George Mason University
College of Education and Human Development
Ph. D. in Education and Human Development

EDRS 821 - 001: Advanced Applications of Quantitative Methods
(3 Credits) Spring 2023
Tuesday 4:30pm-7:10pm, Thompson Hall L014, Fairfax Campus

Instructor: Marvin Powell, Ph. D.
Office Hours: by appointment
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Prerequisite: Successful completion of EDRS 811 or the equivalent (knowledge of univariate statistics including ANOVA models).

EDRS 810[B-] and EDRS 811[B-].
[B-] Requires minimum grade of B-.

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 using the Statistical Package for Social Sciences (SPSS), 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 SPSS software, including testing the assumptions of the technique, interpret the results of the SPSS output and write the results in APA 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) Access to R software (https://www.r-project.org). R is free and open source. R can be installed on almost any computer with any operating system (e.g., Windows, Mac, Linus). There are also computer labs on campus that provide access to R. Also R Studio (https://www.rstudio.com/products/rstudio/download/).

(2) There are also required articles/book chapters included on the reference list at the end of this document which will be posted on blackboard and/or available online through the library portal.

(3) Access to SPSS software. There are computer labs on campus that provide access to SPSS. You can access SPSS software through GMU's virtual computer library at www.vcl.gmu.edu. Information about how to use the virtual computer library is available at http://itservices.gmu.edu/services/view-service.cfm?customel_dataPageID_4609=5689. It is the student's responsibility to ensure access to SPSS outside of class time as there will not be sufficient time in class to complete required assignments.

Recommended Resource:

American Psychological Association (2019). *Publication manual of the American Psychological Association* (7th Ed.). APA.

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.

ASSESSMENT:

Online Quizzes (10%): 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. 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.**

'Article Style' Write Up of Results (10% each): For four (4) analyses learnt in this class, you will write a results section in **correct APA format** including: results of hypotheses tests and interpretation of results similar to what would be found in a published research article. **I highly encourage you to find research articles in your area of interest that use these methods of analysis and review carefully how the results are presented.**

Presentation/Teaching (10%): Students will select ONE topic from a provided list of statistical techniques. Students are expected to present/teach said topic to the class.
Topics:
1. Critical Quantitative Methodologies
2. Nonparametric Procedures
3. Latent Profile Analysis
4. Multidimensional Scaling
5. Multivariate Regression
6. Propensity Score Matching
7. Regression Discontinuity

Exams (20% each): The two exams will cover the material from the class and textbook, include the generation and interpretation of SPSS and/or R output, and writing up results in APA format.

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: Students are expected to exhibit professional behaviors and dispositions at all times. 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/.

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 http://ods.gmu.edu/).
- Students must follow the university policy stating that all sound emitting devices shall be silenced during class unless otherwise authorized by the instructor.

Campus Resources

- Support for submission of assignments to Tk20 should be directed to tk20help@gmu.edu or https://cehd.gmu.edu/aero/tk20. Questions or concerns regarding use of Blackboard should be directed to http://coursessupport.gmu.edu/.
- 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, interpersonal violence, and stalking: As a faculty member, I am designated as a "Responsible Employee," and must report all disclosures of sexual assault, 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 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 Schedule

	Class	Topic	Reading	Due/*Presentation*
01/24	1	Intro and Review: Cleaning Data Missing Data	Chapters 1, 3-4	
01/31	2	Multiple Regression Assumptions	Chapter 5	
02/07	3	MR/GLM Categorical Predictors Hierarchical Regression	Chapter 5 Pdf on Bb Chapter 18	
02/14	4	MR-Moderation (cat.)	Pdf on Bb	#1:MR
02/21	5	MR-Moderation (cont.)	Pdf on Bb	*Multivariate Regression*
02/28	6	MR-Mediation	Pdf on Bb	#2: Mod
03/07	7	Logistic Regression	Chapter 10	#3: Med *Regression Discontinuity*
03/14	8	**SPRING BREAK – NO CLASS**		
03/21	9	Factor Analysis	Chapter 13 Pdf on Bb	*Multidimensional Scaling*
03/28	10	**EXAM 1**		
04/04	11	Factor Analysis	Chapter 13 Pdf on Bb	*Latent Profile Analysis*
04/11	12	Canonical Correlation Analysis	Chapter 12	#4: FA
04/18	13	MANOVA Discriminant Analysis	Chapters 7, 9	
04/25	14	Reading Results: HLM and SEM	Chapters 14, 15	
05/02	15	Presentations		*Critical Quant Methods* *Nonparametric Procedures* *Propensity Score Matching*
05/10	16	**EXAM 2**		

Note: Faculty reserves the right to alter the schedule as necessary, with notification to students.

Other Required Readings and Useful References

Mediation & Moderation

Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs, 76*, 408-420.

Hayes, A. F., Glynn, C. J., & Huge, M. E. (2012). Cautions regarding the interpretation of regression coefficients and hypothesis tests in linear models with interactions, *Communication Methods and Measures, 6*, 1-11.

Other Valuable Resources

Regression Models and Assumptions

Fox, J. (1991). *Regression diagnostics*. Sage.

Hardy, M.A. (1993). *Regression with dummy variables*. Sage.

Moderation & Mediation

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis.* Guilford Press.

Moderation

Jaccard, J. & Turrisi, R. (2003). *Interaction effects in multiple regression* (2nd ed.). Sage

Mediation in Multiple Regression

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879-891.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*, 185-227

MacKinnon, D.P., Fairchild, A.J., & Fritz, M.S. (2007). Mediation analysis. *Annual Review of Psychology, 58*, 593-614. (Read through page 605 bottom).

MacKinnon, D.P. (2008). *Introduction to statistical mediation analysis*. Lawrence Erlbaum.

MacKinnon, D.P., Lockwood, C.M., Hoffman, J.M., West, S.G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*, 83-104.

Shrout, P.E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods, 7*, 422-445.

Introduction to Path Analysis

Keith, T.Z. (2006). *Multiple regression and beyond.* Pearson Education, Inc. (Chapters 10 and 11.)

Logistic Regression

Grimes, D.A. and Schulz, K.F. (2008). Making sense of odds and odds ratios. *Obstetrics and Gynecology*, *111,* 423-426.

Hosmer, D.W. & Lemeshow, S. (2000). *Applied logistic regression* (2nd ed.). John Wiley & Sons, Inc.

Menard, S. (2002). *Applied logistic regression analysis* (2nd ed.). Sage Publications, Inc.

General Resources

Cohen, J., Cohen, P., West, S.G., & Aiken, L.S. (2003). *Applied multiple regression/correlation for the behavioral sciences* (5th ed.). Lawrence Erlbaum.

Dugard, P., Todman, J., & Staines, H. (2010). *Approaching multivariate analysis* (2nd ed.). Routledge.

Ferguson, S. L., Moore, E. W. G., & Hull, D. M. (2019). Finding latent groups in observed data: A primer on latent profile analysis in Mplus for applied researchers. *International Journal of Behavioral Development,* 1-11. doi: 10.1177/0165025419881721

Grimm, L.G. & Yarnold, P.R. (1995). *Reading and understanding multivariate statistics*. American Psychological Association.

Grimm, L.G. & Yarnold, P.R. (2000). *Reading and understanding more multivariate statistics*. American Psychological Association.

Meyers, L.S., Gamst, G. C., Guarino, A. J. (2017). *Applied multivariate research: Design and interpretation.* (3rd ed.). Sage Publications. ISBN: 9781412988117