EDMS 722: Structural Equation Modeling

SPRING SEMESTER 2009

******* I will not be taking on any new dissertation committees at this time.*******

Professor
Dr. Gregory R. Hancock
1230D Benjamin Building
tel: 301.405.3621 fax: 301.314.9245 e-mail: *ghancock@umd.edu*

Office hours
Tu 3:00-4:00pm, first come first serve
or at other times by appointment

Required Course Material

- Kline, R. B. (2004). *Principles and practice of structural equation modeling* (2nd ed.). New York: The Guilford Press.
- Hancock, G. R., & Mueller, R. O. (Eds.). (2006). *Structural equation modeling: A second course*. Greenwich, CT: Information Age Publishing, Inc.

***Optional* Course Material**

- Bollen, K. A. (1989). *Structural equations with latent variables*. New York: John Wiley & Sons.

Weekly lecture materials

Prior to coming to class each week students are to print out lecture materials for that week from the instructor's website:
http://education.umd.edu/EDMS/fac/Hancock/greg.html
Materials should be posted by the morning of the day of class.

Bring a laptop

During some lessons we will try to run some hand-on exercises using the LISREL software. If you have a laptop, bring it to class! Or pair up with a classmate and bring one laptop between you.

Course Overview

This course will build upon students' knowledge of multiple regression and factor analysis by introducing them to one of the newer and more sophisticated multivariate techniques — structural equation modeling. This technique goes by many names, among them *covariance structure analysis*, *latent variable analysis*, and *causal modeling*, and subsumes many other multivariate methods (e.g., path analysis and confirmatory factor analysis). An understanding of structural equation modeling will be developed by relating it to students' previous knowledge of multiple linear regression and exploratory/confirmatory factor analysis.

This course has as its prerequisites EDMS651 (multiple regression) and EDMS657 (factor analysis). It assumes no prior experience with structural equation modeling, and is intended as both a theoretical and practical treatment. The course will use the popular software package LISREL for examining structural models, which the student learned in EDMS657. A free student version of this package, limited to 15 variables but otherwise fully functional, may be downloaded at:

Student: http://www.ssicentral.com/lisrel/student.html

Students interested in acquiring a full version (not required for this course) may either do so by renting LISREL or purchasing it:

Rental: http://www.ssicentral.com/rental/index.html
Purchase: http://www.ssicentral.com/ordering/index.html

In general, the course will proceed through the following topics; some will take much longer than others.

- measured variable path analysis (standardized and unstandardized)
- confirmatory factor analysis
- latent variable path analysis
- multi-group covariance structure models
- latent means models
- models for longitudinal data (e.g., panel models; latent growth modeling)
- cautions in modeling
- special topics **if time** (e.g., nonnormality, nonlinearity, missing data, power analysis, multilevel models)

Formal Course Assessment

Homework:

There will be several assignments, each designed to give students a chance to apply and practice the concepts learned in class. Most of these will involve using LISREL to solve modeling problems. *Feel free to consult each other when doing homework, although students must submit their own assignment with their own explanations.*

Typed work is strongly preferred. In your homework you should cut and paste relevant portions of your computer output into the appropriate places in your homework to show where you got your answers. Students should not write, "See p.136 of the attached computer printout to see where I got my answer." should be very neat, and free from spelling, grammar and punctuation errors. Also, you should always keep a photocopy or electronic copy of your work for your own protection.

Assignments are due as specified in class, and should be submitted on time for full earned credit. I do *not* prefer electronic submissions. Late work will be accepted for full earned credit if and only if arrangements are made with the instructor prior to time due. Otherwise, 5% of the points possible will be deducted for each weekday the assignment is late.

Project:

Based on your own data, that of a faculty member in your area, that from a journal article in your area, or that from an available database (e.g., on the web), students will develop a poster with a brief write-up for an analysis involving structural equation modeling, to be presented in a class poster session during part of the last day of regular class (5/12). Details of this poster/paper will be given as the semester progresses. Meanwhile, students should start hunting for some data ripe for structural equation modeling. Once students have an idea, however vague, they should come see me as soon as possible. Don't wait until the last minute! Also, it is strongly preferred that students work in pairs on the project, although doing so is not mandatory.

Quizzes:

After every two class lectures (tentatively, 17 Feb, 3 Mar, 7 April, 28 April, 12 May) a short quiz will be administered. Each quiz will cover material from the lessons since the last quiz or exam (unless otherwise specified) and should not take more than 10 or 15 minutes. You may use one 8.5"x11" two-sided page of notes (however, students seem to be much better prepared if they don't need to rely on it too heavily). *Students should bring a calculator to the quizzes.* All quizzes will count (i.e., none will be dropped).

Exams:

There will be a midterm exam (3/10) and a ("quasi-cumulative") final exam (5/19). For each exam, students may use three 8.5"x11" two-sided pages of notes; tables and scratch paper will be provided at the time of the exam as needed. *Students should bring a calculator to the exams.*

Course grades

This course is not graded on a curve. Homework, quizzes, and exams will be combined according to the percentages shown on the left. A worksheet for computing grades is provided. Final grades will be assigned using the scale to the right (without rounding):

assessment	***weight***	***overall course percent***	***grade***
Total quiz points converted to a percentage	10%	98.0000 % — 100 %	A+
Total homework points converted to a percentage	20%	92.0000 % — 97.9999 %	A
Total project points converted to a percentage	15%	90.0000 % — 91.9999 %	A-
Total midterm exam points converted to a percentage	25%	88.0000 % — 89.9999 %	B+
Total final exam points converted to a percentage	30%	82.0000 % — 87.9999 %	B
		80.0000 % — 81.9999 %	B-
Unless a computational error has been made, grades will not		78.0000 % — 79.9999 %	C+
be changed after the end of the semester. Please do not come		72.0000 % — 77.9999 %	C
to my office with "extenuating circumstances" for why your		70.0000 % — 71.9999%	C-
grade should be changed, or requesting extra credit oppor-		65.0000 % — 69.9999 %	D+
tunities. If you find these grading criteria to be unsatisfactory,		60.0000 % — 64.9999 %	D
you should seek out another SEM class on campus.		55.0000 % — 59.9999 %	D-
		≤54.9999 %	F

Grades of "Incomplete":

Grades of "Incomplete" will not be given for EDMS 722 except in cases of extreme emergency.

Policy on auditors

Student and faculty auditors are welcome in this class. They are requested *not* to submit work, however. Part of what allows me to have such a large class is that auditors honor this request. Thank you.

Academic Accommodations

In compliance with and in the spirit of the Americans with Disabilities Act (ADA), I want to work with you if you have a documented disability that is relevant to your work in this course. If you need academic accommodation by virtue of a documented disability, please contact me as soon as possible to discuss your needs. Students with documented needs for an accommodation must meet the same achievement standards required of all other students, although the exact way in which achievement is demonstrated may be altered. All requests for academic accommodations should be made as early as possible in the semester. Further information concerning disability accommodations can be obtained at http://www.counseling.umd.edu/DSS/.

Academic Integrity
The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.studenthonorcouncil.umd.edu/code.html for details.

Make-Up Examinations
University policy states: "An instructor is not under obligation to offer a substitute assignment or to give a student a make-up assessment unless the failure to perform was due to an excused absence, that is, due to illness (of the student or a dependent), religious observance (where the nature of the observance prevents the student from being present during the class period), participation in university activities at the request of university authorities, or compelling circumstances beyond the student's control. Students claiming excused absence must apply in writing and furnish documentary support for their assertion that absence resulted from one of these causes."

No class
Class will not be held on 3/17 due to spring break, or on 4/14 due to the conference of the American Educational Research Association.

Course Evaluations
As a member of our academic community, you as a student have a number of important responsibilities. One of these responsibilities is to submit your course evaluations each term though *CourseEvalUM* in order to help faculty and administrators improve teaching and learning at the University of Maryland. Please make a note now of the dates for *Spring 2009 (Tuesday, April 28 through Wednesday, May 13)* and the link at which you can access the submission system (www.courseevalum.umd.edu). More information is at: https://www.irpa.umd.edu/Assessment/CourseEval/stdt_faq.shtml.

Readings
Here are the readings students are expected to be doing, whether or not the material is explicitly addressed in class. Because I don't know how long topics will take to cover, I can't give a detailed calendar. The best I can do is provide the following coordinated reading grid; a more complete description of the readings follows. Students should keep up with readings from all four sources.

Topic	Kline	Hancock & Mueller
Background and overview	Ch. 1, 2, 3, 4	Ch. 1
Multiple regression *Measured Variable Path Analysis*	Ch. 5, 6	
Confirmatory Factor Analysis	Ch. 7	Ch. 3
Higher order models	Ch. 7	
Latent Variable Path Analysis	Ch. 8	
Multi-group SEM	Ch. 11	
Latent means models	Ch. 10	Ch. 5
Growth curve models	Ch. 10	Ch. 6
SEM cautions	Ch. 12	Ch. 2 (lightly)

Special topics as time allows

EDMS 722 Course Grade Worksheet

	Quiz 1	Quiz 2	Quiz 3	Quiz 4	Quiz 5	Total
your score:	_____	_____	_____	_____	_____	☐
points possible:	6	6	6	6	6	☐

% of quiz points possible ☐

	Assmt 1	Assmt 2	Assmt 3	Assmt 4	Assmt 5	Assmt 6	Total
your score:	_____	_____	_____	_____	_____	_____	☐
points possible:	_____	_____	_____	_____	_____	_____	☐

% of assignment points possible ☐

Project		Midterm		Final Exam	
your score:	_____	your score:	_____	your score:	_____
points possible:	_____	points possible:	_____	points possible:	_____
% of project points possible ☐		% of midterm points possible ☐		% of final exam points possible ☐	

Assessment	weight	decimal	your % score	decimal × % score
Quizzes	10%	.10	_____	_____
Assignments	20%	.20	_____	_____
Project	15%	.15	_____	_____
Midterm Exam	25%	.25	_____	_____
Final Exam	30%	.30	_____	_____

TOTAL WEIGHTED COURSE PERCENTAGE: ☐

Total weighted course %	*grade*
98.0000 % — 100 %	A+
92.0000 % — 97.9999 %	A
90.0000 % — 91.9999 %	A-
88.0000 % — 89.9999 %	B+
82.0000 % — 87.9999 %	B
80.0000 % — 81.9999 %	B-
78.0000 % — 79.9999 %	C+
72.0000 % — 77.9999 %	C
70.0000 % — 71.9999 %	C-
65.0000 % — 69.9999%	D+
60.0000 % — 64.9999%	D
55.0000 % — 59.9999%	D-
≤54.9999%	F