



## COLLEGE of SOCIAL AND APPLIED HUMAN SCIENCES

DEPARTMENT OF FAMILY RELATIONS  
AND APPLIED NUTRITION

# FRAN\*6440 Applied Factor Analysis and SEM

COURSE OUTLINE – Winter 2022

## 1. GRADUATE CALENDAR DESCRIPTION

This course introduces students to exploratory factor analysis, confirmatory factor analysis, and structural equation modeling. Topics include: model selection and validation, multiple group models, measurement equivalence/invariance and latent mean analyses. This course is data-driven and students will learn through hands-on analytic experiences accompanied by in-class lectures and readings.

<b>Credit Weight:</b>	0.5 credits
<b>Course Hours:</b>	3-0 (36 lecture; 0 lab/seminar)
<b>Pre-Requisite(s):</b>	<b>FRAN*6000, FRAN*6010</b>
<b>Co-Requisites(s):</b>	
<b>Restriction(s):</b>	Consent required for non- FRAN students

## 2. COURSE DESCRIPTION

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 appropriate in applied social/health science research. 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 “tool box” we started in the earlier course.

Employing multivariate analysis allows us to examine more realistic, complex problems. The use of SEM software will show you how complex systems of variables are 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 course.

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

### 3. TIMETABLE

**Lecture:** Tuesday - 11:30 - 2:20

**Location:** MACS 331\*

\*We will meet remotely until January 25<sup>th</sup>, as per UoG policy

I will be using Zoom and making recordings available on CourseLink

### 4. INSTRUCTIONAL SUPPORT

**Course Instructor:** Scott B. Maitland, Ph.D.

**Email:** smaitlan@uoguelph.ca

**Telephone:** 519-824-4120 ext. 56156

**Office:** 225 Macdonald Institute

**Office Hours:** **Wednesday 2:30 – 3:30, others by appt.**

### 5. LEARNING RESOURCES

#### Required Resource(s):

Byrne, B. M. (2016). *Structural equation modeling with AMOS* (3<sup>rd</sup> ed.). New York, NY: Routledge.

Data to accompany Byrne: [http://s3-euw1-ap-pe-ws4-cws-documents.ri-prod.s3.amazonaws.com/9781138797031/data\\_sets.zip](http://s3-euw1-ap-pe-ws4-cws-documents.ri-prod.s3.amazonaws.com/9781138797031/data_sets.zip)

#### Recommended additional readings

Little (2013). *Longitudinal structural equation modeling*. Guilford Press.

Todd Little has a way with words. This book does a splendid job of telling the reader about both the basics of SEM and the more advanced longitudinal components of it in simple (and often funny!) language without ignoring the complexities. A must read for anyone wishing to push their SEM knowledge further.

Brown (2015). *Confirmatory factor analysis for applied research*. Guilford Press.

An amazing compendium of CFA knowledge. A bit more on the technical side. Recommended for more advanced usage.

Kline (2015). *Principles and practices of structural equation modeling*. Guilford Press.

Covers the basic ‘Principles and Practices’ underlying SEM. Like Brown (2015), it is a bit more advanced – however – like Little (2013) it is a must read for anyone who wishes to push their knowledge.

Additional readings (e.g., published articles or chapters) discussing topics covered, and SPSS guides (i.e., chapters from SPSS manuals) are listed in the “Additional References” file.

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 Mackinnon 028 computer lab. 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 (Mackinnon 028). It is strongly recommended that students purchase a copy of AMOS. One option is Studica: <https://www.studica.com/en/ibm-spss-amos-grad-pack-v28-academic-authorized-user-term-license-subscription-and-support-12-months>

You may also find it even cheaper at:

<https://estore.onthehub.com/WebStore/OfferingDetails.aspx?o=fde68673-10bf-eb11-813b000d3af41938&pmv=00000000-0000-0000-0000-000000000000>

## 6. LEARNING OUTCOMES

At the completion of the course, successful students will be able to:

1. Develop research questions and hypotheses, evaluate normality of data, select appropriate statistical tests and run analyses in SPSS and AMOS.
2. Interpret results from analyses, report and describe results accurately, understand outcomes and next steps in the research process, as appropriate for publication and/or thesis/dissertation.

## 7. TEACHING AND LEARNING ACTIVITIES/CLASS SCHEDULE

Week	Topics	Assigned Readings & Assignment info
Jan 11	<p><b>Introduction to course</b></p> <p><b>Exploratory Factor Analysis &amp; Principal Components Analysis</b></p>	<p><i>Stats:</i> Hertzog &amp; Nesselroade (2003)</p> <p><i>EFA:</i> Bandalos &amp; Boehm-Kaufman (2009); Costello &amp; Osborne (2005); Dwyer et al. (2012); Fabrigar et al (1999); Field (2018); Fried &amp; Flake (2018) ; Horn &amp; McArdle, (2007); Jones (2007); Milhausen et al. (2010); Pituch &amp; Stevens (2016)</p> <p><i>SEM overview:</i> Dillala (2000) &amp; Byrne (2010, Ch 1-2)</p> <p><i>SPSS:</i> Chapter 18 – EFA (Field, 2018); Chapter 17 – Factor Analysis (Norusis, 2004)</p> <p>Also start working with AMOS Tutorial in AMOS book</p>
Jan 18	<p><b>Exploratory Factor Analysis (EFA) &amp; Principal Components Analysis (PCA) con't</b></p>	<p><i>Stats:</i> see above</p> <p><i>SPSS:</i> see above</p> <p><b>Hand out Assignment 1</b></p>
Jan 25	<p><b>Introduction to AMOS &amp; Structural Equation Modeling (SEM)</b></p>	<p><i>Stats: SEM:</i> Barrett, (2007); Dilalla (2000); Hooper, Coughlan, &amp; Mullen (2008)</p> <p><i>AMOS:</i> Getting running with AMOS graphics</p> <p><i>Byrne:</i> Ch 1-2</p>
Feb 1	<p><b>Measurement Models and Confirmatory Factor Analysis (CFA)</b></p>	<p><i>Stats: CFA:</i> Byrne (2005); Hoyle (2000); Whittaker (2016)</p> <p>AMOS Examples: Ex. 8</p> <p><i>Byrne:</i> Ch 3-4</p> <p>Gottlieb et al. (2013)</p> <p><b>Assignment 1 due Tues, Feb 1<sup>st</sup></b></p>
Feb 8	<p><b>Factorial Validity &amp; CFA</b></p>	<p><i>Stats:</i></p> <p>Hussey &amp; Hughes (2018);</p> <p>Byrne: Ch 4-5;</p> <p><b>Examples:</b></p> <p>Landis, Edwards, &amp; Cortina (2009); Milhausen et al (2010); Noar (2003); Vandenberg &amp; Lance (2000); Maitland et al. (2001); Maitland et al. (2009a &amp; b); Maitland et al., (2021)</p>
Feb 15	<p><b>Second Order CFA, Validity &amp; Causal Structures</b></p>	<p>Maitland et al (2009a &amp; b);</p> <p>AMOS examples:</p> <p>Byrne: Ch 6</p>

Week	Topics	Assigned Readings & Assignment info
Feb 22	<b>NO CLASSES THIS WEEK</b>	Reading week
Mar 1	<b>Introduction to Multiple Group Models</b>	Byrne: Ch 7-8  AMOS examples: Ex. 11, 12 (most examples below)  <b>Assignment 2 Handed Out</b>
Mar 8	<b>Measurement Equivalence/Invariance (ME/I)</b>	Byrne: Ch 7-8; Byrne (2004)  <b>Examples:</b> Bontempo & Hofer (2007); Dwyer et al (2012); Gottlieb et al. (2013); Maitland et al. (2001); Maitland et al. (2004); Maitland et al. (2021); Milhausen et al. (2010); Quinn-Nilas et al. (2019); Vandenberg & Lance (2000)
Mar 15	<b>More on ME/I: Examples and applications including analysis of Latent Means</b>	Byrne: Ch 9; Ployhart & Oswald (2004); Williams et al. (2003) AMOS examples: Ex. 15  <b>Examples:</b> Gottlieb et al. (2013); Maitland et al. (2004); Quinn-Nilas et al. (2019)  <b>Assign 2 due Tuesday, Mar 15<sup>th</sup></b>
Mar 22	<b>Invariant patterns in the full latent variable model</b>	Byrne: Ch 10  <b>Examples:</b> Gottlieb et al., (2013); Maitland et al., (2021)
Mar 29	<b>Advanced Topics in SEM – Latent Growth Curve Models and longitudinal designs.</b>	Byrne: Ch 11, 12, 13 (as time permits)  Readings: Byrne & Crombie (2003); Curran, Obeidat, & Losardo (2010); Willett & Sayer (1994); Willett & Keiley (2000);  <b>Examples:</b> Maitland et al. (2012); Maitland et al (2013); Maitland et al (in press); Quinn-Nilas (2019)
Apr 5	<b>Pulling it all together, Course evaluation</b>  <b>Final Project</b>	

## 8. ASSESSMENT DETAILS

Assessment	LOs Addressed	Due Date	% of Final
Assignment 1	1,2	End of Wk3	30%
Assignment 2	1,2	End of Wk10	30%
Assignment 3	1,2	Apr 11	40%
<b>Total:</b>			<b>100%</b>

## 9. COURSE STATEMENTS

### Illness:

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

### Safety Protocols:

For information on current safety protocols, follow these links: <https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/>

<https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

### Disclaimer:

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email. This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

### Course Website:

There is a course website at <http://courselink.uoguelph.ca>. All components of this course will be housed on the CourseLink site including this course outline, assignments, and links to further resources. Your assignments will be submitted through the Dropbox function. Marks and feedback will also be released on the site. Please familiarize yourself with this website as soon as possible and visit it regularly throughout the semester.

### Late Assignments:

Late assignments will be accepted up to 5 days following the due date and will receive a penalty of 10% per day EXCEPT under documented grounds for compassionate consideration. Assignments submitted more than one week late without documented grounds will receive a grade of zero. If you are going to hand an assignment in late, you must contact your course instructor to inform them when you will be submitting your assignment.

### Receipt of Grades:

After you receive a grade on CourseLink, please review your feedback. Any inquiry or dispute over the grade must be made within two weeks from the date they are posted. If you fail to protest any grade during this time limit, changes to the grade will not be considered.

## **10. UNIVERSITY STATEMENTS**

### **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 course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Graduate Calendar for information on regulations and procedures for [Academic Consideration](#).

### **Drop date:**

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for [Dropping Courses](#) are available in the Graduate Calendar.

### **Copies of out-of-class assignments:**

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### **Accessibility:**

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

More information: [www.uoguelph.ca/sas](http://www.uoguelph.ca/sas)

### **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.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The [Academic Misconduct Policy](#) is outlined in the Graduate Calendar.

### **Recording of materials:**

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

### **Resources:**

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

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