University of Victoria

PSYC 513 A02 – Quantitative Analysis: (31587) Advanced Applications of SEM and MLM

Summer 2022

Dates: June 2 – June 24, 2022
Meeting Time: **MTWThF** 11:30am–1:20pm
Location: HSD 170

Instructor: Jonathan Rush, PhD
Office hours: Flexible (before/after class); By appointment
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TERRITORY ACKNOWLEDGEMENT

We acknowledge with respect the Lekwungen peoples on whose traditional territory the university stands and the Songhees, Esquimalt and WSÁNEĆ peoples whose historical relationships with the land continue to this day.

COURSE DESCRIPTION

This graduate course is designed to introduce you to a variety of advanced applications within the Structural Equation Modeling (SEM) and Multilevel Modeling (MLM) frameworks. Both SEM and MLM are flexible analytic frameworks that permit researchers to build statistical models that appropriately address their research questions. Modern statistical software (e.g., Mplus, R) enable applied researchers to readily utilize these advanced frameworks. The aims of this course are to provide an in-depth look into the practical application of more advanced topics that are often given cursory attention in core statistical courses. Topics to be covered will include: *Latent Growth Curve Models*, *Multi-group Analysis*, *Multilevel Structural Equation Models*, and *Heterogeneous Variance Models*. A large focus will be on translating the conceptual models into corresponding software code and scripts, interpreting statistical software output, and subsequently translating back into findings communicated through presentations and Results sections of manuscripts. To maximize learning, give consideration to how each topic applies to your own data and research interests. This is a project-based course, where students are encouraged to apply one or more of the approaches covered to their own data project.

COURSE PREREQUISITES

Although there are no official course prerequisites listed in the UVic calendar for PSYC 513, our coverage of advanced applications will assume introductory knowledge of the foundational features of SEM and MLM. Given the condensed nature of the course, there will not be time for thorough review of foundation knowledge.

COURSE FORMAT AND LEARNING GOALS

This advanced graduate course is designed to promote learning through lecture, practical application, dialogue, and sharing of ideas and issues. Our meeting time will integrate conceptual learning with practical application. Because a large emphasis will be on practical application, lectures will intentionally take up a small portion of class time, with much time allocated to hands-on analysis using both example data and personal data. I encourage each of you to engage in discussions (both in small and large groups), raising questions relevant to your personal research questions, troubleshooting with your fellow colleagues, and sharing solutions. Given the diversity of research questions and individual datasets, there will be much value in collectively sharing about the setbacks and solutions we encounter, fostering creativity in how we may think about our own research questions and analysis. Furthermore, the coverage of topics will flexibly adapt to the analytic approaches most suitable to your analytic projects.

After completing this course, I am committed to you achieving the following learning outcomes:

1. Obtain practical skills in specifying (i.e., generating/adapting software code/scripts for) a variety of advanced analytic techniques within the SEM and MLM frameworks

2. Be able to identify, interpret, and communicate relevant output and whether the results support the research questions at hand

3. Have an adequate understanding of when to apply each of the techniques covered, given the circumstances and nature of research questions and design

4. Enhance your communication skills (e.g., share ideas, hone presentation skills, respond to questions) when discussing statistical findings

5. Refine your scientific writing by producing (a) a **Methods** section that succinctly summarizes your population, procedure, measures, and analytic strategy employed; and (b) a **Results** section that summarizes findings from your analysis project.

ACADEMIC EXPECTATIONS

To achieve the learning outcomes, it is necessary for you to be engaged with class content and discussions, and to complete each of the assignments. Should circumstances prevent your attendance, please inform me (in advance if possible). If you are unable to submit the final written assignment on the specified date due to illness or family affliction, you should apply to the Dean of Graduate Studies for an academic concession (deferral or DEF). Failure to complete one or more class assignments will result in a grade of "N" regardless of the cumulative percentage of all other elements of the course. N is a failing grade and factors into GPA as a value of 0.

In accordance with University's policy on academic concessions, "A student who completes all course requirements is not eligible for an academic concession". Consequently, students can only request deferrals for the completion of required course components and not for non-essential course components.

You are expected to abide by the University policy on plagiarism and cheating.

EVALUATION AND GRADING POLICY

Evaluation of your progress toward the course objectives will be based upon several graded requirements, including: (a) 2-page analytic proposal; (b) class presentation; (c) written Methods & Results section; (d) class engagement.

Evaluation	Date	Percentage of Grade
2-page Analytic Proposal	*June 8*	**20%**
Class Presentation on Analytic Process/Findings	*June 22-24*	**35%**
Methods and Results Section	*June 30*	**35%**
Class Engagement	*Daily*	**10%**
		_____
		100%

a)   2-Page Analytic Proposal (20%)

The purpose of this assignment is to create a very brief outline/summary of your proposed analytic project for the class presentation and final written assignment. It is not expected to have a fully flushed out proposal at the outset, but rather to be a starting point for your analytic project that will continue to be refined through discussions and feedback to enable you to settle on an appropriate and optimal analytic approach for your research questions and data.

The 2-page summary should include:

- A brief introduction to your research area and associated research questions (including relevant hypotheses)
- A brief description of the data you will be using: e.g., sample size, study design, variables of interest (and measurement scale)
- A conceptual description of the analytic approach you intend to apply and why that approach is well suited to address your research questions (based on your understanding at this stage)
- (Optional) A figure or equations that outline the model you propose to examine

The 2-page proposal is due by end of day on **Wednesday, June 8** (via electronic submission).

b)   Class Presentation on Analytic Process/Findings (35%)

During the final 3 (or 4) scheduled classes, you will be asked to give an oral presentation that describes your analytic approach and summarizes key findings from your analytic project. Each student will give a 15-min presentation, followed by approximately 5 minutes of discussion.

The presentation should outline the research area, associated hypotheses, study sample, measures, statistical approach and models, key findings, and implications of the results. Additionally, I encourage presenters to allocate some time to describing the real-world process (e.g., challenges / setbacks / solutions) of applying the analytic approach to their data. Given the variety of potential analytic approaches utilized, this will be a great opportunity to not only share and communicate your own process and findings, but also to learn from your colleagues about real-world challenges and solutions in applying different approaches to actual data.

Presentation sign-up will take place during our second class: **Friday, June 3.**
Class presentations will take place during the final 3 classes: **Wednesday – Friday, June 22 – 24**

c) **Final Written Assignment: Methods and Results Section (35%)**

Your final written assignment will be a **manuscript-length Methods and Results** section based on your personal analytic project. This should build naturally upon the 2-page proposal and include many of the details already compiled for your oral presentation. The Methods and Results section should provide the level of detail typical of articles published in APA journals (e.g., *Psychology and Aging, Developmental Psychology, Journal of Personality and Social Psychology*) and should be formatted using APA style (i.e., subsection heading levels, tables, figures, citations).

Please ensure you include *Methods subsections* describing: (a) participants and procedure (i.e., research design); (b) measures; and (c) analytic strategy (where you detail the analytic approach used and depict the model(s) through a figure or equations). The *Results section* should summarize all key findings relevant to your research questions (including Tables and/or Figures to succinctly display your findings is encouraged). In addition to the Methods and Results section, please also include a *brief introduction* (≤ 1 page) that summarizes the research area and research hypotheses (this can be written similar to a **Current Study** subsection commonly included in manuscripts); and a *brief discussion* (≤ 1 page) highlighting the key findings and their implications, as well as any limitations.

The length of your Methods and Results sections will depend on the nature of you research project, but should ***not be more than 15 double-spaced pages*** (excluding References, Tables, and Figures). The goal is to write these sections in the same manner you would when submitting a manuscript, not to detail everything you have learned or encountered about this analytic approach.
Part of mastering your skills in writing effective Methods and Results sections is finding the balance between including enough detail to adequately describe what you have done/found, while still being succinct and adhering to word limit constraints imposed by many journals.

Finally, as each of you will have very different research questions and will likely employ different models, there is not one single example article that will match the style and formatting for all projects. As you develop and refine your analytic project, I will be happy to help guide you towards published articles that can serve as stylistic templates for you to consult for your final assignment.

The final written assignment is due by **Thursday, June 30, 2022**

d) **Class Engagement (10%)**

You are encouraged to take an active part in the direction and content of the course by preparing for and contributing to class discussions, sharing with others your (direct or indirect) research experience, challenges and successes, working through issues collectively, or simply being a sounding board for others to talk through their ideas. Often the best learning experiences occur spontaneously through shared attempts. Subtle things, such as allowing a colleague to look over your shoulder and ask questions, or looking over their shoulder and asking questions, go a long way in consolidating understanding of the analytic process.

The final letter grade in the course will be weighted and aggregated to yield a total percentage score. Grades that end with a decimal point of 0.5 or above will be rounded to the next higher whole number, and grades that end with a decimal point below 0.5 will be rounded to the next lower whole number. Final grades will be assigned according to the following scale: 90-100%=A+; 85-89=A; 80-84=A-; 77-79=B+; 73-76=B; 70-72=B-; 65-69=C+; 60-64=C; 50-59=D; 0-49=F.

CLASS SCHEDULE AND SUGGESTED READINGS

Because this course will cover a variety of advanced topics, there is no one textbook that will provide adequate coverage of the course material. Instead, I have selected articles and chapters that specifically focus on each topic. Most of class time will be devoted to broad conceptual understanding and in-depth practical application of the analytic approaches. As such, the suggested readings often cover the more technical details of these approaches that will be useful as you engage more deeply. Due to the condensed timeframe of this course, it is not expected that all of these readings will be absorbed and fully understood within the 3-week class period. Rather, the readings are provided as available resources that you can come back to again and again, and will continue to be of value as you build your mastery of these advanced approaches.

Date	Content	Readings*
June 2	INTRODUCTION AND REFRESHER: SEM AND MLM Course objectives, syllabus, and requirements Getting to know you, your goals, and your data Overview of foundational SEM and MLM models Sneak-peak at planned topics	Rodgers (2010)
June 3	LATENT GROWTH CURVE MODEL Longitudinal Change Introduction to Mplus	Ram & Grimm (2007)
June 6	LATENT GROWTH CURVE MODEL Comparing and contrasting LGC within SEM and MLM frameworks (*spoiler*: they are the same 😶)	Curran (2010) Bauer (2003)
June 7	MULTI-GROUP ANALYSIS Comparing groups through interactions vs. Comparing groups through invariance testing	TBA
June 8	MULTI-GROUP ANALYSIS Moderated mediation through model comparisons	Ryu & Cheong (2017)
June 9	MEDIATION AND MODERATION IN SEM AND MLM Interactions within and across levels	Preacher (2016) Rush et al. (UR)
June 10	MULTILEVEL STRUCTURAL EQUATION MODELING (MSEM) The best of both worlds (SEM + MLM) Multilevel CFA	Geldolf & Preacher (2014) Rush & Hofer (2014)
June 13	MULTILEVEL SEM: MEDIATION ANALYSIS Single-level and multi-level mediation; Endogenous and exogenous variables within and across levels	Preacher et al. (2010, 2011)
June 14	MULTILEVEL SEM Random slopes as outcomes and predictors Parallel growth models	Rush et al. (2019) Sin et al. (2021)

June 15	HETEROGENEOUS VARIANCE MODELS (aka: Mixed-Effects Location Scale Models) Simultaneously modeling individual differences in variability	Heddeker (2009) Rast et al. (2012)
June 16	HETEROGENEOUS VARIANCE MODELS Individual variability as predictor Individual variability as outcome	Rast et al. (2020)
June 17	IN-CLASS SUPPORT FOR INDEPENDENT PROJECTS	
June 20	SPECIAL(ER) TOPICS: Power analysis in SEM and MLM MonteCarlo Simulations in Mplus to estimate power	Rush et al. (2020)
June 21	IN-CLASS SUPPORT FOR INDEPENDENT PROJECTS	
June 22	*CLASS PRESENTATIONS*	
June 23	*CLASS PRESENTATIONS*	
June 24	*CLASS PRESENTATIONS*	
June 30	**FINAL METHODS & RESULTS SECTION DUE**	

Recommended readings

Please note that this is a *tentative schedule and reading list* that will evolve according to your individual datasets and interests.

COURSE REGISTRATION

You are personally responsible for checking your registration status before the end of the course-add period (June 4, 2022). Please verify and confirm your registration status with me as, according to University policy, I am unable to facilitate a course addition after this date even if you have been attending class. Also note that Thursday, June 16, 2022 is the last day for officially withdrawing from PSYC 513 without academic penalty. University policy state that failing to attend lectures does not constitute official withdrawal.

Sexualized Violence Prevention and Response at UVic

UVic takes sexualized violence seriously, and has raised the bar for what is considered acceptable behaviour. We encourage students to learn more about how the university defines sexualized violence and its overall approach by visiting www.uvic.ca/svp. If you or someone you know has been impacted by sexualized violence and needs information, advice, and/or support please contact the sexualized violence resource office in Equity and Human Rights (EQHR). Whether or not you have been directly impacted, if you want to take part in the important prevention work taking place on campus, you can also reach out:

Where: Sexualized violence resource office in EQHR, Sedgewick C119

Phone: 250.721.8021

Email: svpcoordinator@uvic.ca

Web: www.uvic.ca/svp

UNIVERSITY OF VICTORIA
Department of Psychology

Important Course Policy Information
Summer 2022

Commitment to Inclusivity and Diversity

The University of Victoria is committed to promoting, providing and protecting a positive and supportive and safe learning and working environment for all its members.

Policy on Academic Integrity including Plagiarism and Cheating
The Department of Psychology fully endorses and intends to enforce rigorously the Senate Policy on Academic integrity
https://www.uvic.ca/calendar/future/grad/index.php#/policy/BJujesM_E?bc=true&bcCurrent=02%20-%20Policy%20on%20Academic%20integrity&bcGroup=Faculty%20Academic%20Regulations&bcItemType=policies . It is of utmost importance that students who do their work honestly be protected from those who do not. Because this policy is in place to ensure that students carry out and benefit from the learning activities assigned in each course, it is expected that students will cooperate in its implementation.

 The offences defined by the policy can be summarized briefly as follows:
1. **Plagiarism**. You must make sure that the work you submit is your work and not someone else's. There are proper procedures for citing the works of others. The student is responsible for being aware of and using these procedures.

2. **Unauthorized Use of an Editor**. The use of an editor is prohibited unless the instructor grants explicit written authorization.

3. **Multiple Submission**. Only under exceptional circumstances may a work submitted to fulfill an academic requirement be used to satisfy another similar requirement. The student is responsible for clarifying this with the instructor(s) involved.

4. **Falsifying Materials Subject to Academic Evaluation**. This includes falsification of data, use of commercially prepared essays, using information from the Internet without proper citation, citing sources from which material is not actually obtained, etc.

5. **Cheating on Assignments, Tests, and Examinations**. You may not copy the work of others in or out of class; you may not give your work to others for the purpose of copying; you may not use unauthorized material or equipment during examinations or tests; and you may not impersonate or allow yourself to be impersonated by another at an examination. The Department of Psychology has a policy of not making old examinations available for study purposes. Therefore, use of old exams without the express written permission of the instructor constitutes cheating by the user, and abetting of cheating by the person who provided the exam.

6. **Aiding Others to Cheat**. It is a violation to help others or attempt to help others to engage in any of the conduct described above.

Instructors are expected to make every effort to prevent cheating and plagiarism. This may include the assignment of seating for examinations, asking students to move during examinations, requests to see student identification cards, and other measures as appropriate. Instructors also have available to them a variety of tools and procedures to check for Internet and electronic media-based cheating. In instances of suspected or actual plagiarism or cheating, instructors, following prescribed procedures, are authorized to take steps consistent with the degree of the offence. These measures will range from a zero on the test or assignment or a failing grade for the course, probation within a program to temporary or even permanent suspension from the University.

Rights of Appeal are described in the Policy on Academic Integrity in the University calendar January 2022.

The definitive source for information on Academic Integrity is the University Calendar

Other useful resources on Plagiarism and Cheating include:
1. The Ombudsperson's office: https://uvicombudsperson.ca/academic-integrity/
2. The Office of the Ombudsperson is an independent and impartial resource to assist with the fair resolution of student issues. A confidential consultation can help you understand your rights and responsibilities. The Ombudsperson can also clarify information, help navigate procedures, assist with problem-solving, facilitate communication, provide feedback on an appeal, investigate and make recommendations. Phone: 250-721-8357; Email: ombuddy@uvic.ca   Web: uvicombudsperson.ca.
3. UVic Library Resources: https://www.uvic.ca/library/help/citation/plagiarism/index.php
4. https://www.uvic.ca/library/research/citation/documents/avoiding%20plagiarism%20guideUpdate_Sept_2013.pdf

BE WELL

A note to remind you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone.

Discovering Victoria, UVic and your Community:
Grad school can involve a lot of time studying and researching on your own – but it does not have to be an isolating experience. There are a lot of other grad students out there like you who are looking to connect outside of academics.
https://www.uvic.ca/graduate/campus/student-services/index.php

Counselling Services:
Counselling Services can help you make the most of your university experience. They offer free professional, confidential, inclusive support to currently registered UVic students. https://www.uvic.ca/student-wellness/wellness-resources/mental-health/index.php

Health Services:
The Student Wellness Centre also provides a full service primary health clinic for students. https://www.uvic.ca/student-wellness/contacts/student-wellness-team/index.php#ipn-physicians

Centre for Accessible Learning*:*
The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations https://www.uvic.ca/graduate/campus/student-services/index.php#ipn-accessible-learning . The sooner you let us know your needs, the quicker we can assist you in achieving your learning goals in this course.

Elders' Voices:
The Office of Indigenous Academic and Community Engagement (IACE) has the privilege of assembling a group of Elders from local communities to guide students, staff, faculty and administration in Indigenous ways of knowing and being.
www.uvic.ca/services/indigenous/students/programming/elders/

Mental Health Supports and Services:
Mental health supports and services are available to students from all areas of the UVic community: https://www.uvic.ca/graduate/campus/student-services/index.php#ipn-health-wellness