PSY 610: STRUCTURAL EQUATION MODELING
Fall 2019, Mondays 9:00 to 11:50 AM, 006 Straub

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Office hours: Wed 11-11:50 AM or by appointment, 329 Straub

This course is an introduction to structural equation modeling (SEM). SEM is a general framework for building, comparing, and evaluating models of data. SEM can be used to fit and evaluate models of measurement, association, causation, and change over time. Specific techniques that are part of SEM include path analysis, confirmatory factor analysis, causal models with latent variables, growth curve models, and more. SEM is useful in a wide variety of research applications, including the analysis of experiments and interventions, observational designs, and designs with repeated measurements (such as within-subjects experiments, longitudinal studies, and multiple time series).

The course will include an accelerated review of multiple regression and a treatment of principles of causal inference. The majority of the course will cover "classical" SEM applications like confirmatory factor analysis and structural regression models. These classical applications are the building blocks for more modern developments (such as analyzing longitudinal data), which we will cover as time permits. Class meetings will include both classroom lectures and hands-on practice in the computer lab.

Prerequisites: Completion of PSY 611, 612, and 613.

Software

Examples and exercises in class will be done using the lavaan package in R. Rstudio, R, and lavaan are installed on the computers in the lab.

R literacy prerequisite or self-study: If you are not already familiar with R, you will need to learn some basics **by the time we cover Topic 2**. Specifically, you should know how to:

- Read datasets from files (including comma-delimited and SPSS datasets).
- Do basic data management like creating new variables, transforming variables, etc.
- Run some basic statistics, including regression

The Quick-R website (http://www.statmethods.net/) is geared toward people transitioning from SPSS and may be a useful resource. I also highly recommend the tidyverse set of packages for data management, visualization, etc. The book *R for Data Science* is available online for free and is an excellent introduction to the tidyverse (http://r4ds.had.co.nz/index.html).

Although it is not required, I also encourage students to learn and use RMarkdown to complete homework assignments. You can learn about RMarkdown here: http://rmarkdown.rstudio.com/lesson-1.html. RMarkdown is also covered in *R for Data Science*.

Readings

Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). New York: Guilford.

In addition, you will be assigned a number of required articles and chapters. See the section labeled "Schedule and Readings" for a list.

Grading and course requirements

60% Attendance and participation, assignments, and quizzes
40% Final project (due Wednesday, December 11)

Attendance and participation is what it sounds like. Everybody gets 1 free absence. If you will need to miss more than that, come talk to me.

Assignments will include homework and in-class assignments.

Quizzes will be in class most weeks. They will typically cover major points or concepts from the readings assigned for that day, so make sure you are up to date!

Final project. For the final project, you will have a choice of submitting either a *proposal* or a *data analysis writeup.* For a proposal, you will propose an application of SEM in a dataset that you might collect and analyze in the future. In a data analysis writeup, you will actually analyze some data and write up what you did and found out. More details will be given in class.

Accessibility and disabilities

My goal is to create an accessible and inclusive learning environment. Please talk to me if there are aspects of this course that create barriers to your participation. If you anticipate needing accommodations in this course, please make arrangements to meet with me as soon as possible. For accommodations involving graded work, I ask that you provide documentation from the Accessible Education Center (http://aec.uoregon.edu/).

Changes

Topics, readings, course requirements, or other aspects of this course may be changed at the instructor's discretion at any time. Changes will be announced in class or on the course website.

SCHEDULE AND READINGS

Always complete readings before the class meeting where we cover a topic.

The plan is to cover 1 topic per week; however, our actual progress may be faster or slower depending on the pace of our class meetings, and I might change things around depending how the class goes. In other words, this schedule is subject to change!

Topic 1
Regression review

Kline, chapters 1-4

Optional:

Judd, C. M. (2000). Everyday data analysis in social psychology: Comparisons of linear models. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in personality and social psychology* (pp. 370-392). New York: Cambridge.

Rodgers, J. L. (2010). The epistemology of mathematical and statistical modeling: A quiet methodological revolution. *American Psychologist, 65,* 1-12.

Topic 2
Specification and identification of path models

Kline, chapters 6-7

lavaan tutorial: http://lavaan.ugent.be/tutorial/index.html

Topic 3
Causal inference

West, S. G., & Thoemmes, F. (2010). Campbell's and Rubin's perspectives on causal inference. *Psychological Methods, 15,* 18-37.

Bullock, J. G., Green, D. P., & Ha, S. E. (2010). Yes, but what's the mechanism? (Don't expect an easy answer). *Journal of Personality and Social Psychology*, *98*, 550-558.

Optional:

Kline, chapter 8

Topic 4
Specification and identification of latent variable models

Kline, chapters 9 and 10

Topic 5
Estimation and fit

Kline, chapters 11-12

Enders, C. K. (2013). Dealing with missing data in developmental research. *Child Development Perspectives, 7,* 27-31.

Optional:

MacCallum, R. C., Wegener, D. T., Uchino, B. N., & Fabrigar, L. R. (1993). The problem of equivalent models in applications of covariance structure analysis. *Psychological Bulletin, 114,* 185-199.

MacCallum, R. C., Roznowski, M., & Necowtiz, L. B. (1992). Model modifications in covariance structure analysis: The problem of capitalization of chance. *Psychological Bulletin, 111,* 490-504.

Topic 6
Analyzing measurement models

Kline, chapter 13

John, O. P., & Soto, C. J. (2007). The importance of being valid: Reliability and the process of construct validation. In R. W. Robins, R. C. Fraley, & R. F. Krueger (Eds.), *Handbook of Research Methods in Personality Psychology* (pp. 461-494). New York: Guilford.

Topic 7
Analyzing structural regression models

Kline, chapter 14

Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to parcel: Exploring the questions, weighing the merits. *Structural Equation Modeling, 9,* 151-173.

Topic 8
Measurement invariance

Kline, chapter 16

Gregorich, S. E. (2006). Do self-report instruments allow meaningful comparisons across diverse population groups? Testing measurement invariance using the confirmatory factor analysis framework. *Medical Care, 44,* S78-S94. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1808350/

Topic 9
Growth models

Kline, chapter 15

Collins, L. M. (2006). Analysis of longitudinal data: The integration of theoretical model, temporal design, and statistical model. *Annual Review of Psychology, 57,* 505-528.