

## SC708: HIERARCHICAL LINEAR MODELING

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### Course Description

This applied course is designed for graduate students with a prior background in statistics at the level of SC703: Multivariate Statistics (or its equivalent). This means that students should have considerable experience with multiple regression and an ability to conduct such analyses using some statistical software. The major topics of the course will include two-level models for continuous, categorical, and count outcomes, three-level models, growth curve models, models for couple data, and cross-nested models. We will use HLM software to perform the analyses; no prior knowledge of the software is required. The goals of the course are to develop the skills necessary to identify an appropriate technique, estimate models, and interpret results for independent research and to critically evaluate contemporary social research using hierarchical linear modeling. The course will be applied in the sense that we will focus on estimating models and interpreting the results, rather than understanding in detail the mathematics behind the techniques.

### Course Policies

For each topic in the course, I will give a lecture focusing on the reasoning behind the techniques and an interactive review of the syntax used to do the analyses as well as the generated output. Throughout that process, you will get a chance to practice conducting the analyses and interpreting the results. We will also discuss and critically evaluate published research based on the various techniques.

Make sure that you carefully read these examples of published research before class and be prepared to discuss them. The course is based on an interactive relationship between the instructor and students, as well as on collaboration among the students. You are strongly encouraged to ask questions and discuss the material in class. I also encourage collaboration among the students; you will be working closely with your peers as you will be providing feedback on their projects.

I also would like to stress that you are always welcome to come and see me with any additional questions. If I am not in my office, email is the best way to get in touch with me – I check my email very often. You are also welcome to call me either in my office or at home (any time between 9 AM and 10 PM); however, be prepared to leave your name and number if I am not available to pick up the phone. Also, make sure to check your email – typically, each week I will post course notes for you to print out and notify everyone by email when the notes are available; I may also send other announcements.

Finally, a note on feedback. I would like to know how I could make this course experience as useful and interesting as possible. Therefore, every week in the end of class I will ask you to send me an email with at least one sentence of reaction to that class meeting, indicating what you learned, or something you liked or did not like, found interesting or controversial, found clear or too simplistic, or found confusing and in need of further (or better) explanation. You may also submit comments on the course in general.

### Required Materials:

The following book should be available for purchase at the BC bookstore. It will also be placed on reserve at the library:

Hox, Joop. 2010. *Multilevel Analysis: Techniques and Applications*. 2<sup>nd</sup> edition. Routledge.

Other required readings will be available on electronic reserve in the library: <http://www.bc.edu/reserves>

## **COURSE REQUIREMENTS AND GRADING:**

The main assignment for this course will be to write a solid draft of a journal article based on HLM analyses. In preparation for that, you will submit a proposal (10% of your grade), the first draft of your data analysis for peer review (5% of your grade), the first draft of your article (5% of your grade), and the final draft of your data analysis (30% of your grade) and article (30% of your grade). You will also provide peer feedback to two of your classmates (10% of your grade). In addition, there will be a few mini-assignments (questions about articles, coefficient interpretation exercises, etc.) throughout the semester; these will constitute another 10% of your grade.

All components of this assignment will be submitted electronically (by email or using MyFiles, Dropbox, Google Drive, etc.). When you submit the first drafts of your analysis and article for peer review, please make sure to include me in your communication. Likewise, when sending the feedback to your peer, please send it to me as well. Finally, when you submit your final assignment to me, please make a one hour appointment with me (ideally during the finals week) to go over what you did.

Proposal. The proposal will involve identifying a research question and conducting preliminary literature review, selecting a dataset, and identifying relevant variables. You should also identify your target journal. Please consult me early on if you need help to locate appropriate data or advice on journals.

Data Analysis. For the first draft of your data analysis, you will conduct data management, run all the necessary analyses, conduct diagnostics and apply remedies, and write a brief interpretation of your findings (you will also use graphs to assist your interpretation). For your data management, you can use any statistical software (e.g., SPSS or Stata). Drop the variables you do not plan to use and recode the variables for your analysis. Make sure to keep all ID variables in the dataset, decide on your strategy to deal with the missing data, and create any aggregate variables you might need for your analyses. When finished with data management, you will import the data into HLM (create an MDM file) and conduct your analyses. For some of the diagnostics, you will have to also use either SPSS or Stata. For this component of your assignment, you will submit an annotated log that will contain the output (with your brief comments) for all of the tasks that you will perform for this assignment. You will have to assemble that log file manually (in your Word processor) as you will go between your main statistical software (e.g., SPSS or Stata) and HLM, paste various pieces of syntax and output, and provide brief comments. Those of you who work with SPSS might be unaccustomed to documenting what you do while using the menus; make sure you paste your commands into a syntax file before executing them. There is no page limit for your annotated log but please edit it to contain only the relevant syntax, output, and graphs (i.e., omit any unproductive steps).

Article. Your article will include an introduction, literature review, data and methods, results, and conclusion, all written in journal format. Your introduction will provide a short substantive description of your theoretical argument and your research questions (typically about 2 pages). Your literature review will discuss any relevant theoretical literature as well as prior empirical research on this issue, and identify your main hypotheses (typically, this section should not exceed 8 pages). Your data and methods section will describe the dataset, variables, and your analytic methodology. Make sure to include a discussion of diagnostics and variable modifications in this section. Also, include a table with descriptive statistics for your sample. Next, your results section will discuss your findings. Please include tables (in journal format) and graphs assisting in the interpretation of results. Finally, please include a conclusion summarizing your findings, linking them to prior literature and to theory, and addressing study limitations and main contributions.

The letter grades for the course will be determined as follows:

93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
60-79	C
0-59	F

## **COURSE OUTLINE.**

### **January 15: Introduction to Hierarchical Linear Modeling (HLM)**

#### **January 22: HLM Software**

Hox, Joop. 2010. Chapters 1, 2 from *Multilevel Analysis: Techniques and Applications*. 2<sup>nd</sup> edition. Routledge.

Raudenbush, Stephen W. et al. 2004. Chapter 2 from *HLM 6: Hierarchical Linear and Nonlinear Modeling*. Scientific Software International, Inc.

#### **January 29: Two-Level HLM Models**

Raudenbush, Stephen W. et al. 2004. Chapter 12 from *HLM 6: Hierarchical Linear and Nonlinear Modeling*. Scientific Software International, Inc.

#### **February 5: HLM Model Building Strategies**

\*\*\**Proposal due*\*\*\*

Hox, Joop. 2010. Chapters 3 and 4 from *Multilevel Analysis: Techniques and Applications*. 2<sup>nd</sup> edition. Routledge.

#### **February 12: HLM Diagnostics**

Snijders, Tom A. B., and Roel J. Bosker. 1999. Chapter 9 from *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Thousand Oaks, CA: Sage.

#### **February 19: Missing Data in HLM**

Taris, Toon W. 2000. Chapter 2 from: *A Primer in Longitudinal Data Analysis*. Thousand Oaks, CA: Sage Publications.

#### **February 26: Missing Data in HLM , Part 2**

Acocck, Alan C. 2005. Working with Missing Values. *Journal of Marriage and Family* 67: 1012–1028.

#### **March 5: Spring Break**

#### **March 12: Reading HLM Article**

Huffman, Matt L. 2004. “More Pay, More Inequality? The Influence of Average Wage Levels and the Racial Composition of Jobs on the Black–White Wage Gap.” *Social Science Research*, 33, 498–520.

**March 19: Longitudinal Data Analysis using HLM**

\*\*\**Data Analysis draft due for peer review*\*\*\*

Hox, Joop. 2010. Chapters 5 and 16 from *Multilevel Analysis: Techniques and Applications*. 2<sup>nd</sup> edition. Routledge.

**March 26: Longitudinal Data Analysis using HLM**

\*\*\**Peer feedback due*\*\*\*

Singer, Judith D., & John B. Willett. 2003. Chapters 7 and 8 from *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. New York: Oxford University Press.

Baldwin, Scott A., and John P. Hoffmann. 2002. "The Dynamics of Self-Esteem: A Growth-Curve Analysis." *Journal of Youth and Adolescence*, 31, 2, 101–113.

**April 2: Three-Level Models**

Raudenbush, Stephen and Anthony Bryk. 2002. Chapter 8 from *Hierarchical Linear Models: Applications and Data Analysis Methods*. 2<sup>nd</sup> edition. Newbury Park, CA: Sage.

Johnson, Brian D. 2006. "The Multilevel Context of Criminal Sentencing: Integrating Judge- and County-Level Influences." *Criminology* 44: 259-298.

**April 9: HLM Models for Categorical and Count Data**

\*\*\**Revised analysis draft and article first draft due for peer review*\*\*\*

Hox, Joop. 2010. Chapter 6 and 7 from *Multilevel Analysis: Techniques and Applications*. 2<sup>nd</sup> edition. Routledge.

Litwin, Kenneth J. 2004. "A Multilevel Multivariate Analysis of Factors Affecting Homicide Clearances." *Journal of Research in Crime and Delinquency*, 41, 327-351.

**April 16: Models for Dyadic Data**

\*\*\**Peer feedback due*\*\*\*

Kenny, David A., Deborah A. Kashy, and William L. Cook. 2006. Chapters 4 and 7 from *Dyadic Data Analysis*. New York: Guilford Press.

Widman, Laura, Deborah P. Welsh, James K. McNulty, and Katherine C. Little. 2006. "Sexual Communication and Contraceptive Use in Adolescent Dating Couples." *Journal of Adolescent Health* 39: 893-899

**April 23: Cross-Nested Models**

Hox, Joop. 2010. Chapter 9 from *Multilevel Analysis: Techniques and Applications*. 2<sup>nd</sup> edition. Routledge.

Wheaton, Blaire, and Philippa Clarke. 2003. "Space Meets Time: Integrating Temporal and Contextual Influences on Mental Health in Early Adulthood." *American Sociological Review* 68: 680-706.

**April 30: Sample Size and Power Analysis for HLM**

\*\*\**Data Analysis and Article final drafts due*\*\*\*

Hox, Joop. 2010. Chapter 12 from *Multilevel Analysis: Techniques and Applications*. 2<sup>nd</sup> edition. Routledge.

**May 7: No class.**

\*\*\**Please make individual appointments for this week to discuss your final project*\*\*\*