PSYC489K: Mediation, Moderation, and Conditional Process Analysis

Section Syllabus, Summer 2025

Professor Information
Professor: Dr. Jacob J. Coutts (he/him/his)
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Location: Zoom
Student hours: Wed 4:00-5:00 (and by appt)

Course Information
Mode: Online
Synchronous sessions: Wed 10:00-12:00PM
Credits: 3
Recommended Prerequisites: PSYC300

Course Description

Welcome to PSYC489K! My name is Dr. Jacob Coutts (you can call me Dr. J) and I will be your guide this summer term. The weather will be warm, but I want the class to be chill and a place where you can learn about something interesting and crucial to conducting science. The below description is a little technical, but I promise the class is going to teach you everything you need to know to understand it!

Identifying cause and effect relationships is the primary goal of science. Regardless of the discipline, researchers want to know whether a proposed cause (*X*) is responsible for the variation observed in an outcome (*Y*). Psychologists may want to know whether a treatment causes an increase or decrease in depression; public health experts may want to know whether an intervention causes a change in a target behavior; and marketing scholars may want to know whether a new advertising strategy increases sales.

Although establishing this *X*–*Y* relationship is a nice goal, it is often no longer enough to study *whether X* causes *Y* given the depth of many theories and the complexity of modern statistical techniques. Researchers can enrich their research questions by studying *when* or *for whom* a relationship is present versus absent, positive versus negative, or stronger versus weaker. For example, what if a depression treatment is less effective for people with a family history of mental illness? Such questions are the target of *moderation analysis*. It is also possible to identify *how* or *by what means* one variable causes another, which is the goal of *mediation analysis*. For example, is a public health intervention effective because it first causes people to trust scientists more, which in turn causes them to follow guidelines from experts?

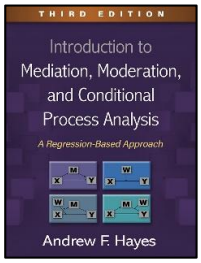
In this class, we will go over the conceptual and statistical criteria of moderation and mediation analysis in addition to models that contain both moderated and mediated effects (sometimes called *conditional process analysis* or *moderated mediation*). By the end of this class, you will be able to translate any research question into estimable regression equations, fit these models in software, and interpret the results.

Learning Outcomes

After successfully completing this course, you will be able to:

Convert any research question into conceptual and statistical diagrams and equations.	Fit mediation/moderation models to data and interpret conditional (and) indirect effects.	Use R to analyze data rather than rely on external software (and learn the PROCESS macro).
Explain historical and modern approaches to indirect effects.	Apply principles of data visualization to probe interactions.	Identify mediation and moderation research questions.

Required Resources



Hayes, A. F. (2022). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach (3rd Ed.). New York: The Guilford Press.

The textbook is **loosely required** for this class. (You will be expected to know the content, but the lectures will deliver most of it. The textbook is a fantastic supplement.) The second or third edition suffice, but the third edition has R code in it and the most up-to-date information. You can access the second edition of the book for free here. A link to the third edition for free access will be on ELMS. The textbook publisher has a copy for sale here. (Several other retailers, like Amazon, also have copies.) I will do my best to upload as much from the book as I legally can. You may also find free or cheap versions online if you Google hard enough. Any other readings will be available on Canvas.

Course Structure

This course is **online**. The lecture component to the class is asynchronous. Each week, there will be **optional** synchronous work sessions on Wednesday that function similar to a lab or open student hours. This session is **not** for a grade and will be recorded for those unable to make it. During the session, we will code in R, work on the assignments, and I will be available to answer any questions you have about the course material. In a class as compressed as this, it is important to take time to engage with the material in different ways. The blend of theoretical lectures that you can watch on your own time, live work/coding sessions, and applied assignments will be essential in helping you master our course learning goals.

- Computer access is essential to succeed in this class. You will need access to a computer to follow along with coding demonstrations, access the lecture videos, and perform other course-related duties.

What we will (and will not) cover

Topics covered:

- Conceptual diagrams, statistical diagrams, and regression in R.
- Resampling methods (e.g., bootstrapping) as an inferential test.
- Specifying, testing, and interpreting direct, total, and indirect effects in simple mediation analysis.
- Multiple mediator models and comparing indirect effects.
- Specifying, testing, and interpreting interaction effects in simple moderation analysis.
- Probing and visualizing up to two-way interactions.
- The effects of variable scaling on result interpretation.
- Specifying, testing, and interpreting conditional indirect effects (aka moderated mediation).

Topics not covered (at least in detail):

- Dichotomous, ordinal, or count variable models or other models not based on OLS regression.
- Latent variable models.
- Multilevel models and longitudinal analyses with more than two time points.
- The potential outcomes or counterfactual approach to mediation analysis (unless we have time).

Tips for Success in this Course

1. **Attend Student Hours.** You may have heard about "office hours," but I feel like this term does not adequately convey what this time is for. It is for YOU. During this time, I am available to answer your questions about class, graduate school, careers in psychology/statistics, internships, professional development, or anything else on your mind. Meetings are held virtually with me (during my posted hours or by appointment).
2. **Email me.** The best way to reach me is via email (jjcoutts@umd.edu). I typically respond to emails during the week within 24 hours. If you email outside of business hours (9:00 AM-5:30 PM), I may not see the email until the next day. Please put "PSY489K" in the subject of all course-related emails to ensure I see them. Please ask questions about anything, and do so early and often. Even the same question multiple times if the answer is still not clear. There are no bad questions, just bad decisions (i.e., not asking questions you have). You will learn a great deal more by clarifying your understanding of the material, and I will learn, too.
3. **Do not fall behind.** All the material builds on itself over the course of the semester. This means that keeping up is crucial to succeeding in this class. (e.g., If you do not understand mediation well, it will be impossible to understand conditional indirect effects.) **If you are feeling lost or having trouble maintaining pace with the coding or statistical concepts, please let me know early on so we can work to get you up to speed.**
4. **Use ELMS notification settings.** Pro tip! Canvas can ensure you receive timely notifications of course updates via email or text. I recommend you enable announcements to be sent instantly (or at least daily). I will send out weekly announcements detailing what is to come, as well as intermittent announcements throughout the week.

Course Breakdown

There are a number of ways you will earn points in this class (e.g., coding assignments, discussion boards). There aren't many assignments, so each one has a purpose for you and your learning. Take these seriously as a growth opportunity!

DataCamp Completion (5% of grade)

- The best way to learn is to do. Coding takes a lot of trying (and failing) to get good at. DataCamp is a widely respected, gamified coding practice outlet. Usually it is quite expensive, but I acquire semester licenses for free. You have been assigned four "assignments" through DataCamp. You must complete one of the four to earn points in this assignment category. You can complete either the intermediate regression or inference in regression for extra credit. The DataCamps are due by the last day of class, **are all or nothing**, and cannot be submitted late.

Discussion Board Posts (20% of grade)

- To emulate in-class participation, there will be several discussion board posts. These are meant to gauge your understanding of the course concepts and help improve the class intra- and inter-semester. These will be graded on completion and effort.

Assignments (35% of grade)

- There will be three assignments throughout the term (on regression, mediation, and moderation). These will be graded for correctness and effort.

Projects (40% of grade)

- There are two project grades. A "midterm project" where you propose the idea for your final project (and declare whether you want to do SURC, more below). There will also be a final project that involves selecting, obtaining, or collecting a dataset, doing an analysis, and creating an academic poster that **can** be presented at a future conference. UMD has a Student Undergraduate Research Conference (SURC) that is on 25 July 2025 (two weeks after class ends). I recommend you present it there as it will be a great addition to your CV/resume, but presenting it is not required or for a grade.

Extra Credit (up to 3% of grade)

- There are three extra credit assignments: the extra DataCamp (intermediate regression or inference in regression) assignment and a pretest and posttest on the course material, **each worth 1% of your grade and based on completion**. The deadlines for these are firm because they correspond with key assessment milestones. (More on late policies on the next page.)

Grading

Grades in this class are based on **skill development.** If you put in effort and improve each week, you need not worry. Grades will be assigned based on the total percent earned using the following rubric. Grades will not be rounded under any circumstances. If you think there is an error with a particular grade, please come talk to me during student hours or schedule an appointment and we can discuss the grade and correct it if need be.

A+	97.0-100%	B+	87.0-89.9%	C+	77.0-79.9%	D+	67.0-69.9%	F	<60.0%
A	93.0-96.9%	B	83.0-86.9%	C	73.0-76.9%	D	63.0-66.9%		
A-	90.0-92.9%	B-	80.0-82.9%	C-	70.0-72.9%	D-	60.0-62.9%		

Course Policies

Late Work

Every assignment, with the exception of the final assignments and extra credit, will be due on the Sunday of the week specified in the syllabus. The due date of each assignment will be stated clearly in the assignment description. Assignments will be accepted up to one week after they are due, but will not be accepted after that. **All assignments** must be in by 11:59 PM on the final day of class.

Statement on Artificial Intelligence (AI)

AI platforms are ultimately tools. In the hands of experts, they can improve workflow, generate ideas, and facilitate learning. However, like all tools, they can ruin things in the wrong hands. You are not an expert. You are here to learn and grow your knowledge base in an important topic. Consequently, the appropriate use case of AI is narrow. You can use it to help debug your code (i.e., help identify errors), generate practice questions, and ask for additional explanations on topics. You may not, under any circumstances, use AI to generate answers to problems, replace your own ideas, write code, or contribute to graded assignments in any other way. If you're struggling, attend student hours. If you're busy, utilize drops. If

you're overworked, reach out to me. Do not waste the instructional team's time having us read content generated by an LLM. It will be treated as a violation of the student code of conduct. I don't want to see an algorithm's prediction based on other's ideas; I want to see yours. If you want to go anywhere in the world of data science and research, you must know this content well, and you simply won't if you rely on AI.

Academic Dishonesty

- Cheating in any form (e.g., copying, falsifying signatures, plagiarism) will not be tolerated. It will result in a referral to the Office of Student Conduct regardless of scope and circumstances, as required by university rules and regulations. There are severe consequences of academic misconduct, some of which are permanent and could appear on your transcript. If you have any questions regarding the University's policies on scholastic dishonesty, please see https://policies.umd.edu/academic-affairs/university-of-maryland-code-of-academic-integrity. It is very important that you complete your own assignments, and do not share files (excluding raw data), partial work, or final work. For more about the Student Honor Council or Code of Academic Integrity, please visit https://studentconduct.umd.edu/.
- For this course, some of your assignments will be collected via Turnitin on our course ELMS page. I have chosen to use this tool because it can help you improve your scholarly writing and help me verify the integrity of student work. For information about Turnitin, how it works, and the feedback reports you may have access to, visit Turnitin Originality Checker for Students.
- Course assistance websites such as CourseHero are **NOT** permitted. Material taken or copied from these sites will be deemed a violation of the university's academic integrity policy. Relying on restricted sources will hamper your learning process, particularly the critical thinking steps necessary for college-level assignments. As future professionals, your commitment to high ethical standards and honesty begins with your time here at the University of Maryland.

Accommodations

Please come and see me as soon as possible if you think you might need any special accommodations for disabilities. In addition, please contact the Disability Support Services (301) 314-7682 or by web at https://www.counseling.umd.edu/ADS/. Disability Support Services will work with us to help create appropriate academic accommodations for any qualified students with disabilities. If you experience psychological distress during the course of the semester you can get professional help at the Counseling Center (301-314-7651 or https://www.counseling.umd.edu/.

Names/Pronouns and Self-Identification

- The University of Maryland recognizes the importance of a diverse student body and we are committed to fostering equitable classroom environments. I invite you, if you wish, to tell me how you want to be referred to both in terms of your preferred name and your pronouns (e.g., he/him, she/her, they/them). The pronouns someone indicates are not necessarily indicative of their gender identity. Visit https://lgbtq.umd.edu/trans-resources-policies to learn more.
- Additionally, how you identify in terms of your gender, race, class, sexuality, religion, and dis/ability, among all aspects of your identity, is your choice whether to disclose (e.g., should it come up in classroom conversation about our experiences and perspectives) and should be self-identified, not

presumed or imposed. I will do my best to address and refer to all student accordingly, and I ask you to do the same for all of your fellow Terps.

Reporting Racism and Other Forms of Hate and Bias

- If you experience racism or other form of bias or hate in this class or any psychology course, we encourage you to do at least one of the following: Please report the experience to the instructor or teaching assistant and/or report to the Department of Psychology's Diversity and Inclusion Committee using this link: https://umdsurvey.umd.edu/jfe/form/SV_06ZuAUj7eJnQVqR (reports can be made anonymously).
- Please also report all incidents of hate and bias to the Office of Diversity and Inclusion at https://www.diversity.umd.edu/hbrp/.

Reporting Sexual Misconduct

ALL instructors and teaching assistants are required to report any PAST OR PRESENT instances of sexual misconduct to the Title IX office. All incidents faced by members of the campus community or visitors must be reported, regardless of where the incident occurred (i.e., on or off campus), when the incident occurred (i.e., recently or many years past), how the instructor or teaching assistant learned of the incident (i.e., directly from the individual who experienced it or from their friend/colleague), and regardless of whether the incident was previously reported.

What I'm conveying in the above sections is that I am your **ally**, and there are many amazing resources in the Department of Psychology and at the University of Maryland that will help you feel comfortable and safe in this learning environment. Regardless of what you're struggling with, there is a resource for you.

Tentative Course Schedule

All readings, assignments, and due dates are subject to change. Refer to Canvas for the most current version of activities and due dates.

Week	Date	Topic	Readings	Assignments
1	2 June – 6 June	**Course Introduction and Linear Regression/R** *Overview of course and course software (JupyterHub, R, PROCESS)* *Conditions of causality* *Simple/multiple linear regression* *Interpreting coefficients* *Statistical inference/assumptions* *Conceptual/statistical diagrams*	Ch. 1-2 ELMS	*Regression Assignment* **Welcome Discussion Board DUE** **Extra Credit Pretest DUE**
2	9 June – 13 June	**Mediation Analysis I** *Path analysis (total, direct, and indirect effects) and power* *Inference and assumptions*	Ch. 3-4 ELMS	*Mediation Assignment* **Regression Assignment DUE**

		Equivalent models		
3	16 June – 20 June	**Mediation Analysis II** *Multiple mediator models* *Comparing indirect effects* *Other extensions*	Ch. 5 ELMS	*Project 1* **Mediation Assignment DUE**
4	23 June – 27 June	**Moderation Analysis I** *Conditional effects* *Two-way interactions* *Inference and assumptions*	Ch. 7-8	*Moderation Assignment* **Final Project Proposal DUE** **Discussion Board 2 DUE**
5	30 June – 4 July	**Moderation Analysis II** *Principles of data visualization* *Probing interactions* *Centering, standardizing, and multicollinearity*	Ch. 9 ELMS	*Final Poster* **Moderation Assignment DUE**
6	7 July – 11 July	**Conditional Indirect Effects** *Types of models* *Testing conditions IEs* *Visualizing conditional IEs* *Interpreting results*	Ch. 11 ELMS	**Final Poster DUE** **Final Discussion Boards DUE** **DataCamp(s) DUE** **Extra Credit Posttest DUE**

Supplemental Texts

If you wish to gain additional practice in data science, statistics, programming languages (e.g., Python, R), or other related topics, consider reading and accessing some of the texts below:

R for Data Science, 2nd Edition https://r4ds.hadley.nz/
R Cookbook, 2nd Edition https://rc2e.com/

University Links

Canvas ELMS Site elms.umd.edu
Division of Student Affairs (Your Ally) https://studentaffairs.umd.edu/basic-needs-security
Writing Center https://english.umd.edu/writing-programs/writing-center
Counseling counseling.umd.edu
IT Helpdesk helpdesk.umd.edu

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