

EDP 382K
STRUCTURAL EQUATION MODELING
Summer, 2013

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The easiest way to contact me is via electronic mail.

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Office hours: TBD

The class will meet 1:00-3:30 PM Monday, Wednesday, and Friday, in room 284 Sanchez Building.

Overview:

This course will build on your knowledge of multivariate statistical analysis by introducing you to one of the newer and most general multivariate techniques: structural equation modeling. This technique includes an entire family of methods known by many names, among them analysis of covariance structures, latent variable analysis, confirmatory factor analysis, path analysis, causal modeling, and latent growth curve modeling. An understanding of structural equation modeling will be developed by relating it to your previous knowledge of multiple regression, and expanding to allow for correlated and causally related latent constructs.

This course assumes no prior experience with this technique, and is intended as both a theoretical and practical introduction. My primary interest is that you develop a *conceptual*, rather than numerical, understanding of the method. To do so, you will need considerable practice conducting SEM analyses and interpreting the results of those analyses. Thus, I strongly urge you to work through the examples provided in the text and at the end of each chapter. I will provide several data sets for you to use in working through problems and assignments, and for your general exploration and enjoyment.

Prerequisites for this class are Experimental Design and Statistical Inference, Correlation and Regression, and Survey of Multivariate Methods.

I will use the Amos software package for estimating structural equation models. (Mplus scripts will be available for some problems, although I will not be teaching using Mplus.) You are free to use any full-featured SEM program. You will also need access to a general statistical analysis program, such as SPSS or SAS. I will use Amos and SPSS for Windows to do class examples. There are several options available for you to get access to Amos and SPSS:

1. You may “rent” Amos 20 (12 month license) for \$30-50 at the Campus Computer Store if you already have a license for the SPSS for Windows “GradPack” (\$99). These are also available on-line: <http://www.onthehub.com/spss/> (although it looks like the price there may be a little more). It’s a great deal: a regular version of Amos (with education discount) is \$599. Note that you should buy **SPSS for Windows** even if you use a Mac, because the Amos is a windows-only program. **This is the option I recommend.**
2. If you do not want to purchase Amos you can access the Mplus program and many other statistics programs (but not SPSS) for a nominal fee (\$5/year) through a “windows services account.” See <http://ssc.utexas.edu/software/stat-apps-server>. Only a limited number of people can use these “terminal services” at the same time. Mplus is a very powerful SEM program, but is not as easy to use as Amos.
3. You can download a free “student version” of Amos 5.0 from www.amosdevelopment.com. The Amos student version is similar to the current full commercial version of Amos except that the student version is limited to eight observed variables and 54 parameters. This version can be used for approximately the first half of class. The Amos web site also includes useful tutorials. This link is listed on our Blackboard website in the “External Links” section. The version of Amos I will be using in class (20.0) has a number of improvements and differences compared to version 5.0. You can download the Amos 20 User’s Guide at this website also. If you use this option and subsequently purchase the full version of Amos, you should uninstall the student version before installing the full version.

Textbooks and Other Readings and Materials:

Textbooks:

Arbuckle, J. L. (2011). *IBM SPSS Amos 20 user’s guide*. Crawfordville, FL: Amos Development. (available as a pdf file at www.amosdevelopment.com).

Keith, T. Z. (2006). *Multiple regression and beyond*. Boston: Allyn & Bacon.

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York: Guilford. (Recommended)

SPSS, Inc. The SPSS “Grad Pack” for Windows + Amos (recommended; available at the Campus Computer Store)

Make sure you visit the websites for our two traditional textbooks! Supplemental chapters for the Keith text will also be posted on Blackboard.

Other Readings:

Hancock, G. R. (1997). Structural equation modeling methods of hypothesis testing of latent variable means. *Measurement and Evaluation in Counseling and Development*, 30, 91-105.

Lawrence, F. R., & Hancock, G. R. (1998). Assessing the change over time using latent growth modeling. *Measurement and Evaluation in Counseling and Development*, 30, 211-224.

Steiger, J. H. (2001). Driving fast in reverse: The relationship between software development, theory, and education in structural equation modeling. *Journal of the American Statistical Association*, 96, 331-338

Numerous other readings are posted on the Blackboard site and organized topically.

Other Materials:

I will post Amos output on Blackboard. You should print these out and bring them to class. Mplus input and output will also be available.

The data sets you will need to work the examples in the Keith book are available on the Allyn & Bacon website (www.ablongman.com/keith1e) and on Blackboard. The data are saved in a variety of formats (SPSS, Excel, plain text). I may also post additional data on Blackboard.

Requirements:

Exams:

There will be three take-home exams for this class. Many of these exam questions will require you to conduct analyses on the computer. You are on your honor to do the exam completely independently; *anyone found doing otherwise will be subject to the maximum university penalties.*

Exams will be due at beginning (1:00 pm) of the next class. Late work will be accepted for full earned credit IF AND ONLY IF arrangements are made with me PRIOR TO THE DUE DATE. Otherwise, 10% of the points possible will be deducted for each weekday the exam is late.

The tentative schedule has me giving you the exams on a Friday, due on the following Monday. It may not be possible to stick to that schedule, however, depending on what we accomplish in class.

Assignments:

Assignments and exercises will also be given on a regular basis. Many of the assignments will not be graded, but are important for your understanding of the material presented in class and in the text. I encourage you to work together on ungraded assignments. All work on graded assignments, however, must be your own.

Reading assignments are listed in the tentative schedule. I also encourage you to bring in articles you encounter that use SEM (or should have used SEM) so that we can discuss those articles in class.

You will fall behind if you do not keep up with the readings and assignments; it is difficult to catch up in this class if you fall behind!

Course Grades:

Your exams and projects will be averaged according to the percentages (weights) shown below.

Assessment	Weight
Exam 1	30%
Exam 2	30%
Exam 3	30%
Graded Homework	10%

Final grades will be assigned based on the scale below:

Overall course percent	Grade
93.0% - 100%	A
90.0% - 92.9%	A-
87.0% - 89.9%	B+
83.0% - 86.9%	B
80.0% - 82.9%	B-
77.0% - 79.9%	C+
70.0% - 76.9%	C
Below 70%	F

Unless I have made a computational error, grades will not be changed after the end of the semester.

Extra Credit:

You can earn 1 extra credit point (on your total final grade) by bringing a copy of an article in your field of study that used SEM in the analysis. Ideally, articles should include a correlation matrix and standard deviations of the measured variables in the model.

Incompletes:

Unless you can demonstrate that near-catastrophic events have led to a case of extreme hardship, grades of “incomplete” will not be given.

Attendance:

Attendance will not be part of your grade. Students who attend class, of course, tend to be better prepared for exams and assignments. *Please be on time for class!*

Evaluation of the Course:

At the end of the semester, a formal evaluative questionnaire regarding both the curriculum and my instruction will be administered. The information gathered from this process will be used to improve future courses and instruction. Additionally, I strongly encourage you to provide feedback to me during the semester either in person or anonymously – I am here to teach you and want to do a good job!

Disability Services:

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TTY.

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Tentative Schedule

Class	Date	Topic to be Covered	Assignments (to be completed prior to class)
1	June 7 F	Introduction & overview Plans for the course Review of multiple regression	
2	June 10 M	Introduction to path analysis Causality Path analysis via MR	Keith, chaps 9 & 10; Kline, 1, 5
3	June 12 W	Dangers of path analysis Introduction to Amos	Keith, 11,12; Amos, pp 13-34
4	June 14 F	Path analysis via SEM programs Equivalent models Exam 1	Keith, 12; Amos, example 4;
5	June 17 M	Exam 1 due Measurement error Intro to CFA	Keith, 13, 14; Amos, ex 8
6	June 19 W	More CFA Competing models, hierarchical models	Keith, 14; Kline, 9
7	June 21 F	Introduction to latent variable models	Keith, 15; Amos, ex 5
8	June 24 M	More on latent variable models	Keith, 16; Kline, 10
9	June 26 W	More latent variable models Multi-sample models Estimating means & intercepts	Amos, ex 10, 11, 12; Keith (BB), latent means Kline, 11
10	June 28 F	Mean structures Exam 2	Amos, ex 9, 13-16; Kline, 11
11	July 1 M	Exam 2 due More on mean structures	
12	July 3 W	CFA revisited Invariance	Keith (BB), CFA-2
13	July 5 F	Latent growth models	Keith (BB), LGM Kline, 11
14	July 8, M	Loose ends, cautions, neglected issues Exam 3	Keith, 17; Kline, 12, 13
	July 10 W	No Class: work on exam	
15	July 12 F	Exam 3 due	