1. COURSE DESCRIPTION/OBJECTIVES
This course is intended to provide a comprehensive introduction to social science measurement models and structural equation modelling (SEM) commonly known as the LISREL/EQS models. Structural equation modeling is a regression-based technique that incorporates elements of path analysis and confirmatory factor analysis to model structural relationships and measurement properties, respectively. The general goal of the course is to provide a thorough background in the conceptual aspects, broad statistical underpinnings, and application of this method that will facilitate your ability to conceptualize hypothesis testing in an SEM framework, estimate and evaluate hypothesized models, write results sections detailing SEM findings, and be able to competently review the SEM analyses of others (as in peer review). The emphasis is on applications and applying the relevant techniques wisely for data analysis which requires a good understanding of the corresponding theories and the relevant assumptions. At the end of the course, we expect participants to have a solid, conceptual foundation of structural modeling issues, be able to analyze data using an SEM package (AMOS and/or EQS), critically evaluate professional articles, and write up SEM results.

2. COURSE MATERIALS


*Note: Acquisition of the principal text, or of some other book at a similar level, is advised. However, the lectures may not directly follow any particular text book and may contain materials not found in any of them. The chapters and sections listed below correspond to the principal text. (See tentative schedule)

Other Materials:

Geoffrey M. Maruyama (1997), Basics of Structural Equations Modeling, Sage publications, California

Articles and class notes to be posted on Moodle

3. INSTRUCTIONAL METHODS

The course will be taught using a lecture, discussion, and report model. Major issues and concepts will be initially introduced by the instructor in a lecture format with discussion of related readings. To consolidate understanding, students are expected to study these concepts and report on a topic of their choice with consent and guidance from the instructor. In addition to lecture and discussion, to facilitate students’ understanding and usage of the software, the instructor will provide examples of computer input and output of relevant topics and an opportunity for students to reproduce them in a computer lab. The instructor notes will be posted in advance on Moodle. Students are encouraged to peruse and review these notes prior to attending each class and read the relevant chapters of the text.

- Lectures /Article Discussions
- Assignments/Homework
- Term Project (individual)

4. COURSE OBJECTIVES

1. Understand the process of measurement in social science, the meaning of reliability, validity and apply them for operationally defining various concepts that they may use in their research.

2. Differentiate between the classical approaches and the modern approaches for assessing psychometric properties of a measurement instrument.

3. Understand the applications of factor analysis in the literature and evaluate them critically.

4. Demonstrate skill and self-confidence in undertaking a study involving instrument development and modelling.

5. Apply confirmatory factor analysis and the related techniques to an area of empirical research.

6. Evaluate the effect of measurement error on validity of statistical inference and utilize techniques for correcting parameter estimates in the presence of measurement error.

7. Conduct path analysis and formulate a research problem involving latent variables into testable hypotheses through structural equation modelling.
8. Use a structural equation-modelling program such as EQS or LISREL in a meaningful fashion.

5. INTEGRATION

- Class examples taken from various disciplines.
- Use of software in some assignments for analyzing data.
- Projects in an application setting related to business and economics.

6. EVALUATION

Evaluation will be based on assignments/homework, presentation, participation and a term project.

- Students will be required to carry out a project. You will be expected to attend all class (Tuesday) having read all assigned materials. You will be expected to complete two homework assignments wherein you analyze data via SEM, and two peer review of SEM articles (one to be presented in the class).
- Finally, you will be required to complete a final project, where you test a particular hypothesis using SEM techniques and write an APA style methods and results section detailing your findings. You will turn in an outline of your project idea approximately 1/2 of the way through the semester so that we can evaluate the appropriateness of the idea for the final project. You will give a brief overview of your project and findings to the class via powerpoint presentation during the last week of class.

Specific EVALUATION*

The final grade will be based on at least 2 assignments which will be due at various points during the term, a term project and presentation. Assigned tasks are to be handed in at the beginning of class on due dates. Evaluation will be based on assignments, data analysis projects, a final project, presentation of a topic of your choice, and active class participation as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Participation (active)</td>
<td>5%</td>
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<tr>
<td>Assignments/Data Analysis</td>
<td>20%</td>
</tr>
<tr>
<td>Presentation (article)</td>
<td>20%</td>
</tr>
<tr>
<td>Final Project (Individual)</td>
<td>40%</td>
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<tr>
<td>Presentation (project)</td>
<td>5%</td>
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Letter Grades

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A+</td>
<td>95-100%</td>
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<tr>
<td>A</td>
<td>90-95</td>
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<tr>
<td>A-</td>
<td>89-90</td>
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<td>B+</td>
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<td>C</td>
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*To get a passing grade, a student must obtain at least 60%

- Assignment/Homework/Data Analysis

A typed cover page giving the student's name, assignment number, and due date should accompany the submissions. As much as possible, answers should be typed and supporting output clearly labeled. The homework assignments will constitute 25% of the total mark for the course.
• Project (Individual project)

The Objective of the term project is the resolution of one important problem of choice and a clear interpretation in terms of the subject-matter concepts. Individual proposal describing the project for approval as to its suitability for the course must be submitted no later than the beginning of week 6 of the term.

Projects will involve both statistical and pragmatic issues. Grades will be awarded based on student proficiency in handling both the theoretical and the pragmatic challenges of each proposed project. The quality of the presentation in the report will also be a significant factor. The students who have well thought out justified reasons for their results and who are able to explain and demonstrate their thinking will receive the highest grades. Statistical results without analysis, justification, and explanation is of no value. The project report is worth 40% of the total mark for the course. Additional 5% is assigned for the short presentation.

• Policy on assigned work:

Students are free to discuss homework assignments and projects among each other on a conceptual level. However, wholesale copying of problem solutions is prohibited. Late assignments are unacceptable.
Reading List and Weekly Schedule (tentative)

(Make sure to read at least the indicated chapters of the handbook or the references marked with an asterisk before the class and participate in class discussion)

(Papers/Chapters other than Byrne available on Moodle):

Week 1:

Introduction

Tuesday, September 6, 2016: Discussion of syllabus/expectations/course structure, Introduction to terms. This class provides a road map of the course, the rational for studying SEM and introduces the path analysis notation. The AMOS and EQS models both in the form of path analysis and matrix notations will be also introduced.

READINGS:

*Byrne, Chapters 1 and 2


Geoffrey M. Maruyama (1997), Basics of Structural Equations Modeling, Sage publications, California (chapters 3 & 8)

Week 2: (September 13)

Model specification Estimation and Identification rules

*Chapter 3 Byrne

Geoffrey M. Maruyama (1997), Basics of Structural Equations Modeling, Sage publications, California (chapters 3 & 4)

Bollen, Kenneth A. (1989), Structural Equations with Latent Variables, New York: John Wiley and Sons. (Chapter 4)

Week 3 (September 20):
Continuation of the AMOS/EQS model and demo of the AMOS/EQS program

*Chapter 2 Byrne
*Get Running with AMOS Graphics, IBM® SPSS® Amos™ 22 User’s Guide by James L. Arbuckle
*Chapter 19, Handbook of Structural Equation Modeling.

Week 4 (Sept. 27):
Effect of Measurement Error, Classical Measurement Model and Exploratory Factor Analysis

*Chapter 2 and 3 Byrne

Week 5 (October 4)
Confirmatory Factor Analysis and demonstration of AMOS/EQS

*Byrne chapter 3, 4

Chapters 4 and 22, Handbook of Structural Equation Modeling

Week 6 (October 11)
Measurement Models continued (Reliability and Validity) and Fit indices

*Byrne chapter 5, 6
*Chapter 28, Handbook of Structural Equation Modeling


Fit indices
*Chapter 13, Handbook of Structural Equation Modeling


**Week 7 (October 18)**
Model modification and Treatment of Missing Data.

*Chapters 23, Handbook of Structural Equation Modeling
*Byrne chapter 13

**Week 8 (October 25)**
The General Structural Equation Model, Formative and reflective measures, MIMIC and PLS

*Byrne 10

**Formative and reflective measures**

**MIMIC**

**PLS**
Week 9 (November 1)
Causality, Analysis of Experimental data, Multiple Groups and Analysis of Categorical Data.

Causality
*Chapter 5, Handbook of Structural Equation Modeling
*Byrne 5, 6, 9, 10


Analysis of Experimental data
*Chapter 24, Handbook of Structural Equation Modeling

Multiple Groups
*Chapter 23, Handbook of Structural Equation Modeling

Categorical Data
*Chapter 12, Handbook of Structural Equation Modeling

Week 10 (November 8)
Second-Order Factor Model, Structural Analysis of Correlation Matrix, Means and Covariance Structure, and Sample Size and Power
*Byrne chapter 5


Structural Analysis of Correlation Matrix

Means and Covariance Structure

Sample Size and Power
*Chapter 11, Handbook of Structural Equation Modeling

Week 11 (November 11) Mediator and Moderator, Latent Variables Interaction and Analysis of Time Series data
*Chapter 25, Handbook of Structural Equation Modeling

Interaction and nonlinear models
*Chapter 26, Handbook of Structural Equation Modeling

**Week 12 (November 18) Longitudinal and Multi-level modeling**
*Chapters 27 and 35, Handbook of Structural Equation Modeling
Latent growth curve Model

**Multi-level modeling**
*Chapter 30, Handbook of Structural Equation Modeling

**Week 13 (November 25) Presentation of projects, review, and a group lunch (optional)**
The following chapter/papers provide guidelines for reporting SEM results
*Chapters 21, Handbook of Structural Equation Modeling

**Project Presentation on December 1, 2016**

We will discuss this later
Academic Integrity

“The integrity of University academic life and of the degrees, diplomas and certificates the University confers is dependent upon the honesty and soundness of the instructor-student learning relationship and, in particular, that of the evaluation process. As such, all students are expected to be honest in all of their academic endeavors and relationships with the University,” (Academic Code of Conduct, art. 1)

All students enrolled at Concordia are expected to familiarize themselves with the contents of this Code. You are strongly encouraged to visit the following web address:


Plagiarism:

The most common offense under the Academic Code of Conduct is plagiarism which the Code defines as "the presentation of the work of another person as one's own or without proper acknowledgement." This could be material copied word for word from books, journals, internet sites, professor's course notes, etc. It could be material that is paraphrased but closely resembles the original source. It could be the work of a fellow student, for example, an answer on a quiz, data for a lab report, a paper or assignment completed by another student. It might be a paper purchased through one of the many available sources. Plagiarism does not refer to words alone _ it can also refer to copying images, graphs, tables, and ideas. "Presentation" is not limited to written work. It also includes oral presentations, computer assignments and artistic works. Finally, if you translate the work of another person into French or English and do not cite the source, this is also plagiarism.

In Simple Words:
DO NOT COPY, PARAPHRASE OR TRANSLATE ANYTHING FROM ANYWHERE WITHOUT SAYING FROM WHERE YOU OBTAINED IT!

(Source: The Academic Integrity Website: http://provost.concordia.ca/academicintegrity/plagiarism/)

DISCLAIMER

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.