PSY 610: STRUCTURAL EQUATION MODELING
Fall 2015, Mondays 9:00 to 11:50 AM, 008 Straub

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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 begin with two preliminaries: (1) an accelerated review of multiple regression with an emphasis on model building and comparison, and (2) 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 may 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 as well as in Mplus. Both R/lavaan and Mplus 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 week 3 of class**. Specifically, you should know how to:
- Read datasets from files (including comma-delimited and SPSS datasets) using read.table, read.csv, read.spss (in the foreign package), etc.
- Do basic data management like creating new variables, transforming variables, etc.
- Run some basic plots (scatter, histogram) and statistics, including regression

The Quick-R website (http://www.statmethods.net/) is geared toward people transitioning from SPSS and may be a useful resource.

R and lavaan are free, and they will be sufficient for this class (meaning that you do not need to purchase Mplus for your personal computer). However, Mplus offers some advanced features (beyond what we will cover in this class) and it is used in a number of labs around the department and UO. Students who wish to have Mplus installed on their own computers can purchase it at a discounted rate (see www.statmodel.com). The free demo version available on their website is too restricted to be useful for this course.

Readings

Kline, R. B. (2010). *Principles and practice of structural equation modeling* (3rd 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/participation, in-class quizzes and exercises, and homework
40%   Final project (due Friday, December 11)

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. Before you start writing, you should read:

McDonald, R. P., & Moon-Ho, R. H. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods, 7,* 64-82.

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 <u>before</u> 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.

Topic 1
Introduction; review of regression

No assigned readings

Topic 2
Regression continued; causal inference

Kline, ch. 1-4

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.

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

Recommended:

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

Topic 3
Mediation and path analysis

Kline, ch. 5-6

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

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, *40*, 879-891.

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.

Topic 4
Measurement models, Part 1

Kline, ch. 7-8

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.

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

Topic 5
Measurement models, Part 2

Kline, ch. 9

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.

Edwards, J. R., & Bagozzi, R. P. (2000). On the nature and direction of relationships between constructs and measures. *Psychological Methods, 5,* 155-174.

Topic 6
Structural regression models

Kline, ch. 10

Topic 7
Not so fast! Challenges to inference and interpretation

Kline, ch. 13

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 8
Longitudinal models

Kline, ch. 11

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.

Topic 9
Measurement invariance

Kline, ch. 11

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 10
TBD