PSYC 948, Spring 2013
Latent Trait Measurement and Structural Equation Models
Syllabus

Professor
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Course Information
Wednesdays: 12:30 pm – 3:20 pm
Room 79 Burnett Hall

Prerequisite
PSYC 943 (PSYC 930 in Fall 2012)

Office Hours
Wednesdays: 10:00am-12:00pm or
by appointment

Course Website
http://psych.unl.edu/psycrs/948

Course Facebook Page
https://www.facebook.com/Psyc948Spring2013

PSYC 948, Latent Trait Measurement and Structural Equation Models, is a course about the fundamentals of latent variable modeling, path analysis, and structural equation modeling, combining theoretical and practical perspectives. The course is designed to provide details of structural equation modeling, from the statistical underpinnings to how to run many various types of structural equation analyses.

Course Objectives

Overall, this course is a course that teaches multivariate statistical thinking, structural equation modeling, and the language of both methods. By the end of the course, students are expected to:

- Understand the types of hypotheses and research questions for which structural equation modeling is used
- Know and perform structural equation modeling techniques using Mplus
- Understand how structural equation models fit into a larger framework of statistical methods

Be advised: this course will challenge you, and will require a significant commitment, both in amount of time and in amount of work. **Expect to spend 9 - 12 hours outside of class each week on this course.** Reading the assigned papers and chapters in advance of lecture, completing the homework each week, and attending class are keys to your success.

Required Textbook

None- Readings will be assigned and administered via Dropbox each week.

Prerequisite

This course assumes you have taken multivariate statistics coursework. Within the Department of Psychology at the University of Nebraska-Lincoln, this means having taken and completed PSYC 943. The first homework (assigned the first day of class and due next Wednesday) is designed to test your knowledge of the prerequisites.

Statistical Computing

This course will use Mplus for all statistical analyses. Mplus, a powerful generalized modeling package, is available to you in two ways:

1. You can purchase your own copy of Mplus through the Muthen & Muthen website: https://www.statmodel.com/orderonline/categories.php?category=Mplus-Software/Student-Pricing/Click-here-to-order-download-only (easy but expensive)

2. You can sign up to use Mplus through the Holland Computing Center using secure shell terminal connections (technical and frustrating, but free – see the first lecture)

Because of new software licensing policies, Mplus will likely be unavailable through the Burnett computer labs. Please be advised as each homework assignment will require the use of Mplus.

Academic Honesty

As a reminder, the University has a policy on academic honesty (see the Graduate Studies Bulletin for further details). All course assignments should be done individually.

Accommodating Persons with Disabilities

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of UNL to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Course Website/Technology

This course will not use Blackboard. Instead, we will use freely available commercial software for communication and dissemination of course materials.

Audio/Video Recordings of Class

I will be making a flash recording of each class, which will be posted on the website by the end of the day following class.

Class Page on Facebook
In order to facilitate communication, I have created a Facebook page where I will:

1. Post information about the course
2. Hold online office hours (as needed)
3. Answer your questions directly using the wall feature

The Facebook page is designed to facilitate discussion in a manner that is easily accessible by all students and auditors of the course. To be a part of the discussion, please search for PSYC 948 or use the link: https://www.facebook.com/Psyc948Spring2013. To follow us on Facebook, you must "like" the page.

Course Materials Over Dropbox
All course readings will be available over a shared folder on Dropbox, a file repository online (www.dropbox.com). **To gain access to the shared folder, please send me an email.** You do not have to install the Dropbox application as you can download files from any web browser.

If you do not have a Dropbox account, please email me for an invitation.

Course Website
Course lecture slides, lecture examples, flash video files, assignments, and information are available on the website. The website for the course is http://psych.unl.edu/psycrs/948.

Course Structure and Student Evaluation

Student evaluation will be made on the basis of homework grades. **All homework and answers must be your own and not be copied or paraphrased from anyone else's answers.** You are responsible for your own work.

Homework
Homework assignments will be administered in order to give students practice applying techniques discussed in class and will be due at the start of class the following week. Each assignment must be at least 75% complete in order to be accepted for grading. **Homework must be submitted electronically (email jtemplin@uga.edu) in the form of Microsoft Word document with the name: 948_FirstLast_HW#.docx.** Late homework will have a penalty of 10% of the total per calendar day (any homework later than 10 days late will not be accepted). Resubmission of late homework is allowed, but the maximum grade cannot exceed the maximum amount allowed by the late penalty.

Do not wait until the last minute to do your homework.

Note: Each homework assignment will have a section where you can perform similar analyses on data that is your own. If you do not have your own data set, please contact me to obtain one to use throughout the semester.

Course Grading System

Percentage of Points	Grade
100-97	A+
96-93	A
92-90	A-
89-87	B+
86-83	B
82-80	B-
79-77	C+
76-73	C
72-70	C-
69-60	D
Below 60	F

Course Style and Content

Lecture Format

Most lectures will have notes (slides) available digitally, with slides available online by the morning of the day of the lecture. Please check the course website before coming to class if you would like to bring a printout of the slides with you. If nothing is posted, then we will be having lecture without slides. I strongly encourage you to participate in lecture by asking questions whenever anything is unclear.

Reading Assignments

To be fully successful in this course, I **strongly** encourage you to read the assigned papers and/or chapter(s) prior to the coming to class when we will cover the topic. Even if you have difficulty reading the material, exposure to the information prior to lecture will aid in your understanding of the course. Remember, this course is about learning the language of structural equation modeling and multivariate statistics – something that takes immersion in the readings.

How to Succeed in this Course

- Read the assigned papers (even if it doesn't make sense to you – it will eventually)
- Come to class (and bring your questions about what you just read that week)
- Ask questions when you do not understand
- Come to office hours
- Do the homework (consider it practice on applying statistics)
- Compare your homework with the solutions online before receiving your feedback

Tentative Course Schedule (subject to change as necessary)

Month	Day	Week	Topic(s)
January	9	1	Course Introduction; Review of Matrix Algebra/Multivariate Normal Distribution; Introduction to Mplus
January	16	2	Maximum Likelihood and Robust Maximum Likelihood
January	23	3	Path Analysis
January	30	4	Confirmatory Factor Analysis (CFA): Concepts/Identification/Model Fit
February	6	5	Scale Building with CFA
February	13	6	Contrasting CFA with Sum Scores
February	20	7	Multifactor CFA
February	27	8	"Factor analysis" and Related Methods for Binary Outcomes
March	6	9	"Factor analysis" and Related Methods for Categorical Outcomes
March	13	10	"Factor analysis" and Related Methods for Count and Other Types of Outcomes
March	**20**	**NO CLASS: SPRING BREAK**	
March	27	11	Structural Equation Modeling: Path Analysis with Latent Variables (Part 1)
April	3	12	Structural Equation Modeling: Path Analysis with Latent Variables (Part 2)
April	10	13	Multiple Group Analyses and Factorial Invariance
April	17	14	Exploratory Factor Analysis, Principal Components Analysis, and Exploratory Analyses with CFA
April	24	15	Diagnostic Classification Modeling

Course Reading List

Month	Day	Week	Readings
January	9	1	Mplus introduction website: http://www.ats.ucla.edu/stat/mplus/seminars/IntroMplus/default.htm Kline, Chapter 1: Introduction. Johnson & Wichern, Chapter 2: Matrix algebra and random vectors. Johnson & Wichern, Chapter 4: The multivariate normal distribution.
January	16	2	Enders, Chapter 3: An introduction to maximum likelihood estimation. Enders, Chapter 5: Improving the accuracy of maximum likelihood analyses.
January	23	3	Kline, Chapter 5: Introduction to path analysis. Kline, Chapter 6: Details of path analysis. Pajares & Miller (1994).
January	30	4	Brown, Chapter 3: Introduction to confirmatory factor analysis. Brown, Chapter 4: Specification and interpretation of confirmatory factor models. Hu, L., & Bentler, P. M. (1999).
February	6	5	Brown, Chapter 5: Confirmatory factor analysis model revision and comparison.
February	13	6	Raykov & Marcoulides, Chapter 6: Reliability. Raykov & Marcoulides, Chapter 7: Procedures for estimating reliability.
February	20	7	Kaplan, Chapter 3: Factor analysis. Brown, Chapter 8: Other types of confirmatory factor analysis models: higher-order factor analysis, scale reliability evaluation, and formative indicators.
February	27	8	Embretson & Reise, Chapter 4: Binary item response theory models. Embretson & Reise, Chapter 6: The trait level measurement scale: meaning, interpretations, and measurement-scale properties.

March	6	9	Embretson & Reise, Chapter 5: Polytomous item response theory models. Embretson & Reise, Chapter 8: Calibrating items: Estimation.
March	13	10	Embretson & Reise, Chapter 9: Assessing the fit of item response theory models. Atkins, D. C., & Gallop, R. J. (2007). Bauer, D. J., & Hussong, A. M. (2009).
March	**20**		**NO CLASS: SPRING BREAK**
March	27	11	Raykov & Marcoulides, Chapter 5: Structural regression models. Kline, Chapter 8: Models with structural and measurement components. McDonald, R. P., & Ho, M.-H. R. (2002).
April	3	12	DeShon, R. P. (1998). Boomsma, A. (2000). Raykov & Marcoulides, Chapter 1: Introduction (p. 22-37).
April	10	13	Kline, Chapter 11: Multi-Sample SEM. Brown, Chapter 7: Confirmatory factor analysis with equality constraints, multiple groups, and mean structures. Kaplan, Chapter 4: Structural equation modeling in single and multiple groups.
April	17	14	Johnson & Wichern, Chapter 8: Principal components. Johnson & Wichern, Chapter 9: Factor analysis and inference for structured covariance matrices.
April	24	15	Rupp, Templin, & Henson, Chapter 3: Diagnostic decision making with diagnostic classification models Rupp, Templin, & Henson, Chapter 7: The LCDM Framework

Books:

Brown, T. A. (2006*). Confirmatory factor analysis for applied research*. New York: Guilford.

Embretson, S. E. & Reise, S. P. (2000). *Item Response Theory for Psychologists.* Mahwah, NJ: Erlbaum.

Enders, C. K. (2010). *Applied Missing Data Analysis*. New York: Guilford

Johnson, R. A. & Wichern, D. W. (2002). *Applied Multivariate Statistical Analysis* (5th Ed.). Upper Saddle River, N.J., Prentice-Hall.

Kaplan, D. (2009). *Structural equation modeling: foundations and extensions* (2nd Ed.). Thousand Oaks, CA: Sage.

Kline (2005). *Principles and practice of structural equation modeling (2nd Ed.).* New York: Guilford.

Raykov, R. & Marcoulides, G. A. (2011). *Introduction to psychometric theory.* New York: Routledge.

Rupp, A. A, Templin, J., Henson, R. A. (2010). *Diagnostic measurement: Theory, Methods, and Applications*. New York: Guilford.

Articles:

Atkins, D. C., & Gallop, R. J. (2007). Rethinking how family researchers model infrequent outcomes: A tutorial on count regression and zero-inflated models. *Journal of Family Psychology, 21*(4), 726-735.

Bauer, D. J., & Hussong, A. M. (2009). Psychometric approaches for developing commensurate measures across independent studies: Traditional and new models. *Psychological Methods, 14*(2), 101-125.

Boomsma, A. (2000). Reporting analyses of covariance structures. *Structural Equation Modeling, 7*(3), 461-483.

DeShon, R. P. (1998). A cautionary note on measurement error corrections in structural equation models. *Psychological Methods*, *3*, 412-423.

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

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

Parajes, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analyisis. *Journal of Educational Psychology, 86,* 193-203.