

35352 Syllabus

Advanced Multilevel Modeling, PSYC 8060, 3.00 Credits

Tuesday & Thursday, 2:00pm – 3:15pm, J.S. Coon 150

Instructor Information

Instructor	Email	Drop-in Hours & Location
Audrey J. Leroux, Ph.D.	aleroux@gatech.edu	TBD, J.S. Coon 220A or https://gatech.zoom.us/my/audreyleroux

General Information

Description

This course is designed to extend upon the foundational knowledge of multilevel modeling by providing theoretical and applied understanding of advanced multilevel modeling concepts. The basic concepts taught in multilevel modeling are built upon with the introduction of several new analyses in the family of multilevel models, including growth modeling, three-level modeling, and cross-classified modeling. The course also includes instruction in R programming and interpretation of the software output for conducting advanced multilevel modeling.

Pre- &/or Co-Requisites

This course assumes a solid understanding of the foundations of multilevel modeling and is essential for comprehending many of the concepts in this advanced course. This course will also require the use of R, SPSS, SAS, Stata, or any other software of your choice for data cleaning.

Course Goals and Learning Outcomes

By the end of this course, students should be able to:

- Understand the foundations of MLM and extensions to two-level growth and logistic modeling.
- Recognize longitudinal data as a special case of multilevel data, with *time* at level one.
 - Know various ways to center *time* at level one.
 - Specify appropriately and interpret results from non-linear growth models.
 - Consider sample size and statistical power for two-level longitudinal designs.
- Recognize when variables have been collected at more than two (nested) levels.
 - Write out a three-level model, including assumptions about variance components.
 - Interpret model parameters (including fixed effects and variance components) from a conventional three-level model and a three-level growth model.
 - Consider sample size and statistical power for three-level cross-sectional and longitudinal designs.
- Recognize when multilevel data have a more complex nested structure.
 - Write out a cross-classified model, including assumptions about variance components.
 - Interpret model parameters (including fixed effects and variance components) from a cross-classified model.
 - Understand the difference between cross-classified and multiple membership data.
 - Know how to specify and estimate a multiple membership model.
- Recognize other more advanced extensions related to multilevel modeling (such as multivariate multilevel modeling, modeling count and ordinal outcomes, and simulating multilevel data).

Course Requirements & Grading

Assignment	Date	Weight
Homework 1	Jan. 28	15%
Homework 2	Feb. 18	15%
Homework 3	Mar. 4	15%
First draft of paper	Apr. 1	15%
Peer review	Apr. 8	10%
Final paper	Apr. 29	30%

Description of Graded Components

Homework Assignments

Homework is assigned about every two weeks in the first half of the semester. The three homework assignments provide further opportunity for you to apply and test your understanding of the material discussed in class and involve using R software to analyze data.

- HW 1: Review of multilevel modeling
- HW 2: Longitudinal & three-level modeling
- HW 3: Cross-classified modeling

Note, for these assignments you need access to R software. Assignments are submitted through Canvas as a **PDF file** along with your R script/markdown file.

First Draft of Paper

You will write a paper between 20-30 pages (not including abstract, references, tables, or figures) in which a multilevel model is the primary method of analysis conducted in R. You should choose one of the following topics for your paper:

- Analysis of your own or advisor's data (assuming IRB approval)
- Analysis of public data
 - For example, datasets are publicly available on the [ICPSR site](#), [Harvard Dataverse](#), and other data repositories online.
- A methodological study in the area of multilevel modeling

The first draft of your paper must follow American Psychological Association (APA) format and will contain only the introduction, literature review, and method sections. More details about what should be contained in your first draft and the rubric for assessing your first draft will be provided later in the semester. The first draft is due about two-thirds of the way through the semester.

Peer Review

You will write a double-blind peer review of the first draft of a peer's paper, using the grading rubric, McCoach (2019) chapter, and other readings discussed in class. More details about this assignment will be provided later in the semester. The peer review is due one week after turning in the first draft.

Final Paper

The final paper will contain the revised first draft along with the results and discussion sections. More details about what should be contained in your final paper and the rubric for assessing your final paper will be provided later in the semester. You are expected to present your final paper during the last week of class (April 20th, April 22nd, or April 27th). The final paper is due at the end of the semester.

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Course Materials

Course Text

O'Connell, A. A., McCoach, D. B., & Bell B. A. (Eds.). (2022). *Multilevel modeling methods with introductory and advanced applications*. Information Age Publishing.
(Available for free online through the Georgia Tech Library)

Additional Materials/Resources

Hox, J. J. (2010). *Multilevel analysis: Techniques and applications* (2nd ed.). Routledge.
Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Sage.
Roback, P., & Legler, J. (2021). *Beyond multiple linear regression: Applied generalized linear models and multilevel models in R*. Taylor & Francis Group.
Snijders, T. A. B., & Bosker, R. J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling* (2nd ed.). Sage.

Course Website and Other Classroom Management Tools

Important course information will be posted on [Canvas](#). The site contains a copy of the syllabus, course lecture notes, homework assignments, relevant links, and supplemental materials. Due to copyright constraints, please DO NOT distribute any materials posted on the site. Please login to Canvas as well as check your Georgia Tech email on a regular basis. Failure to do so is NOT an excuse for not knowing about information pertaining to the course.

Course Policies, Expectations, & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review [Georgia Tech's Honor Code](#) and the [Student Code of Conduct](#).

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Limited Generative AI Use Permitted on Certain Assignments

Use of Generative AI (such as Copilot, ChatGPT, Perplexity, etc.) in this course will vary from assignment to assignment. Some assignments may permit Generative AI usage within **instructor-approved boundaries** (e.g., drafting responses to questions about your project, stages of writing your project, or support tasks such as grammar refinement or coding assistance) while other assignments may entirely

prohibit use of Generative AI. Please check the instructions on each assignment to determine what, if any, usage of Generative AI is allowed. Do not assume that because Generative AI was allowed for one assignment, it will be allowed on other assignments.

When allowed for limited usage on an assignment, responsible use is expected, which means your submission must include a brief AI Usage Statement outlining:

- Tool used and date of access
- The input or questions (i.e., prompt) you provided
- A copy of the output
- A description of how you edited and verified the AI-generated content

Failure to follow assignment guidelines for Generative AI—including using Generative AI when it is not permitted or failing to disclose its use when it is—may be considered a violation of Georgia Tech’s academic integrity policies. When in doubt, always consult your instructor before using Generative AI.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the [Office of Disability Services](#) (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Attendance and/or Participation

Class meetings consist of a mixture of lecture, demonstration, and exercises designed to help you master the relevant material. Your active engagement in the class meetings is **essential** for success in the course.

Attendance in class meetings is expected, except under extenuating circumstances. Tardiness and early exits disrupt class. Students are responsible for all the material discussed during the class meetings. If you miss a class meeting, it is your responsibility to find out what you missed, including any lecture notes, handouts, homework assignments, etc.

Public health continues to be an important concern, and students should be encouraged to stay home when sick in order to take care of themselves and each other. An option to join the course remotely may be possible for students to participate when they cannot be present physically.

Collaboration & Group Work

You are encouraged to discuss the concepts, material, and homework (including the paper) with other students in order to better understand them. However, you must write your own responses to the homework (and paper) assignments, which should be neat and free from spelling, grammar, and punctuation errors. You may work in a group of two for the paper assignment.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Late work is not accepted for a few reasons. Assignments are posted at least two weeks in advance of their due date. Grading is done one question at a time and without knowing the student’s name on the assignment to ensure as much grading consistency and fairness as possible. Graded assignments are also returned in about a week (or less) so that you have feedback prior to submitting the next assignment. This process would not be possible to accomplish if late work were accepted. If you have special circumstances, then please reach out to me before the assigned due date.

Inclement Weather and Digital Learning Days

If a weather-related event affects campus operations, instructors (informed by departmental and/or program considerations) have the discretion to cancel class or pivot to remote instruction.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The [Student-Faculty Expectations](#) articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Campus Resources for Students

Graduate Student Academic and Professional Success Resources

A list of resources for graduate students is given on the [Office of Graduate and Postdoctoral Education](#) website. Specific information for [current graduate students](#) includes:

- [Academic Resources](#) such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance.
- [Student Resources](#) such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide.
- [Professional Development](#) such as the programming from the Career Center and other professional development resources and events.

Student Well-Being

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive [list of wellness related resources](#) has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being.

Tentative Course Schedule

Week	Date	Topic	Reading Before Class	Assignment	Due
1	1/12	MLM review: Why MLM & two-level models	Ch. 2, pp. 13-22		
	1/14	MLM review: Estimation, random effects, & centering	Ch. 2, pp. 22-29, 37-38		
2	1/19	MLM review: Interactions, contextual effects, assumptions, & power	McCoach, Ch. 22, pp. 292-301		
	1/21	MLM review: Model building, binary outcomes, & intro to GCM	McCoach, Ch. 22, pp. 301-307		
3	1/26	GCM: Centering <i>TIME</i>	Ch. 9, pp. 313-317		
	1/28	GCM: Time-varying covariates	Ch. 9, pp. 325-331	HW 1	11:59pm
4	2/2	GCM: Quadratic growth	Ch. 9, pp. 336-343		
	2/4	GCM: Piecewise growth	Ch. 9, pp. 331-336, 345-350		
5	2/9	Three-level models	Ch. 2, pp. 39-43		
	2/11	Three-level GCM	Bryk & Raudenbush (1988)		
6	2/16	Three-level power & sample size	Spybrook et al. (2016)		
	2/18	Partially nested data	Cox et al. (2023)	HW 2	11:59pm
7	2/23	Cross-classified models	Ch. 6, pp. 165-190		
	2/25	Cross-classified models, cont'd	Ch. 6, pp. 190-204		
8	3/2	Multiple membership models	Beretvas, Ch. 16		
	3/4	Multiple membership models, cont'd	Chen & Leroux (2018)	HW 3	11:59pm
9	3/9	No Class – Spring Break			
	3/11	No Class – Spring Break			
10	3/16	Simulation studies	Burton et al. (2006)		
	3/18	Simulation studies, cont'd	Morris et al. (2019)		
11	3/23	Bayesian estimation of MLMs	Bürkner, pp. 1-12		
	3/25	Simulating MLM data			
12	3/30	Ordinal outcomes	Ch. 7, pp. 219-225, 239-246		
	4/1	Count outcomes	Ch. 8, pp. 275-297	First draft	11:59pm
13	4/6	Multivariate regression	Snijders & Bosker, Ch. 16		
	4/8	Multivariate multilevel modeling	Hox, Ch. 10, pp. 188-197	Peer review	11:59pm
14	4/13	Multilevel IRT models	Kamata (2001)		
	4/15	Multilevel IRT models, cont'd	Pastor (2003)		
15	4/20	<i>Paper presentations</i>			
	4/22	<i>Paper presentations, cont'd</i>			
16	4/27	<i>Paper presentations, cont'd</i>			
	4/29	No Class		Final paper	11:59pm

The last day to withdraw and receive a “W” is March 17th.