Introduction to Applied SEM short course
June 21, 28, 9am – 5pm
Conference room in Suite 6700, 4444 Forest Park Ave.

Instructor:
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Prerequisites: graduate level courses covering linear regression and research design, or permission from the instructor

Course Description:

This course will provide a brief introduction to structural equation modeling (SEM), a statistical technique for analyzing latent constructs and the inter-relations among them. The focus of the course will be to familiarize students with the language, logic, and uses of SEM. The course will provide students with a strong foundation for understanding, designing, and testing sound measurement models, which can then be combined into more complex structural equation models. The majority of the course will cover conceptual aspects and classical SEM applications like confirmatory factor analysis, path analysis, and causal modeling (including tests for mediators and moderators). Students will learn how SEM is similar and different from other common statistical procedures, and the strengths and limitations of SEM. Time permitting, the course will provide a brief discussion of more complex SEM analyses such as growth curve modeling and latent class analysis. Students will gain hands-on experience analyzing sample models using a trial version of AMOS and/or Mplus software. In-class examples will focus on the basic conceptual and procedural issues involved with analyzing a variety of models and interpreting and presenting results.

Recommended textbook:

Kline, R. B. Principles and Practice of Structural Equation Modeling. New York: Guilford Press, 2005.

References for relevant articles will be provided in class with recommendations for students' specific interest areas.

Software:

Trial versions of SEM software including AMOS and Mplus are available for free download from the internet. Students are encouraged to bring laptops to class with the program already installed. Sample datasets will be provided in class.

For Amos, you will be asked to register a name and email address etc. with SPSS before being able to download AMOS. The AMOS demo is only available for 10 days so don't load it too soon. Let us know if you do NOT have SPSS; you will have to use an excel data file with AMOS instead.
>   Download Amos 21 Trial software **Must have Windows
>   http://www-03.ibm.com/software/products/us/en/spss-amos

For Mplus 7.1, the demo does not appear to have an expiration date, but it can only analyze simple models (up to 2 IVs and 6 DVs).
>   Download Mplus 6.0 http://www.statmodel.com/demo.shtml

Lecture Content (Approximately 15 hours; not evenly distributed across topics):

Topic 1. Overview. Regression vs. SEM (path analysis and causal models)
>   Regression models will be compared to SEM approaches to help students learn that SEM is within their realm of understanding and experience, but improves upon traditional regression techniques to accommodate latent variables and inter-relations between factors. Traditional SEM illustrations and nomenclature will be covered. Strengths and weaknesses will be reviewed.

Topic 2. Confirmatory factor analysis (CFA)
>   Observed vs. latent measures will be reviewed. Exploratory vs. confirmatory factor analysis will be reviewed. More model nomenclature will be discussed. Examples for testing and building CFAs will be presented, along with selecting fit indices, and issues regarding model modification. A brief discussion of specification and estimation procedures, parcels, treatment of missing data, and power/sample size requirements will be included.

Topic 3. Measurement bias and testing for measurement invariance
>   Discuss the concept and rationale for testing measurement invariance (equivalence) across subgroups. In-class examples will demonstrate the different steps for assessing invariance and allowing for partial invariance.

Topic 4. Basic SEM
>   Introduce the addition of structural paths to measurement models, possible correlated factors and errors, and effects on convergence, fit, and interpretations. Discuss temporal pathways.

Topic 5. Longitudinal SEM
>   Discuss direct, indirect (i.e., mediated), and moderated pathways. Review bootstrap options.

Topic 6. Advanced SEM
>   Additional options available through Mplus software. SEM with dichotomous outcomes. Clustered/nested models. Latent growth models. Categorical latent variable modeling. Latent class analysis. Multilevel latent models.

Assignments:
Only students taking the course for a grade will be expected to complete assignments.

1. *Article review (50% of grade)*
Students will select an empirical article from the list below to review. Students will type up a brief report summarizing the study by answering the questions included in the attached article review report form. Reports can be as short as 1 page if the required content is complete.

Eligible articles for review:

Fuentes, M., Hart-Johnson, T., & Green, C.R. The association among neighborhood socioeconomic status, race, and chronic pain in Black and White older adults. *Journal of the National Medical Association, 99(10):* 1160-1169, 2007.

Kershaw, T.S., Mood, D.W., Newth, G. et al., Longitudinal analysis of a model to predict quality of life in prostate cancer patients and their spouses. *Annals of Behavioral Medicine, 36:* 117-128, 2008.

Rhodes, R. E., and Courneya, K. S. Investigating multiple components of attitude, subjective norm, and perceived control: An examination of the theory of planned behaviour in the exercise domain. *British Journal of Social Psychology, 42:* 129-146, 2003.

Schwarzer, R. & Luszczynska, A. How to overcome health-compromising behaviors: The Health Action Process Approach. *European Psychologist, 13(2):* 141-151, 2008.

Singh-Manoux, A., Richards, M., & Marmot, M. Socioeconomic position across the lifecourse: How does it relate to cognitive function in mid-life? *Annals of Epidemiology, 15:* 572-278, 2005.

2. *Proposal (50% of grade)*
Students will propose an analysis plan using SEM (path model, confirmatory factor analysis, or causal model) for real or hypothetical data. Students will type up a brief proposal (suitable for a manuscript or grant proposal) covering the points in the attached proposal report form. Proposals should be no more than 2 pages single spaced or 5 pages double spaced.

Typed reports are due by <mark>July 12, 2013</mark> by 5pm; email the Instructor and be sure to get confirmation of receipt. Late reports will be reduced 10 points per day until 5pm July 16, 2013 after which no more reports will be accepted.

Use 1 inch margins, Times New Roman or Arial font size 12, and Microsoft word or pdf documents for printed reports

Grades: Points will be summed and divided by the total. 93-100% = A; 90-92% = A-; 88-89% B+; 83-87% B; 80-82% = B-; 78-79 = C+; 73-77% = C; 70-72% = C-; 60-69% = D; ≤59% = F

ARTICLE REVIEW REPORT FORM

	Question	Points
1.	What is the research question(s) being tested with SEM?	10
2.	Describe the data: What is the <u>sample size</u> used in analysis? *Does this seem adequate? Why/not?* What is the amount of <u>missing data</u> and how do the authors deal with missing data in their analysis? What <u>measures</u> are included, how many items per measure, did the authors parcel items or use all indicators, and what are the response distributions for each measure?	30
3.	*Decide whether SEM was appropriate. What other statistical techniques could have been used instead and how might that have changed the treatment of data and findings?*	10
4.	What criteria did the authors use to assess model fit and what procedures did they go through to determine their final model? *Do you agree or disagree with the authors' assessment of fit and acceptance of the final model? Why/not?*	20
5.	*Critique the presentation of results (text, tables, figures). Was all the information reported clearly for readers to be able to understand the analyses conducted, the steps taken, and the results? Why/not?*	10
6.	*Critique the use of SEM and the <u>conclusions</u> that were drawn from the results. For example, did the authors use causal language in the discussion for an analysis that cannot prove causality? Alternatively, did the authors compare the relative effects of correlated predictors of an outcome variable that could not have been determined from linear regression analyses?*	10
7.	*Provide a summary statement about what you liked and did not like about this article (relevant to the analysis and presentation of SEM findings)? What did you (re)learn about SEM from this article?*	10
Total		100

All questions in italics must be in your own words but you can use information provided in the course or in the article to support your argument/opinion. All other questions can be answered by quoting (with page numbers for reference) from the article.

PROPOSAL REPORT FORM

	Content	Points
1.	What is(are) your research question(s) being tested with SEM?	5
2.	Provide justification for why SEM is the best analytic technique to answer this research question.	10
3.	Include a figure of the hypothesized model(s) to be tested.	10
4.	Provide theoretical and/or empirical rationale for your model. Include rationale for all structural paths or explain the exploratory purpose.	10
5.	Clearly describe your data. What is your proposed sample size? Include justification for this size. Describe your measures in detail including how many items per measure, response scales, expected distributions, and expected amount of missing data per measure. Justify your plans to use EFA and/or CFA for each latent measure included in your model	25
6.	How will you deal with missing data – both if you have only a little vs a lot	10
7.	What criteria will you use to assess model fit? Include references.	15
8.	What steps will you use to determine your final model? What modifications, if any, will you allow? Why or why not?	15
Total		100

Be advised that grant proposals should include a description of the software package being used, and reviewers may benefit from a general description of the benefits of SEM specific to your study.