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# MULTILEVEL MODELING IN DEVELOPMENTAL AND FAMILY RESEARCH

**Class:** Tuesdays and Thursdays 12-1:15pm Stanley Coulter Hall (SC) room 183

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| **Professor:** Kristine Marceau  **Office:** 225 Hanley Hall  **Phone:** 494-9410  **Email:** [KristineMarceau@purdue.edu](mailto:KristineMarceau@purdue.edu)  **Office hours:** by appointment | **TA:** Emily Rolan  **Office:** 355 Hanley Hall  **Phone:** 494-6610  **Email:** rolan@purdue.edu  **Office hours:** by appointment |

**Class Website:** <http://itap.purdue.edu/tlt/blackboard/>

The course webpage is hosted by Blackboard Learn. When you login to Blackboard you should automatically have access to the webpage. The webpage will contain: PowerPoints from presentations given in lecture, SAS scripts and data sets, homework assignments, supplemental readings, etc. I will also email updates to the class through blackboard.

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# Required Text:

# Raudenbush, S. W. & Bryk, A. S. (2002). Hierarchical linear models: Applications and data analysis methods (2nd ed). Thousand Oaks, CA: Sage Publications. (Referred to as HLM in the schedule)

# Course Description and Objectives:

This course is an introduction to multilevel (mixed-effects) modeling, which is an analytic method used throughout the sciences. The course is designed to provide you with an understanding of both the statistical underpinnings and the application of multilevel models (MLMs). While mathematical basics of statistical methods are covered, emphasis is placed on model development, the conceptual understanding of models, and interpretation of model results. The course will introduce the basic two-level MLM and relate it to regression and ANOVA modeling methods. Nesting in both the contextual and longitudinal data situations are examined. Three-level MLMs are also covered. Data preparation, hypothesis testing and estimation approaches for MLMs are introduced throughout the course. Students should finish the course with the ability to apply MLMs to their substantive research questions and to understand and communicate their meaning.

# Communication:

The course has a listserv, which I frequently use to communicate with the class. Updates and reminders on upcoming readings and homework assignments are provided through email.

Changes to the schedule are also provided this way. Students may communicate with the class via the listserv. It is often a good tool to ask questions that are likely important to other students. (Note that your email address will be made available to the class when you use the listserv.)

**Learning objectives:**

* Develop a basic understanding of multilevel models including proper application, interpretation, and evaluation of the models
* Develop an understanding of the underlying statistics including model notation, model structure, and hypothesis testing
* Learn the benefits and limitations of MLMs including when it is advantageous to use this modeling approach
* Run MLM data analysis using SAS statistical software
* Improve analytic and critical thinking skills
* Improve written and verbal communication of analytic results
* Use MLM methods to test research questions using real data and statistical software

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# Course Components:

Readings: Reading assignments include readings from the required text as well as supplemented course readings which will be provided on Blackboard. Reading assignments may be updated during class and through the listserv. Completing the readings will greatly aid with your understanding of the material presented in class. Therefore, I encourage you to keep up with the reading as best you can. It is good practice to read statistics in shorter sections rather than reading through entire chapters in one sitting.

Homework: There will be approximately five homework assignments over the course of the semester. These generally will involve application of MLMs to real data using SAS, including communicating the results. The focus will be on proper application of the models and interpretation of model results, but will also include some calculations and problem solving. You may work together with others on assignments, but you should produce your own assignment, particularly with respect to written components. Use your PUID instead of name on all homework assignments. Homework will account for 50% of your final grade.

Class structure: All classes will occur in the lab. Each session will start with some lecture, and we will also practice data preparation and running MLM models using SAS software. On some occasions work on models for the homework. Class attendance is highly recommended, as without class attendance it will be much more difficult to master the material.

Statistical Software: We will learn how to analyze MLMs using SAS statistical software. SAS is available in all ITaP instructional labs across campus as well as through software remote: <https://engineering.purdue.edu/ECN/Support/KB/Docs/UsingITaPGoRemotesof>

SAS 9.4 (for your personal computer) is also available for immediate download by placing a free order on Purdue’s Community Hub: <https://communityhub.purdue.edu/storefront/browse/statistical>. Please contact the TA for additional information about downloading SAS for your personal computer. Note: SAS does not make a Mac version for their software.

Additionally, we will be providing scripts for the analyses in R as well, though this will not be primarily taught this semester.

Quizzes: There will be four pop quizzes during the course of the semester. The quizzes will represent 20% of your final grade (5% each). A major component of the exams will be interpretation of statistics we learn about in the class in short answer format. Use your PUID instead of name on all quizzes. **There will be no make-up quizzes.** Any pop quizzes that are missed due to absence from class will be scored 0. Please inform Dr. Marceau or the TA of any known, planned absences (e.g., for conference travel) at the beginning of the semester.

Final Presentation: There will be a final presentation at the end of the semester. The TA and I will work with each student to define an appropriate research question that can be tested using MLM for the final presentation. Students are encouraged to set a meeting with Dr. Marceau prior to March 27 by which date all topics must be approved. Presentations should be 10-15 minutes in length, and there will be an additional 5 minutes set aside for questions. Presentations should include a brief introduction (2-3 slides), research questions/hypotheses (1 slide), methods (1-2 slides on study and measures), analytic strategy (1-3 slides), results, conclusions (1 slide), and implications (1 slide). The TA will demonstrate an example final presentation a week before presentations begin. The final presentation will represent 30% of your final grade.

Paper Option: If you would like feedback on a final research paper I will be happy to read and comment on it. This option may be useful for students who are working on a paper or a thesis using the data they bring to this course. There will be no additional credit for papers, and it will not be substituted for the final presentation.

**Grading:** Your grade will be weighted based on the following course component percentages:

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| Homework: | 50% |
| Quizzes: | 20% |
| Final Presentation: | 30% |
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Final grades will be assigned according to the following scale:

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| --- | --- | --- |
| A+: | > | 98% |
| A: | 92% - | 97.9% |
| A-: | 90% - | 91.9% |
| B+: | 88% > | 89.9% |
| B: | 82% - | 87.9% |
| B-: | 80% - | 81.9% |
| C+: | 78% > | 79.9% |
| C: | 72% - | 77.9% |
| C-: | 70% - | 71.9% |
| D+: | 68% > | 69.9% |
| D: | 62% - | 67.9% |
| D-: | 60% - | 61.9% |
| F: | < | 60% |

# Course Policies:

**Special Accommodations:** Our goal is for everyone to participate fully in this course. If you have a physical, psychological, medical, or learning disability that may impact your course work, please make an appointment to speak with me in order to discuss any needed adjustments. In addition, you should notify the Disability Resource Center of an impairment/condition that may require accommodations/documentation. <http://www.purdue.edu/drc>

# Academic Integrity: Students are advised to familiarize themselves with the University’s regulations regarding student conduct in academic endeavors. This information is located at the following website: [http://www.purdue.edu/univregs/pages/stu\_conduct/stu\_regulations.html.](http://www.purdue.edu/univregs/pages/stu_conduct/stu_regulations.html) Students who are suspected to be in violation of the University’s regulations regarding academic dishonesty, including but not limited to plagiarism and cheating, will be dealt with in accordance with University policy. This may result in a referral to the Office of the Dean of Students and penalties for the assignment(s) in question.

**Honor Pledge:**

***As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.***

Please refer to Purdue’s Honors Pledge: [*Purdue’s Honor Pledge*](https://www.purdue.edu/provost/teachinglearning/honor-pledge.html) for more details.

# Campus Emergencies:

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. I will try to send out messages through the class listserv regarding emergencies affecting our class.

Emergency information and updates will be posted on Purdue's homepage at [http://www.purdue.edu.](http://www.purdue.edu/) Students should sign up for emergency text messages here: [http://www.purdue.edu/securepurdue/.](http://www.purdue.edu/securepurdue/) Also, the following webpage details university policies and procedures during various emergency events: [https://www.purdue.edu/emergency\_preparedness/flipchart/index.html.](https://www.purdue.edu/emergency_preparedness/flipchart/index.html)

# If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack, https://purdue.welltrack.com/. Sign in and find information and tools at your fingertips, available to you at any time.

# If you need support and information about options and resources, please see the Office of the Dean of Students, http://www.purdue.edu/odos, for drop-in hours (M-F, 8 am- 5 pm).

# If you’re struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and http://www.purdue.edu/caps/ during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

# Tentative Schedule:

The tentative schedule of topics and readings is provided below. **There will inevitably be changes to this schedule and specific readings during the semester.** I will provide updated schedules as we move through the course topics. Additional readings may be added.

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| **Dates** | **Topics Covered** | **Readings** | **Optional Readings** | **Scripts** |
| Jan 8 & 10 | Course Overview  Nested Data Structures  SAS primer I | Hayes, 2006 |  | SAS Primer I \_ dataintro.sas |
| Jan 15 & 17 | SAS primer II  Regression & ANOVA | HLMa, pp. 3-14 |  | SAS Primer II \_ reg\_anova.sas |
| Jan 22 & 24 | The Basic MLM and Submodels | HLM, pp. 16-28,  HLM, pp. 68-81 | Aesaert et al., 2015  Marceau et al., 2017 | Wk3 Basic Models\_Subs.sas |
| Jan 29 & 31 | Generalizing the Basic Model  Centering & Notation | HLM, pp. 29-37 | Enders & Tofighi, 2007 | Wk4 Extension and Center.sas |
| Feb 5 & 7 | Estimation and Hypothesis Testing | HLM, pp. 38-67 |  | Wk5 Estimation HypTesting.sas |
| Feb 12 & 14 | Applications in Longitudinal Research | Nessleroade & Baltes, 1979  Hoffman & Stawski, 2009 | Marceau, Ram, et al., 2015 | Wk6 Longitudinal Plots MLM.sas |
| Feb 20 & 22 | Analysis of Change | HLM, pp. 160-202 | Marceau, Ruttle, et al., 2015 | Wk7 Longitudinal Predictors.sas |
| Feb 26 & 28 | Applications I | HLM, pp. 99-158 |  | Wk8 Applications.sas |
| Mar 5 & 7 | Applications II (discussion) | **TBD** |  |  |
| Mar 12 & 14 | **Spring Break- no classes** | | | |
| Mar 19 | Three Level Models Introduction | HLM, pp. 228-250  Singer, 1998 |  | Wk 11 \_3levelMLM.sas |
| Mar 21 | **Class canceled** (conference) |  |  |  |
| Mar 26 & 28 | Finish Three Level Model Intro  Model Assumptions & Assessment I | HLM, pp. 252-266 |  | Wk12&13 Assumptions and Assessment.sas |
| Apr 2 & 4 | Model Assumptions & Assessment II | HLM, pp. 267-286 |  | Wk12&13 Assumptions and Assessment.sas |
| Apr 9 & 11 | Final Presentation example & power | Lane & Hennes, 2018 Snijders 2005 |  | Power Code Simulations.sas; SAScode for Lane and Hennes2018.sas;  Rcode for Lane and Hennes2018.sas;  Proc Power.sas |
| Apr 16 & 18 | **Final Presentations I** | | | |
| Apr 23 & 25 | **Final Presentations II** | | | |

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