

Psy 523/623 Structural Equation Modeling Syllabus Spring 2020

Instructor

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Meeting Times and Location

Remote meeting via Zoom (invite only) during regular scheduled class times: Tu-Th, 10:00 – 11:50 AM

Text

Kline, R.B. (2016). *Principles and Practice of Structural Equation Modeling, Fourth Edition*. New York: Guilford. ISBN: 146252334X. Online access through the PSU library: https://search.library.pdx.edu/primo-explore/fulldisplay?docid=CP71250299430001451&context=L&vid=PSU&lang=en_US&search_scope=all&adaptor=Local%20Search%20Engine&tab=default_tab&query=creator,contains.kline,AND&query=title,contains,Principles%20and%20Practice%20of%20Structural%20Equation%20Modeling,AND&mode=advanced&offset=0

Optional Text

Bollen, K.A. (1989). *Structural equations with latent variables*. New York: Wiley. Available at the bookstore or used copies may be obtainable online. ISBN: 0471011711. Online access through the PSU library: http://na01.alma.exlibrisgroup.com/view/action/uresolver.do?operation=resolveService&package_service_id=50603398400001451&institutionId=1451&customerId=1450

Also Recommended

Beaujean, A. A. (2014). *Latent Variable Modeling Using R: A Step-by-Step Guide*. New York: Routledge. ISBN: 1848726996.

Geiser, C. (2012). *Data analysis with Mplus*. New York, NY: Guilford. ISBN: 1462502458.

Prerequisites

I assume that students have taken at least one graduate statistics course that covers statistical hypothesis testing at the graduate level and simple and multiple regression analysis, such as (Psy 521/621 and) Psy 522/622.

Overview

This course is intended to introduce students to structural equation modeling. Structural equation modeling (sometimes referred to as covariance structural analysis) is a regression-based technique that incorporates elements of path analysis and confirmatory factor analysis. The general goal is to provide a thorough background in the conceptual aspects, statistical underpinnings, and application of this method rather than a tutorial on a specific software package. At the end of the course, I expect students to have a solid, conceptual foundation of structural modeling issues, be able to analyze data using any SEM package, be able to critically evaluate professional articles, and be able to write up results from structural modeling analyses.

Readings and Commentaries (10%)

There will be several readings assigned each week taken from the text and supplemental sources. The readings will often include an example article that applies SEM. Please read the material prior to class and be prepared for discussion. Students will be required to turn in a **one-page commentary** on all of the readings for that week on each Tues by 9 am via email (in the body of the email please—no attachments). The commentaries should be an informal set of questions, comments, or summary information (summarize only if you cannot think of anything else to say) about the articles. The purpose of the commentaries is to make sure the class is prepared for discussion and to help me identify discussion topics and sources of confusion in the readings. I will assign 2 (complete and well-considered), 1 (did not read some/lacking effort/too long), or 0 (did not read most/minimal effort/late/nothing) points to each, with one freebie for the quarter.

Homeworks (90%)

There will be three homework assignments which will primarily consist of data analysis and write-ups of SEM problems using the demo version of the statistical program, Mplus (Muthen & Muthen, 1998-2017), and the

lavaan package in R. Mplus and lavaan have very simple syntax, allowing us to focus more on statistical and applied issues rather than debugging programs or other software headaches. I will also provide some examples using Amos in class and discuss other software briefly. Some data preparation and descriptive analysis using SPSS or R may be required (let me know if this will be an inconvenience for some reason). The demo version of Mplus Version 8.4 can be downloaded from the following internet site:

<http://www.statmodel.com/demo.shtml>. The demo version has no limitations on analysis types but allows no more than six dependent variables and two independent variables. R software is available at <http://www.r-project.org/>. Although you should not need it, the Mplus users guide can also be downloaded from the Mplus website (<http://www.statmodel.com>). The lavaan package is installed by running `install.packages("lavaan", dependencies=TRUE)` the command line. More information is available at <http://lavaan.ugent.be/>.

Homework due dates are: 4/30/20, 5/21/20, 6/9/20 (10 AM Tues finals week). Please send as pdf via email. Late assignments are not accepted without penalty (10% per day) unless there are extenuating circumstances, such as illness or family emergency. Please let me know if there are extenuating circumstances as early as possible.

Grades

Grades are based on an average of the three homework assignments (90%) and weekly commentaries (10%). Total percentages will be assigned the following grades: $\geq 90 = A$, $85-89.9 = B+$, $80-84.9 = B$, $75-79.9 = C+$, $70-74.9 = C$.

Other Resources

There are several internet sites devoted to SEM that may be of use. Dave Kenny has a great website with introductory material on most SEM topics at <http://davidakenny.net/cm/causalm.htm> (including a free pdf copy of his book, *Correlation and Causation*). There is a SEM discussion list called SEMNET which you can subscribe to (I think it would be a great idea if everyone would subscribe during this term) through the following site: <https://listserv.ua.edu/cgi-bin/wa?SUBED1=semnet&A=1>. The Mplus website has lots of example programs, white papers, and an Mplus discussion section <http://www.statmodel.com/>. Finally, I have compiled a list of hundreds of articles and books on SEM organized by topic at my website <http://web.pdx.edu/~newsomj/>.

Sexual Harrassment, Sexual Violence, and Discrimination

As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. Please be aware that as a faculty member, I have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment, sexual violence or discrimination to a confidential employee who does not have this reporting responsibility, you can find a list of those individuals or contact a confidential advocate at 503-725-5672. For more information about Title IX please complete the required student module Creating a Safe Campus in your D2L.

Disabilities

I am happy to make any necessary arrangements with students who have a disability and are in need of academic accommodations. If you have not done so already, please contact the Disability Resource Center, 116 Smith Memorial Student Union, <http://www.pdx.edu/drc/>, Email: drc@pdx.edu, for assistance and any testing arrangements. I would appreciate it if you would check with me as soon as possible to discuss any needed accommodations and to make sure that I have received a faculty notification letter. If any aspects of instruction or course design result in barriers to your inclusion or learning, please let me know.

Course Readings
Psy 523/623 Structural Equation Modeling
Spring 2020

Primary Text: Kline, R.B. (2016). *Principles and Practice of Structural Equation Modeling, Fourth Edition*. New York: Guilford. **Homework due dates** are underlined (due by 10 AM).

Commentaries are due at 9 AM on Tuesday of each week (second date listed in each topic section below)

4/2,4/7 Overview and History of SEM and Matrix Algebra

Kline, Chapter 1, "Coming of Age"

Tabachnick, B. G., & Fidell, L. S. (2013)., Appendix A, "A Skimpy Introduction to Matrix Algebra" in *Using multivariate statistics*, sixth edition. Pearson (*Optional*: Section A.7)

Pedhazur, E.J. (1997). Chapter 6, "General method of multiple regression analysis: Matrix operations." In *Multiple regression in behavioral research: Explanation and prediction (3rd Edition)*. Fort Worth: Harcourt Brace.

Kenny, D.A. (1979). Chapter 2, "Covariance Algebra" in *Correlation and causation*. New York: Wiley.

Optional (regression review): Kline, Chapter 2, "Regression Fundamentals"; Pedhazur, E.J. (1997). Chapter 2, "Simple linear regression and correlation" & Chapter 5, "Elements of multiple regression analysis: Two independent variables" in *Multiple regression in behavioral research: Explanation and prediction (3rd Edition)*. Fort Worth, TX: Harcourt Brace.

4/9,4/14 Path Analysis

Loehlin, J. (2004), Chapter 1 "Path Analysis" (pp. 1-16, 23-28 only), *Latent Variable Models*, Fourth Edition.

Kline, Chapter 7 "Identification of Observed-Variable (Path) Models (pp. 145-150 only).

Kline, Chapter 6 "Specification of Observed-Variable (Path) Models" (129-138 only), Appendix 6.A

Example article: Bryce, C. I., Goble, P., Swanson, J., Fabes, R. A., Hanish, L. D., & Martin, C. L. (2017). Kindergarten School Engagement: Linking Early Temperament and Academic Achievement at the Transition to School. *Early Education and Development*, 1-17. DOI: 10.1080/10409289.2017.1404275

Optional: Fritz, M. S., Taylor, A. B., & MacKinnon, D. P. (2012). Explanation of two anomalous results in statistical mediation analysis. *Multivariate Behavioral Research*, 47, 61-87.

4/16,4/21 Confirmatory Factor Analysis I: Theory, Model Fitting Concepts, and Software

Loehlin, J. (2004), Chapter 1 "Path Analysis" (pp. 16-22 only), *Latent Variable Models*, Fourth Edition.

Kline, Chapter 9, "Specification and Identification of Confirmatory Factor Analysis Models," Appendix 9.A

Bollen, K. A. (2002). Latent variables in psychology and the social sciences. *Annual review of psychology*, 53(1), 605-634. (*Optional sections:* "Latent Variables in Limited Dependent-Variable Models," "Latent Curve Models," "Item Response Theory," and "Latent Class Analysis")

Preacher, K.J., & MacCallum, R.C. (2003). Repairing Tom Swift's electric factor analysis machine. *Understanding Statistics*, 2, 13-43

Optional: Chapter 9 Exploratory Factor Analysis. Pituch, K. A., & Stevens, J. P. (2016). *Applied multivariate statistics for the social sciences: Analyses with SAS and IBM's SPSS*. New York: Routledge.

4/23,4/28 Confirmatory Factor Analysis II: Model Comparisons and Fit indices

Hayduk, L. A. (1987). Ch. 5 (pp. 127-139 only). "Estimating Structural Coefficients with Maximum Likelihood Estimation" in *Structural equation modeling with LISREL: Essentials and advances*. Jhu Press.

Kline Chapter 11, Estimation and Local Fit Testing (pp. 231-239 only)

West, S.G., Taylor, A.B., & Wu, W. (2012). "Model Fit and Model Selection in Structural Equation Modeling." In Hoyle, R. H. (Ed.), *Handbook of structural equation modeling*. New York: Guilford press.

Example article: Mancini, J.A., & Marek, L.I. (2004). Sustaining community-based programs for families: Conceptualization and measurement. *Family Relations*, 53, 339-347.

Optional: Ferron, J. M., & Hess, M. R. (2007). Estimation in SEM: A concrete example. *Journal of Educational and Behavioral Statistics*, 32, 110-120.

Optional: Hu, L.-T., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-55.

4/30,5/5 Full Structural Models I: Practical Issues, Model Modifications, & Missing Data

Kline, Appendix 10.A

Weston, R., & Gore Jr, P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist*, 34(5), 719-751.

Enders, C.K. (2013). Analyzing structural equation models with missing data. In G.R. Hancock & R.O. Mueller (Eds.), *Structural equation modeling: A second course, 2nd edition* (pp.493-520). Charlotte, NC: Information Age Publishing.

Example article: Easterbrooks, M. A., Fauth, R. C., & Lamoreau, R. (2017). Effects of a home visiting program on parenting: Mediating role of intimate partner violence. *Journal of Interpersonal Violence*. DOI: 10.1177/0886260517736879

Optional article: Newman, D. A. (2014). Missing data: Five practical guidelines. *Organizational Research Methods*, 17, 372-411.

5/7,5/12 Full Structural Models II: Nonnormality, Categorical Variables, & Alternative Estimators

Finney, S.J., & DiStefano, C. (2013). Nonnormal and categorical data in structural equation modeling. In G.R. Hancock & R.O. Mueller (Eds.), *Structural equation modeling: A second course, 2nd edition* (pp. 439-492) Charlotte, NC: Information Age Publishing.

Example article: de Beer, L., Rothmann Jr, S., & Pienaar, J. (2012). A confirmatory investigation of a job demands-resources model using a categorical estimator. *Psychological Reports*, 111, 528-544.

Optional: Kaplan, D., & Depaoli, S. (2012). "Bayesian Structural Equation Modeling." In Hoyle, R. H. (Ed.), *Handbook of structural equation modeling*. New York: Guilford press.

5/14,5/19 Multigroup Structural Models and Second-Order Factor Models

Kline, Chapter 16, "Multiple-Samples Analysis and Measurement Invariance"

Bontempo, D. E., & Hofer, S. M. (2007). Assessing factorial invariance in cross-sectional and longitudinal studies. In A.D. Ong & M. van Dulmen (Eds.), *Handbook of methods in positive psychology* (pp. 153-175). Oxford University Press.

Example article: Yap, S. C. Y., Donnellan, M.B., Schwartz, S.J., et al. (2014) Investigating the structure and measurement invariance of the Multigroup Ethnic Identity Measure in a multiethnic sample of college students. *Journal of Counseling Psychology*, 61, 437-446.

5/21,5/26 Issues of Causality and Longitudinal Modeling

Kenny, D.A. (1979). Chapter 1, "Correlational Inference", in *Correlation and causation*. New York: Wiley.

Newsom, J.T. (2015). Chapter 4, "Fundamental concepts of stability and change". *Longitudinal Structural Equation Modeling: A Comprehensive Introduction*. New York: Routledge.

Newsom, J.T. (2015). Chapter 5, "Cross-lagged panel models". *Longitudinal Structural Equation Modeling: A Comprehensive Introduction*. New York: Routledge.

Example article: Burkholder, G.J., & Harlow, L.L. (2003). An Illustration of a Longitudinal Cross-Lagged Design for Larger Structural Equation Models. *Structural Equation Modeling*, 10, 465-486.

Optional: Bollen, K.A., & Pearl, J. (2013). Eight myths about causality and structural equation models. In S.L. Morgan (Ed.), *Handbook of Causal Analysis for Social Research* (pp. 301-328), New York: Springer

Optional: Kline, Chapter 8, "Graph Theory and the Structural Causal Model"

5/28,6/2 Latent Means and Growth Curve Models

Kline, Chapter 15, "Mean Structures and Latent Growth Models"

Newsom, J.T. (2015). Chapter 7, "Linear latent growth curve models". *Longitudinal Structural Equation Modeling: A Comprehensive Introduction*. New York: Routledge.

Example article: Hussong, A. M., Curran, P. J., Moffitt, T. E., Caspi, A., & Carrig, M. M. (2004). Substance abuse hinders desistance in young adults' antisocial behavior. *Development and psychopathology*, 16, 1029-1046.

Optional: Thompson, M.S., & Green, S.B. (2013). Evaluating between-group differences in latent variable means. In G.R. Hancock & R.O. Mueller (Eds.), *Structural equation modeling: A second course, 2nd edition* (pp. 163-218). Charlotte, NC: Information Age Publishing.

6/4, 6/9* Wrapping Up, Reporting, Cautions

Kline, Chapter 18, "Best Practices in Structural Equation Modeling"

Mueller, R. O., & Hancock, G. R. (2008). Best practices in structural equation modeling. In J.W. Osborne (Ed.), *Best practices in quantitative methods* (pp. 488-508). Thousand Oaks, CA: Sage.

McCoach, D.B., Black, A.C., & O'Connell, A.A. (2007). Errors of inference in structural equation modeling. *Psychology in the Schools*, 44, 461-470.

*Tuesday, finals week