Course syllabus «Covariance structure models»

Approved by
Programme Academic Council
Protocol Nr. 10 from 27.08.2019

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Number of credits	4
Contact hours	48
Self-study hours	104
Course	1,2
Educational format	Without use of online course

I. Goals and Results of Mastering the Discipline; Prerequisites

This course is designed for MASNA students who would like to acquire a significant familiarity with the statistical techniques known collectively as "structural equation modeling," "causal modeling," or "analysis of covariance structures." The general objectives of the course are:

1. To provide you with an understanding of the basic principles of latent variable structural equation modeling and lay the foundation for future learning in the area.

2. To explore the advantages and disadvantages of latent variable structural equation modeling, and how it relates to other methods of analysis.

3. To develop your familiarity, through hands on experience, with the major structural equation modeling programs, so that you can use them and interpret their output.

4. To develop and/or foster critical reviewing skills of published empirical research using structural equation modeling. As a result, students should:

Know:
- the basic idea of implied matrices and what is happening in SEM
- the major structural equation modeling programs
- how to translate conceptual thinking into models that can be estimated.

Be able to:
- use the major SEM programs to estimate common types of models:

- Multi-equation path analysis models
- Path models with fixed, non-zero error terms
- Models with multiple mediating effects
- Latent variable multi-equation models
- Formative indicator models
- Second-order factor models
- Multi-group models with mean structures
- Models with latent variable interactions

- Latent growth curve models, latent state-trait-occasion models, etc.
- If time permits: Multi-level models

Have:
- an understanding common problems related to model specification, identification, and estimation.
- a working knowledge of the different ways to analyze models with covariance structures.

Basic knowledge of introductory linear models course are required for this course.

The basics of this discipline should be used in the following courses and activities:
•research seminar
•all other program related courses

The course is strongly related and complementary to other compulsory courses provided in the first year (e.g. Applied Linear Models II, Contemporary Data Analysis) and sets a crucial prerequisite for later courses and research projects as well as for the master thesis. The course gives students an important foundation to develop and conduct their own research as well as to evaluate research of others.

1. Course Introduction
   a. Course Requirements
   b. A Model of the Research Process
2. Problem Selection and Conceptualization
   a. Choosing a Worthwhile Topic
   b. Defining Constructs
   c. Generating Hypotheses
3. 3. Fundamentals of LVSEM (Part 1)
4. Basic Model
   a. Path Diagrams
   b. Rules for Determining Model Parameters
   c. Model Implied Covariance Structure
5. Fundamentals of LVSEM (Part 2)
   a. Parameter Estimation
   b. Identification
6. Fundamentals of LVSEM (Part 3)
   a. Model Testing and Evaluation
   b. Two-Step Approach for Testing Models
7. Software Programs
   a. LISREL 8.8, Amos 6, Mplus 4.21, EQS 6.1
8. Observed Variable Models – Path Analysis
   a. What is path analysis?
   b. Example model
   c. Modeling Measurement Error in Path Analysis Models
9. Testing Mediation
   a. Direct and Indirect Effects
   b. Testing Indirect Effects

10. Effect Decomposition
    a. Latent Variable Structural Equation Models
    b. What is confirmatory factor analysis?
    c. What is a structural regression model?
    d. The Consequences of Measurement Error
    e. Controlling for Method Biases and "Third Variables"
11. Measurement Model Specification
    a. Types of Measurement Relations
    b. Specification of Second-Order Measurement Relationships
    c. Item Parceling
12. Assessing Construct Validity and Reliability
    a. Validity
    b. Reliability
    c. Scaling Procedures
13. Multiple Groups Analysis
    a. Multiple Group Analyses
    b. Analysis of Mean Structures
    c. Imposing Constraints Within and Between Groups
    d. Cross-Validation of Measurement and/or Structural Relationships
    e. Examples
14. Latent Variable Interactions
    a. Why use this?
    b. Model Specification
15. Latent Change Analysis
    a. What is latent change analysis?
    b. Simple One Factor LCA Model
    c. Level and Shape Model
    d. Studying Correlates and Predictors of Latent Change
16. Special Topics

II. Course grade will be completed as follows:

Assignments	Date Due	Percent of Grade
#1: Answers to Readings Questions	08-29-07	2%
#2: Basics Exam	10-03-07	18%
#3: Path Analysis and Mediating Effects	10-17-07	20%
#4: Latent Variable Model	11-07-07	20%
#5: Moderating Effects with Latent Variables	11-28-07	20%
#6: Special Topic Presentation	12-05-07	20%

If the final grade is non-integer, it is rounded according to algebraic rules. If has a half (.5) at the end, we are rounding upward. Rounding of cumulative grades and other rounding issues are performed according to the HSE rules.

IV. Grading Tools

This class contains several assignments that test student knowledge and understanding throughout the course.

In-class Labs

There will be a lab assignment in almost every seminar, depending on our progress. Seminar labs should help you with the task of mastering network modeling. You are required to submit your completed seminar work (with all questions answered).

Projects

In addition to seminars, I will also assign some datasets for independent explorations. I call these assignments "projects," because they will come with very little in terms of specific instructions. It will be up to you which models to build, so these assignments are not unlike real-life projects that you will face in your career. However, you are welcome to work in groups.

V. Resources

5.1 Main Literature

1. Raykov, Tenko, and George A. Marcoulides (2006), A First Course in Structural Equation Modeling (2nd Edition). Mahwah, NJ: Lawrence Erlbaum Associates.

2. Netemeyer, Richard G., William O. Bearden, and Subhash Sharma (2003), Scaling Procedures: Issues and Applications. Thousand Oaks, CA: Sage Publications, Inc.

5.2 Additional Literature

1. Byrne, Barbara M. (1998), Structural Equation Modeling with LISREL, PRELIS and SIMPLIS. Mahwah, NJ: Lawrence Erlbaum Associates.
2. Byrne, Barbara M. (2001), Structural Equation Modeling with AMOS. Mahwah, NJ: Lawrence Erlbaum Associates.
3. Bollen, Kenneth A. (1989), Structural Equations With Latent Variables. New York: Wiley.
4.

5.3 Software

№ п/п	Name	Access conditions
1.	MicrosoftWindows 7 Professional RUS MicrosoftWindows 10 MicrosoftWindows 8.1 Professional RUS	*From the university's internal network (contract)*
2.	Microsoft Office Professional Plus 2010	*From the university's internal network (contract)*

3.	R, R studio	*Open access. URL: https://www.r-project.org/*

5.3 Material and technical support

Classrooms for lectures on the discipline provide for the use and demonstration of thematic illustrations corresponding to the program of the discipline, consisting of:

- PC with Internet access (operating system, office software, antivirus software);
- multimedia projector with remote control.