PSYC 575 Multilevel Modeling

Units: 4
Term–Day–Time: Fall 2022–Tues & Thurs–10:00-11:50 am

Location: THH B10

Instructor: Hok Chio (Mark) Lai
Office Hours: Tues 12:00–1:00 pm, and by appointment.
Contact Info: (Email) hokchiol@usc.edu, (Slack) https://usc.enterprise.slack.com/.
Timeline for replying to emails: within 48 hours.

IT Help: ITS, Blackboard
Contact Info:
ITS (Email, Monday – Friday, 8:00 A.M. – 6:00 P.M.) consult@usc.edu, (Phone, 24/7/365)
213-740-5555, (Online) ServiceNow Portal
Blackboard (Email, 24/7/365) blackboard@usc.edu, (Online Help) Blackboard Help for Students

Course Description

This is a graduate-level class in statistical methods on multilevel modeling, a popular technique in behavioral and social science research. The course covers topics in multilevel modeling, including two- and three-level hierarchical linear models (HLM), random intercepts and slopes, longitudinal models and growth curve models, and some recent development in multilevel modeling.

The course begins with a brief overview of the ubiquity of multilevel data and the problems of using conventional methods to handle such data. It then transitions to the conceptual and statistical foundations of two-level multilevel models. Students will learn from different real data examples, and perform analyses using data of their own or provided by the instructor. Later material covers the use of multilevel modeling as a general framework for longitudinal data analysis, and other modeling considerations such as categorical data, non-hierarchical (e.g., cross-classified) data structure, and study designs. Students are also encouraged to provide input in suggesting topics to be covered for this course.

Learning Objectives

After the successful completion of this course, students will be able to . . .

1. Explain the problems of analyzing clustered data with multiple regression/ANOVA;
2. Identify the types of multilevel data structure in different research scenarios;
3. Describe the statistical and conceptual foundations of multilevel modeling;
4. Independently analyze real data using statistical software for multilevel modeling;
5. Evaluate published research that uses multilevel modeling;
6. Apply multilevel modeling in a research project, and effectively communicate findings/products in an oral research presentation or a written research report.

Prerequisite(s): PSYC 503: Regression and the General Linear Model (or a similar regression class)

Co-Requisite(s): None

Concurrent Enrollment: None

Recommended Preparation: Experience with statistical software (preferably R)

Course Notes

This class will be in-person and will follow a flipped course design. The benefit of a flipped course model is that the lecturer can spend more time with students to go through applications of concepts and hands-on exercises of data analyses.

The lecture videos and course materials will be available at https://psyc575-2022fall.netlify.app by 9:00 am of each Monday, and students are expected to review these materials and the assigned readings on their own. Please note that the lecture slides only serve to guide class discussions and cannot replace the assigned readings.

Students are expected to have reviewed the lecture videos before attending the Tuesday meetings. The **Tuesday meetings** are structured in two halves: (a) software demonstration by the instructor and (b) quizzes and Q&A sessions. During the **Thursday meetings**, students will complete in-class exercises, which are part of their participation grades.

Before attending the class sessions, students are expected to have

1. Reviewed the posted videos and materials.
2. Identified questions that come up in their learning.
3. Started working on the homework problems.

Communication

To promote independence and critical thinking, students are encouraged to work through the following process for obtaining answers to course-related questions before contacting the instructor:

- consult the course syllabus;
- consult a classmate;
- post your questions on the Q&A channel on Slack;
- meet with the instructor during office hours or Q&A sessions on Tuesdays;
- for personal questions, email the instructor at hokchiol@usc.edu

Technological Proficiency and Hardware/Software Required

- R and RStudio are needed to complete the course assignments. It is highly recommended that students update to the latest versions of both software (R 4.2.1, RStudio 2022.07.1, or above). We will discuss how to set up R and RStudio in Week 1.
- Stable internet connection (for reviewing lecture videos)

USC Computing Center Laptop Loaner Program

If you need a laptop to successfully participate in this class, you may be eligible for the USC Computing Center Laptop Loaner Program.

USC Technology Support Links

Blackboard help for students
Slack information for students
Software available to USC Campus

Required Readings and Supplementary Materials

Recommended

- Snijders, T. A. B., & Bosker, R. J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling* (2nd ed.). Thousand Oaks, CA: Sage.
- (Alternative text) Hox, J. J., Moerbeek, M., & van de Schoot, R. (2018). *Multilevel analysis: Techniques and Applications* (3rd ed.). New York, NY: Routledge.
- Other required readings will be posted on Slack

References

- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage.
- Gelman, A., & Hill, J. (2006). *Data analysis using regression and multilevel/hierarchical models.* Cambridge, UK: Cambridge University Press.
- Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence.* Oxford, UK: Oxford University Press. [For longitudinal data analysis]
- West B. T., Welch, K. B., & Gałecki, A. T. (2014). *Linear mixed models: A practical guide using statistical software* (2nd ed.). Boca Raton, FL: CRC. [A reference for using different software]
- Gałecki, A. T., & Burzykowski, T. (2013). *Linear mixed-effects models using R: A step-by-step approach.* Springer.
- Luke, D. A. (2020). *Multilevel modeling* (2nd ed.). Sage.
- Heck, R. H., Thomas, S. L., & Tabata, L. N. (2014). *Multilevel and longitudinal modeling with IBM SPSS (2nd ed.).* New York, NY: Routledge. [A reference for SPSS users]

Description and Assessment of Assignments

1. In-class exercises (12%). During the Thursday sessions, students will participate in group exercises. If students miss a session for any reason, they can complete the exercise posted on Blackboard within 36 hours (i.e., Friday by end of day, Pacific Time) to get credits.

2. Homework problems (60%). There will be 10 homework assignments for students to apply the concepts and techniques discussed in class to analytic problems. The assignments typically involve performing data analyses using data sets of your own or provided by the instructor, and interpreting the results with some guided questions.
   You must submit your work electronically to Blackboard by the assigned due date. See policy on late work.

3. Final project (28%: 5% prospectus, 3% peer review, 20% presentation/final paper). You will complete a research project related to multilevel modeling, typically a research report of an empirical study using real data or a theoretical/methodological paper about certain aspects of multilevel modeling. Students interested in other project ideas (e.g., software package development) should discuss their ideas with the instructor. Each student can choose to work on their own or in a group of up to three people. Each student/group will schedule an appointment with the instructor to talk about their project during weeks 9 and 10 (October 17–28).

   There are three grading components for your final project:

   - Prospectus (5%)
     A prospectus about your project should be submitted by **Monday, October 17**.

The prospectus should contain a concise description of what you (or your group) plan to do for your project, including a preliminary plan for statistical analysis. The prospectus should be limited to 1 single-spaced page (excluding tables, figures, references, and other supplemental materials).

- Peer Review (3%)
  After the individual meeting with the instructor, each individual/group will refine their research questions and post a summary of their research questions and preliminary analyses by **Friday, November 4**. Each student will then give specific comments to the analyses of other students/groups by **Monday, November 14**. More information on what feedback to give will be included in the grading rubric.

- Final Presentation/Paper (20%)
  If you choose to do a final paper, your paper will be due **Tuesday, December 13, at 10:00 am Pacific Time** (the assigned final exam time for the class). The final paper should include four sections: introduction, method, results, and discussion, or comparable sections; however, **more emphasis should be put on describing the technical details of the analysis and the interpretations of the results**. There should also be a link to the reproducible codes for your analyses. The final paper should be 8-15 double-spaced pages of text (i.e., excluding the title page, abstract, references, tables, figures, and appendices).

Participation

Participation accounts for 12% of the course grade. To earn full credit for participation, students should complete and turn in all in-class exercises.

Grading Breakdown

Assignment	% of Grade
In-class exercises	12
Homework 1-10	60
Prospectus	5
Peer review	3
Final presentation/paper	20
TOTAL	100

Grading Scale

Course final grades will be determined using the following scale

A	93-100
A-	89-92
B+	85-88
B	81-84
B-	77-80
C+	73-76
C	70-72
C-	Below 70 (failing)

Course-specific Policies

Assignment Submission

The assignments should be submitted through Blackboard by Fridays. If needed, students can submit the homework before Sunday at 5:00 pm, without any penalty.

Grading Timeline

Generally, all graded work will be returned no later than one week from the submission deadline. However, given the high number of students in the class, the instructor may only grade selected questions in each assignment. Solutions will be posted so that students can check their work.

Late work

Late work will be penalized by a 10% deduction in the assignment grade every 24 hours late unless due to an emergency excused by the instructor. Email the instructor as soon as possible to discuss alternate arrangements due to an emergency.

Technology in the classroom

Phones

Your phone should be turned off or in silent mode (not on vibrate), and should not be used in the classroom.

Tablets and Laptops

During lecture time in the classroom, students can use tablets and laptops only for purposes of viewing course materials and taking notes. During the in-class exercises, students should use their laptops to complete the assignments.

Attendance

Students are expected to attend all Thursday class sessions on time. If they miss a session, they should complete the class exercises and turn in their work within the timeframe specified in Description and Assessment of Assignments.

Classroom Norms

From USC's COVID-19 safety and other key reminders on August 2,

> Monitor your symptoms before coming to campus. If you experience symptoms consistent with COVID-19, stay home and do not go to class, work or any other location. Arrange to be tested for COVID-19.

> We strongly recommend wearing medical-grade masks or respirator masks (including surgical, N95, KN95, KF94) when indoors around others to reduce transmission and risk of infection.

The following applies to both in-person and online communications (e.g., Slack discussions and email communications)

- Respect each other's views.
- In written communication messages, make sure they are something you could say to someone to their face.
- Recognize and/or remember that we have different backgrounds.
- Criticize ideas, not individuals or groups.
- Either support statements with evidence, or speak from personal experience.

Course Evaluation

Student feedback is essential for the instructor and the Department to keep improving this course. Students are encouraged to share their feedback and suggestions in an early-term feedback survey around week 4 to 5, and respond to the standard USC course evaluation survey at the end of the semester.

(Tentative) Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings	Assignment Dates
Week 1 Aug 23 & 25	• Overview of multilevel models • R Markdown • Review of regression	• SB ch 1, 2 • R Markdown Intro • rmarkdown cheatsheet	• Exercise 1 • Quiz on Regression • HW 1
Week 2 Aug 30 & Sep 1	• What are statistical models? • Review of regression	• Gelman et al. ch 1.1, 1.2, 1.4 • Gelman et al. ch 4.1, 4.2, 4.4, 4.5	• Exercise 2 • HW 2
Week 3 Sep 6 & 8	• The random intercept model	• SB ch 3.1–3.4, 4.1–4.5, 4.8	• Exercise 3 • HW 3
Week 4 Sep 13 & 15	• Effect decomposition • Random coefficient model • Cross-level interactions	• SB ch 4.6, 5.1–5.3	• Exercise 4 • HW 4
Week 5 Sep 20 & 22	• Model estimation • Model testing	• SB ch 4.7, 6 • Gelman et al. ch 4.1, 4.2, 4.4, 4.5	• Exercise 5
Week 6 Sep 27 & 29	• Model assumptions and diagnostics • Reporting results	• SB ch 10 • 10 quick tips to improve your regression modeling	• Exercise 6 • HW 5
Week 7 Oct 4 & 6	• Sample size planning	• SB ch 11	• Exercise 7 • HW 6
Week 8 Oct 11 & 13 (Fall recess)	• MLM for experimental designs • Cross-classified Models	• SB ch 13.1 • Hoffman & Rovine (2007)	• HW 7
Week 9 Oct 18 & 20	• Models for longitudinal data I	• SB ch 15	• Exercise 8 • Prospectus
Week 10 Oct 25 & 27	• Models for longitudinal data II	• Hoffman (2014) ch 4.1 • Hoffman (2014) ch 8	• Exercise 9 • HW 8
Week 11 Nov 1 & Nov 3	• Causal inference with multilevel data	• TBD	• Exercise 10 • HW 9
Week 12 Nov 8 & 10	• Multilevel logistic regression	• SB ch 17.1–17.3	• Exercise 11 • Preliminary analysis

	Topics/Daily Activities	Readings	Assignment Dates
Week 13 Nov 15 & 17	• Missing data	• SB ch 9	• Exercise 12 • HW 10
Week 14 Nov 22 ~~& 24~~ (Thanksgiving)	• Predictive modeling	• TBD	
Week 15 Nov 29 & Dec 1	Final Presentation		Upload slides (on presentation day)
FINAL			Final paper (due Dec 13, 10:00 am)

SB = Snijders & Bosker (2012)

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on Research and Scholarship Misconduct.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

studenthealth.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call

suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call

studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086

eeotix.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776

osas.usc.edu

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 821-4710

campussupport.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

ombuds.usc.edu

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-3340 or otfp@med.usc.edu

chan.usc.edu/otfp

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.