SOCIOLOGY 613
STRUCTURAL EQUATION AND LATENT VARIABLE MODELS
(*Previous Course Title: Advanced Theory Construction and Causal Modeling*)

Spring 2010
Monday & Wednesday 5:10pm – 6:30pm
211 East Hall

INSTRUCTOR AND OFFICE HOURS

Dr. David Peters, Assistant Professor of Sociology

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Office hours are on Mondays and Wednesday from 3:00pm to 5:00pm, or by appointment. Questions can be e-mailed at any time.

COURSE DESCRIPTION AND LEARNING OBJECTIVES

The purpose of this 3-credit hour graduate-level course is to introduce students to general linear structural equation and latent variable models. The course will give students a firm theoretical understanding and direct experience estimating these models. Topics covered include path analysis, confirmatory factor analysis, and structural equation models with latent variables. Mathematical models will be presented and analyzed. Instruction will be complemented by appropriate statistical software packages, mainly AMOS, MPLUS, and SAS.

The specific learning objectives of this course are:
- To understand and apply structural equation and latent variable models to research problems in the social sciences.
- To understand the assumptions, proper uses, and limitations of structural equation and latent variable models.
- To learn how to incorporate measurement errors, use estimation procedures, determine model identification, and assess model fit.
- To have a working knowledge of statistical packages to perform structural equation and latent variable models.

Prerequisites for this course are a grade of C or better in the following courses: (a) *Stat 404 Regression for Social and Behavioral Sciences*; (b) *Soc 511 Intermediate Research Methods*; and (c) *Soc 512 Advanced Linear and Factor Models*. Equivalent courses are acceptable provided they sufficiently cover the following topics: research design, types of data, sampling, validity and reliability, hypothesis testing, analysis of variance, correlation, matrix algebra, least squares linear regression, logistic regression, exploratory factor analysis, and general linear models. In addition, intermediate knowledge of SAS and SPSS is also required.

PERFORMANCE MEASURES AND GRADING

Student performance will be evaluated using article reviews and statistical papers. All reviews and papers shall be submitted no later than 5:00pm CST on the day that they are due. Late submissions will be assessed a 25 percent penalty for each calendar day they are past due, with zero points being awarded past four calendar days past due.

There will be one **basics of structural equation models homework** worth 10 points. Students will be required to specify SEM models using LISREL notation, specify assumptions, perform covariance algebra, and analyze regression models using covariance structure programs (i.e. AMOS, MPLUS, or SAS).

There will be three **article reviews** each worth 5 points each for a total of 15 points for the course. Students will find a peer-reviewed journal article that uses one of the multivariate techniques covered in class. Students are to write a review of the methods and results, focusing on the appropriateness of the technique, testing of assumptions, correct interpretation, and presentation of output. The purpose is to enable students to critically evaluate social science research in the peer-review process. Each article review is expected to be about 3 pages in length.

There will be five **statistical analysis papers** each worth 15 points each for a total of 75 points for the course. Students will be provided a dataset which they will analyze and interpret using the multivariate techniques presented in class. Statistical papers will be in narrative form and will be evaluated along data screening, checking assumptions, appropriate analysis and interpretation of results, supporting tables and charts, and documentation of results through statistical syntax and output. The purpose of the statistical papers is to enable students to conduct and communicate the results of multivariate analyses. Each statistical paper is expected to be about 15 pages in length, and should be written as the methods and results section of an academic paper.

Course grades are based on 100 total possible points to be earned in this course. Letter grades are assigned along the following scale: A=100.0-89.5, B=89.4-79.5, C=79.4-69.5, D=69.4-59.5, F=59.4-0.0. Plus and minus grades will not be given in this course. Students electing to take this course as a Pass / No Pass are expected to earn an average course score of B or better to receive a Pass grade for the course. Incompletes will be given only for extreme circumstances; and reasonable documentation may be required.

It is your responsibility to attend and participate in class. You will be held responsible for all information assigned through readings as well as that information presented solely in class.

REQUIRED TEXTS

Bollen, K.A. 1989. *Structural Equations with Latent Variables*. New York, NY USA: John Wiley and Sons, Inc.

Byrne, B.M. 2001. *Structural Equation Modeling with AMOS*. Mahwah, NJ, USA: Lawrence Erlbaum Associates Publishers.

SUPPPLEMENTAL TEXTS

Bollen, K.A. and J.S. Long. 1993. *Testing Structural Equation Models*. Newbury Park, CA USA: Sage Publications, Inc.

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

Tabachnick, B.G. and L.S. Fidell. 2007. *Using Multivariate Statistics (Fifth Ed)*. Boston, MA, USA: Pearson – Allyn and Bacon.

COURSE SCHEDULE

Introduction to SEM

<u>Lectures</u>
January 11, 2010	Overview and Equations (Bollen Chp.1; Byrne Chp.1)
January 13, 2010	Covariances and Path Diagrams (Bollen Chp.2, Appendix A)
January 18, 2010	*No Class – MLK Day*
January 20, 2010	Syntax and Examples – 106 MacKay Hall
January 25, 2010	Syntax and Examples – 106 MacKay Hall

<u>Assignments</u>
February 1, 2010	HOMEWORK DUE – SEM Basics (10 points)

Structural Models or Path Analysis

<u>Lectures</u>
January 27, 2010	Causality (Bollen Chp.3)
February 1, 2010	Covariances and Equations (Bollen Chp.4, Appendix B)
February 3, 2010	Identification
February 8, 2010	Estimation
February 10, 2010	Interpretation
February 15, 2010	Miscellaneous Topics
February 17, 2010	Syntax and Examples – 106 MacKay Hall (Byrne Chp.2)
February 22, 2010	Syntax and Examples – 106 MacKay Hall

<u>Assignments</u>
February 24, 2010	REVIEW DUE – Path Analysis (5 points)
March 1, 2010	ANALYSIS DUE – Path Analysis (15 points)

Measurement Models or Confirmatory Factor Analysis

<u>Lectures</u>
February 24, 2010   Measurement Error (Bollen Chp.5)
March 1, 2010   Validity and Reliability (Bollen Chp.6)
March 3, 2010   Overview and Equations (Bollen Chp.7)
March 8, 2010   Covariances and Identification
March 10, 2010   Interpretation
March 15, 2010   *No Class – Spring Break*
March 17, 2010   *No Class – Spring Break*
March 22, 2010   Extensions
March 24, 2010   Extensions
March 29, 2010   Syntax and Examples – 106 MacKay Hall (Byrne Chp.3,4,5)
March 31, 2010   Syntax and Examples – 106 MacKay Hall

<u>Assignments</u>
March 29, 2010   REVIEW DUE – Confirmatory Factor Analysis (5 points)
April 7, 2010   ANALYSIS DUE – Confirmatory Factor Analysis (15 points)
April 12, 2010   ANALYSIS DUE – Higher-Order Factor Analysis (15 points)

Structural Models with Latent Variables

<u>Lectures</u>
April 5, 2010   Equations, Covariances, and Identification (Bollen Chp.8)
April 7, 2010   Interpretation
April 12, 2010   Extensions (Bollen Chp.9)
April 14, 2010   Missing Data
April 19, 2010   Syntax and Examples – 106 MacKay Hall (Byrne Chp.6)
April 22, 2010   Multilevel SEM
April 26, 2010   Multilevel SEM
April 28, 2010   Syntax and Examples – 106 MacKay Hall

<u>Assignments</u>
April 21, 2010   REVIEW DUE – Structural Model with Latent Variables (5 points)
April 26, 2010   ANALYSIS DUE – Structural Model with Latent Variables (15 points)
May 5, 2010   ANALYSIS DUE – Multilevel Structural Models (15 points)

<u>ACADEMIC MISCONDUCT</u>

Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. To further serve this end, the University supports a Student Code of Conduct which addresses the issue of academic dishonesty (see the Undergraduate or Graduate Studies Bulletin for complete text.) All acts of dishonesty in any work constitute academic misconduct. Student disciplinary regulations will be followed in the event of academic misconduct. Depending on the act, a student could receive an F grade on the test/assignment, F grade for the course, and could

be suspended or expelled from the University. Academic misconduct includes all acts of dishonesty in any academically-related matter and any knowing attempt to help another student commit an act of academic dishonesty. Academic dishonesty includes, but is not limited to each of the following acts when performed in any type of academic or academically-related matter, exercise, or activity:

Obtaining unauthorized information. Information is obtained dishonestly, for example, by copying graded homework assignments from another student, by working with another student on a take-home test or homework when not specifically permitted to do so by the instructor, or by looking at your notes or other written work during an examination when not specifically permitted to do so.

Tendering of information. Students may not give or sell their work to another person who plans to submit it as his or her own. This includes giving their work to another student to be copied, giving someone answers to exam questions during the exam, taking an exam and discussing its contents with students who will be taking the same exam, or giving or selling a term paper to another student.

Misrepresentation. Students misrepresent their work by handing in the work of someone else. The following are examples: purchasing a paper from a term paper service; reproducing another person's paper (even with modifications) and submitting it as their own; having another student do their computer program or having someone else take their exam.

Bribery. Offering money or any item or service to a faculty member or any other person to gain academic advantage for yourself or another is dishonest.

Plagiarism. "Unacknowledged use of the information, ideas, or phrasing of other writers is an offense comparable with theft and fraud, and it is so recognized by the copyright and patent laws. Literary offenses of this kind are known as plagiarism."

AMERICANS WITH DISABILITIES ACT

Any student who may require an accommodation under the provisions of the Americans with Disabilities Act should contact the course instructor in this matter as soon as possible and no later than the end of the first week of classes.

NON-DISCRIMINATION STATEMENT

Iowa State University does not discriminate on the basis of race, color, age, religion, national origin, sexual orientation, gender identity, sex, marital status, disability or status as a U.S. veteran. Inquiries can be directed to the Director of Equal Opportunity and Diversity, 3210 Beardshear Hall, (515) 294-7612. This policy is enacted in accordance with ISU policy and with various federal and state discrimination laws including Title VII of the Civil Rights Act of 1964, Title IX of the Educational Amendments of 1972, Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990.