UPDATED: 5 FEB 2019

Course Syllabus
EPsy 8266: Statistical Analysis Using Structural Equation Models

Spring 2019, 3 Credits
T/Th 11:15 AM – 12:30 PM
Peik Hall 315
Prerequisite: EPSY 8252 or equivalent
Web site: http://cddesja.github.io/epsy8266

Chris Desjardins

RMCC
E-mail: cdesjard@umn.edu

Office hours: Th 1:00 – 2:00 or by appt.
Office location: ICD 226

Ethan Brown - TA

E-mail: brow3821@umn.edu

Office hours: M 11:20 – 12:10 or by appt.
Office location: Elliot S402

College of Education & Human Development Mission Statement

The mission of the University of Minnesota College of Education and Human Development is to contribute to a just and sustainable future through engagement with the local and global communities to enhance human learning and development at all stages of the life span.

Department Mission Statement

Educational psychology involves the study of cognitive, emotional, and social learning processes that underlie education and human development across the lifespan. Research in educational psychology advances scientific knowledge of those processes and their application in diverse educational and community settings. The department provides training in the psychological foundations of education, research methods, and the practice and science of counseling psychology, school psychology, and special education. Faculty and students provide leadership and consultation to the state, the nation, and the international community in each area of educational psychology. The department's scholarship and teaching enhance professional practice in schools and universities, community mental health agencies, business and industrial organizations, early childhood programs, and government agencies.

Program Mission Statement
Quantitative Methods in Education

To prepare students to become high quality professionals in educational measurement, evaluation, statistics, and statistics education, through excellence in teaching, research, and service; and through investigating and developing research methodology in education.

Course Description

Quantitative techniques using manifest/latent variable approaches for analysis of educational/social science data. Introduction to structural equation modeling approaches to multiple regression, factor analysis, path modeling. Developing, estimating, interpreting structural equation models.

Instructional strategies include small-group activities, discussion, lectures, and simulation. **If you have a laptop and can bring it, please do!**

Course Goals, Objectives and Expectations

1. To be able to understand, interpret, and evaluate a variety of structural equation models.
2. To be able to understand the measurement and structural components of structural equation models.
3. To be able to use R and lavaan to estimate a variety of structural equation models.
4. To be able to express models using path diagrams and mathematical notation.
5. To be able to reproduce findings from papers with published data and critique published structural equation models.
6. To be able to run simulations to check modeling assumptions and estimate power.
7. To be able to test theories of mediation and moderation using path analysis.

Textbooks and Materials

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). New York, NY: Guildford Press. **REQUIRED**

Bollen, K. A. (1989). *Structural equations with latent variables*. New York, NY: John Wiley & Sons. OPTIONAL

In this course, I will try to bridge the gap between these two books. Sometimes Kline isn't mathematical enough, while Bollen usually is too mathematical. I will draw heavily from these books in class.

I will also post additional, non-required, readings on the course website.

R Programming Language

R is a free and open-source programming language for statistical computing and graphics. R will be used throughout the semester for in-class activities, out-of-class assignments, and the final course project. This course will largely rely on base R functions for simulations, power analyses, and statistical modeling. You will be expected to write your own code/functions by adapting code/functions used during activities and in course notes for your assignments and the final project.

Regarding R, I expect that my students come in with a mix of experiences, interests, and phobias with R. I will try to teach to the lowest common denominator and you do not need to have outside R experience to succeed. All the R code needed to complete the course will be provided for you. However, you are expected to try and learn R and it's necessary to try and understand what the code is doing so that you can 1) know the model that is being fit and 2) be able modify the code later. If you find R to be a daunting component of this course, please come and see me so that we can talk about some good resources for you.

For structural equation modeling, this course will use lavaan. The lavaan, **la**tent **va**riable **an**alysis, package was selected because of its ease of use, similarity to Mplus syntax, and its active

development and support[1]. Depending on the speed that we move through the course material, we may also use the nlsem package.

I will use RStudio throughout the course and strongly recommend that you do the same.

Assignments

Lab Assignments

There will be a total of eight lab assignments. These lab assignments will all involve using R in some manner. You are welcome to work in small groups of up to three. **If you work in a small group, you must turn in a single assignment with all the group members names on it.** By signing your name on the group assignment, you attest that you 1) contributed to the work and that 2) you understand and can justify your group's responses to the questions.

For the labs, you will turn in **either your R script and a text document with your responses** or **a compiled RMarkdown document**. The RMarkdown document enable you to embed your output, code, and responses within a single document. This will allow me to more easily reproduce your analyses if you go astray. If you can, I would strongly recommend using RMarkdown. Regardless of your decision, please thoroughly comment your code.

Each day that an assignment is late, 10% of your total score will be deducted. After 10 days, an assignment will not receive credit. If you are not able to turn in your homework on time for a legitimate reason, please send an e-mail in advance.

Final Project

In addition to the labs, you will be required to work on a final project using your own data set and **you are expected to complete project alone**. More details about this assignment will be provided in the middle/end of February. However, you should begin to identify a data set as soon as possible.

Course Outline, Topics & Assignments

Tentative Course Schedule:

1/22	*Course Overview and Introduction* Readings: Kline, Ch 1
1/24 – 2/7	*Regression review, R, Simulations, and Bootstrapping* Readings: Kline, Ch. 2 – 4 **Lab 1 – "Introduction to R, lavaan, and Regression" due 2/4** **Lab 2 – "Simulation and Bootstrapping" due 2/14***
2/12 – 2/21	*Observed Variable Path Analysis* Readings: Ch 6 – 7 **Lab 3 – "Mediation and Path Analysis" due 2/28**
2/26 – 3/7	*Confirmatory Factor Analysis*

[1] https://groups.google.com/forum/#!forum/lavaan

	Readings: Kline, Ch 9 & 13 **Lab 4 – "Confirmatory Factor Analysis" due 3/14**
3/19 – 4/4	*Structural Regression Models* Readings: Kline, Ch 10 & 14 **Lab 5 – "Structural Regression Model" due 4/2**
4/9 – 4/16	*Latent Means and Latent Growth Models* Readings: Kline, Ch 15 **Lab 6 – "Power Analysis via Simulation" due 4/9**
4/18 – 4/25	*Measurement Invariance and Multi-Group Models* Readings: Kline, Ch 16 **Lab 7 – "Latent Growth Curve Models" due 4/18**
4/30 – 5/2	*Interactions and Multilevel SEM* Readings: Kline, Ch 17 **Lab 8 – "Measurement Invariance" due 4/30**
5/9	**Final Project Due**

Note. I will be out of town on the 2/12, 2/14, and 4/4. Geoff Maruyama will teach on the 2/12 and 2/14 and I will try and find a substitute for 4/4 as well. This schedule is ambitious, likely too ambitious, and we will likely not get to interactions and multilevel SEM this semester.

Readings
Please try and keep up with the course readings. My lecture notes and course materials will build on Kline, but will try not to just repeat Kline. Kline is a very good book and I strongly encourage you to read it.

Final Exam:
There is NO midterm or final examination, but a final paper that requires students to effectively use the methods as they can be applied to the discipline and research area of each student.

Attendance Policy:
Attendance is not required, but the quickest way to get lost and behind in the course is to not attend classes, for the work is cumulative, and builds upon prior classes. Even topics that seem elementary are tied to later, more complex classes and their methods, so even ones that seem to cover a topic that one has covered in another course may be presented differently. Additionally, many of the in-class activities will relate to out-of-class assignments. If you miss a class, I strongly recommend that you contact me or another student to find you what you missed.
Bottom line: attendance is **highly** recommended.

Workload Expectation (Policy: Expected Student Academic Work per Credit)
Student workload expectations per undergraduate credit. For fall or spring semester, one credit represents, for the average University undergraduate student, three hours of academic work per week.
Graduate School and Professional School Courses. It is expected that the academic work required of Graduate School and professional school students will exceed three hours per credit per week.

Evaluation of Student Performance

Your lab assignments, and project will be combined using a weighted average grading scheme with the corresponding weights given below. Final letter grades will then be assigned based on the given scale (there will be no rounding).

Grading Standards:

Grades are criterion-referenced and not norm-referenced. Therefore, there will be no curve in the class. The lab assignments are worth 60% (7.5 pts each) and the final project is worth 40%.

The final grade is recorded according to U of MN definition of grades:

93-100%	A	For exceptional work, well above the minimum criteria
90-92%	A-	For outstanding work, well above the minimum criteria
87-89%	B+	For excellent work, significant above the minimum criteria
83-86%	B	For work above the minimum criteria
80-82%	B-	
77-79%	C+	
73-76%	C	For work which meets the course requirements in every respect
70-72%	C-	
67-69%	D+	
63-66%	D	Worthy of credit even though it fails to meet the course requirements
0-62%	F	Failed to meet minimum course requirements

Make-up policy

Because the assignments are completed outside of class time, all assignments should be completed in a timely manner regardless of whether class is attended. For unavoidable circumstances, once assignments are discussed in class, alternative assignments would need to be completed.

Incomplete policy

Incompletes need to be negotiated based on individual circumstances with the instructors prior to the end of the course.

Extra credit policy

There are no opportunities for extra credit. If assignments are missed for legitimate reasons, alternative assignments will be given.

How to Access Your Grades

You can view your grades on the Grades tab in MyU: Academics. Additional instructions can be found on One Stop at https://onestop.umn.edu/academics/viewing-grades.

Returning Papers, Exams, and Projects

Assignments will be returned as quickly as possible, often during the class. For the final project, please include an addressed and stamped (if U.S. mail) envelope if you want the project sent to you.

Any papers/assignments not picked up by the end of the fourth week of the following fall semester in 250 Ed Sciences may be discarded and no longer available.

Student Conduct Code

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community. As a student at the University you are expected adhere to Board of Regents Policy: Student Conduct Code. To review the Student Conduct Code, please see: http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf.

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Use of Personal Electronic Devices in the Classroom

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: http://policy.umn.edu/education/studentresp.

Scholastic Dishonesty

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code: http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf) If it is determined that a student has cheated, the student may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: http://policy.umn.edu/education/instructorresp.

The Office for Community Standards has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: https://communitystandards.umn.edu/avoid-violations/avoiding-scholastic-.... If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether

collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

Makeup Work for Legitimate Absences:

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see: http://policy.umn.edu/education/makeupwork.

Appropriate Student Use of Class Notes and Course Materials

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see: http://policy.umn.edu/education/studentresp.

Grading and Transcripts

The University utilizes plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following:

A	4.000 - Represents achievement that is outstanding relative to the level necessary to meet course requirements
A-	3.667
B+	3.333
B	3.000 - Represents achievement that is significantly above the level necessary to meet course requirements
B-	2.667
C+	2.333
C	2.000 - Represents achievement that meets the course requirements in every respect
C-	1.667
D+	1.333
D	1.000 - Represents achievement that is worthy of credit even though it fails to meet fully the course requirements
S	Represents achievement that is satisfactory, which is equivalent to a C- or better.

For additional information, please refer to: https://policy.umn.edu/education/gradingtranscripts.

Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an

intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy:
http://regents.umn.edu/sites/regents.umn.edu/files/policies/SexHarassment.pdf

Sexual Assault and higher education: Training modules and information

The Department of Educational Psychology supports the efforts of the University of Minnesota towards prevention of sexual assault. We encourage all students to participate in the free online training that has been established for undergraduate students and graduate students. The training highlights pertinent issues regarding sexual assault, including, but not limited to: defining healthy relationships, consent, bystander intervention, and gender roles. Haven (for undergraduate students under the age of 25) and Haven Plus (for undergraduates over 25, graduate students, and professional students) is the training available at no cost to University of Minnesota students. Additionally, to learn more about how you can help reduce sexual assault at the University of Minnesota, please visit the Aurora Center.

Equity, Diversity, Equal Opportunity, and Affirmative Action

The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy:
http://regents.umn.edu/sites/regents.umn.edu/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations

The University of Minnesota views disability as an important aspect of diversity, and is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you have, or think you have, a disability in any area such as, mental health, attention, learning, chronic health, sensory, or physical, please contact the DRC office on your campus (UM Twin Cities - 612.626.1333) to arrange a confidential discussion regarding equitable access and reasonable accommodations.
- Students with short-term disabilities, such as a broken arm, can often work with instructors to minimize classroom barriers. In situations where additional assistance is needed, students should contact the DRC as noted above.
- If you are registered with the DRC and have a disability accommodation letter dated for this semester or this year, please contact your instructor early in the semester to review how the accommodations will be applied in the course.
- If you are registered with the DRC and have questions or concerns about your accommodations please contact your (access consultant/disability specialist).

Additional information is available on the DRC website: https://diversity.umn.edu/disability/ or e-mail drc@umn.edu with questions.

Mental Health and Stress Management:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: http://www.mentalhealth.umn.edu.

Academic Freedom and Responsibility: for courses that do not involve students in research

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".

This publication/material is available in alternative formats upon request. Please contact the Educational Psychology Department, 250 Education Sciences Building, 612-624-6083 or edpsych@umn.edu.