George Mason University
College of Education and Human Development
Educational Psychology and Research Methods

EDRS 821.001 – Advanced Applications of Quantitative Methods
3 Credits, Spring 2021
Tuesdays, 4:30-7:10 PM
Innovation, 222

Faculty

Name:	Jung Yeon (Ellie) Park, Ph.D.
Office Hours:	Wednesdays 2-4 PM and By Appointment
Office Location:	West Building 2204, Fairfax Campus
Email Address:	jpark233@gmu.edu

COVID 19 Procedures: Spring 2021

Students, please be aware of and follow all policies and procedures for Mason's Safe Return to Campus: https://www2.gmu.edu/Safe-Return-Campus

Prerequisites/Corequisites

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

University Catalog Course 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 Overview

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 Delivery Method

The class sessions will include lecture, small group discussion, and discussion of SPSS 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.

Learner Outcomes or Objectives

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.

Professional Standards

Not Applicable

Required Materials

(1) Tabachnick, B.G. & Fidell, L. S. (2019). Using Multivariate Statistics. (7th Ed.). NY: Pearson Education. ISBN: 9780134790541

(2) 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.

(3) There are also some 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). Washington, DC: APA.

Note: In weeks one and two of the class, students are expected to review the reporting standards for statistics in APA style. Student may complete an optional short assignment covering the standards to verify knowledge. Feedback will be provided.

Course Performance Evaluation

- **Assignments**
  - **Online Quizzes (10%)**: There will be a short quiz posted on BB immediately on Tuesdays. The quizzes are composed of short answer and multiple-choice items which will cover the basic concepts presented in class and in the textbook. These quizzes are designed to provide you (and me) with feedback about your course progress. Your quiz score cannot lower your overall course grade (unless you have received 0's on quizzes due to failure to complete them). You must complete the online quiz by Mondays at midnight.

  - **Annotated Analysis (20%)**: 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.

  - **'Article Style' Write Up of Results (15%)**: For each type of analysis (except the first write up see above) that we will learn 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. These results are based on the analysis from your groups. **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**. Results are submitted individually and even though they are based on the group SPSS output they should reflect your individual interpretation and presentation. Duplicate work is considered plagiarism and will receive a score of 0.

  - **Midterm Exam (20%)**: The two online exams will cover the material from the class and textbook and include multiple choice and short answer questions as well as interpretation of SPSS output. The midterm exam is worth 20% and the final exam is worth 20%.

- **Final Project (25% = 20% + 5% for presentation)**: The final project may be done by group (2-3 persons per group) or individually. You may choose your own research questions and datasets. You will write a complete "dissertation style" methods and results section in correct APA format including data cleaning, selecting an appropriate analysis, testing of appropriate assumptions, inclusion of any necessary preliminary descriptive statistics and tables, results of hypotheses tests, and interpretation of results.

- **Other Requirements**
  - **Participation (10%)**: Students should ask their own questions or reply back to the instructor's comments, or share their thoughts on other students' questions on BB Discussion Board at least once every week.

- **Grading**

  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%		

Professional Dispositions

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

Class Schedule

Date	Class	Topic	Reading/Due	Submission	
				Group work	Individual work
1/26	1	▪ Intro to Advanced Quant ▪ Review: ANOVA/ ANCOVA	▪ Ch. 1 ▪ Ch. 2: overview ▪ Review Ch. 3 & Ch. 6 as needed ▪ Ch. 4 ▪ Quiz (class 1 review) posted		
2/2	2	▪ Multiple Regression (MR) ▪ Assumptions ▪ Categorical Predictors ▪ Hierarchical Regression	▪ Ch. 5 (5.1- 5.3, 5.7.1- 5.7.3) ▪ Ch. 5 (5.4-5.6.4) ▪ Quiz (class 2 review) posted ▪ #1 MR assignment posted		
2/9	3	▪ MR: Moderation (cat.)	▪ PDF on BB ▪ Ch. 5 (5.6.6) ▪ Quiz (class 3 review) posted	▪ #1 analysis due	
2/16	4	▪ MR: Moderation (cont.)	▪ PDF on BB ▪ Quiz (class 4 review) posted ▪ #2 MR: Moderation assignment posted		

2/23	5	▪ MR: Mediation	▪ Ch. 5 (5.6.7) ▪ PDF on BB ▪ Quiz (class 5 review) posted ▪ #3 MR: Mediation assignment posted	▪ #2 analysis due	
3/2	6	▪ MANOVA ▪ MACOVA	▪ Ch. 7 ▪ Quiz (class 6 review) posted ▪ #4 MAN(C)OVA assignment posted	▪ #3 analysis due	
3/9	7	▪ Catch-up			▪ #1 - #3 write-up due
3/16	8	***Midterm Exam***			
3/23	9	▪ Profile Analysis	▪ Ch. 8 ▪ Quiz (class 9 review) posted	▪ #4 analysis due	
3/30	10	▪ Discriminant Analysis	▪ Ch. 9 ▪ Quiz (class 10 review) posted ▪ #5 Discriminant Analysis assignment posted		
4/6	11	▪ Logistic Regression	▪ Ch. 10 ▪ Quiz (class 11 review) posted ▪ #6 Logistic Regression assignment posted	▪ #5 analysis due	
4/13	12	▪ Exploratory Factorial Analysis (EFA)	▪ Ch. 13 (13.1-13.4) ▪ Quiz (class 12 review) posted ▪ #7 EFA assignment posted	▪ #6 analysis due	
4/20	13	▪ Cluster Analysis	▪ PDF on BB ▪ Quiz (class 13 review) posted	▪ #7 analysis due	
4/27	14	▪ Final project prep			▪ #4 - #7 write-up due
5/4	15	***Final Project Presentation***			

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

Other Required Readings and Useful References

<u>Mediation & Moderation</u>

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.

<u>Logistic Regression</u>

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

Other Valuable Resources

Regression Models and Assumptions

Fox, J. (1991). *Regression diagnostics*. Thousand Oaks, CA: Sage Publications, Inc.

Hardy, M.A. (1993). *Regression with dummy variables*. Thousand Oaks, CA: Sage Publications, Inc.

Moderation & Mediation

Hayes, A. F. (2013). *Introduction to Mediation, Moderation, and conditional Process Analysis*. New York, NY: Guilford Press.

Moderation

Jaccard, J. & Turrisi, R. (2003). *Interaction effects in multiple regression* (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

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*. New York: 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*. Boston, MA: Pearson Education, Inc. (Chapters 10 and 11.)

Logistic Regression

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

Menard, S. (2002). *Applied logistic regression analysis* (2nd ed.). Thousand Oaks, CA: 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 edition). Mahwah, NJ: Lawrence Erlbaum.

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

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

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

Meyers, L.S., Gamst, G., & Guarino, A.J. (2014). *Applied multivariate research*. 2nd Ed. Thousand Oaks, CA: Sage Publications, Inc.

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

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 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 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 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, 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/ .