EDF 9850 Section 001/301 Fall 2026: Multilevel Models for Educational Data

Instructor Information:	**Professor Lesa Hoffman (she/her—you can call me Lesa)** Department of Education and Human Development Email: LesaH@clemson.edu *(preferred mode of contact)* Office: 213D Tillman Hall (*infrequently used*)
Course Location and Time:	206 Tillman Hall or via zoom Thursdays 5:00–7:45 PM Eastern
Zoom-Only Office Hours:	Mondays 10–11 AM and Tuesdays 12–1 PM Eastern in a group format on zoom (first-come, first-served, no appointments) or individually by request
Zoom Link for Class and Office Hours:	https://clemson.zoom.us/j/8236434097 Meeting ID: 823 643 4097; Mobile Access: +19292056099 *(please use your real name as your account name to be admitted)*

Graduate Catalog Description:

Introduction to multilevel modeling, focusing on designs common in educational research, such as students nested within classrooms or schools. Covers the specification, estimation, and interpretation of random intercept and random slope models, with attention to analyzing grouped data and contextual effects.

Communication and Office Hours:

- The planned schedule of topics and events given here may need to be adjusted during the course. The **course's external website** will always have the **most current schedule of events and due dates**.
- The instructor will provide announcements and reminders via email; larger changes will also be announced through Canvas. Emails will be answered within 1–2 business days barring unforeseen circumstances.
- Instructor office hours will be held only **on zoom** in a group format (first-come, first-served), in which multiple participants can receive assistance in succession (or simultaneously) without an appointment. Individual zoom meetings with the instructor are also available upon request.

Modality and Attendance:

- **This "HyFlex" course will meet synchronously in person in 206 Tillman Hall and in the instructor's zoom room Thursdays from 5:00 PM to 7:45 PM at the latest. Participants may change their modality—in person as a "roomer" or online as a "zoomer"—without notice each week as desired.**
- Specific class sessions will be held only on zoom for logistical reasons, as noted in the online syllabus.
- **Attendance is expected and strongly encouraged** but is not formally required. Auditors and visitors are always welcome. No required sessions will be held outside the regular class time (i.e., no exam sessions).
- If you are seriously ill, please DO NOT attend class in person! Similarly, if the instructor has been exposed to illness or the weather prohibits safe travel to class, course meetings will move to a zoom-only format.

Learning Objectives and Prerequisite Skills:

- This course will illustrate the uses of **multilevel models** (aka, general linear mixed-effect models, hierarchical linear models), primarily for the analysis of **clustered data** (i.e., persons nested in naturally-occurring groups), and potentially for longitudinal data (i.e., occasions nested in persons), time permitting.
- The overall course learning objective is for participants to be able to **complete all the necessary steps in a multilevel analysis**: deciding which type of model is appropriate; organizing the data for analysis and creating predictor variables; testing fixed and random effects; predicting multiple sources of variation; and interpreting and presenting one's own empirical findings and those reported by others.
- Participants should know how to use at least one statistical software package and be comfortable with **general linear models** (e.g., regression, ANOVA). Review materials are available within **EDF 9770**.

Structure and Behavioral Expectations:

- **Class time** will be devoted primarily to lectures, examples, discussions, and in-class activities, the materials for which will be available at the **course's external website**. Canvas will only be used for announcements, collecting work, and access to readings (as suggested for each unit and which may be updated later).
- **Video recordings** of portions of each class will be hosted on a **class-specific YouTube playlist** so that searchable closed captioning will be provided, and out-of-class recordings will be posted to the playlist as well. Only the screen share and classroom/ instructor audio will be captured on these video recordings.
- The instructor wants all participants to feel welcome and encouraged to actively participate in this course. **There is no such thing as a "stupid" question** (or answer). All course participants—enrolled students and auditing visitors—should always feel welcome to ask whatever questions will be helpful to understand the course content. **Questions are welcome at any point**: during class (aloud or using the zoom chat window, either to everyone or a direct message to the instructor), in office hours, over email, or in individual appointments with the instructor (by request). Students with special needs are encouraged to contact the instructor for a confidential discussion of their individual considerations for academic accommodation.
- To facilitate communication and connection across modalities, both **roomers and zoomers should be logged into zoom with their cameras on** (with audio muted for roomers). Please use the name you wish for us to call you so that it appears on your zoom window while in use. Please do not log into zoom while driving or any other potentially hazardous locations. During zoom-only classes, students may join zoom from the in-person classroom if desired.
- Rather than missing class, it is preferable to join late, leave early, or re-join during class as needed.
- It is expected that the use of cell phones, non-class-related applications, and other distractions are kept to a minimum during class in either modality.

Requirements and Allowed Uses of Artificial Intelligence (AI):

Participants can earn **up to 100 total points** by completing course requirements as follows:

- Up to **10 points** can be earned from submitting answers to group-based **in-class activities** (5 planned initially) using Canvas. These are designed to reinforce lecture concepts through visualization and applied practice. Participants may work through the questions alone or in small groups of their choosing, and then responses will be discussed as a class. For each, **2 points will be given automatically** for reasonable

answers (generated without the use of AI) to the activity's questions (to be submitted using Canvas before the next class as an individual or group, as was selected during class). Participants who miss class may still complete the activity outside of class and submit their individual answers separately to receive credit.

- Up to **14 points** can be earned from submitting **formative assessments** (FAs; 7 planned initially) using Canvas. These are designed to provide a comprehension check, especially over material covered in videos watched outside of class. They should be completed **individually without the use of AI** (which defeats their purpose). For each, **2 points will be given automatically** for brief but thoughtful completion regardless of accuracy, and points may be reduced for AI-generated responses. No individual feedback will generally be given, but responses will be summarized and discussed during the next class.
- Up to **32 points** can be earned from submitting **homework assignments** (HWs; 3 planned initially) through the **instructor's custom online system**. These are designed to provide scaffolded practice doing data analysis, should be completed individually, and will be **graded for accuracy**. The computational questions allow infinite attempts, whereas the multiple-choice results questions allow one attempt. Complete individual feedback will be available after the due date passes. HWs will be based directly on examples given in class, such that no AI use should be needed. However, using AI to better understand the syntax or how to interact with RStudio is permitted. To ensure participants are building their own examples of syntax and output for their Future Selves, the **syntax and output used to complete each HW must also be submitted individually using Canvas before any homework points will be given**. Nearly-identical files submitted by different students may result in a loss of HW points and/or disciplinary action.
- Up to **44 points** may be earned from completing a **data analytic project alone or in pairs**. Each student or pair will give a short **presentation on zoom** designed to mimic a presentation at an academic conference (25 points). **Written components** include a **plan** (5 points; describing the sample, variables, and research questions), **check-in** (10 points; documenting the analyses and results to be presented), and a **peer review** (4 points; providing feedback for another presentation). AI may be used to assist in data management, analysis, and creation of graphics or tables, but not for peer reviews. Each student must be able to explain and defend their work, as well as provide syntax and output documenting their process. **Presentations may be revised once** via a submitted recording. Details and a rubric will be shared later.
- Up to **2 points of extra credit** can be earned through **HW 0**; there may be other extra credit opportunities at the instructor's discretion.
- Revisions to the planned course schedule and/or content may result in fewer requirements (and thus fewer total points) at the instructor's discretion. If so, this syllabus will be updated to reflect the new point totals. Further, the due dates currently listed below may be pushed later if needed, but never sooner.

Course Grading Policies:

Because the **material** for this course **builds cumulatively**, the following policies are designed to reinforce the need for participants to complete coursework in a **consistent and timely manner**.

- Participants may submit coursework **up to 2 weeks late** with these **point penalties**: in-class activity (−1), FA (−1), HW (−3), project plan (−2), project check-in (−4), presentation (−10), and peer review (−2) penalty.
- **Extensions** without penalty will be granted as needed for extenuating circumstances (e.g., conferences, comprehensive exams, family obligations) if **requested in writing** at least **two weeks in advance** of the due date.

- A final grade of "incomplete" will only be given in unforeseen dire circumstances for participants who have otherwise kept up with the coursework and entirely at the instructor's discretion. **All work must be submitted by 11:59 PM on Friday, December 11, 2026, to be included in the course grade.**
- **Final grades** will be determined by the ***percentage*** **earned** out of the total possible points:

  ≥93 = A, 90–92% = A−, 87–89% = B+, 83–86% = B, 80–82% = B−, 77–79% = C+, 73–76% = C, 70–72% = C− **(PASS)**, 67–69% = D+, 63–66% = D, 60–62% = D−, <60% = F

The instructor realizes that this course is not your only obligation in your work or your life. While class attendance in real time is not strictly mandatory, it is strongly encouraged because frequent review of the material will be your best strategy for success in this course. However, if work or life events may compromise your ability to succeed, please contact the instructor for a confidential discussion so that we can work together to make a plan for your success. **Please do not wait until you are too far behind to try to catch up!**

Required Software:

This course will use **R software** for statistical analysis, which is free online. Participants will need to first i**nstall R software** and then **install RStudio software**. Alternatively, participants can access R through **CU APPS**.

Recommended Readings (located in "Files" in Canvas):

Arend, M. G., & Schäfer, T. (2019). Statistical power in two-level models: A tutorial based on Monte Carlo simulation. *Psychological Methods, 24*(1), 1–19. https://doi.org/10.1037/met0000195

Enders, C. K. (2010; chapters 3–5). *Applied missing data analysis* (1st ed). Guilford.

Guo, Y., Dhaliwal, J., & Rights, J. D. (2024). Disaggregating level-specific effects in cross- classified multilevel models. *Behavior Research Methods, 56*, 3023–3057. https://doi.org/10.3758/s13428-023-02238-7

Hamaker, E. L., & Muthén, B. (2020). The fixed versus random effects debate and how it relates to centering in multilevel modeling. *Psychological Methods, 25*(3), 365–379. https://doi.org/10.1037/met0000239

Hoffman, L. (2015). *Longitudinal analysis: Modeling within-person fluctuation and change*. Routledge/Taylor & Francis. Available for free through the Clemson University library at this link.

Hoffman, L. (2025). Disaggregating associations of between-person differences in change over time from within-person associations in longitudinal data. *Multivariate Behavioral Research, 60*(6), 1312–1330. https://doi.org/10.1080/00273171.2025.2519348

Hoffman, L., & Walters, R. W. (2022). Catching up on multilevel modeling. *Annual Review of Psychology, 73*, 629–658. https://doi.org/10.1146/annurev-psych-020821-103525

McNeish, D. (2017). Small sample methods for multilevel modeling: A colloquial elucidation of REML and the Kenward-Roger correction. *Multivariate Behavioral Research, 52*(5), 661–670. https://doi.org/10.1080/00273171.2017.1344538

McNeish, D. (2026). A practical guide to selecting and blending approaches for clustered data: Clustered errors, multilevel models, and fixed-effect models. *Psychological Methods, 31*(2), 225–251. https://doi.org/10.1037/met0000620

Padilla, B., Dorman, E., & Hoffman, L. (2026). Multilevel analysis for communication scientists. In L. Shen (Ed.) *Quantitative research methods in communication science: Data analysis* (pp. 95–122). De Gruyter Brill.

Rights, J. D. (2023). Aberrant distortion of variance components in multilevel models under conflation of level-specific effects. *Psychological Methods, 28*(5), 1154–1177. https://doi.org/10.1037/met0000514

Rights, J. D., & Sterba, S. K. (2019). Quantifying explained variance in multilevel models: An integrative framework for defining R-squared measures. *Psychological Methods, 24*(3), 309–338. https://doi.org/10.1037/met0000184

Rights, J. D., & Sterba, S. K. (2020). New recommendations on the use of R-squared differences in multilevel model comparisons. *Multivariate Behavioral Research, 55*(4), 568–599. https://doi.org/10.1080/00273171.2019.1660605

Rights, J, D., & Sterba, S. K. (2023). On the common but problematic specification of conflated random slopes in multilevel models. *Multivariate Behavioral Research, 58*(6), 1106–1133. https://doi.org/10.1080/00273171.2023.2174490

ten Hove, D., Jorgensen, T. D., & van der Ark, L. A. (2022). Interrater reliability for multilevel data: A generalizability theory approach. *Psychological Methods, 27*(4), 650–666. https://doi.org/10.1037/met0000391

Walters, R. W. & Hoffman, L. (2017). Applying the hierarchical linear model to longitudinal data. *Culture and Education, 29*(3), 666–701. https://doi.org/10.1080/11356405.2017.1367168

Yaremych, H. E., Preacher, K. J., & Hedeker, D. (2023). Centering categorical predictors in multilevel models: Best practices and interpretation. *Psychological Methods, 28*(3), 613–630. http://dx.doi.org/10.1037/met0000434

Other Suggested Textbooks for General Linear Models or Multilevel Models:

Darlington, R. B., & Hayes, A. F. (2016). *Regression analysis and linear models: Concepts, applications, and implementation*. Guilford. Available electronically from the Clemson library.

O'Connell, A. A., McCoach, D. B., & Bell, B. A. (Eds.). (2022). *Multilevel modeling methods with introductory and advanced applications*. Information Age Publishing.

Hox, J. J., Moerbeek, M., & van de Schoot, R. (2017). Multilevel analysis: Techniques and applications (3rd ed.). Routledge. https://doi.org/10.4324/9781315650982

S & B: Snijders, T. A. B., & Bosker, R. J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling.* Sage.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Sage Publications.

Schedule of Events for Weeks 1–6:

Week	Weekday and Date		Topics and Course Materials	Readings
1	Due by 11:59 PM	8/19	**No Formative Assessments (FA), Homework (HW), Activity Answers, or Project Components Due**	Hoffman & Walters (2022)
	During Class	8/20	***MEET ON ZOOM ONLY*** Lecture 1: Introduction to this Course and to Multilevel Models (MLMs)	
2	Due by 11:59 PM	8/26	**Watch Lecture 1 Part 2** **Watch Lecture 2 Parts 1 and 2** **FA1 (Quiz in Canvas)** **Install R and then RStudio software for use in class**	
	During Class	8/27	Discussion of HW and FA1 Lecture 2 and Example 2: From Empty Models to Level-2 Predictors Activity 1	McNeish (2017)
3	Due by 11:59 PM	9/2	**Watch Lecture 3 Part 1** **FA2 (Quiz in Canvas)** **HW0 (online, for 2 points extra credit over the syllabus)** **Activity 1 (Assignment in Canvas)**	
	During Class	9/3	Discussion of course requirements, Activity 1, and FA2 Lecture 3 and Example 3: Fixed Slopes of Level-1 Predictors Activity 2	Rights & Sterba (2019, 2020) Yaremych et al. (2023)
4	Due by 11:59 PM	9/9	**Watch Lecture 3 Part 2** **FA3 (Quiz in Canvas)** **Activity 2 (Assignment in Canvas)**	
	During Class	9/10	Discussion of FA3 and Activity 2 Lecture 3 and Example 3, continued Activity 3	Hamaker & Muthén (2020) McNeish (2026)
5	Due by 11:59 PM	9/16	**Watch Lecture Reviewing Interactions** **HW1 (online, based on Example 2)** **Activity 3 (Assignment in Canvas)**	
	During Class	9/17	***MEET ON ZOOM ONLY*** Discussion of Activity 3 Lecture 3 and Example 3, continued	
6	Due by 11:59 PM	9/23	**Watch Lecture 4 Part 1** **Project Plan (Assignment in Canvas)**	
	During Class	9/24	Lecture 4: Random Slopes and Cross-Level Interactions Example 4a: Random Slopes and Cross-Level Interactions of Cluster-Mean-Centered Level-1 Predictors Activity 4	Rights & Sterba (2023) Rights (2023)

Planned Schedule of Events for Weeks 7–12:

Week	Weekday and Date		Topics and Course Materials	Readings
7	Due by 11:59 PM	9/30	**Watch Lecture 4 Part 2** **FA4 (Quiz in Canvas)** **Activity 4 (Assignment in Canvas)**	
	During Class	10/1	***MEET ON ZOOM ONLY*** Discussion of FA4 and Activity 4 Lecture 4, continued	
8	Due by 11:59 PM	10/7	**Optional: Watch Lecture 4 Part 3** **Project Plan Revisions (if needed, Assignment in Canvas)** **HW2 (online, based on Example 3)**	
	During Class	10/8	Lecture 4, continued Example 4b: Random Slopes and Cross-Level Interactions of Hybrid Level-1 Predictors Activity 5	Enders (2010) ch. 3–5 Hoffman (2015) ch. 5
9	Due by 11:59 PM	10/14	**Watch Lecture 5 Part 1** **FA5 (Quiz in Canvas)** **Activity 5 (Assignment in Canvas)**	
	During Class	10/15	Discussion of FA5 and Activity 5 Lecture 5: Longitudinal Models Example 5a: Time-Varying Predictors of Within-Person Fluctuation	Hoffman (2015) ch. 1, 6–9
10	Due by 11:59 PM	10/21	**HW3 (online, based on Example 4)**	
	During Class	10/22	***NO CLASS*** **Watch Lecture 5 Part 2**	Padilla et al. (2026)
11	Due by 11:59 PM	10/28	**Project Check-In (Assignment in Canvas)**	
	During Class	10/29	Lecture 5 and Example 5a, continued Example 5b: Time-Invariant Predictors of Within-Person Change	Walters & Hoffman (2017) Hoffman (2025)
12	Due by 11:59 PM	11/4	**Watch Lecture 6** **FA6 (Quiz in Canvas)**	
	During Class	11/5	Discussion of FA6 Lecture 6: Two-Level Cross-Classified Designs Example 6a: Crossed Primary and Secondary Schools Example 6b: Subjects Crossed with Items	Guo et al. (2024) Hoffman (2015) ch. 12 ten Hove et al. (2022)

Planned Schedule of Events for Weeks 13–16:

Week	Weekday and Date		Topics and Course Materials	Readings
13	Due by 11:59 PM	11/11	**Project Check-In Revisions (if needed, Assignment in Canvas)**	
	During Class	11/12	***MEET ON ZOOM ONLY*** Student Project Presentations	
14	Due by 11:59 PM	11/18	Nothing Due	
	During Class	11/19	***MEET ON ZOOM ONLY*** Student Project Presentations	
15	Due by 11:59 PM	11/25	Nothing Due	
	During Class	11/26	***NO CLASS***	
16	Due by 11:59 PM	12/2	**Project Peer Reviews (via email)** **FA7 (Quiz in Canvas)**	
	During Class	12/3	***MEET ON ZOOM ONLY*** Discussion of FA7 Study Planning; TBD	Arend & Schäfer (2019) Hoffman (2015) ch. 13
17	Due by 11:59 PM	12/11	**Project Presentation Revisions and All Other Work**	