Analysis of Covariance Structures (Psyc 577)
William Breland, Ph.D.
Spring 2020

Office: SGM 627; e-mail: wbreland@usc.edu
Office hours general availability: TBA;
students should always email and schedule time before dropping by office hours

Course Objectives

This course offers an introduction to structural equation modeling (SEM), a general quantitative technique used to simultaneously evaluate complex, multivariate relationships among both manifest (observed) variables and latent (unobserved) variables. The principal emphases will consider basic SEM techniques such as path analysis, latent variable analysis, and confirmatory factor analysis. Our discussions will broaden across the semester to consider how such basic elements can be combined in multiple, interconnected ways within a single structural model.

Our general objective is to explore SEM from a conceptual perspective. However, to well-grasp the essential procedures and goals of an SEM analysis, it is necessary to consider a few algebraic and statistical issues. For this reason, enrolled students should have a basic understanding of statistics, especially as regards regression, multiple regression, and exploratory factor analysis. We will use the *lavaan* package in R to work through different SEM examples and problems. This software is freely downloadable over the Internet. You are not expected to be fluent in the use of R; you will be given enough basic information to understand and execute all the course tasks that require the use of R.

Upon completing the course, each student will be able to:

1. interpret figural depictions of published structural models,
2. specify figural models to represent his/her own hypotheses in his/her own area of interest,
3. recognize problems with structural models and violations of SEM assumptions
4. understand and describe SEM estimation procedures,
5. evaluate simple path structures, confirm simple factor structures, and assess more complex combinations where both measurement and regression hypotheses are proposed with direct, indirect, and moderating influences,
6. test competing, "nested" structural models,
7. recognize and interpret appropriate "fit indices" to differentiate among tested-models, and
8. report the results of SEM analyses in a manner appropriate for publication,

Course Prerequisites
USC-Psyc 503: *Regression and the General Linear Model* (or comparable coursework to Psyc 503 and Psyc 501).

Required Text
Kline, R. B. (2016). *Principles and Practice of Structural Equation Modeling, 4th edition*. New York, NY: The
        Guilford Press.

Evaluation Criteria
Grades for this course are based on six major components. Each of these will be assessed separately and posted in the Blackboard grade-book on the basis of 100 points. For example: a score of 100 is the best score possible; a score of 70 indicates 70% correct; and so on. However, the proportionally weighted importance of each in computing the final total course score is not the same for each separate component.

The weighted importance for each component on your final total course grade will be as follows:

Component	Weight
Mid-term examination I	10 %
Mid-term examination II	10 %
Class Participation and Preparedness	15 %
Extra-Class Assignments	15 %
Presentation of Research Report	20 %
Written Research Report	30 %

Cut-Points for Letter Grades
In percentages your letter grade will be assigned as follows:
A = 93.5 (and above), A- = 89.5 to 93.4,
B+ = 86.5 to 89.4, B = 82.5 to 86.4, B- = 79.5 to 82.4,
C+ = 76.5 to 79.4, C = 72.5 to 76.4, C- = 69.5 to 72.4
D = 60 to 69.4, F = below 60.

Examinations
There will be two midterm examinations – they will be offered as take-home exams. There will be no final exam – the final research report and presentation will serve as the final exam since they are expected to offer real-world verification of each student's understanding of and ability to apply and use the content of this course.

Class Participation and Preparedness
Each student is expected to read the assigned readings and prepare for each class. A Blog portal on the course Blackboard will be open for students to submit (prior to class) brief, summary impressions/understandings/confusions about the assigned readings (submissions are due by the end of the day prior to each class). Your submitted impressions are not expected to be extensive – they are only expected to indicate your basic orientation to the material that will be discussed.

Extra-Class Assignments
Throughout the semester, extra readings may be assigned to supplement the materials offered in the text book. These readings may be assigned to each student as individuals to integrate into the full class discussions -or- to small groups of students for shared discussions within those groups during "break-out" sessions during class. There are no lab sections per se during the semester, so all lab instruction will take place during class time. Assignments from those intra-class lab-instruction moments will be expected to be turned in to the "Extra-Class Assignments" portal on Blackboard.

Written Research Report and Presentation
The primary assignment in Psyc 577 is to write a publishable quality, APA-style research report where SEM is the major analysis employed. Thirty percent of the course grade depends on the technical correctness and quality of this written report. The adjoining presentation of the findings of this report is worth twenty percent of the course grade.

The topic of the report is chosen by each individual student and he/she is expected to obtain his/her own data for this report. Generally students request appropriate data from their advisors or locate archival data that is deemed appropriate for their proposed analysis. A brief proposal for the research report will be due as an extra-class assignment no later than mid-semester. Each student's proposal must be approved by Dr. Breland before initiating the analyses.

Each student is allowed 15 minutes for his/her Powerpoint presentation to identify and theoretically support the main hypotheses, describe the model, and report/interpret the findings. Presentations will be scheduled at the end of the semester.

Missed assignments and/or examinations
Missed assignments and examinations cannot be made up and will result in a grade of zero unless excused due to university sanctioned reason (such as illness or death in family). Students who experience medical emergencies preventing them from completing assignments or examinations by the due dates are required to contact Dr. Breland within one week to explain their reasons. *Students honoring religious holy days are treated in a similar fashion*.

Notice on Intellectual Properties
Students are held to the highest standards of ethical conduct. All the materials presented for this course in lecture, lab, discussion, sent via email, or posted on Blackboard are "all rights reserved" by the course instructor. Some of it may be copyrighted and distributed by a publishing corporation for in-class use only. You should be aware that it is a violation of student ethics to store, post, distribute, sell, or purchase any course materials with the intent of offering that material to or receive it from any student who is not presently enrolled in this course (applicable to commercial Internet sources).

Statement on Academic Conduct and Support Systems

Academic Conduct
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs
Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321; HSC: (323) 442-1000 – 24-hour emergency or report crime.
Provides overall safety to USC community. dps.usc.edu

Psyc 577 Course Schedule

Wk #	Date	Lectures	Analysis/Discussion	Assigned Readings
1	1/13	Introduction to Course Initial Considerations and Cautions for SEM	R, "lavaan," and "Onyx" (uploading computer freeware for the course) Exercise: "Galton's Peas"	Reference: *Principles and Practice of SEM-R. Kline* – Chapter 1
2	1/20	*** Monday – MLK Birthday – University Holiday*** Basic Statistical Review to Orient SEM Variance, Covariance, Regression, Multiple Regression	Blog: Regression Fundamentals Exercise: Review Various Types of Correlation, Partial & Part Correlation, & Regression	Reference: *Principles and Practice of SEM-R. Kline* – Chapter 2
3	1/27	Consideration of Significance Testing vs. SEM focus	Blog: Significance Testing Exercise: Relationship of Partial & Part Correlations to Residualized Variables; Bootstrapping Example	Reference: *Principles and Practice of SEM-R. Kline* – Chapter 3
4	2/3	Brief Psychometric Review and Introduction to SEM Computer Tools	Blog: Data Prep & Computer Tools Exercise: Simulating Scores - issues of "true score" vs. "error" & clarifying reliability vs. validity	Reference: *Principles and Practice of SEM-R. Kline* – Chapters 4 & 5
5	2/10	Introduction to SEM Model "Specification" Drawing Models with Graphical Symbols Specifying Manifest Variables and Relationship Paths	Blog: Specifying "Path Analyses" Exercise: Graphically Drawing Personally Relevant Theoretical Path Relationships with Consideration of "Nested" Models	Reference: *Principles and Practice of SEM-R. Kline* – Chapter 6
6	2/17	*** Monday – President's Day – University Holiday*** **Mid-Term Exam #1 (topics of 1st 5 wks)** **Take-Home Exam…Due 5 PM on day after holiday –** **1st Lecture Cancelled due to Take-Home Exam (& holiday)** Matrix Algebra and SEM Model "Identification"	Blog: ### None Due ### Exercise: Brief Introduction to Matrix Algebra and the RAMpath Matrices	Reference: *Principles and Practice of SEM-R. Kline* – Chapters 1 – 6 are relevant to Exam Reference: *MX: Statistical Modeling-M. Neale* – Appendix C (on Blackboard)
7	2/24	*** Brief* Proposal of Final Paper's Specified Primary Model due prior to Weekend** Linking Matrix Algebra & SEM "Identification" to *Sewall Wright's Path Tracing Rules*	Blog: Identifying Path Models Exercise: ### None Due ### *** Proposal Due ***	Reference: *The Relative Importance of Heredity and Environment…Guinea-Pigs-S. Wright* – Article, skim read (on BlackBoard) Reference: *Principles and Practice of SEM-R. Kline* – Chapter 7
8	3/2	Non-recursive Models and Comparisons of Exploratory and Confirmatory Factor Analyses	Blog: Specifying/Identifying CFA models Exercise: Exploratory Factor Analysis; Importing and Exporting Data in R; SEM Confirmatory Factor Analysis with Onyx	Reference: *Principles and Practice of SEM-R. Kline* – Chapter 9

Wk #	Date	Lectures	Analysis/Discussion	Assigned Readings
8	3/2	Non-recursive Models and Comparisons of Exploratory and Confirmatory Factor Analyses	Blog: Specifying/Identifying CFA models Exercise: Exploratory Factor Analysis; Importing and Exporting Data in R; SEM Confirmatory Factor Analysis with Onyx	Reference: *Principles and Practice of SEM- R. Kline* – Chapter 9
9	3/9	Introduction to 'lavaan' in R Translating Onyx SEM Graphics to lavaan SEM syntax	Blog: ### None Due ### Exercise: Introducing 'lavaan'… Comparing personally relevant, "nested" CFA models	Reference: *Principles and Practice of SEM- R. Kline* – Chapters 9 (cont.)
10	3/16	*SPRING BREAK*	*SPRING BREAK*	*SPRING BREAK*
11	3/23	Considering Structural Regression Models Specifying / Identifying / Simulating Relationships	Blog: Structural Regression Models Exercise: Continued work with Onyx and lavaan – simulating data, working with covariance/correlation matrices as observed data	Reference: *Principles and Practice of SEM- R. Kline* – Chapter 10 & 11
12	3/30	SEM Confirmatory Factor Analysis Measurement Model Issues Chi-square./df, RMSEA, CFI, Evaluating Model Fit	Exercises with Confirmatory Factor Analyses	Reference: *Principles and Practice of SEM- R. Kline* – Chapter 11 & 12
13	4/6	Evaluating Structural Regression Models with Multiple Latent Variables and Manifest Variables	Exercises with SEM Structural Regression Models	Reference: *Principles and Practice of SEM- R. Kline* – Chapter 14
14	4/13	***Mid-Term Exam #2 (topics of wks 7-12)** **Take-Home Exam…Due 5 PM on day of week's 1st Lecture** **1st Lecture Is Cancelled Due To Take-Home Exam** Recap of Course Best Practices in SEM Preview of What Lies Ahead in SEM Analyses	Demonstration of Various Other Types of SEM Analyses	*No Readings Assigned.*
15	4/20	**FINAL PRESENTATIONS** **(see page 2 of syllabus)**	** Final Presentations*	** Final Presentations*
16	4/27	**FINAL PRESENTATIONS** **(see page 2 of syllabus)**	** Final Presentations*	** Final Presentations*
		FINAL PAPER DUE PRIOR TO MAY 12		