Psychology 9555A. Structural Equation Modeling (Winter 2021)

COURSE OUTLINE

Instructor: Paul F. Tremblay
Email: ptrembla@uwo.ca
Course OWL website: here
Format: Zoom meetings Fridays (10:00 – 11:30 am) beginning January 15
Asynchronous weekly prerecorded lectures (slides and videos posted weekly on OWL website)
Individual or group appointments: Please contact me to set online appointment to discuss course material or projects.

I. COURSE DESCRIPTION

My aim in this course is to help you develop a solid conceptual and theoretical understanding and ability to use SEM and its extensions correctly and effectively in your own independent research. Although no prior experience with SEM is required, experience in multiple linear regression, factor analysis, and psychometric principles of reliability and construct validity would be ideal. The course topics include the foundational concepts of the measurement and structural models, confirmatory factor analysis (CFA), traditional path analysis, and basic principles of model building including specification, identification, estimation, hypothesis testing, and modification. Topics also include applications and extensions of SEM such as multi-item scale construction and validation, mediation and moderation, multi-group analyses, item response theory, measurement invariance and bias, latent growth modeling and mixture modeling. Students will have the opportunity to work on projects tailored to their research interests and needs. Students are free to use software of their choice (e.g., Mplus, R lavaan, (JASP), AMOS, EQS, LISREL. Prerequisite: must have taken Psychology 9540 (Research Design) or obtained the permission of the instructor.

II. COURSE READINGS

I use a combination of textbooks and articles for the lectures. The textbooks are all available online at Western Library.

Brown, T. A. (2015). *Confirmatory Factor Analysis for Applied Research. Second Edition*. New York: Guilford Press.

Kline, R. B. (2016). *Principles and Practice of Structural Equation Modeling*. *Fourth Edition*. New York: Guilford Press.

See also supplementary journal articles in the Lecture Schedule.

III. METHOD OF EVALUATION

40%: Four lab assignments. Four assignments will be distributed throughout the course to help you gain hands-on experience with SEM analysis. These assignments will consist of running analyses, interpreting results, and writing short (one to two page) reports.

60%: Two-part individual project:

Part 1. An initial multi-item measurement analysis project (30%) due March 5. This will involve a combination of exploratory and confirmatory methods. You will need to have your topic and a data set located by no later than Feb 5. You will need to provide a brief report, written as a research article but with greater emphasis on the Results and Discussion sections with syntax and output in an Appendix.

Part 2. A complete SEM analysis (30%) due April 16 (one week after final class). This part can be a continuation of Part 1 or a different project with a different data set. For the complete SEM model, you should have both a measurement model and a structural model. The model should also include one of the following: (1) a mediation analysis (2) a moderation (interaction) analysis, (3) a multi-group analysis, (4) a longitudinal analysis, or (5) another SEM application approved by the instructor. Alternatively, the Part 2 project could consist of an extension of your measurement project (e.g., measurement invariance across groups or time, bifactor model evaluation). You will need to provide a brief report (either on its own or as a continuation of Part 1) written as a research article but with greater emphasis on the Results and Discussion sections with syntax and output in an Appendix.

Late work. Recognizing that we are working during a pandemic, please inform me ahead of time if you anticipate not being able to meet a deadline for a legitimate reason. Otherwise, there is a 5% deduction per day for a late assignment (including the project).

IV. STATEMENT OF ACADEMIC OFFENCES

Scholastic offences are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

V. LECTURE SCHEDULE

Jan 15. Introduction and overview

Brown (Ch 1). Introduction

Tarka, P. (2018). An overview of structural equation modeling: its beginnings, historical development, usefulness and controversies in the social sciences. *Quality & Quantity. International Journal of Methodology*, *52*, 313-354.

Weston, R. & Gore Jr, P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist*, *34*, 719-751. doi: 10.1177/0011000006286345

Jan 22. Factor Analysis

Brown (Ch 2). The common factor model and exploratory factor analysis model.

DiStefano, C., Zhu, M., & Mindrila, D. (2009). Understanding and using factor scores: Considerations for the applied researcher. *Practical Assessment Research & Evaluation*, *14* (20).

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, *4*, 272-299. doi: 10.1037//1082-989X.4.3.272

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

Watkins, M. W. (2018). Exploratory factor analysis: A guide to best practice. *Journal of Black Psychology*, *44*, 219-246. doi: 10.1177/0095798418771807

Jan 29. Introduction to CFA – part I

Brown (Ch 3). Introduction to CFA

Kline, R. B. (2013). Exploratory and confirmatory factor analysis. In Y. Petscher & C. Schatschneider (Eds.), *Applied quantitative analysis in the social sciences* (pp. 171-207). New York: Routledge.

Bollen, K. A., & Bauldry, S. (2011). Three Cs in measurement models: Causal indicators, composite indicators, and covariates. *Psychological Methods*, *16*, 265-284. DOI: 10.1037/a0024448

Marcus, K. A., & Borsboom, D. (2013). Reflective measurement models, behavior domains, and common causes. *New Ideas in Psychology*, *31*, 54-64.

Tay, L., Jebb, A. T. (2018). Establishing construct continua in construct validation: The process of continuum specification. *Advances in Methods and Practices in Psychological Science*, *1(3),* 375–388. doi.org/10.1177/2515245918775707

Feb 5. Introduction to CFA – part II

Brown (Ch 4). Specification and interpretation of CFA models

Kline (Ch 9). Specification and identification of confirmatory factor analysis models
Kline (Ch 11). Estimation and local fit testing
Kline (Ch 12). Global fit testing
Kline (Ch 13). Analysis of CFA models

Feb 12. CFA: Measurement and test construction

Brown (Ch 5). Model revision and comparison
Brown (Ch 6). CFA of multitrait-multimethod matrices (skim)

Asparouhov, T., & Muthen, B. (2009). Exploratory structural equation modeling. *Structural Equation Modeling*, *16*, 397-438. doi: 10.1080/10705510903008204

Marsh, H. W., Morin, A. J. S., Parker, P. D., & Kaur, G. (2014). Exploratory structural equation modeling: An integration of the best features of exploratory and confirmatory factor analysis. *Annual Review of Clinical Psychology*. Downloaded from www.annualreviews.org. doi: 10.1146/annurev-clinpsy-032813-153700

Feb 26. CFA: Extensions I: Invariance, Means

Brown (Ch 7). CFA with equality constraints, multiple groups, and mean structures

Kline (Ch 15). Mean structures and latent growth models
Kline (Ch 16). Multiple-samples analysis and measurement invariance

Wu, A. D., & Zumbo, B. D. (2007). Decoding the meaning of factorial invariance and updating the practice of multi-group confirmatory factor analysis: A demonstration with TIMSS data. *Practical Assessment, Research & Evaluation*, 12(3). Available online: http://pareonline.net/getvn.asp?v=12&n=3

Mar 5. CFA Extensions II: Higher-order models, bi-factor models, and categorical Data

Brown (Ch 8). Other types of CFA models
Brown (Ch 9). Data issues in CFA: Missing, non-normal, and categorical data

Flora, D. B., & Curran, P. J. (2004). An empirical evaluation of alternative methods of estimation for confirmatory factor analysis with ordinal data. *Psychological Methods*, *9*, 466-491. doi: 10.1037/1082-989X.9.4.466

Morin, A. J. S., Arens, A. K., & Marsh, H. W. (2016). A bifactor exploratory structural equation modeling framework for the identification of distinct sources of construct-relevant psychometric multidimensionality. *Structural Equation Modeling*, *23*, 116-139. doi: 10.1080/10705511.2014.961800

Rodriguez, A., Reise, S. P., & Haviland, M. G. (2016). Evaluating bifactor models: Calculating and interpreting statistical indices. *Psychological Methods*, *21*, 137-150. http://dx.doi.org/10.1037/met0000045

Mar 12. SEM Full Models: Mediation

Kline (Ch. 2). Regression fundamentals (if you want a review)
Kline (Ch. 3). Significance testing and bootstrapping
Kline (Ch. 6). Specification of observed variable (path) models
Kline (Ch. 14). Analysis of structural regression models

Hayes, A. F., & Rockwood, N. J., (2016). Regression based statistical mediation and moderation analysis in clinical research: Observations, recommendations and implementation. *Behaviour Research and Therapy*, 1-19. http://dx.doi.org/10.1016/j.brat.2016.11.001

Mar 19. SEM Models including interactions (moderation)

Klein, A. G., & Muthén, B. O. (2007). Quasi-maximum likelihood estimation of structural equation models with multiple interaction and quadratic effects. *Multivariate Behavioral Research*, *42(4)*, 647–673. doi:10.1080/00273170701710205

Kline (Ch 17). Interaction effects and multilevel structural equation modeling. (Focus on interaction)

Mar 26. Longitudinal models: Latent growth curve and multilevel models

Curran, P. J., & Hussong, A. M. (2003). The use of latent trajectory models in psychopathology research. *Journal of Abnormal Psychology*, *112*, 526-544. doi: 10.1037/0021-843X.112.4.526

Curran, P. J., Obeidat, K., & Losardo, D. (2010). Twelve frequently asked questions about growth curve modeling. *Journal of Cognition and Development*, *11*, 121-136.

Hertzog, C., & Nesselroade, J. R. (2003). Assessing psychological change in adulthood: An overview of methodological issues. *Psychology and Aging*, 18, 639-657.

Apr 2. Monte Carlo simulation of power (no Zoom meeting)

Brown (Ch 10). Statistical power and sample size (focus on Monte Carlo section)

Mplus manual (Ch 12). Monte Carlo Simulation Studies

Muthén, L. K., & Muthén, B. O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling*, *9*, 599-620.

Apr 9. Latent Class/Profile Analysis and Growth Mixture Modeling

Lee, C.-T., Leoutsakos, J.-M., Lyketsos, C. G., Steffens, D. C., Breitner, J. C. S., & Norton, M. C. (2012). Latent class-derived subgroups of depressive symptoms in a community sample of older adults: the Cache County Study. *International Journal of Geriatric Psychiatry*, *27*, 1061-1069. doi: 10.1002/gps.2824

MacLeod, M. A., Tremblay, P. F., Graham, K., Bernards, S., Rehm, J., & Wells, S. (2016). Psychometric properties and a latent class analysis of the 12-item World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) in a pooled dataset of community samples. *International Journal of Methods in Psychiatric Research*, *25*, 243-254. doi: 10.1002/mpr.1523

Jackson, K. M., Sher, K. J. (2006). Comparison of longitudinal phenotypes based on number and timing of assessments: A systematic comparison of trajectory approaches II. *Psychology of Addictive Behaviors*, *20*, 373-384.