

The University of Manitoba
Faculty of Arts
Department of Psychology

PSYC 7730 (A01) Problems in Psychological Research: Structural Equation Modeling

(3 credit hours)

Course Outline Jan. 2007 to Apr. 2007

Time: Tuesday/Thursday, 1:00 p.m. to 2:30 p.m. (Slot 10)
Room: P432 Duff Roblin Building
Office Hours: by appointment

Instructor: Dr. Robert Renaud
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Course Overview:

This section of PSYC 7730 will focus on the fundamentals of structural equation modeling (SEM), which basically is a synthesis of advanced statistical techniques that are increasingly being used in the social sciences (psychology, education, and sociology). The course will be conducted as a seminar and students will be expected to understand, evaluate, and apply these techniques. Students will need a basic understanding of multiple regression and factor analysis and they will need access to a data set with at least 10 variables and 200 subjects (if you don't have access to a sufficient data set, I can easily provide you with one). The goal of this course will be for students to collaborate with each other, the instructor, and other professors in analyzing data and writing papers for presentation at learned conferences and for publishing in learned journals.

Objectives:

Students must read and understand the assigned text chapters and articles before each seminar and they must be prepared to discuss the issues raised from the readings and in class. The course has four interrelated objectives:

1. To understand the fundamentals of structural equation modeling;
2. To critically evaluate, in both oral and written presentations, selected articles that use these techniques;
3. To use these techniques to analyze data; and
4. To write articles using these techniques.

Required Text:

Byrne, B. M. (2001). *Structural equation modeling with AMOS: Basic concepts, Applications, and programming*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Web sites:

<http://amosdevelopment.com/> - A very useful site that includes many resources to support AMOS 7.0 such as the AMOS 7.0 User's Guide, instructional videos, free student version for download, and related external links.

<http://www.utexas.edu/its/rc/tutorials/stat/amos/> - A brief introduction and overview of structural equation modeling using the AMOS software.

<http://www2.gsu.edu/~mkteer/index.html> - Ed Rigdon's SEM page - collection of external links of researchers, software, and SEMNET

<http://www.upa.pdx.edu/IOA/newsom/sembooks.htm> - A fairly comprehensive list of SEM books

<http://www.upa.pdx.edu/IOA/newsom/semrefs.htm> - A fairly comprehensive list of SEM articles

<http://bama.ua.edu/archives/semnet.html> - SEMNET archives

<http://www.davidakenny.net/books.htm> - Correlation and Causality book by David Kenny (can be downloaded for free)

Supplemental Readings:

Alhija, F. N-A. & Wisenbaker, J. (2006). A monte carlo study investigating the impact of item parceling strategies on parameter estimates and their standard errors in CFA. *Structural Equation Modeling*, 13, 204-228.

Bandalos, D.L. (2002). The effects of item parceling on goodness-of-fit and parameter estimate bias in structural equation modeling. *Structural Equation Modeling*, 9, 78-102.

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

Bryk, A. S., Raudenbush, S. W. (2002). *Hierarchical linear models: Applications and data analyses methods*. Newbury Park, CA: Sage.

Hancock, G. R., Mueller, R. O. (2006). *Structural Equation Modeling: A Second Course*. Greenwich, CT: Information Age.

Kenny, D. A. (2004). *Correlation and Causation* (2nd ed.). Online at http://davidakenny.net/doc/cc_v1.pdf.

Lei, M. & Lomax, R. G. (2005). The effect of varying degrees of nonnormality in structural equation modeling. *Structural Equation Modeling*, 12, 1-27.

Marsh, H. W., Hau, K-T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling*, 11, 320-341.

Marsh, H. W., Wen, Z., & Hau, K -T. (2004). Structural equation models of latent interactions: Evaluation of alternative estimation strategies and indicator construction. *Psychological Methods*, 9, 275-300.

Maruyama, G. M. (1998). *Basics of structural equation modeling*. Thousand Oaks, CA: Sage.

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

Myung, I. J. (2000). The importance of complexity in model selection. *Journal of Mathematical Psychology*, 44, 190-204.

Myung, I. J. (2003). Tutorial on maximum likelihood estimation. *Journal of Mathematical Psychology*, 47, 90-100.

Pedhazur, E. J. (1997). *Multiple regression in behavioral research: Explanation and prediction*. (3rd ed.). New York: Holt, Rinehart, and Winston.

Raykov, T., Tomer, A., & Nesselroade, J. R. (1991). Reporting structural equation modeling results in psychology and aging: Some proposed guidelines. *Psychology and Aging*, 6, 499-503.

Raykov, T. & Marcoulides, G. A. (2000). *A first course in structural equation modeling*. Mahwah, NJ: Lawrence Erlbaum.

Schumacher, R. E., & Lomax, R. G. (1996). *A beginner's guide to structural equation modeling*. Mahwah, NJ: Lawrence Erlbaum.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. (4th ed.). Boston, MA: Allyn and Bacon.

Evaluation:

Participation in Seminars (20 points). Students must attend and participate in each seminar. In addition, each student will lead discussions on the assigned reading and the analyses for his/her articles.

Critical Review of an Article (20 points). Each student will select an article from a journal that uses structural equation modeling and write a short paper that summarizes and critically assesses the article. The review of the article will be due on February 28, 2007.

Research Article (60 points). Students will write articles that use structural equation modeling for the analysis of data. The articles will include all the sections of a standard published article in the social sciences (education, psychology, or sociology). The research article will be due at the end of the course.

Topics for the Seminars:

1. A brief history: From path analyses to structural equation modeling.
 - a. Path analysis
 - i. *Pedhazur (1997) Chapter 18*
 - ii. *Maruyama (1998) Chapter 3*
 - b. Confirmatory Factor Analysis (CFA)
 - i. *Byrne (2001) Chapter 1*
 - ii. *Maruyama (1998) Chapter 7*
 - iii. <http://amosdevelopment.com/video/trainthetrainer/confirmatoryfa/confirmatoryfa.html>
 - c. Measurement and structural models
 - i. *Byrne (2001) Chapter 1*
2. Looking inside the black box...how it works
 - a. Covariances, matrices, and matrix algebra
 - i. *Kenny (2004) Chapter 2*
 - ii. *Pedhazur (1997) Chapters 2 & 5*
 - iii. *Maruyama (1998) Appendix A*
 - b. Estimation methods - maximum likelihood
 - i. *Myung (2003). Tutorial on maximum likelihood estimation. Journal of Mathematical Psychology, 47, 90-100.*
3. Developing and revising models
 - i. *Myung (2000). The importance of complexity in model selection. Journal of Mathematical Psychology, 44, 190-204.*
4. Using AMOS
 - i. *Byrne (2001) Chapters 2 & 3*
5. Interpreting the output
 - i. *Byrne (2001) Chapter 3*
 - ii. *Marsh, H. W., Hau, K-T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. Structural Equation Modeling, 11, 320-341.*

6. Data
 - a. Normality, univariate and multivariate
 - i. *Byrne (2001) Chapter 11*
 - ii. <http://amosdevelopment.com/video/trainthetrainer/bootstrap/bootstrap/bootstrap.html>
 - iii. *Lei, M. & Lomax, R. G. (2005). The effect of varying degrees of nonnormality in structural equation modeling. Structural Equation Modeling, 12, 1-27.*
 - b. Missing data
 - i. *Byrne (2001) Chapter 12*
 - c. Item parceling
 - i. *Bandalos, D.L. (2002). The effects of item parceling on goodness-of-fit and parameter estimate bias in structural equation modeling. Structural Equation Modeling, 9, 78-102.*
 - ii. *Alhija, F. N-A. & Wisenbaker, J. (2006). A monte carlo study investigating the impact of item parceling strategies on parameter estimates and their standard errors in CFA. Structural Equation Modeling, 13, 204-228.*
7. Specific applications
 - a. Multigroup comparisons
 - i. *Byrne (2001) Chapters 7-10*
 - b. Latent mean differences
 - i. *Byrne (2001) Chapter 9*
 - c. Interaction effects
 - i. *Marsh et al. (2004). Structural equation models of latent interactions: Evaluation of alternative estimation strategies and indicator construction. Psychological Methods, 9, 275-300.*
 - ii. *Marsh et al. (2006). Structural equation models of latent interaction and quadratic effects. In Hancock & Mueller (Chapter 8).*
 - d. Longitudinal models
 - i. *Maruyama (1998) Chapter 6*
 - e. Monte carlo studies
 - i. *Bandalos, D. L. (2006). The use of monte carlo studies in structural equation modeling research. In Hancock & Mueller (Chapter 12).*
8. Reporting SEM results
 - i. *McDonald, R. P. & Ho, M-H. R. (2002). Principles and practice in reporting structural equation analyses. Psychological Methods, 7, 64-82.*
 - ii. *Raykov, T., Tomer, A., & Nesselroade, J. R. (1991). Reporting structural equation modeling results in psychology and aging: Some proposed guidelines. Psychology and Aging, 6, 499-503.*
 - iii. *Boomsma, A. (2000). Reporting analyses of covariance structures. Structural Equation Modeling, 7, 461-483.*

Department of Psychology's Common Course Outline Statement Regarding Plagiarism, Cheating, and Examination Impersonation

Plagiarism or any form of cheating is subject to serious academic penalty. It is the responsibility of the student to acquaint themselves with Section 7 from the University of Manitoba Undergraduate Calendar for the current academic year – see Policies on Plagiarism and Cheating, and Examination: Personations. Academic dishonesty can result in serious consequences, eg. A grade of zero on an assignment or test, an F on a transcript (with a notation "CW" indicating compulsory withdrawal). The penalty can also include suspension for a period of up to five years from registration in courses taught in a particular department in Arts or from all courses taught in this Faculty. The Faculty reserves the right to check any work suspected of plagiarism through electronic resources. Speak to your instructor if you have any questions.

The following outlines three forms of academic dishonesty:

Plagiarism is to take the words or ideas (found on paper or electronic format) of another person and pass them off as one's own. Submission of a paper written in part or in whole by someone other than yourself is considered to be plagiarism and/or cheating.

Cheating in examinations or tests can take a variety of forms including, but not limited to, the use of unauthorized materials, and copying material from others. An assignment that is prepared for one course cannot be submitted for another course; this is called duplicate submission and is a form of cheating.

Examination Personation – A student who arranges for another individual (student or non-student) to write any nature of examination, as well as the individual who writes the exam, will be subject to discipline under the University of Manitoba's Student Discipline Bylaw.