PSYED 3408: Hierarchical Linear Modeling
School of Education
University of Pittsburgh
Spring, 2021

Tuesday 11:00-11:45 pm

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Office Hour: By appointment

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Office Hour: By appointment

Course Overview:

Many studies in social sciences and biological sciences are longitudinal or multilevel or both. In longitudinal studies, we may repeatedly observe participants to assess growth in academic achievement or change in health status. Multilevel data arise because participants are clustered within social settings such as classrooms, schools, and neighborhoods.

In this course, we will begin by considering two-level studies in which persons ("level-1 units") are nested within organizations ("level-2 units") such as schools. Next, we consider two-level studies of individual change. In this case, we view time-series data (level 1) as nested within persons (level 2). The level-1 model specifies how a person is changing over time as a function of person-specific "micro-parameters." The level-2 model describes the population distribution of the micro-parameters of individual change as a function of macro-parameters. Next, we will consider three-level models. Out initial focus will concern the case in which repeated measures (level 1) are nested within persons (level 2) who are themselves nested in organizations (level3). However, not all multilevel date involve a pure nesting. In many important cases, observations are cross-classified by two higher-levels of random variation. For example, persons may be nested in "cells" defined by the cross-classification of schools and neighborhoods; time-series observations may be cross-classified by the child and the classroom when repeated measures are collected on children who change classrooms during the elementary years. We will consider these cases and also cases that involve both nesting and crossing of random factors. All of the studies considered so far will involve nearly continuous outcomes for which the normality assumption is at lease plausible. Our next aim is to generalize two- and three-level models to other kinds of outcomes, including binary, counts, ordered, and multinomial outcomes. All of these cases fall into the framework of the hierarchical generalized linear model.

This course emphasizes applications of hierarchical linear models. Examples will be drawn from education, psychology, and other social sciences disciplines.

Prerequisites

PSYED 2410 (Applied Regression) or equivalent

Required Books

Raudenbush, S. W. Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*, 2nd edition. Newbury Park, CA: Sage.
(**Electronic copies of textbook chapters will be available on reserve for several weeks. The detailed visible period for each chapter can be found on the last page.** Please follow the following steps to access the book:
1. Go to library.pitt.edu
2. Search for "PSYED 3408" in the PittCat catalog box
3. Select the "available online" link below the course
4. Enter the password (mlh212) and select the item you wish to access)

Raudenbush, Bryk, Cheong, & Congdon (2010). *HLM7 (manual)*. Lincolnwood, IL: SSI.
(**The manual is available via the HLM 7 Manual option on the Help menu.**)

Course Documents:
The course uses a hybrid learning method with a blend of asynchronous and synchronous online learning.

- **Asynchronous: On each date listed on the last page, pre-recorded videos and slides for the corresponding lecture will be posted on Canvas.** In the videos that are based on the slides, I will introduce the concepts and show how to use statistical methods to address substantive research questions by conducting analyses and interpreting the results. Please read the slides and the associated chapters listed on the last page, and watch the videos in the following week.
- **Synchronous**: **On each date listed on the last page, a 45-minute synchronous session will be held from 11:00 am to 11:45 am via Zoom**. You will have 15 minutes to discuss any questions regarding the previous lecture and the next assignment in study groups in breakout rooms. The TA will then lead the discussion among the whole class. In the week following each assignment due date, the instructor will provide feedback on the ssignment in the synchronous session. **You are required to attend every synchronous session. If you are not able to attend due to a valid emergency, you should contact the instructor beforehand.**

Software

We will use the computer program—HLM—for this course. Information about the software and HLM in general can be found at the website for Scientific Software International (http://www.ssicentral.com/index.php/product/hlm). **The software is available on the virtual lab. Please follow the instruction on Canvas to learn how to access the lab.**

Collaboration and Study Groups

Collaborative learning is central in this course and serves as a way to foster deep learning and leverage expertise. 4 students from different disciplines will be assigned to one study group. Discussions about the course materials and assignments within study groups are strongly encouraged. Discussion boards are available on Canvas. If you have any questions, please feel free to post them on either the class discussion board (see main menu on the left of your

homepage) or the group discussion board in your own group's view (click your group number on the right of your homepage).

Homework Assignments

There will be four assignments based on data provided by the instructor. The aim of having these is to insure a minimum competency in applying the basic methods. Each homework assignment will be posted on Canvas two or three weeks before the due date and should be submitted before 5 pm on the due date listed on the last page.

- Please submit your assignment following the instruction here: https://community.canvaslms.com/t5/Student-Guide/How-do-I-upload-a-file-as-an-assignment-submission-in-Canvas/ta-p/274
- Collaborations within assigned study groups are encouraged. Please understand that each student must turn in individual homework assignments, not group work. Your text should reflect your own understanding of the material. **Students who submit group homework assignments will be given zeros.** To properly acknowledge the contribution of your collaborators, please indicate on the cover page of each assignment the names of the people with whom you worked.
- Because homework solutions are made available after the homework is turned in, **late homework will not be accepted. In a valid emergency appropriate accommodations will be made. It is best, if possible, to contact the instructor prior to the due date.**
- If you have questions/concerns about your grades, please directly email the instructor and TA rather than leaving a comment on the Canvas grading page, because we will not get automatic notifications.

Final Presentation

Presentation of re-analyses of existing data. Students may analyze their own data or may choose from among several data sets made available by the instructor. The presentation should contain the following elements.

1. A clearly stated research question along with a brief explanation of why this question is important for theory or policy. A detailed literature review is not required.

2. A description of the sample and data, including a clear definition of the variables; and a brief justification for choosing a hierarchical modeling strategy.

3. Specification of the HLM or HGLM with a definition of the terms in the model and the assumptions embedded in the model. It is typically a good idea to tell your reader how knowledge of the model parameters would supply an answer to your research question(s).

4. A concise description of your results from fitting this model.

5. A discussion of your findings, including a discussion of the assumptions under which your results give us answers to your question(s). It is usually helpful to consider and, if possible, evaluate or at least discuss alternative explanations for the findings.

During the synchronous sessions on 03/16/2021 and 03/23/2021, each student has 15 minutes to meet with the instructor and TA to discuss the final presentation proposal.

You will present your work during the synchronous sessions on 04/20/2021 or 04/27/2021. The presentation should be around 10 minutes in length and include all the above elements. Writing papers are not required.

Evaluation

You will be evaluated on the basis of your assignments (70%) and final presentation (30%).

Letter grades will be based on actual points earned as follows:

Point	Letter		Point	Letter
Above 93	A		77-80	C+
90-93	A-		74-77	C
87-90	B+		70-74	C-
84-87	B		67-70	D+
80-84	B-		64-67	D
			60-64	D-
			Below 60	F

Academic Integrity:

Please make sure you read the university guidelines on Academic integrity (http://www.pitt.edu/~provost/ai1.html). Attention to this policy is particularly important in a course like PSYED 3408, in which collaboration with other students is encouraged. If, for instance, you work closely with other students during the planning, execution, or interpretation of your data analyses – a process that I encourage and fully support – you should make sure that the other students' contributions are recognized explicitly in your written account. If you have any questions about what constitutes appropriate collaboration, or how to define what constitutes your own work, please see me.

Special Accommodation:

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services, 140 William Pitt Union, (412) 648-7890/(412)383-7355 (TTY), as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Tentative Course Outline

Week	Date	Topic	Reading in HLM	Assignment
1	Jan 19	Introduction Random-intercept models (I)	Chapter 1 Chapters 2 & 4	
2	Jan 26	Random-intercept models (II) Random-slope models	Chapters 2 & 4	Assignment 1 Posted
3	Feb 2	Centering	Chapters 2 & 4	
4	Feb 9	Estimation and hypothesis testing	Chapter 3	Assignment 1 Due
5	Feb 16	Model building	Chapters 9	Assignment 2 Posted
6	Feb 23	No class (Self-care day)		
7	Mar 2	Assumptions and diagnostics	Chapters 9	Assignment 2 Due
8	Mar 9	Two-level models for individual change (Growth Curve) (I)	Chapter 6	Assignment 3 Posted
9	Mar 16	Two-level models for individual change (Growth Curve) (II)	Chapter 6	
10	Mar 23	Three-level models and power analysis	Chapter 8	
11	Mar 30	Cross-classified random effects models	Chapter 12	Assignment 3 Due
12	Apr 6	Hierarchical generalized linear models (I)	Chapter 10	Assignment 4 Posted
13	Apr 13	Hierarchical generalized linear models (II)	Chapter 10	
14	Apr 20	Final presentation		
15	Apr 27	Final presentation		Assignment 4 Due

Note: 1. On each date listed in the second column, pre-recorded videos and slides for the corresponding lecture will be uploaded, and any questions regarding the previous lecture and the next assignment will be discussed in the synchronous session. 2. Each assignment will be submitted via Canvas at 5:00 pm on the due date, and feedback will be provided in the next synchronous session.

Dates When Textbook Chapters are Available on Reserve

Chapter 1	Dec 21 - Feb 9
Chapter 2	Dec 21 - Feb 16
Chapter 4	Dec 21 - Feb 16
Chapter 3	Feb 9 - Mar 2
Chapter 9	Feb 16 - Mar 16
Chapter 6	Mar 9 - Mar 30
Chapter 8	Mar 23 - Apr 6
Chapter 12	Mar 30 - Apr 13
Chapter 10	Apr 6 - Apr 27