule:

Jan. 10  Course introduction, logic of Hierarchical Linear Models, illustrative applications of HLMs, and illustration of HLM5 software

Reading: Chapters 1, 2, and 4 of Raudenbush and Bryk
HLM6 Program Guide, Sections 1 and 2

Jan. 17  Martin Luther King Holiday—no class

Jan. 24  Applications to research on individual change
Reading: Chapter 6 of Raudenbush and Bryk
Estimation Theory
Reading: Chapter 3 of Raudenbush and Bryk

Jan. 31  Application of HLM to research on organizational effects
Reading: Chapter 5 of Raudenbush and Bryk

First assignment due—analyzing how aspects of school organization effects the size of the “minority gap” on student achievement.

Feb. 7  Introduction to 3-level models

Reading: Chapter 8 of Raudenbush and Bryk; also skim sections 3 and 4 of the HLM6 program guide

Feb. 14 Hierarchical models with discrete level-1 outcomes (binomial and count data)

Reading: Chapter 10 of Raudenbush and Bryk, pp. 291-316.
Skim HLM6 program guide sections 5 and 6.

Second assignment due—a three level problem: modeling growth in student achievement over time as a function of both person and school characteristics.
Feb. 21  Cross classified models (e.g. the joint effects of schools and communities)

Reading: Chapters 12 of Raudenbush and Bryk
          Skim HLM6 program guide sections 10 and 11.

Feb. 28  Assessing the adequacy of Hierarchical Linear Models and power considerations
          Progress reports on course projects

Reading: Chapter 9 of Raudenbush and Bryk
          HLM6 program guide, p.36 – 46.
          Skim HLM6 program guide section 6.

Third assignment due—modeling discrete outcomes: high school course failures and dropping out as a function of person and school characteristics.

March 7  Advanced models and applications continued (latent variable models, missing data models, measurement models)

Reading: Chapters 11 of Raudenbush and Bryk
          HLM6 program guide, pp. 173 -179.

Mar. 14  In-Class presentations of final projects
          (subsequently to be submitted in “article form”.)

Final project papers due on March 18.

Course Texts:

2. HLM6 computer manual and student version of the program.

Grading:

Each of the first 3 individual assignments counts 20 percent. The final group project (class presentation plus paper) counts 40 percent.