

Syllabus for PADM 576
Multivariate Statistical Methods
Spring 2024
T 6-9 pm, Olmsted W-140

Professor: Dr. Daniel J. Mallinson

Office:	Olmsted W-160K
Office Hours:	TTh 1:30 - 3pm, T 4:30 - 5:30 pm, By appointment
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Class hashtag	#padm576
Course Webpage	https://sites.psu.edu/djmallinson/padm-576/

Course Description

This course introduces students to applications of multivariate statistical procedures used by scientists and practitioners. The course will focus on both theoretical and practical uses of statistics. The student completing this course will have a greater understanding of causal inference, technical knowledge of multivariate statistics, and competency with the software used to estimate them. They will be able to apply this knowledge when reading research articles and conceptualizing statistical analyses for future research projects. Further, the course will develop students' skills as academicians by increasing their capability of executing rigorous quantitative research.

Prerequisites: PADM 503 or equivalent coursework.

Learning Goals and Objectives

- Goal 1: Students will understand the fundamental assumptions of multivariate statistical analyses
 - Objective 1a: Students will identify and explain the core assumptions of each statistical technique that they learn
 - Objective 1b: Students will appraise the extent of assumption violations present in datasets used in the course
 - Objective 1c: Students will execute the appropriate correction for violations of statistical assumptions

- Goal 2: Students will understand the appropriate application of multivariate statistical analyses
 - Objective 2a: Students will identify the appropriate statistical test for research hypotheses
 - Objective 2b: Students will implement those tests correctly
 - Objective 2c: Students will interpret statistical results correctly
- Goal 3: Students will conduct their own research with multivariate statistical analyses
 - Objective 3a: Students will design their own replication and extension study using secondary data
 - Objective 3b: Students will implement all phases of the research process, including appropriate statistical analysis choices and interpretation
 - Objective 3c: Students will appraise the meaning, as well as theoretical and practical implications of their findings

Methods for Learning and Teaching: This course will contain a mix of lecture and application exercises. It is vital for your own comprehension of the course material that you come to class prepared to discuss assigned readings.

Reaching Our Goals

Attendance: Your attendance in class is always expected. It is easy to fall behind in a research methods course and attending class will go a long way to helping you keep up with the course material. Please contact me via [e-mail](#) if you are unable to attend class. I will follow the University's attendance policy when it comes to excused absences. See <https://handbook.psu.edu/content/class-attendance>.

Students also have an obligation to notify me within the first three weeks of the semester if they will miss any class session due to a religious observance. I am pleased to do this, but will need notification in order to plan make-up work.

Preparation and Participation: I expect you to read the assigned material before class and be able to discuss what you read. I also expect you to come to class prepared with questions regarding things in the reading that were unclear.

Do Not Suffer in Silence: Please do not suffer in silence throughout the course if you are struggling. Instead, let me know — as soon as possible — what things are not making sense and we can work it out. If you are having a problem of any kind in the course, please talk to me about it as soon as possible.

Be Flexible: While the syllabus represents an agreement between us, I reserve the right to revise and modify it throughout the course, if it is necessary to achieve our goals. Situations beyond either of our control can also emerge that require changes to the course. I will notify you right away when any changes are made.

E-mail Policy: I will work to respond to e-mails by the next business day. This means that e-mails sent on the weekends will be responded to by Monday.

Required Readings

The following books are required for the course:

Huntington-Klein, Nick. 2022. *The Effect*. CRC Press. <https://theeffectbook.net>.

Jenkins-Smith, Hank C. et al. 2020. *Quantitative Research Methods for Political Science, Public Policy and Public Administration: With Applications in R*. Fourth Edition. CC-BY-4.0. <https://bookdown.org/josiesmith/qrmbook/>.

Additional required readings will be made available on Canvas.

Recommended Reading

Matloff, Norman. 2011. *The Art of R Programming*. No Starch Press.

Or some other “how-to” on R programming. There are lots of them out there.

Cunningham, Scott. 2021. *Causal Inference: The Mixtape*. Yale University Press.

Lecture Slides

I will be using lecture slides throughout the course. These will be uploaded to the course website (<https://sites.psu.edu/djmallinson/padm-576/>) and Canvas prior to each class period.

Assessing Your Progress Towards Our Goals

The following types of assessment will be used to track your progress towards meeting our course goals: weekly exercises and a final research paper.

Each component represents the following percentage of your final grade:

Weekly Exercises	60%
Replication and Extension Paper	40%

We will use the following grade scale:

Letter	Percent
A	94 to 100
A-	90 to 93
B+	87 to 89
B	84 to 86
B-	80 to 83
C+	77 to 79
C	70 to 76
D	60 to 69
F	Below 60

Weekly Exercises: In a typical week in the course we will spend the first half of class discussing a method and its theoretical and mathematical foundations, then the second half working on an exercise applying that week's material. The exercise will be due by next Tuesday's class.

Research Paper: As a culminating experience, students will work in pairs or alone to develop their own replication and extension study that applies the material we learn in class. The goal would be to produce a publishable quality final paper, with feedback from the professor. See Appendix [A](#) for details.

Make-Up Grades: You are allowed to make-up academic work only in the case of excused absences. These absences may include missing class for a [University-sanctioned activity \(with proper documentation\)](#), [illness](#), [religious observance](#), or [family responsibilities](#). If you know in advance that you are going to miss class, please contact me before the absence to make arrangements for completing the work. If you are absent for an unexpected reason, please check in with me as soon as possible. You will have one week from the day of your return to class to make up a missed assignment.

Academic Integrity Academic dishonesty is not limited to simply cheating on an exam or assignment. The following is quoted directly from the *PSU Faculty Senate Policies for Students* regarding academic integrity and academic dishonesty: "Academic integrity is the pursuit of scholarly activity free from fraud and deception and is an educational objective of this institution. Academic dishonesty includes, but is not limited to, cheating, plagiarizing,

fabricating of information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students.”

All University and Penn State Harrisburg policies regarding academic integrity/academic dishonesty apply to this course and the students enrolled in this course. Refer to the following URL for further details on the academic integrity policy of Penn State Harrisburg: <https://harrisburg.psu.edu/academics/academic-guidelines-and-policies>. Each student in this course is expected to work entirely on her/his own while taking any exam, to complete assignments on her/his own effort without the assistance of others unless directed otherwise by the instructor, and to abide by University and Penn State Harrisburg policies about academic integrity and academic dishonesty. Academic dishonesty can result in an assignment of “F” or “XF” as the final grade for the student.

Disability Access

Penn State welcomes students with disabilities into the University’s educational programs. Penn State values diversity and inclusion; we are committed to a climate of mutual respect and full participation. Our goal is to create environments that are usable, equitable, inclusive, and welcoming. Every Penn State campus has a Student Disability Resources office. Student Disability Resources at Penn State Harrisburg is located in the Student Enrichment Center Room 205. The Assistant Director of Student Disability Resources, Alan Babcock, can be reached via email at aub15@psu.edu or phone 717-948-6025.

To receive consideration for accommodations, please contact Student Disability Resources (SDR), participate in an intake interview, provide documentation of your disability, and complete an online Introductory Questionnaire. Please know that you are not required to already have documentation to begin the process with SDR, as SDR can assist with the process of requesting accommodations. Additional information is available on the (<https://harrisburg.psu.edu/student-disability-resources>). If the documentation supports requests for reasonable accommodations, SDR will provide you with an accommodations letter, which you can then give to your professors. Please know that requests for accommodations and support must be initiated by the student and communication with professors regarding the approved accommodations must be initiated by the student. You will receive accommodations after you give your accommodations letter to your professors. It is recommended that you share your accommodations letters with your professors as early in the semester as possible. Professors do not provide accommodations retroactively.

Counseling Services

Success in college depends heavily on your personal health and wellbeing. Please recognize

that some stress and anxiety is a normal part of life and the college experience, and it can be compounded by unexpected setbacks or life changes outside the classroom. Penn State Harrisburg has a number of support options listed in this syllabus.

If you are experiencing issues that feel unmanageable, you reach the point that you have difficulty concentrating and/or feeling motivated, or have anxiety or feelings of depression that interfere with your ability to take care of yourself or your daily responsibilities, please consider talking with someone in CAPS (Counseling and Psychological Services). We have a range of services to help you navigate issues that are impacting your ability to be healthy, well, and productive at college.

You can learn more about the confidential mental health services available on campus by visiting the [Counseling and Psychological Services website](#) or by calling (717) 948-6025 Monday through Friday 8am to 5pm. CAPS is located on the 2nd floor of the Student Enrichment Center, Suite 205. You can access crisis services 24/7/365 by calling 1-877-229-6400 or by texting “LIONS” to 741741. Find us on Instagram or on [Facebook](#).

Educational Equity

Penn State takes great pride in fostering a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, harassment, and/or incivility due to age, ancestry, color, disability, gender, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity at the Report Bias site: <https://equity.psu.edu/reportbias>. Penn State’s Code of Conduct can be found at the following link: <https://studentaffairs.psu.edu/support-safety-conduct/student-conduct/code-conduct>.

Direct all inquiries regarding the nondiscrimination policy to The Office of Diversity, Equity, and Inclusion at Penn State Harrisburg at 717-948-6016, and to Student Diversity, Equity, and Inclusion at 717-948-6180.

Mandated Reporting

Penn State is committed to equal access to programs, facilities, admission, and employment for all persons. It is the policy of the University to maintain an environment free of harassment and free of discrimination against any person because of age, race, color, ancestry, national origin, religion, creed, service in the uniformed services (as defined in state and federal law), veteran status, sex, sexual orientation, marital or family status, pregnancy, pregnancy-related conditions, or physical or mental disability, gender, perceived gender, gender identity, gender expression, genetic information or political ideas. Discriminatory conduct and harassment, as well as sexual misconduct and relationship violence, violates the dignity of individuals, impedes the realization of the University’s educational mission, and

will not be tolerated. Gender-based and sexual harassment, including sexual violence, are forms of gender discrimination in that they deny or limit an individual's ability to participate in or benefit from University programs or activities. For reporting resources, and support, please visit titleix.psu.edu.

Penn State strongly encourages all members of the campus community to take appropriate action by providing support and encouraging those impacted by such incidents to submit a report to the Title IX Coordinator. You may also submit a report online by using the Incident Report Form found here: Office of Sexual Misconduct Prevention & Response Incident Report Form. If the University Title IX staff receives information about an incident, they will reach out to offer information about resources, rights, and procedural options available to you.

At Penn State Harrisburg, your point of contact is:

Nicholas Paesano Sexual Misconduct Resource Person Penn State Harrisburg E-126 Olmsted Building 717-948-4385

Penn State's Title IX Coordinator is: Amber Grove 212 Rider Building University Park, PA 16802 814-867-5088 titleix@psu.edu

Other resources that are available include:

- Penn State Harrisburg Counseling and Psychological Services, SEC 205 - 717-948-6025
- Suicide and Crisis Lifeline - 988
- Department of Safety & Police
 - Campus Police: 717-979-7976
 - Local Police: 717-543-2200 or 911
- YWCA Confidential Domestic Violence & Sexual Assault Services: 1-800-654-1221 (available 24/7)
- Contact Helpline: 800-932-4616 (24-hour community crisis hotline)
- Pinnacle Health Harrisburg: 717-782-3131
- Penn State Harrisburg Student Health Services, 220 Capital Union Building: 717-948-61015
- Penn State Hotline: 800-560-1637 (Anonymous reporting)

In Case of Emergency In the event of a University-wide emergency, course requirements, classes, deadlines, and grading schemes are subject to changes that may include alternative delivery methods, alternative methods of interaction with the instructor, class materials, and/or classmates, and a revised semester calendar and/or grading scheme.

For more general information about the emergency situation, please refer to:

- Penn State Harrisburg's home page at <http://harrisburg.psu.edu/>
- PSUAlert (<http://psualert.psu.edu/psualert/>). This is a service designed to alert the Penn State community via text messages to cell phones when situations arise on campus that affect the ability of the campus - students, faculty and staff - to function normally. Everyone is encouraged to sign up to receive the text alerts.
- Messages will be placed at the 717-948-6000 campus phone number

In the case of a University-wide emergency, please refer to the following about changes in this course:

- Canvas: <https://psu.instructure.com/courses/2116052>
- Instructor's email: mallinson@psu.edu

Basic Needs Statement

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Office of Student Affairs (syw10@psu.edu, 717-948-6180) for support. Furthermore, please notify the professor if you are comfortable in doing so. This will enable him to provide any resources that he may possess.

Writing Tutoring and Other Academic Support

The Russell E. Horn Sr. Learning Center may have a tutor who can assist you with this course. An appointment is recommended. Appointments are available in-person or on Zoom, depending on your preference.

To make an appointment:

Visit: Student Enrichment Center Room 201 Or go to: starfish.psu.edu and click on "My Success Network" Or call: 717-948-6475 Or email: PSHLearningCtr@psu.edu

The Learning Center can help you in a variety of ways:

Academic Success Coaches Get help with time management, organization, test-taking, study skills, as well as speech and presentation preparation and delivery.

Subject Area Tutoring Courses including accounting, biological and behavioral science, computer science, economics, finance, mathematics, physical sciences, statistics, engineering, and some world languages are supported by peer and professional tutoring.

Writing Get help with the development of essays, papers, resumes, cover letters, scholarship applications and much more. We can help at any stage from brainstorming ideas to citing sources to polishing your final product.

The Lambert Undergraduate Advising Center can assist you with exploring majors and minors, understanding academic policies, and planning courses for future semesters.

Drop-in Quick Question Advising is available during the semester both in-person and online (no appointment necessary!). See dates, times, and locations at: bit.ly/whatsnextbgb

To contact the Advising Center:

Visit: Student Enrichment Center Room 204 Or call: 717-948-6604 Or email: HBGAdvisingCenter@psu.edu

Course Schedule

We will attempt to follow this schedule as closely as possible, but we may take more time on some concepts and less time on others. For this reason, a digital version of this syllabus can be found on [my website](#). Slides used in class will also be posted on the online syllabus and Canvas before class. All changes to the schedule will be announced in class or via e-mail and the online syllabus will be constantly up-to-date. Required course readings are listed and due dates for assignments are in bold. Links to some additional readings are included in the syllabus on my website, others will be uploaded to Canvas. If you have trouble, please do not hesitate to [e-mail](#) me.

Week 1: Introductions, Reproduction, and Publication(1/9)

- Introduction to the course and each other
- King, Gary. (1995). “[Replication, Replication.](#)” *PS: Political Science and Politics* 28: 444-452.
- King, Gary. (2006). “[Publication, Publication.](#)” *PS: Political Science and Politics* 39:

119-125.

- Review Huntington-Klein [Chapters 1-4](#).

Week 2: Let's Learn R and Quarto (1/16)

- Check out:
 - [Beginners](#). *R Studio Education*.
 - Grolemond, Garrett. 2023. [Getting Started with R](#). Posit Support. December 11.
 - Irizarry, Rafael A. *Introduction to Data Science*. Chapters 1-11.
 - [Quarto Tutorials](#).

Week 3: Let's Learn Causal Inference (1/23)

- Huntington-Klein. [Chapters 5-11](#).

Week 4: OLS Review (1/30)

- Huntington-Klein. [Chapter 13](#).
- [Jenkins-Smith et al](#). Chapters 7-15

Week 5: OLS Review Continued (2/6)

- Huntington-Klein. [Chapter 13](#).
- [Jenkins-Smith et al](#). Chapters 7-15
- **Submit replication paper and extension proposal**

Week 6: Hierarchical Linear Modeling (2/13)

- Field, Miles, and Field. *Discovering Statistics Using R*. “Multilevel Linear Models.” Chapter 19.
- **OLS Assignment Due**

Week 7: GLMs: Dichotomous, Count, and Ordinal DVs (2/20)

- [Jenkins-Smith et al.](#) Chapter 16.
- Date, Sachin. (2019). “[An Illustrated Guide to the Poisson Regression Model](#).” *Towards Data Science*. September 21.
- Greene, William H. and David A. Hensher. (2009). *Modeling Ordered Choices*. Chapters 1 and 2. Don’t get bogged down in the estimation strategies and their math.
- **HLM Assignment Due**

Week 8: Fixed Effects (2/27)

- Huntington-Klein. [Chapter 16](#).
- **GLMs Assignment Due**

Week 9: Spring Break (3/5)

- No Class

Week 10: Difference-in-Differences (3/12)

- Huntington-Klein. [Chapter 18](#).
- Zedlow, Bret and Laura Hatfield. 2019. “[Difference-in-Differences](#).”
- **Fixed Effects Assignment Due**

Week 11: Instrumental Variables (3/19)

- Huntington-Klein. [Chapter 19](#).
- **DiD Assignment Due**

Week 12: Regression Discontinuity (3/26)

- Huntington-Klein. [Chapter 20](#).
- Cattaneo, Matias D., Nicolas Idrobo, and Rocio Titiunik. 2019. “[A Practical Introduction to Regression Discontinuity Designs: Foundations](#).”
- **Instrumental Variables Assignment Due**

Week 13: Course Paper (4/2)

- Meetings on Class Papers
- **Initial Draft and Analysis Files Due Sunday 3/31 by 11:59 pm**

Week 14: Principal Component and Factor Analysis (4/9)

- “[Factor Analysis vs. PCA](#).” AnalytixLabs. May 5, 2021.
- Field, Miles, and Field. “Exploratory Factor Analysis.” [Discovering Statistics Using R](#). Chapter 17.
- **Regression Discontinuity Assignment Due**

Week 15: Structural Equation Modeling (4/16)

- Hox, J.J. and T.M. Bechger. 1999. “[An Introduction to Structural Equation Modeling](#).” *Family Science Review* 11: 354-373.
- Rosseel, Yves. 2012. “[lavaan: An R Package for Structural Equation Modeling](#).” *Journal of Statistical Software* 48(2): 1-36.
- **PCA and Factor Analysis Assignment Due**

Week 16: Duration Models (4/23)

- Box-Steffensmeier, Janet M. and Bradford S. Jones. (2004). *Event History Modeling: A Guide for Social Scientists*. Chapters 1 and 2.
- “When Should You Use Non-Parametric, Parametric, and Semi-Parametric Survival Analysis.” BoostedML. November 25, 2018.

Week 18: Finals Week

- **Final Research Paper Due Tuesday April 30 by 11:59pm**

Appendices

A Research Paper

This project is meant to be the culmination of the material you learn in this course as well as PADM 503 and 504. For this assignment, you will work with a partner or design your own replication and extension study using data. As we will learn on the first night of class, replication is an important part of scientific advancement. Multiple social science fields have experience replication crises in the past decade, where important findings were found to not replicate outside the original research context. Thus, replication is important to understanding what is true and what is aberration in scientific findings.

As we read in the articles by Gary King, replications are also good early publication opportunities for graduate students. Thus, my aim in this process is to help you learn more about the publication process. Thus, you will be not only selecting a study to replicate and extend, but will also pick a target journal for submission and will format your final paper using the journal's formatting requirements. You may choose to work by yourself or with a partner for this project.

Choosing a Paper

Your first step will be to identify a paper published in a public administration or public policy journal within the last 20 years. You will need to find an article that either uses the methods that we are learning in this course, or could benefit from using them. If possible, find one that makes its data available in a public repository like Harvard's [Dataverse](#). Next, you will need to identify a potential journal for article submission. Some journals have specific submission types for replications, which communicates their encouragement of these studies. For examples, see [Public Administration](#). **A copy of the paper and a short one paragraph proposal of your extension are due February 6. The extension proposal should include the target journal for submission.**

The next step will be to, ideally, obtain the original data from the authors of the study. If it is not publicly available, please email the authors to request the data. I would like to see your draft contact email first before you send it. You will then need to first reproduce the original results using the data. If they do not reproduce, you will need to figure out why. Once you have done this, you will need to conduct your original extension analysis. A good extension can come in the forms of adding to the dataset (e.g., adding new observations to an over-time analysis), including missing theoretically-important variables, or using a better method than the original paper. **A rough draft of your paper, including results and code, is due March 31. We will have meetings on April 2 to discuss your progress.**

The final research paper should contain the following sections:

- Introduction, including a statement of the research question and aims of the project
- Brief literature review and theory
- Specific hypotheses that will be tested
- Description of data and key measures
- Description of methodology for analyzing the data
- Results
- Conclusion
- Technical Appendix

The final paper must also be formatted based on the author guidelines at your chosen target journal. The paper's length will be dictated by the journal's rules, not my arbitrary choice, so please do not produce a paper longer than the allowable word limit of your target journal. **The final paper is due April 30.**

Now, I do not expect the final paper to be necessarily ready to submit to the journal. But I will encourage you to follow through in doing so after receiving feedback from me. I am also happy to join as an author and be more engaged in revising the manuscript and shepherding it through the publication process. But that is up to you. You are not required to include me.