

Applied Factor Analysis & Structural Equation Modeling (SEM)
Family Relations and Applied Nutrition
FRAN 6440
Winter 2014

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Office Hours: Wed. 1:30 - 3:00
by appt.

Class: Tues. 8:30 - 9:30/10:00 in MACS 331
Tues. 9:30/10:00 - 11:30 in MACS 311a

Web Site: There is also a Courselink site for the course.

Course Description

This course introduces students to exploratory analysis (including exploratory factor analysis and principal components analysis), confirmatory factor analysis, and structural equation modeling approaches appropriate in applied social/health science research. The course covers conceptual and practical applications of statistical analyses with emphasis on selection of appropriate methods and models to address complex, multi-factorial data. This course is data-driven and students will learn primarily through hands-on analytic experiences accompanied by in-class lectures and readings.

Required Readings

There is one required text:

Byrne, B. M. (2010). *Structural equation modeling with AMOS* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Data to accompany Byrne: <http://www.psypress.com/sem-with-amos>

Additional readings (e.g., published articles or chapters) discussing topics covered, and SPSS guides (i.e., chapters from SPSS manuals) will be distributed or made available for duplication.

Required Software

SPSS will be used for the first part of this course. Additionally, AMOS software is required for confirmatory factor analyses/SEM. SPSS is available in the computer labs in both MACS and

MacKinnon buildings. For those wishing to obtain a copy of SPSS the **free concurrent version** is available from:

<http://www.uoguelph.ca/ccs/software/software-distribution>

Limited copies of AMOS will be available in the computer lab (MACS 311a). It is strongly recommended that students purchase a copy of AMOS.

Course Objectives

Recent advances in computers, software, and statistics have made multivariate statistics more easily accessible. This course will explore many extensions and variations of factor analysis (both exploratory and confirmatory approaches) and structural equation modeling. The unique combination of backgrounds and the various foci of research among class participants make a course like this very interesting. However, the basic tools remain the same and share a common language across disciplines, and the new methods you will gain will be applicable to your specific interests.

In this course you will have the opportunity to:

- Examine testable hypotheses/relationships in complex environments
- Expand your abilities to work with SPSS to include multivariate analytic procedures, and learn how to use AMOS to help test advanced models

And, not surprisingly, we will still emphasize:

- Interpretation of computer output, focusing on critical components necessary for properly reporting results, and understand what story the data tell
- Practice writing skills necessary for technical reports, methods and results sections
- Preparation for thesis work, publication efforts, and future professional activities by adding advanced methods to the methodological Atool box@ we started in the earlier module

Course Structure

Class time will be divided between: (1) introduction of new material in lecture (MACS 331); and, (2) demonstrations and interpretations of statistical techniques using empirical examples (MACS311a).

Course Requirements

Employing multivariate analysis allows us to examine more realistic, complex problems. The use of SEM software will show you how complex systems of variables can be examined simultaneously. Materials are presented in an applied, conceptual manner aided by hands-on examples demonstrating concepts discussed in lecture. It is not the purpose of this course to overload you with symbols and equations, although this is more difficult to achieve in the current versus previous modules.

Please keep in mind that you are expected to be present, thoroughly prepared, and ready to be an active participant in this course.

Evaluation

Data Application

There will be **two** graded assignments contributing a total of **60%** to your grade. You are expected to hand in a write-up that includes a modified version of an APA methods, results, and brief discussion section, demonstrating your understanding. You should also have your SPSS or AMOS output available in electronic format in case I request it to review. The best method for learning a statistical software package, a new analysis, or to understand output is to actually do it yourself. Whereas I encourage you to ask your colleagues questions, you are strongly urged to do your own work rather than relying on someone else for answers. Your ability to complete the assignment will correspond directly to your ability to complete the course examination.

Final Project

There will be **one** take-home final project contributing **40%** to your final grade.

Keep the following issue in mind:

More ≠ better! The take-home format does not mean you have to write hundreds of pages. You are expected to answer the questions and discuss and interpret the results. Concise scientific writing is actually more difficult to accomplish than lengthy diatribes. Strive to be concise!

The due date for the final project will be announced in class. I will try to maximize the amount of time you have to complete the project while I ensure that I have time to complete assessment and submit grades on time!

Class Participation

I consider active participation in the learning process vital to meeting the goals and objectives of this course. You will be expected to participate as an equal team member in this class. In practice, this means focusing on furthering class discussions.

E-mail Communication

As per university regulations, all students are required to check their **uoguelph.ca** e-mail account regularly: e-mail is the official route of communication between the University and its students.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the instructor in writing, with your name, id#, and e-mail contact. See the graduate calendar for information on regulations and procedures for Academic Consideration:

http://www.uoguelph.ca/registrar/calendars/graduate/2013-2014/genreg/sec_d0e1415.shtml

Drop Date

The last date to drop one-semester courses, without academic penalty, is **Friday, March 7th**.

Refer to the Graduate Calendar for the schedule of dates:

<http://www.uoguelph.ca/registrar/calendars/graduate/current/sched/sched-dates-w11.shtml>

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. The Academic Misconduct Policy is detailed in the Graduate Calendar: http://www.uoguelph.ca/registrar/calendars/graduate/2013-2014/genreg/sec_d0e1702.shtml

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded in any electronic media without the permission of the presenter, whether the instructor, a classmate or guest lecturer.

Assignments are due by 5 p.m. on due dates. Late papers will be accepted with a penalty of 5% deduction per day.

Class Schedule and Reading Assignments

Date	Topic	Readings and Comments
January 7	<p>Introduction to course</p> <p>Exploratory Factor Analysis & Principal Components Analysis</p>	<p>Stats: Hertzog & Nesselroade (2003)</p> <p>EFA: Bandalos & Boehm-Kaufman (2009); Beres et al (2004); Costello & Osborne (2005); Cudeck (2000); Dwyer et al. (2012) ; Fabrigar et al (1999) ; Field (2013) ; Gould (1981) ; Milhausen et al. (2010) ;</p> <p>SEM overview: Dillala (2000) & Byrne (2010, Ch 1-2)</p> <p>SPSS: Chapter 17 – Factor Analysis (Norusis, 2004)</p> <p>Also start working with AMOS Tutorial in AMOS book</p>
January 14	Exploratory Factor Analysis (EFA) & Principal Components Analysis (PCA) con't	<p>Stats: see above</p> <p>SPSS: see above</p> <p>Hand out Assignment 1</p>
January 21	Introduction to AMOS & Structural Equation Modeling (SEM)	<p>Stats: SEM: Barrett, (2007); Dilalla (2000)</p> <p>AMOS: Getting running with AMOS graphics</p> <p>Byrne: Ch 1-2</p>
January 28	Measurement Models and Confirmatory Factor Analysis (CFA)	<p>Stats: CFA: Byrne (2005); Hoyle (2000); Gottlieb et al. (2013);</p> <p>AMOS Examples: Ex. 8</p> <p>Byrne: Ch 3-4</p> <p>Assignment 1 due Friday, Jan 31st</p>

February 4	Factorial Validity & CFA	<p>Byrne: Ch 4-5; Landis, Edwards, & Cortina (2009); Milhausen et al (2010); Noar (2003); Vandenberg & Grelle (2009)</p> <p>Maitland et al. (2001) Maitland et al. (2009a & b)</p>
February 11	Second Order CFA, Validity & Causal Structures	<p>Maitland et al (2009a & b)</p> <p>AMOS examples:</p> <p>Byrne: Ch 6</p>
February 25	Introduction to Multiple Group Models	<p>Byrne: Ch 7-8</p> <p>AMOS examples: Ex. 11, 12</p> <p>Assignment 2 Handed Out</p>
March 4	Measurement Equivalence/Invariance (ME/I)	<p>Byrne: Ch 7-8; Byrne (2004)</p> <p>Bontempo & Hofer (2007) Dwyer et al (2012); Gottlieb et al. (2012); Maitland et al. (2001); Maitland et al. (2004); Milhausen et al. (2010); Vandenberg & Lance (2000)</p>
March 11	More on ME/I: Examples and applications including analysis of Latent Means	<p>Byrne: Ch 9 ; Ployhart & Oswald (2004) ; Williams et al., (2003) AMOS examples: Ex. 15</p> <p>Gottlieb et al. (2012) ; Maitland et al. (2004)</p> <p>Assignment 2 due Friday, Mar 14th</p>
March 18	Invariant patterns in the full latent variable model	<p>Byrne: Ch 10</p> <p>Gottlieb et al., (2012)</p>

March 25	Advanced Topics in SEM – Latent Growth Curve Models and longitudinal designs.	Byrne: Ch 11, 12, 13 (as time permits) Readings: Byrne & Crombie (2003); Willett & Sayer (1994); Willett & Keiley (2000) Maitland et al. (2012); Maitland et al (2013)
April 1	Pulling it all together, Course evaluation Final Project	

References

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