Psychological and Quantitative Foundations (PSQF) 6271 Section 0001: Longitudinal Multilevel Models Fall 2022

Instructor and Home Department Information:	**Professor Lesa Hoffman (she/her—you can call me Lesa)** Educational Measurement and Statistics Program *PSQF Dept Office: South 361 Lindquist Center; DEO: Professor Saba Ali*
Instructor Contact Information:	Email: Lesa-Hoffman@UIowa.edu *(preferred mode of contact)* Office: 356 South Lindquist Center *(mostly unattended)* Phone: 319-384-0522 *(mostly unattended)*
Zoom Link for Class and Office Hours:	https://uiowa.zoom.us/my/lesahoffmaniowa Meeting ID: 5044356512; Mobile Access: +13126266799
Course Location and Time:	166 North Lindquist Center or via zoom Tuesdays and Thursdays 12:30–1:45 PM
Zoom-Only Office Hours:	Mondays and Wednesdays 3:30–4:30 PM in a group format or individually by appointment

Schedule of Topics and Events:

This course will meet **synchronously in person and on zoom.** The planned schedule of topics and events given here will likely need to be adjusted throughout the course. The **course website** will always have the **most current schedule of events and due dates**: http://www.lesahoffman.com/PSQF6271/index.html

Course Objectives, Pre-Requisites, and Materials:

This course will focus the uses of multilevel models (i.e., general linear mixed-effect models, hierarchical linear models) for the analysis of longitudinal (repeated measures) data. The course objective is for participants to be able to complete all the necessary steps in a longitudinal analysis involving time-invariant predictors: deciding which type of model is appropriate, restructuring the data and creating predictor variables, evaluating fixed and random effects and/or alternative covariance structures, predicting multiple sources of variation, and interpreting and presenting empirical findings. Prior to enrolling, participants should be comfortable with general linear models (e.g., regression, ANOVA).

Class time will be devoted primarily to lectures, examples, and spontaneous review, the materials for which will be available for download at the course website. Readings and other resources have been suggested for each topic and may be updated later. Synchronous attendance (in person or via zoom) is encouraged but not required, and you do not need to notify the instructor of a single class absence. Video recordings of each class will be made available on YouTube so that closed captioning will be provided, and supplemental videos for specific topics (e.g., software demos) may be added as well. Auditors and visitors are always welcome to attend class. No required class sessions will be held outside the regular class time given above (i.e., no additional midterm or final exam sessions). However, because the course will have an applied focus requiring the use of statistical software, participants are encouraged to attend group-based office hours (via zoom only), in which multiple participants can receive immediate assistance on homework assignments simultaneously.

Course Requirements:

Course participants will have the opportunity to earn **up to 100 total points** by completing work outside of class. Up to **86 points** can be earned from submitting **homework assignments** (approximately 5 in total) through a custom online system—these will be graded for accuracy. Up to **14 points** may be earned from submitting **formative assessments** (approximately 7 in total) through ICON; these will be graded for effort only—incorrect answers will not be penalized. Participants may earn up to **2 extra credit points** for completing homework 0; there may be other opportunities to earn extra credit at the instructor's discretion. Finally,

revisions to the planned course schedule and/or content may result in fewer homework assignments and formative assessments (and thus fewer total points) at the instructor's discretion.

Policy on Accepting Late Work and Grades of Incomplete:

Participants may submit work at any point during the semester to be counted towards their course grade. However, in order to encourage participants to keep up with the class**, late homework assignments will incur a 2-point penalty, and late formative assessments will incur a 1-point penalty.** Extensions will be granted as needed for extenuating circumstances (e.g., conferences, comprehensive exams, family obligations) if requested at least two weeks in advance of the due date. A final grade of "incomplete" will only be given in dire circumstances and entirely at the instructor's discretion. **All work must be submitted by Friday, December 16, 2022, at 5:00 PM to be included in the course grade.**

Final grades will be determined by the *percentage* earned out of the total possible points:

>96% = A+, 93–96% = 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

Course Software:

Participants will need to have access to statistical software—**SAS, STATA, or R+Rstudio**—that can estimate the models presented. Each of these programs are freely available to course participants in multiple ways:

- You can connect to the U Iowa Virtual Desktop (connect to the U Iowa VPN first) for free
- You can connect to the U Iowa Research Remote Desktop (connect to the U Iowa VPN first) for free
- You can install R software for free on your local machine, along with the free graphical Rstudio interface that makes R easier to use (install second after R software)
- You can connect to the web-based SAS OnDemand platform for free on your local machine
- You could also pay $48 to install a 6-month student copy of STATA on your local machine

Course Textbook:

Hoffman, L. (2015). *Longitudinal analysis: Modeling within-person fluctuation and change*. New York, NY: Routledge. Available at the University of Iowa library in electronic form.

Other Course Readings (all available in ICON under "Files"):

Note—I know this is A LOT of readings, but we are covering a lot of material! I encourage you to prioritize reading the textbook, as it will map most closely onto what we cover in class. Then should come class participation and completing course work, followed by these extra readings as time permits (included to give you some additional background and/or exposure to current best-practices in each topic).

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

Castro-Schilo, L., & Grimm, K. J. (2018). Using residualized change versus difference scores for longitudinal research. *Journal of Social and Personal Relationships, 35*(1), 32–58. https://doi.org/10.1177/0265407517718387

Enders, C. K. (2010; chapters 3–5). *Applied missing data analysis*. New York, NY: Guilford.

Johnson, T. L., & Hancock, G. R. (2019). Time to criterion latent growth models. *Psychological Methods, 24*(6), 690–707. https://doi.org/10.1037/met0000214

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. (2020). Relaxing the proportionality assumption in latent basis models for nonlinear growth. *Structural Equation Modeling, 27*(5), 817–824. https://doi.org/10.1080/10705511.2019.1696201

McNeish, D., & Matta, T. (2018) Differentiating between mixed-effects and latent-curve approaches to growth modeling. *Behavior Research Methods, 50*, 1398–1414. https://doi.org/10.3758/s13428-017-0976-5

Preacher, K. J., & Hancock, G. R. (2015). Meaningful aspects of change as novel random coefficients: A general method for reparameterizing longitudinal models. *Psychological Methods, 20*(1), 84–101. https://doi.org/10.1037/met0000028

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

Stoel, R. D., Garre, F. G., Dolan, C., & van den Wittenboer, G. (2006). On the likelihood ratio test in structural equation modeling when parameters are subject to boundary constraints. *Psychological Methods, 11*(4), 439–455. https://doi.org/10.1037/1082-989X.11.4.439

Tuliao, A. P., Hoffman, L., & McChargue, D. E. (2017). Measuring individual differences in responses to date-rape vignettes using latent variable models. *Aggressive Behavior, 43*(1), 60–73. https://doi.org/10.1002/ab.21662

Walters, R. W., & Hoffman, L. (2017). Applying the hierarchical linear model to longitudinal data / La aplicación del modelo lineal jerárquico a datos longitudinales, *Cultura y Educación, 29*(3), 666–701. https://doi.org/10.1080/11356405.2017.1367168

Willett, J.B. (1989). Some results on reliability for the longitudinal measurement of change: Implications for the design of studies of individual growth. *Educational and Psychological Measurement, 49,* 587-602. https://doi.org/10.1177%2F0013164489049003009

Yuan, K.-H., Zhang, Z., & Deng, L. (2019). Fit indices for mean structures with growth curve models. *Psychological Methods, 24*(1), 36–53. https://doi.org/10.1037/met0000186

Academic Misconduct:

As a reminder, the University of Iowa College of Education has a formal policy on academic misconduct, which all students in this course are expected to follow. While students can work with each other to understand the course content, all homework assignments must ultimately be completed individually using the student-specific datasets provided for each assignment. Please consult the instructor if you have questions.

Respect for Each Other:

The instructor wants ALL students to feel welcome and encouraged to 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 in helping them understand the course content. **Questions or comments are welcome at any point** during class (aloud or using the zoom chat window), in office hours, over email, or in individual appointments with the instructor (available by request). Students with disabilities or who have any special needs are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation.

All participants are welcome to attend class via zoom instead of in person for any reason at any time. If you do attend class in person, the University of Iowa encourages everyone to be vaccinated against COVID-19 and to wear a face mask in all classroom settings. **If it possible that you have been exposed to COVID-19 or any other illness, please DO NOT attend class in person!** Similarly, if the instructor has been exposed to illness or the weather prohibits safe travel to class, the course will move to a temporary zoom-only format to protect all course participants. **When using zoom, please provide the name you wish for us to call you inside your zoom account** (i.e., so that it appears on your window while in use). Student use of cameras and microphones while on zoom is also encouraged but not required (out of respect for your privacy and/or limited bandwidth). Please note that class video recordings posted on YouTube will NOT include any video from course participants (only the class audio and screen share from the instructor will be captured). Participants who do not wish for their audio to be captured can use the zoom chat window (which also allows for private direct messages to the instructor), even while attending in person.

The University of Iowa is committed to **making the class environment (in person or online) a respectful and inclusive space** for people of all gender, sexual, racial, religious, and other identities. Toward this goal, students are invited to optionally share the names and pronouns they would like their instructors to use to address them. The University of Iowa prohibits discrimination and harassment against individuals on the basis of race, class, gender, sexual orientation, national origin, and other identity categories. For more information, contact the Office of Institutional Equity. Additional university guidelines about classroom behavior and other student resources are provided here, student complaint procedures are provided here, and the university acknowledgement of land and sovereignty is here.

Respect for The Rest of Your World:

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 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!**

Schedule of Events for Weeks 1–8:

Week Number	Weekday and Date		Topics	Readings for Each Topic
1	M	8/22	**NO OFFICE HOURS TODAY** **NO HOMEWORK (HW) OR FORMATIVE ASSESSMENTS (FA) DUE**	
	T	8/23	Lecture 1: Introduction to the Course and Multilevel Models for Longitudinal Data	Hoffman (2015) ch. 1 Willett (1989)
	R	8/25	Lecture 1, continued Lecture 3: Introduction to Within-Person Analysis and RM ANOVA Unit 2: Review of General Linear Models (review Lecture 1 and Example 1 from this class on your own)	 Hoffman (2015) ch. 3 Hoffman (2015) ch. 2
2	M	8/29	**HW0 (2 points extra credit) DUE ONLINE BY 11:59 PM**	
	T	8/30	Lecture 3, continued Example 3a: Between vs. Within-Person Models	Castro-Schilo & Grimm (2018)
	R	9/1	Example 3a, continued	
3	M	9/5	**NO HW OR FA DUE**	
	T	9/6	**OFFICE HOURS TUESDAY 9/6 INSTEAD OF MONDAY 9/5** Lecture 3 and Example 3a, continued Example 3b: Repeated Measures Analysis of Variance (RM ANOVA)	
	R	9/8	**MEET ON ZOOM ONLY** **OFFICE HOURS THUR 9/8 INSTEAD OF WED 9/7** Lecture 3 and Example 3b, continued	
4	M	9/12	**FA1 DUE VIA ICON BY 11:59 PM**	
	T	9/13	Lecture 4 and Example 4: Describing Within-Person Fluctuation over Time via ACS Models	Hoffman (2015) ch. 4
	R	9/15	Lecture 4 and Example 4, continued	
5	M	9/19	**FA2 DUE VIA ICON BY 11:59 PM**	
	T	9/20	Lecture 5 and Example 5: Introduction to Random Effects of Time and Model Estimation	Hoffman (2015) ch. 5 Enders (2010) ch. 3-5 McNeish (2017)
	R	9/22	Lecture 5 and Example 5, continued	Stoel et al. (2006)
6	M	9/26	**HW1 (based on Lectures 3-4) DUE ONLINE BY 11:59 PM**	
	T	9/27	Lecture 5 and Example 5, continued	McNeish & Matta (2018)
	R	9/29	Lecture 5 and Example 5, continued	Yuan et al. (2019)
7	M	10/3	**FA3 DUE VIA ICON UNDER ASSIGNMENTS BY 11:59 PM**	
	T	10/4	Lecture 5, continued	
	R	10/6	**MEET ON ZOOM ONLY** Lecture 6: Describing Within-Person Change Example 6a: Modeling Change over Time with Polynomial Trends	 Hoffman (2015) ch. 6
8	M	10/10	**HW2 (based on Example 5) DUE ONLINE BY 11:59 PM**	
	T	10/11	Lecture 6 and Example 6a, continued	
	R	10/13	**NO OFFICE HOURS 10/12 AND NO CLASS 10/13**	

Last updated 12/7/2022

Schedule of Events for Weeks 9–17:

Week		Date	Topics	Readings for Each Topic
9	M	10/17	**NO HW OR FA DUE**	
	T	10/18	**MEET ON ZOOM ONLY** Lecture 6 and Example 6a, continued	
	R	10/20	**MEET ON ZOOM ONLY** Lecture 6 and Example 6a, continued	
10	M	10/24	**FA4 DUE VIA ICON BY 11:59 PM**	
	T	10/25	Lecture 6, continued Example 6b: Modeling Change over Time with Piecewise Trends	Tuliao et al. (2017)
	R	10/27	Lecture 6 and Example 6b, continued	
11	M	10/31	**HW3 (based on Example 6a) DUE ONLINE BY 11:59 PM**	
	T	11/1	Lecture 6 and Example 6b, continued	
	R	11/3	Lecture 6, continued Example 6d: Modeling Change over Time with Truly Exponential Models Example 6c: Modeling Change over Time Using Log Time to Approximate Exponential Trends	Johnson & Hancock (2019) McNeish (2020) Preacher & Hancock (2015)
12	M	11/7	**FA5 DUE VIA ICON BY 11:59 PM**	
	T	11/8	Lecture 7a: Review of Unconditional Models of Time	Walters & Hoffman (2017)
	R	11/10	Lecture 7b and Example 7b: Time-Invariant Predictors in Longitudinal Models	Hoffman (2015) ch. 7
13	M	11/14	**FA6 DUE VIA ICON BY 11:59 PM**	
	T	11/15	Lecture 7b, continued	
	R	11/17	Lecture 7b, continued	Rights & Sterba (2019, 2020)
14	M	11/21	**NO CLASS OR OFFICE HOURS THIS WEEK**	
	T	11/22	**NO CLASS OR OFFICE HOURS THIS WEEK**	
	R	11/24	**NO CLASS OR OFFICE HOURS THIS WEEK**	
15	M	11/28	**HW4 (based on Example 6b) DUE ONLINE BY 11:59 PM**	
	T	11/29	Example 7b, continued	Arend & Schäfer (2019)
	R	12/1	Example 7b, continued	
16	M	12/5	**FA7 DUE VIA ICON BY 11:59 PM**	
	T	12/6	Example 7b, continued	
	R	12/8	Discussion of FA7 Storytime	
17	M	12/12	Office hours will be from 3:30-4:30 PM	
	T	12/13	NO CLASS, but office hours will be held from 12:30-3:30 PM	
	W	12/14	Office hours will be from 3:30-4:30 PM	
	R	12/15	NO CLASS, but office hours will be held from 12:30-3:30 PM	
	F	12/16	**HW5 (based on Example 7b) DUE BY 5:00 PM ONLINE** **ALL OUTSTANDING WORK MUST BE COMPLETED BY 5:00 PM**	