RMS 4924: Factor Analysis
Winter 2020 Syllabus

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Make office hour appointments by going to: https://denisdumas.youcanbook.me/
Or Scan this QR Code:

This app will automatically send confirmation emails and put the appointment on my calendar. Try and book at least 12 hours in advance so I know what appointments I need to plan for. Appointments are typically 20 minutes

Graduate Teaching Assistant:
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Office Hours: TBA; Will be hosted in the RMS Cubicles and times will be posted on canvas
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Class Meetings:
Tuesdays 6:00-9:10pm
Classroom: Ruffatto Hall 305

Prerequisites:

Graduate Standing, Psychometric theory (RMS 4921), Regression (RMS 4911).

Purpose and Goals:

Anyone who regularly interacts with the research literature in the social sciences will have encountered factor analysis. It is the principal way that researchers seek to understand the relations among the stimuli we administer to participants and the underlying mental attributes that those stimuli indicate. In this lecture- and computer lab-based course, we will begin with an in-depth study of "hand" methods for factor analysis, in order to discover the underlying mathematical patterns that make the method work. Then, we will move to principal components analysis and exploratory factor analysis, using computational methods to uncover latent dimensions. In the latter part of the course, confirmatory factor analysis (CFA) will be covered, and we will fit CFA models to data in order to determine the best fitting measurement model. Finally, we will fit CFA models to data from multiple groups to determine whether observed variables indicate latent attributes in the same way across the groups (i.e., measurement invariance). We will utilize Stata and Mplus in our modeling, although you are more than welcome to bring in another program if you prefer. Prerequisites for this course should be psychometric theory and regression.

Course Objectives:

1. Students will understand the substantive and mathematical origins of factor analysis as a method.

2. Students will understand the impact of various methodological choices in exploratory factor analysis (EFA) to substantive conclusions in the social sciences.

3. Students will learn methods for determining the number of latent dimensions on a psychometric measure.

4. Students will conduct and interpret an EFA on real data.

5. Students will differentiate between uses of EFA and confirmatory factor analysis (CFA).

6. Students will learn computational code for conducting a CFA via the computer.

7. Students will conduct and interpret a CFA on real data.

8. Students will understand the difference between invariant and non-invariant measurement models.

9. Students will learn how to assess the level of invariance (Configural, metric, and scalar invariance) of a CFA model across salient participant groups.

Materials

Texts

This course does not explicitly require you to purchase any texts. However, it does require you to be curious about and continually reading in your field's peer-reviewed journals. At a number of points throughout the quarter, the class will engage in a discussion of published empirical articles that utilize factor analysis. The articles for discussion are provided on canvas and listed in the course schedule.

Besides this continuous reading, here are some non-required texts that you might want to consider consulting.

1. AERA, APA, & NCME, (2014). *Standards for Educational and Psychological Testing.* AERA press: Washington, DC.
2. Furr, R. M., & Bacharach, V. R. (2013). *Psychometrics: An Introduction*. Sage: Thousand Oaks, CA.
3. Dunteman, G. H. (1989). *Principal components analysis*. Newbury Park, CA: SAGE.
4. Pett, M. A., Lackey, N. R., & Sullivan, J. J. (2003). *Making sense of factor analysis*. Thousand Oaks, CA: SAGE.
5. Byrne, B. M. (2012). *Structural equation modeling with Mplus: Basic concepts, applications, and programming.* New York, NY, US: Routledge/Taylor & Francis Group.

Computer Programs

Officially, I am entirely program agnostic. If there is a particular program with which you are comfortable and to which you have access, great. However, I will always demonstrate all procedures we learn in whatever program that is available on campus that makes the analysis most simple. Some programs are just better for certain types of models. For this course, we will be focusing on *Stata* and *Mplus*.

Calculator

You may need a calculator that is capable of calculating square roots for the quizzes. Students are encouraged to bring calculators to class each day. *I will not provide calculators. No cell-phone calculators please!*

COURSE GRADES

Your attendance, quizzes, labs, midterm presentation, and final presentation will be combined according to the percentages shown. Final grades will then be assigned based on the scale below.

Factors Effecting Course Grade

Attendance/Participation	10%
Quizes (4)	10%
Lab Actvities (4)	50%
Midterm Poster	15%
Final Poster	15%

Official DU description of grade categories:

Grade	Percentage	Description
A A-	93-100 90-92	Denotes work of ***superior quality***, which may be demonstrated in terms of criticism, logical argument, interpretation of material, originality, and creativity.
B+ B	87-89 83-86	Denotes work of ***predominantly good quality***, demonstrating a sound grasp of content, together with efficient organization, and the capacity to make some critical appraisal of the material.
B- C+	80-82 77-79	Denotes work that is of ***barely adequate quality***, with minimal achievement of the course objectives and understanding of the material.
C	73-76	Denotes work that is of weak quality, with ***borderline achievement*** of the course objectives and partial understanding of the material.
C-	70-72	Denotes work that is of low quality, and ***minimal standing in terms of meeting University degree requirements***, with lowest level achievement of the course objectives and barely adequate understanding of the material.
D+ D D- F	67-69 63-66 60-62 0-59	Denotes work that is unacceptable for meeting University degree requirements.

INFORMATION ON ASSESSMENTS

Attendance/participation (10%). This class will feature a number of worked examples and in-class analyses. Some will be conducted by hand, with a calculator, or using another program. In addition, the class will engage in a rich discussion of empirical articles we read. I think it is important for each student to be present in both body and mind for the class meetings, so attendance/participation is worth 10% of the grade.

Quizzes (10%). Quizzes in this course will be brief, multiple-choice, and take place in the very beginning of class. At only 10% of the final grade, the quizzes are designed to help you identify areas in which you need study, not to make/break anyone's grade. Quizzes are zeros if you miss them.

Poster Presentations (30%). Twice over the course of this class you will be required to present a poster based on a published empirical article from your research area of interest that uses methods discussed in class. Both poster presentations are worth 15% of your grade. The first presentation will focus on exploratory methods and the second on confirmatory methods. On the day of the poster presentation, you will bring a paper poster printed to class, and turn in a pdf version of your poster on canvas to be graded. Posters can be collaborative, and if you turn in a poster with a classmate, you both get the same grade. Your poster should briefly highlight the following areas of your chosen study:

1. Scientific context / theoretical framing
2. Data source
3. Tasks / measures
4. Factor analytic modeling procedures and results
5. Discussion of results substantively

Note: Poster printers are available in the library and in the biology/genetics building here at DU. I will bring some tape but bringing tape to hang posters is a huge help.

Lab Activities (50%). Lab activities are completed using provided datasets and statistical software in-class or in the week following the scheduled in-class lab time. Labs can be collaborative, and if you turn in your lab with a classmate, you both get the same grade. I see the labs as an opportunity the "get your hands dirty" doing a psychometric analysis, and they are the main way that you get to practice your analyses and interpretation in class. There are four of them over the quarter, each worth 12.5% of the grade.

Note on Grades: Grades will not be changed unless a computational error has been made. No grades will be dropped. There will be no extra credit. Grades of "Incomplete" will not be given unless the student can demonstrate that near catastrophic events have led to a cause of extreme hardship

RMS 4924 CLASS SCHEDULE: WINTER 2020

Class Number	Class Day	Topic	Readings for Discussion	Assignment Due
1	January 7th	What is a factor?		
2	January 14th	Triad and centroid methods / Triad and Centroid lab (Lab 1)		
3	January 21st	PCA and EFA	Hartwell & Kaplan, 2018 Dombrowksi et al., 2016	Lab 1; Quiz 1
4	January 28th	PCA and EFA Lab (Lab 2)		
5	February 4th	Midterm Poster Presentations		Lab 2; Quiz 2
6	February 11th	CFA	Flake et al., 2015 Lee et al., 2010	
7	February 18th	CFA Lab (Lab 3)		
8	February 25th *IES Grant Panel: Class covered by Yixiao Dong*	Measurement Invariance	Greiff et al., 2013 Guhn et al., 2018	Lab 3; Quiz 3
9	March 3rd	Measurement Invariance Lab (Lab 4)		
10	March 10th	Final Poster Presentations		Lab 4; Quiz 4