

EDRS 821 001: Advanced Applications of Quantitative Methods (3 credits)
College of Education and Human Development, PhD Program

Fall 2023 Wednesday 4:30- 7:10 PM Thompson Hall L014



Instructor: Angela Miller, Ph.D.

Office: West Building Room 2104

Office Hours: Wednesday 3 – 4 pm (in person) and by appointment (please email).

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Prerequisite: Successful completion of EDRS 811 or the equivalent (knowledge of univariate statistics including ANOVA models).

Catalog Description: Advanced study of applications of quantitative methods in educational research, reinforcing and building on concepts and skills acquired in EDRS 811. Uses modular approach, and provides advanced study of techniques appropriate to survey research, group-experimental and quasi-experimental research, selected multivariate procedures and factor analysis, and quantitative synthesis (meta-analysis) of research. Combines reading assignments, critiques, and discussion of relevant journal articles; and application activities.

Course Description: This course will provide advanced study of applications of quantitative methods in the practice of educational research and will reinforce and build upon concepts and skills acquired in EDRS 811. It will employ a modular approach and will contain advanced study of techniques appropriate to analysis of data from tests and surveys; group-experimental and quasi-experimental design; selected multivariate procedures and factor analysis. Students will learn through a combination of text reading assignments, critical analysis of professional journal articles, and hands-on experience in using a computer program for data analysis, and application activities. Students will be expected to identify and report on quantitative methods used in published research, to analyze data, and to provide written reports of methodology and results.

Course goals: This course is a one-semester introduction to several widely used multiple regression (MR) and multivariate statistical methods. By the end of the semester, it is expected that you will be able to:

- Demonstrate a conceptual understanding of multiple regression with mediators and moderators and generalized linear modeling (e.g., logistic regression) as evidenced by your ability to select and justify the statistic that is appropriate to test a particular hypothesis, explain what the procedure is accomplishing and the logic underlying the given procedure.
- Explain what is meant by multivariate statistical techniques and demonstrate the ability to use multiple techniques that are introduced in this class.
- Explain the assumptions of the above analyses and make recommendations when assumptions are violated.
- Conduct all of the statistical techniques noted above using R, including testing the assumptions of the technique, interpret the results of the output and write the results in APA or AMA publication style.

Format: The class sessions will include both lecture and hands-on computer work.

Required Materials:

- (1) Tabachnick, B.G. & Fidell, L. S. (2019). *Using multivariate statistics*. (7th Ed.). Pearson Education. ISBN: 9780134790541
- (2) R software is a free download: <https://www.r-project.org/>

It is the student's responsibility to ensure access to the software outside of class time as there will not be sufficient time in class to complete required assignments.

- (3) There are also required articles/book chapters that will be posted on Bb.

Recommended Resources:

American Psychological Association (2019). *Publication Manual of the American Psychological Association (7th edition)*. APA.

OR

The JAMA Network Editors (2020). *AMA Manual of Style: A Guide for Authors and Editors (11th edition)*.

Class Preparation: Information on course assignments, weekly quizzes, and notes for class lectures are available on the course blackboard site. Occasionally, there will also be short video lectures posted on blackboard as introductions to the concepts we will be studying—these are intended to precede your reading of the assigned chapters and/or articles and help situate your reading.

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:

Online Quizzes (5%): For each topic there will be a short quiz posted on Blackboard. The quizzes are composed of short answer and multiple-choice items which will cover the basic concepts presented in class and in the textbook. Quizzes are timed (usually 25 minutes) and must be completed during the specified time period (due by midnight on Mondays). These quizzes are designed to provide you (and me) with feedback about your course progress. Your quiz score cannot lower your overall course grade. **Please take the quiz as soon after class as possible.**

Annotated Analysis (25%): Each week you will work with data to replicate class or textbook analyses and/or run new analyses in a small group (2-3 students per group). The exercise may also include conceptual questions about the method to help you gain conceptual understanding as you work through the exercises. You may work together or individually on running the analysis; however your responses to the questions and annotations should be a collaborative effort. Your group will upload your annotated output (please cut and paste relevant output to Word) and responses on the Bb site. **You will make corrections to your analyses before writing up and submitting the results in APA format.**

Full Write Up of Regression Results (10%): For the first multiple regression assignment you will write a complete methods and results section in **correct APA/AMA format** including (1) data cleaning (2) testing of appropriate assumptions, (3) inclusion of any necessary preliminary descriptive statistics and tables (4) results of hypotheses tests, and (4) interpretation of results.

Commentaries on Published Results (10%): Each week we will be learning a new statistical analysis. In addition to the textbook readings there will be an example article that is an application of the method we are learning. Please read this example article prior to the following class and be prepared for discussion. Students are required to turn in a one page (typed, double-spaced, 12 point font) commentary on the example article for the topic learned the previous week. **This must be submitted (upload to Bb) by 9 am on Tuesday.** The commentary should be an informal set of questions, comments, or summary information (summarize only if you cannot think of anything else to say) about the article. The purpose of this assignment is to provide information for the class discussion and to help me identify discussion topics and sources of confusion in your understanding of the usage of the statistical method. These are scored on a 2 point scale: 2 (complete and well considered), 1 (did not read thoroughly/lacking effort), or 0 (did not read/minimal effort/late/nothing submitted). There are 6 total topics; you may skip one (a freebie!) for the semester.

‘Article Style’ Write Up of Results (10%): These results are based on the analysis from your groups work on 2 of the topics. **Each student may select which 2 topics they would like to work on writing up.** You will write a results section in **correct APA/AMA format** including: results of hypotheses tests and interpretation of results similar to what would be found in a published research article. Note: Necessary tables should also be included and should be formatted in correct APA/AMA style (cutting and pasting from R is not acceptable). Results are submitted individually and even though they are based on the group output they should reflect your

individual interpretation and presentation. Duplicate work is considered plagiarism and will receive a score of 0.

Exams (20% each): The two exams will cover the material from the class and textbook and include short answer questions as well as interpretation of output.

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.

Late Assignments: *As a general rule, late assignments 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).

Professional Dispositions

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

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 <https://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>

Notice of mandatory reporting of sexual assault, sexual harassment, 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.

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/>.

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

	Class	Topic	Reading	Submissions
8/23	1	Intro to Advanced Quant Usage of R/ RStudio/ RMarkdown Review: Multiple Regression Cleaning Data	Chapter 1 Chapter 2: overview *Review Ch. 3 as needed Chapter 4	
8/30	2	Multiple Regression Assumptions Categorical Predictors Hierarchical Regression	Chapter 5 (5.1- 5.6.4, 5.7.1- 5.7.3)	
9/6	3	MR-Mediation	Chapter 5 (5.6.7) Pdf on Bb	MR analyses
9/13	4	MR-Moderation (cat.)	Pdf on Bb Chapter 5 (5.6.6)	#1: Med
9/20	5	MR-Moderation (cont.)	Pdf on Bb	
9/27	6	Logistic Regression	Chapter 10	#2: Mod
10/4	7	Catch-up		#3: Log
10/11	8	Exam 1		
10/18	9	MANOVA/ MANCOVA	Chapter 7 *Review Ch. 3 & 6 as needed	Last Day to submit Regression Write-up
10/25	10	Discriminant Analysis	Chapter 9	
11/1	11	Exploratory Factor Analysis	Chapter 13 (13.1-13.4)	#4: Man/DA
11/8	12	Cluster Analysis	Pdf on Bb	#5: EFA
11/15	13	Reading Results: HLM & SEM	(Ch.14 & ch.15)	#6: CA
11/22		Thanksgiving Break-No Class		
11/29	14	Catch-up & Review		Last Day to Submit Write- ups
12/6	15	Exam 2		