EDF 7474: Multilevel Modeling
Spring 2024

Course Information

Name:	EDF 7474- Section 1754
Time:	Tuesdays 12:50 pm to 3:50 pm
Room:	NRN 1033
Prerequisite:	EDF 7405 or equivalent

Instructor Information

Instructor:	Dr. Wei Li
Email:	wei.li@coe.ufl.edu
Phone:	352-273-4332
Office:	Normal Hall 2711R or Zoom Conference Room
Office Hours:	Tuesdays, 4:00 – 5:00 pm, or by appointment

Course Objectives

This course introduces multilevel models. These models allow the analysis of nested data. Data with a nested structure occurs often in the context of social science research (e.g. students nested within classrooms or schools, repeated measures nested within subject), as well as within research of other disciplines (e.g. Fisheries & Wildlife, Medicine). When data are nested, the assumption of independence required of many standard analysis techniques is violated. Furthermore, many standard analysis techniques cannot allow the exploration of cross-level interactions (e.g. how does the size of a school change the effect of student SES on achievement?). Multilevel models allow for the dependency present in nested data. Furthermore, these models allow us to explore relationships that traditional ANOVA and regression models do not allow. This course will also discuss how to apply multilevel models to analyze data with nested structures.

Course Website

The course website is at https://ufl.instructure.com/courses/473861. It is a repository for all class activities, including the posting of slides, datasets, assignments, readings, and Zoom recordings. All course slides, readings, and datasets will be posted before class. Assignments and other materials should be submitted through the website unless otherwise instructed. Zoom recordings will be posted after each week's meeting.

Required Texts

Raudenbush, S. W. & Byrk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd edition). (Advanced Quantitative Techniques in the Social Sciences Series, No 1). Thousand Oaks, CA: Sage.

Supplemental Texts

Software

Garson, G. D. (2019) *Multilevel Modeling: Applications in STATA, IBM SPSS, SAS, R, & HLM.* Thousand Oaks, CA: Sage.

Heck, R. H., Thomas, S. L., & Tabata, L. N. (2014). *Multilevel and longitudinal modeling with IBM SPSS* (2nd edition). New York: Routledge.

Rabe-Hesketh, S. & Skrondal, A. (2012). *Multilevel and Longitudinal Modeling Using Stata, Volumes I and II* (3rd edition). College Station, TX: Stata Press.

Statistical Theory

De Leeuw, J., & Meijer, E. (2010). *Handbook of multilevel models*. Springer.

Gelman, A., & Hill, J. (2007). *Data Analysis Using Regression and Multilevel/Hierarchical Models.* Cambridge University Press.

Goldstein, H. (2011). *Multilevel statistical models* (4th edition). Wiley.

Hox, J. J. (2010). *Multilevel Analysis: Techniques and Applications* (2nd edition). New York: Routledge.

Longford, N. T. (1993). *Random coefficient models*. Oxford University Press.

Luke, D. A. (2004). *Multilevel modeling* (Series: Quantitative Applications in the Social Sciences, No. 143). Thousand Oaks, CA: Sage.

Snijders, T. & Bosker, R. (1999) *Multilevel analysis: An introduction to basic and advanced multilevel modeling.* Thousand Oaks, CA: Sage.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press.

Other readings

Albright, J. J., & Marinova, D. M. (2015). Estimating multilevel models using SPSS, Stata, SAS, and R. Available from https://scholarworks.iu.edu/dspace/handle/2022/19737.

Konstantopoulos, S., Miller, S., & van der Ploeg, A. (2013). The Impact of Indiana's System of Interim Assessments on Mathematics and Reading Achievement. *Educational Evaluation and Policy Analysis, 35(4),* 481-499.

Nye, B., Hedges, L.V. & Konstantopoulos, S. (2000). The effects of small classes on achievement: The results of the Tennessee class size experiment. *American Educational Research Journal, 37*, 123-151.

Preacher, K.J., Curran, P.J. & Bauer, D.J. (2006). Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. *Journal of Educational and Behavioral Statistics, 31*, 437-448.

Singer, J. D. (1998). Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models. *Journal of Educational and Behavioral Statistics, 23*, 323-355.

Zhang, Z., Zyphur, M. J., & Preacher, K. J. (2009). Testing multilevel Mediation using hierarchical linear models: Problems and solutions. *Organizational Research Methods, 12*, 695-719.

Statistical Software

I will mainly use Stata to show the applications of the methods we will discuss in this class, and other software (e.g., SAS, SPSS, R, HLM, etc.) will also be briefly introduced if time permits. You are welcome to use any statistical package you prefer to finish the coursework. **However, please note that I am a Stata user, and all course material will be in Stata code/output.** Stata can be obtained for free from the UF Apps Program for UF students at http://info.apps.ufl.edu/.

All faculty, staff, and students are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Overview of Student Evaluation Categories

Class preparation and participation (10%): Students are expected to attend all class sessions and participate in class discussions.

Homework (25%): Homework is an important part of the learning process. You will receive **two** homework assignments during the semester. Each homework assignment is designed to give students a chance to apply and practice the concepts learned in class. The assignments will typically involve using SPSS or Stata to solve problems. They are due as specified.

Midterm exam (25%): There will be a take-home midterm exam.

Final Project: (40%): It is easiest to learn a particular statistical technique when applying it to your own research. Accordingly, you will be asked to finish a final project on a topic of your choosing. Students have two options for the final project.

(1) Empirical Research Paper – This option is intended for students with interests in empirical research. Students could take the opportunity to explore a topic related to their independent research agenda with an application of multilevel models.

(2) Methodology Review/ Innovation Paper – This option is intended for students with interests in the development of quantitative methodology. For this option, students should identify a gap in the literature regarding a specific research topic that is related to MLM and develop an appropriate strategy to fill that gap. For example, students could develop new approaches to check the MLM assumptions. Also, students could employ a simulation study to compare alternative methods that aim to address the same issue.

I will grade this paper primarily on the quality of the statistics. Templates for the final paper will be posted on CANVAS.

You can work on the final paper individually or in a small group of no more than three students.

A short introduction (a couple of paragraphs) to the background and the research questions you are addressing is **due on 4/8**, which is worth 5 points. You or your group will present the paper during the last weeks of this semester (20 mins presentation + 5 mins Q&A). The presentation is worth 5 points. The final paper is worth 30 points. **It is due on 4/29, and no late papers will be accepted.**

Please note that the instructor will not review your answers for any coursework or provide feedbacks to them before you officially submit them. You are welcome to discuss homework problems and midterm exams with your classmates, but you must work independently on the write-up.

Course Grades

Activity	Possible Points	Percentage of Final Grade
Attendance and class participation	10	13%
Assignments	25	25%
Take-home exams	25	25%
Final Project	40	40%
Total	**100**	**100%**

Final grades will be assigned based on the scale below. Unless a computational error has been made, grades will not be changed after the end of the semester.

Overall course percent	Grade
93.0 - 100	A
90.0 - 92.9	A-
87.0 - 89.9	B+
83.0 - 86.9	B
80.0 - 82.9	B-
77.0 - 79.9	C+
73.0 - 76.9	C
70.0 - 72.9	C-
67.0 - 69.9	D+
63.0 - 66.9	D
60.0 - 62.9	D-
59.9 or less	E

Recorded Zoom Class Sessions

Our class sessions may be audio and/or visually recorded for students in the class to refer back and for enrolled students who are unable to attend live, primarily due to health-related concerns.

Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. **If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image.**

Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. **If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live.** The chat will not be recorded or shared.

As in all courses, unauthorized recording and unauthorized sharing of recorded materials are prohibited.

Class Attendance

Students are expected to be present for all classes since much material will be covered only once in class. Students who have extraordinary circumstances preventing attendance, or who must leave early, should explain these circumstances to the course instructor before the scheduled class, or as soon as possible thereafter. Each student is responsible for the content of all classes, including issues raised in the spontaneous class discussions. If you must miss a class, please request notes from your classmates, check course slides and recording carefully. Whenever a student misses a course meeting, the instructor will assign one additional assignment (e.g., reading notes) to the student.

Missed Work and Extra Credit

If assignments, midterm, or final project cannot be submitted at the scheduled time, you will need to make arrangements with me before the deadline. Without prior arrangements, the submissions after the deadline will be deducted 20% credit for each day late for up to 5 calendar days, and subsequently will be scored zero. For example, if a student earns a 100% on an assignment, it will receive an 80% if it is one day late, 60% if it is two days late, and so on.

Unavoidable missed due dates may be excused by the instructor, provided **advanced notice and official documentation** that aligns with UF policies for excused absences. The excuse of a late grade requirement can only be achieved in private consultation with the instructor, and will require written supportive documentation (e.g., doctor's certificate). When in doubt, check with the instructor.

No planned opportunities for extra credit exist in this course.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore,

you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students on the Gator Evals page.

Counseling and Student Health

Students may occasionally have personal issues that arise in the course of pursuing higher education or that may interfere with their academic performance. If you find yourself facing problems affecting your coursework, you are encouraged to talk with an instructor and to seek confidential assistance at the University of Florida Counseling Center, 352-392-1575, or Student Mental Health Services, 352-392-1171. Visit their web sites for more information: http://www.counsel.ufl.edu or http://www.health.ufl.edu/shcc/smhs/index.htm#urgent.

The Student Health Care Center at Shands is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at Shands offers a variety of clinical services, including primary care, women's health care, immunizations, mental health care, and pharmacy services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the web site at: www.health.ufl.edu/shcc. Crisis intervention is always available 24/7 from Alachua County Crisis Center: (352) 264-6789.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see the Notification to Students of FERPA Rights.

Tentative Course Schedule*

Date	**Topic**	**Readings/Assignments**	**Due Date**
Week 1 1/14	Course Introduction; Review of Regression & Intro to Multilevel Models (1)	Course Slides; Raudenbush & Bryk, Chapters 1	
Week 2 1/21	Review of Regression & Intro to Multilevel Models (2) Intro to Stata for OLS regression	Course Slides; Raudenbush & Bryk, Chapters 2 **Assignment 1 distributed: Review of Basic Statistics and OLS regression**	**Assignment 1 due: 1/28**
Week 3 1/28	Introduction to Raudenbush formulas, Logic of HLM; Centering Predictors	Raudenbush & Bryk, Chapter 2	
Week 4 2/4	Building the Models (6 Two-Level Models); Variance Explained; ICC	Raudenbush & Bryk, Chapter 2	
Week 5 2/11	Two-Level Models; Principles of Estimation, Estimation Theory, Hypothesis Testing	Raudenbush & Bryk, Chapter 3 &14	
Week 6 2/18	HLM Illustration; Intro to Stata for HLM (1)	Raudenbush & Bryk, Chapter 4 **Midterm distributed: OLS Regression Analysis and Two-level Models**	**Midterm due: 3/4**
Week 7 2/25	Intro to Stata for HLM (2) Two-Level Models: Organizational & Contextual Effects	Raudenbush & Bryk, Chapter 5	
Week 8 3/4	Linear Growth Models	Raudenbush & Bryk, Chapter 6	
Week 9 3/11	Three-Level Models Lab: Stata for three-level models (1)	Raudenbush & Bryk, Chapter 8 **Assignment 3 distributed: Growth model and three-level models**	**Assignment 3 due: 4/1**
Week 10 3/18 (Spring Break)	**No Class**		
Week 11 3/25	Lab: Stata for three-level models (2) Paper discussion: Nye, Hedges, & Konstantopoulos (2000).	Nye, Hedges, & Konstantopoulos (2000).	

Date	**Topic**	**Readings/Assignments**	**Due Date**
Week 12 4/1	Model Diagnostics; Alternative Models to Multilevel Data	Raudenbush & Bryk, Chapter 9	
Week 13 4/8	Multilevel Logistic Regression; Binary, Ordinal, & Multinomial Outcomes	Raudenbush & Bryk, Chapter 10	**Intro to the final paper due: 4/8**
Week 14 4/15	**Final Paper Presentation: In Person**		
Week 16 4/22	**AERA: No In Person Meeting** **Final Paper Presentation: Zoom**	**The final paper is due on 4/29, by the end of the day. No extension will be offered.**	

Note: the schedule is tentative and subject to change.