**George Mason University**
**College of Education and Human Development**
**Research Methods**

**EDRS 830: 001 Hierarchical Linear Modeling**
**3 Credits Spring 2023**

**Course Time: Wednesday 4:30-7:10 p.m. Thompson Hall L014**
**Instructor: Angela Miller, Ph. D.**
Office Hours: Wednesday 3:00-4:30 and by appointment
Office Hours Location: West Building, Room 2202
Email Address: amille35@gmu.edu (note: this is the best way to contact me)

**Catalog Description:** Analyzes nested data structures (e.g. students within classrooms) as well as student growth. Students will learn through reading assignments, lecture and applications using a computer program for data analysis. Students will be expected to critically read multilevel methods used in published research, analyze data, and provide written report of results in APA format. Offered by Graduate School of Education. May not be repeated for credit.

**Full Course Description:** The purpose of this course is an introduction to hierarchical linear modeling (HLM) appropriate for analyzing nested data structures (e.g. students nested within classrooms) as well as student growth (linear growth models). The content is especially pertinent to applications of quantitative methods in the practice of educational research. The course will reinforce and build upon concepts and skills acquired in EDRS 811 and ESRS 821. Students will learn through a combination of reading assignments, hands-on experience in using a computer program for data analysis, and application activities. Students will be expected to critically read advanced quantitative methods used in published research (i.e., HLM and growth models), to analyze data, and to provide written report of methodology and results in APA format.

**Prerequisite:**
EDRS $821^{B-}$ or $821^{XS}$
$^{B-}$ Requires minimum grade of B-.
$^{XS}$ Requires minimum grade of XS.

Successful completion of EDRS 821 (or its equivalent) or permission of instructor. *Note: The first week of the semester will be a review of multiple regression concepts that that you have already been exposed to (cleaning data, assumptions, multivariate normal distribution).*

**Required Materials:**
(1) Snijders, T.A.B.,& Bosker, R.J. (2012). Multilevel Analysis, ($2^{nd}$ ed.). London, England: Sage Publications

(2) Access R/Rstudio software. There are computer labs on campus that provide access to this software. You can also access this software through GMU's virtual computer library at https://its.gmu.edu/service/citrix-virtual-lab/. R/Rstudio is free open source software; information about how to download will be provided in class. It is the student's responsibility to ensure access to software outside of class time as there will not be sufficient time in class to complete required assignments.

**Course Goals**: This course is a one-semester advanced statistics course design to introduce students' to multilevel modeling (MLM) techniques and an introduction to growth curve analyses. By the end of the semester, it is expected that you will be able to:

(1) Understand basic concepts, terminology, and assumptions pertinent to HLM; random coefficient models (2- and 3-level models) and growth models;
(2) Compare and contrast hierarchical linear modeling with other commonly used statistical procedures such as multiple regression analysis and repeated measures;
(3) Understand and implement the criteria associated with decisions made at each phase of a HLM analysis;
(3) Understand and critique research studies that feature HLM analyses;
(4) Write up the results of HLM analyses.

**Course Format**: The class sessions will include lecture, small group discussion, applied lab instruction and discussion of software output. **Questions are encouraged**. The lab portion of the class will provide time for hands-on computer work that is directly related to the homework and course goals.

**Class Preparation**: Information on course assignments, weekly quizzes, and notes for class lectures are available on the course Blackboard site. For assistance with Blackboard students may email courses@gmu.edu, call (803) 993-3141, or go to Johnson Center Rm 311 (office hours: 8:30 am-5 pm). For general technical assistance, students may call 9703) 993-8870 or go to the counter in Innovation Hall.

**Class Readings:** The readings for this course come from the required textbook as well as journals and other books which provide insight or examples of the topic. Readings, when possible, will be made available to you for download from the Blackboard course website.

**Class Attendance & Participation**: Students are expected to come to class on time, complete assignments, and participate in class discussions.

**My Teaching Philosophy (in a nutshell) and Expectations**

Many people tend to think of statistics as a static and "cut and dry" field when, in fact, it is neither. Advances in computing have enabled the rapid development of more sophisticated modeling tools. There is no way that you will ever know and understand all of them. What you need to understand are the basic assumptions underlying different models, how to select among them, and where to go to get information to learn more if you need something new.

As doctoral students, my main goal for you is to help you become *expert learners*. It is not realistic for me to be your only source of information, nor is it a viable learning model for the scientists and researchers that you are becoming. Make use of the many resources that are easily available on the web and work with one another.

The most important thing you can bring with you to class is a willingness to try to conceptually understand the material. *Please be active--ask questions and participate.* Outside of class, remember that reading statistical information takes a long time, and even when you read slowly and deliberately, you will need to go back and revisit it over and over. Many people find that this is not easy material; you should accept struggles as a normal part of the learning process.

**ASSESSMENT**:

**Exam (20%**): There will be 1 exam consisting of short answer and output interpretation items similar to those from homework assignments. The exam will cover the basic concepts presented in class and in the readings.

**Application & Analysis (30%):** Students will be working with data to replicate class or textbook analyses and/or run new analyses in a small group (2-3 students per group). The exercises will also include several conceptual questions about the method to help you gain conceptual understanding as you work through the assignments. You may work together or individually on running the analysis; however your responses to the questions should be a collaborative effort. Your group will upload your responses to the Bb site.

**Research Article Discussion- (Experts (10%) Critiques (5%) & Questioners (5 %):** Throughout the semester we will be reading publications which are examples of the types of models that we are studying. A group of 2-3 students will serve as experts for each article discussion. Experts have read the article closely and have considered the strengths and weakness of the model(s) as well as the presentation of the results/discussion. Questioners will read the article and submit a short reflection and any questions they have about the article in advance of the class discussion. Questioners need to upload reflections (e.g., questions/comments) to Bb by Sunday noon of the week of the presentation. On the following Wednesday, the Experts will lead the discussion and address the questions posed by the Questioners.

**Final Project (30%):** The final paper for this class is the application of multilevel modeling to a research problem in your area of interest. The goal is to provide full information of the application of an HLM model to a set of data of your choosing. You should begin looking for an appropriate data set early in the semester.
Your project may be one of the following:

- Analysis of your own or faculty mentor's data (assuming appropriate approvals are in place)
- A replication or extension of another author's study (if public data)

Your paper should include the following:

1. A brief statement of the research question and hypotheses,
2. a detailed Methods section;
3. a detailed Results section;
4. a brief Discussion section.

*You will be asked to provide a basic description of the model you plan to test including a brief theoretical rationale

**Late Assignments**: *As a general rule, late papers/projects will not be accepted*. If you believe you have EXCEPTIONAL circumstances and wish to negotiate to have extra time to complete course work, you must discuss this with me before the day the assignment is due. (Negotiating means that you will be sacrificing a portion, perhaps substantial, of your grade for extra time).**Grading Scale:** Grades will be assigned based on the following:

| | | | | | |
|---|---|---|---|---|---|
| A+ | 98-100% | B+ | 88-89% | C | 70-79% |
| A | 93-100% | B | 83-87% | F | below 70% |
| A- | 90-92% | B- | 80-82% | | |

Final grades are based in the assessments described above. "Extra credit" is not available.

## GMU Policies and Resources for Students

*Policies*

- Students must adhere to the guidelines of the Mason Honor Code (see https://catalog.gmu.edu/policies/honor-code-system/ ).
- Students must follow the university policy for Responsible Use of Computing (see http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/).
- Students are responsible for the content of university communications sent to their Mason email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students **solely** through their Mason email account.
- Students with disabilities who seek accommodations in a course must be registered with George Mason University Disability Services. Approved accommodations will begin at the time the written letter from Disability Services is received by the instructor (see https://ds.gmu.edu/).
- Students must silence all sound emitting devices during class unless otherwise authorized by the instructor.

*Campus Resources*

- Support for submission of assignments to VIA should be directed to viahelp@gmu.edu or https://cehd.gmu.edu/aero/assessments . Questions or concerns regarding use of Blackboard should be directed to https://its.gmu.edu/knowledge-base/blackboard-instructional-technology-support-for-students/.
- For information on student support resources on campus, see https://ctfe.gmu.edu/teaching/student-support-resources-on-campus

**Professional Dispositions**

See https://cehd.gmu.edu/students/polices-procedures/

**Core Values Commitment**

The College of Education and Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles: http://cehd.gmu.edu/values/.

**Notice of mandatory reporting of sexual assault, interpersonal violence, and stalking:**
As a faculty member, I am designated as a "Non-Confidential Employee," and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, and stalking to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-380-1434 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

**For additional information on the College of Education and Human Development, please visit our website https://cehd.gmu.edu/students/ .**

## Tentative Course Schedule

(note: some articles will be added along the way and this calendar is tentative.)

| Date | Theme | Topic | Reading | Due |
|---|---|---|---|---|
| 1/25 | Why HLM?<br><br>Review<br><br><br><br>Software | Course Info & Overview<br>What is Nesting? Data appropriate for HLM<br><br>Review: Multiple Regression Concepts<br><br>R skills | Review of 821 notes/text<br><br>SB-Chapters 1&2<br>McCoach Articles | (Locate articles to use as models) |
| 2/1 | | | | |
| 2/8 | How | Intra-Class Correlation Coefficient (ICC)<br>Random Intercepts | SB-Ch. 3 & 4 | |
| 2/15 | | Centering<br>Compositional Effects | SB-Ch. 3 & 4 | **Assn. #1**<br>*Article #1*<br>*(reflection by 9/12)* |
| 2/22 | | Random Coefficients Model | SB-Ch. 5 & 6 | **Assn. #2** |
| 3/1 | | Longitudinal Models | SB- Ch. 15 | *Article #2*<br>*(reflection by 9/26)* |
| 3/8 | | Longitudinal Models-Repeated Measures | SB-Ch. 15 | **Assn.#3**<br>*Article #3*<br>*(reflection by 10/3)* |
| 3/15 | | **Spring Break** | | |
| 3/22 | | Longitudinal Models -variations | SB-Ch. 15 | *Submit model idea |
| 3/29 | | Catch-up / Review | | **Assn #4**<br>*Article #4*<br>*(reflection by 10/17)* |
| 4/5 | | **Exam** | | |
| 4/12 | Before & After HLM analyses | Explaining Findings<br>Assumptions<br>Diagnostics<br>Power | SB-Ch. 7, 8 & 10<br><br>SB-Ch. 11 | |
| 4/19 | Other Variations & Related Topics | (*Possible topics:*<br>*Cross –classified models*<br>*Meta-analysis using HLM*<br>*Non-linear models*) | | |
| 4/26 | | *Some Project Specific Time* | | *Article #5*<br>*(reflection by 11/14)* |
| 5/3 | | **Poster Presentations** | | **Present Model** |
| 5/10 | | | | **Final Project Due** |