

## HDSP-LS 451 MULTILEVEL MODELS

Instructor: Spyros Konstantopoulos  
Time: 2:00 - 5:00 PM Tuesdays  
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### **Course Content:**

Data with nested or hierarchical structure are quite common in the social sciences. A typical example stems from education, where students are nested within classrooms, classrooms are nested within schools, schools are nested within districts and so forth. Another example stems from organizational research, where employees are nested within different departments of firms, and these departments are in turn nested within firms and so forth. In addition, in longitudinal studies (with repeated measures for each individual) observations are nested within individuals, who can be nested within schools or firms etc.

It is important whenever the data have a nested structure to conduct analyses that will take the clustering of the data into account. The last two decades or so, much progress has been made in the development of appropriate methods and software for analyzing multilevel data (e.g., Mason et al. 1984; Goldstein, 1987; Bryk and Raudenbush, 1992). Statistical models for hierarchically structured data are known as hierarchical linear models (HLM) in education.

This course focuses on the logic and use of HLM in the social sciences. Specifically, the primary objective of the course is to illustrate ways in which HLM helps addressing questions in teacher and school effects research, in organizational research, in evaluation research, in the study of individual change, and in longitudinal research. Even though most of the examples that will be covered in this course might be related to education, HLM are applicable to any situation where the data are nested. For example, HLM can be used to examine differences in achievement among classrooms, schools, or firms, or to determine how family background and educational experiences relate to differences in rates of students' cognitive growth.

This course will also illustrate the use of HLM in meta-analysis where effect size estimates are nested within studies, and studies are nested within investigators or labs and so forth. Finally, the course will portray the use of HLM for binary outcomes, or for ordinal, or multinomial data.

The primary text for the course will be Raudenbush and Bryk's [Hierarchical Linear Models: Applications and Data Analysis Methods](#) (Second Edition, 2002). This book will be supplemented with various articles. The software program HLM 6 (for windows and

linux) will be used in the class to demonstrate the usefulness of HLM. HLM is available on linux at NU. The student version of HLM for windows is freely available on the web (<http://ssicentral.com/hlm/student.html>).

### **Requirements:**

1. Five homework assignments (35% of the course grade). Some homework assignments will involve data analysis using pre specified datasets. Group discussion is acceptable, but write-up must to be done individually.
2. Final paper (50% of the course grade, which includes the power point presentation of the paper). The final paper should demonstrate the usefulness of HLM and should be of publishable quality. The paper should include an introduction that discusses the significance of the research question, a non-exhaustive literature review, a data analysis plan, presentation and discussion of the results, concluding remarks and references, tables, figures, and appendixes (if applicable). APA style is recommended. Two large-scale datasets will be available for use (HSB and NELLS). Alternatively, students are encouraged to use their own datasets if available. Again, group discussion is acceptable but write-up must to be done individually. The text should *not* exceed 10 pages (double spaced, 12 point font). Students are expected to do a power point presentation of their projects at the end of the quarter (last class period). The presentation's quality should be comparable to a conference's presentation. The presentation will take about 12-15 minutes and there will be five minutes for questions/discussion. Students can use any software (e.g., HLM, SAS, SPSS, STATA, etc.) to analyze the data. The final project is due March 17 at 5 PM.
3. Participation in class (15% of the course grade).

### **Prerequisite:**

Good understanding of regression is *required*.

### **Textbooks:**

Raudenbush, S., & Bryk, A. (2002). Hierarchical Linear Models: Applications and Data Analysis Methods. Thousand Oakes, CA: Sage.

Raudenbush, S., Bryk, A., Cheong, Y. F., & Congdon, R. (2004). HLM 6: Hierarchical Linear and Nonlinear Modeling. Scientific Software International.

### **Schedule of Topics**

Class 1 (1/8)	Course overview; Rationale for using HLM. Reading: R&B Chapter 1. Review on Regression. First Homework Assignment.
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- Class 2 (1/15) Review on Regression Continued; Introduction to the logic of HLM. Reading: R&B Chapter 2. Connections between HLM and regression models; Estimation. Reading: R&B Chapter 3; First Homework Assignment Due.
- Class 3 (1/22) Introduction to two-level models. Reading: R&B Chapter 4, Lee & Bryk (1989), Raudenbush & Bryk (1986). Second Homework Assignment.
- Class 4 (1/29) Computer Lab: Introduction to the HLM software. The use of HLM in organizational Research. Reading: R&B Chapter 5. Second Homework Assignment Due.
- Class 5 (2/5) Using HLM in evaluation studies. Reading: Seltzer (1994), R&B Chapter 5. The use of HLM in growth models. Reading: R&B pages 160-185, 237-245, 361-364, Huttenlocher et al. (1991). Third Homework Assignment.
- (2/7) Computer Lab (during office hours)
- Class 6 (2/12) Growth Models Continued. Reading: Adam, Seltzer et al. (2003). Third Homework Assignment Due.
- Class 7 (2/19) Using HLM in meta-analysis. Reading: R&B Chapter 7, Konstantopoulos. Introduction to three level models. Reading: Bryk & Raudenbush (1988). R&B Chapter 8. Computer lab in class. Fourth Homework Assignment.
- (2/21) Computer Lab: Three Level Models (during office hours).
- Class 8 (2/26) Three level models continued. Nye et al. (2004), R&B Chapter 8. Fourth Homework Assignment Due.
- Class 9 (3/4) Multilevel models for binary data. Reading: R&B pages 291-309, 317-332, Rumberger (1995). Use of HLM in criminology. Reading: Sampson & Raudenbush (1997). Fifth Homework Assignment.
- (3/6) Computer Lab: HGLM (during office hours).
- Class 10 (3/11) Power Point Presentations. Fifth Homework Assignment Due.
- (3/17) Term Papers Due at 5 PM.