CJ 789: Advanced Statistics II

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Office hours:	Monday 3:00-4:00 PM; Tuesday 3:00-4:00 PM *except* January 22, February 19, March 18, April 22 (faculty meetings); and by appointment
Class times:	Tu 12:00-2:50 PM
Location:	CJC A-181; some days we will move to the lab in CJC A-111.

Course Objectives:

(1) To provide you with sufficent knowledge of multilevel modeling (also known as hierarchical linear modeling or HLM) and structural equation modeling (SEM) to prepare you to understand research using these techniques in criminology and criminal justice.
(2) To help you become sufficiently proficient in the implementation of HLM and SEM to use them in your own research when it is appropriate to do so (and to avoid their use when it is not appropriate).
(3) Depending on what you bring to the course in terms of substantive interests and the data to explore those interests, to produce one paper suitable for presentation and subsequent publication.

Course Philosophy

Students in this course will typically be graduate students in criminal justice (possibly with backgrounds in other social or behavioral sciences) who have had two courses in statistics (frequency distributions, descriptive statistics, contingency tables or crosstabulation, bivariate correlation and regression, nonparametric statistics, and analysis of variance; plus ordinary least squares regression analysis, multiway analysis of variance - not the same, incidentally, as multivariate analysis of variance - and covariance, logistic regression, factor analysis, and a basic understanding of reliability and validity), and who are ready to learn the more advanced techniques that now constitute standard operating procedure in much of statistical analysis in social science research. There is a brief and selective review of basic statistics, focusing on concepts that will be emphasized in SEM and HLM, but students are expected to know most or all of this material already. By the end of this course, you should understand

(1) how to select the appropriate statistical procedures (SEM or HLM) to analyze a research problem,
(2) how to compute the statistics using appropriate software (generally not SPSS; HLM for multilevel modeling, MPlus and maybe a bit of LISREL for SEM) in a Windows environment, and

(3) how to interpret the statistical output to answer research questions and test research hypotheses.

The mathematical content of the course is intended to serve these three goals; it is not the focus of the course. In this course, it is not only (or even primarily) the mathematics and computer applications, but also the substantive content and the ability to translate the computer output into social-scientifically meaningful English prose, that are important.

The coverage in the course will alternate between HLM and SEM, in part because there are some concepts that overlap between the two (SEM using Mplus can be used for multilevel analysis, but HLM is more convenient; and multilevel modeling with HLM can be used for analysis with latent variables, but Mplus is more convenient), and in part to make sure that we get to the "basics" of both techniques earlier in the course.

The Statistics Lab

Periodically (about once every two weeks or so) we will meet in the Criminal Justice Statistics Lab in CJC A111 for sessions involving hands-on practice in using HLM and MPlus; and you will need access either to the lab or to a site licensed copy of HLM and MPlus in order to complete the computer assignments for the course. Based on past experience, I suspect that this is where most of the real learning will occur. When we do go to the lab, we will begin in the classroom for at least 30 minutes (since another class has the lab until 12:30 PM).

Grading and Assignments

(1) Computer Assignments. There will be four computer assignments. Data will be provided, but if you have your own data to analyze, we can tailor the assignment specifically to your own substantive interests. Before you try to analyze your own data, however, you need my authorization (this is just to make sure that the data and the research problem are suitable to the techniques we will be using - a rare case in which I will allow the method to drive the substantive problem instead of the reverse). The four assignments will be designed to give you practice with the main features of the software, including interpretation of the output. An important part of the assignment will be to translate the numbers into English. If you have a research problem that combines elements of more than one of the computer assignments, we may, by mutual agreement, combine two computer assignments into a single assignment. Also, depending on your substantive interests, I may, if you wish, give you a specific research problem to investigate.

Your familiarity with the computer will be assumed; it is up to you to take whatever measures are necessary to make this assumption correct. Appropriate measures include doing the reading, asking me questions, and seeking whatever outside help is necessary, including tutoring if appropriate. Computer assignments will be due two weeks after they are assigned. If you don't see me at least once or twice during these two weeks, one of us is being either unwise or uncommunicative. Talk to me. It helps. Really. A lot. The expectation is not that you go into hiding until the assignment is done; the expectation is that you do what you need to do (including

letting me know when there is something you do not understand) to complete the assignments on time. You are welcome (actually, encouraged) to work together and help each other in learning how to run the software and how to interpret the results.

(2) Oral Presentation. The final two weeks of the course will be devoted to presentations of the work you have done using HLM and SEM. You will choose one of the computer assignments you have done, present (a) the research problem, (b) the theoretical background, if appropriate, (c) the results of the analysis, and (d) the conclusion, much as you would for a presentation at the American Society of Criminology or the Academy of Criminal Justice Sciences annual meetings. Unless there is reason to do otherwise, I would like to schedule the HLM presentations on April 29 and the SEM presentations on May 6 (since we will finish HLM first).

(3) Final Examination. Formally, the final examination period is Tuesday 13 May 2008 from 11:00 AM to 1:00 PM. The fourth computer assignment constitutes the final examination for purposes of this course. Therefore, the fourth computer assignment is due Tuesday 13 May 2008 at 1:00 PM.

(3) Calculation of grades: Each computer assignment is worth 20 points; the oral presentation is also worth 20 points. Grades will be calculated as a percentage of total points.

(4) Early and late assignments and presentations: I will cheerfully accept early computer assignments, and if we need to schedule an oral presentation early, I will do my best to accommodate that need. There is no penalty to your final grade for a late computer assignment, but the course gets harder, not easier, as we proceed, so you will deeply regret not getting the computer assignments done on time (and will probably get stuck with an incomplete for the course - not a good thing, especially if you are counting on funding from the College).

Other Policy Issues

Now some boilerplate syllabus material. It should be unnecessary at this level, but don't make the mistake of not taking it seriously.

Attendance policy: OK, this topic is strongly recommended for inclusion in the syllabus, but you are graduate students; do I really need to tell you that in a graduate seminar, your absence will be noted and cannot possibly have a positive impact on your grade? I don't grade on attendance, but attendance *will* matter.

Tobacco products: Use of tobacco products is not allowed in the classroom at any time. The first violation of this policy will result in a warning; the second violation will result in your dismissal from the class.

Recording classes: Students are free to make audio recordings of class lectures and discussions with the understanding that no copies or transcripts of these lectures or recordings are sold or

otherwise distributed for use by others. The instructor also reserves the right to record classroom lectures and discussions.

Cell phones and other electronic equipment: Please make sure that cell phones and any other electronic communication devices are set to "silent" mode during class.

Academic honesty: The faculty of the College of Criminal Justice expects students to conduct their academic work with integrity and honesty. Acts of academic dishonesty will not be tolerated and can result in failure of a course and dismissal from the university. Academic dishonesty includes but is not limited to cheating on a test, plagiarism, collusion (the unauthorized collaboration with another person in preparing work offered for credit), the abuse of resource materials, and misrepresentation of credentials or accomplishments as a member of the college. The University's policy on academic honesty and appeal procedures can be found in the manual entitled Student Guidelines, distributed by the Division of Student Services (Reference Section 5.3 of the SHSU Student Guidelines). Students are encouraged to review the statements presented in the SHSU Guidelines that refer to instances of academic dishonesty, available in the Office of Student Life or online at

http://www.shsu.edu/students/guide/studlife.html#conduct.

Disabled student policy and services for disabled students: In accordance with SHSU policy, "Students with a disability which affects their academic performance are expected to arrange for a conference with the instructor in order that appropriate strategies can be considered to ensure that participation and achievement opportunities are not impaired." The physically impaired may contact the Director of the Counseling Center as chair of the Committee for Continuing Assistance for Disabled Students by telephone (ext. 1720). Any student in the class may request special learning assistance by submitting a written statement describing your particular need. If necessary, you will be directed to the SHSU Counseling Center for additional assistance. For more detail on university policy regarding special learning needs, see the website at http://www.shsu.edu/students/guide/studlife.html#disabilities; see also http://www.shsu.edu/~vaf_www/aps/811006.html regarding disabled student policy, and http://www.shsu.edu/~counsel/sswd.html regarding services for disabled students.

Student absences on religious holy day policy: Consistent with the Texas Education Code and SHSU policy 861001, students who desire to be absent from a scheduled class in order to observe a religious holy day will present the professor with a written statement concerning the religious holy day(s). Should the religious holy day fall on a day when an assignment is due, the assignment will be due on the next class day. This is the one and only exception to the exam makeup policy.

Bottom Line

By the end of this course, I want all of you to be competent in selecting, computing, and interpreting appropriate statistics involving HLM and SEM. I will be absolutely delighted if I

can justify giving everyone an A at the end of the course; that will mean that you did the reading, worked on the assignments, and had the good sense to ask for explanations whenever there was something you did not understand.

REQUIRED TEXTS:

(A) Multilevel Modeling

T. A. B. Snijders and R. J. Bosker (1999) Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling (Thousand Oaks, CA: Sage), ISBN 0-7619-5890-8. I think this text provides the best balance between breadth of coverage and readability, although sometimes the math in this book is tough going.

D. A. Luke (2004) Multilevel Modeling (Thousand Oaks, CA: Sage), ISBN0-8039-3896-9. This is a much lighter treatment of multilevel modeling, hits all the high points, but not as thorough as Snijders and Bosker. You may want to read this first, then the relevant chapter in Tabachnick and Fidell (chapter 15), then Snijders and Bosker; and then come back and read Tabachnick and Fidell and Luke (2004) again.

S. Raudenbush, A. Bryk, Y. F. Cheong, and R. Congdon (2004) HLM 6: Hierarchical Linear and Nonlinear Modeling (Lincolnwood, IL: Scientific Software International), ISBN 0-89498-054-8. This is simply a computer manual for the HLM 6 software.

(B) Structural Equation Modeling

R. B. Kline (2005) Principles and Practice of Structural Equation Modeling, second edition (New York: Guilford Press), ISBN 1-57230-690-4. This is a good general text on SEM, heavy on the concepts, light on the math, and not much on the software. For SEM assignments, read this first.

T. Raykov and G. A. Marcoulides (2006) A First Course in Structural Equation Modeling, second edition (Mahwah, NJ: Erlbaum - which has since been bought out by another publisher, I forget which one), ISBN 0-8058-5588-2. A little more math and a lot more software (including Mplus and LISREL) than Kline. For SEM assignments, read this second.

L. K. Muthen and B. O. Muthen (1998-2007) MPlus: Statistical Analysis With Latent Variables, User's Guide, fifth edition (Los Angeles, CA: Muthen and Muthen), no ISBN; either this or the fourth edition (which should work about as well for this course) are available as an electronic file. This is simply a computer manual for the Mplus software. For SEM assignments, read this last, when you are ready to actually do some analysis. The nice thing about this manual is that it pretty much gives you simple "cookbook" setups for most of the analyses you will want to do.

S. E. Finkel (1995) Causal Analysis With Panel Data (Thousand Oaks, CA: Sage), ISBN 0-8039-3896-9. This is a brief introduction to linear panel analysis, including SEM applications, and complements the coverage in Kline.

I will also be assigning some chapters from my Handbook of Longitudinal Research (Greenberg, Luke, Finkel, Worrall, Stoolmiller, and a couple of my own chapters, all dated 2008) which I will provide in electronic form [but since I have a daughter in college, I won't object if you decide to pay the exorbitant price to buy the book :-)], and I may from time to time assign additional articles to further illustrate the application of HLM and SEM in criminological and criminal justice research.

RECOMMENDED TEXT:

Barbara G. Tabachnick and Linda S. Fidell (2007) Using Multivariate Statistics, fifth edition (Boston: Pearson/Allyn and Bacon)g, ISBN 0-205-45938-2. This is good for reviewing multivariate statistics, and also has one chapter each on multilevel modeling (chapter 15) and structural equation modeling (chapter 14) that may help by giving a more concise overview. Probably not worth buying the book just for this course (see about getting photocopies of chapters 14-15), but a useful reference in its own right.

NEITHER REQUIRED NOR RECOMMENDED (BUT NOTED IN THE COURSE OUTLINE)

Craig A. Mertler and Rachel A. Vannatta (2005) Advanced and Multivariate Statistical Methods: Practical Application and Interpretation, third edition (Glendale, CA: Pyrczak Publishing), ISBN1-884585-59-0. This is a good statistical workbook with more emphasis on SPSS than is found in Tabachnick and Fidell; in case you want to review statistical material on regression and factor analysis and include some SPSS practice in the review (or if you just find Mertler and Vannatta easier to follow than Tabachnick and Fidell), I have noted the relevant chapters; but although some background in SPSS is assumed, SPSS will not be used in this course.

NOTE: I will also be doing an independent study covering event history (survival) analysis and time series analysis (separate course outline will be provided); let me know if you are interested.

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COURSE OUTLINE, READING ASSIGNMENTS, AND DUE DATES FOR COMPUTER ASSIGNMENTS

	Reading Assignment	Topics [Note: distinct multiple topics will be listed in order of priority and importance using (a) for top priority, (b) for second priority, etc.; please go in the sequence indicated.]
Jan 22	Kline 1-3 (Recommended reviews: Tabachnick and Fidell 1-7; Mertler and Vannatta 1-7; Carmines and Zeller, Sage monograph on Reliability and Validity Assessment, all; Allison, Sage monograph on missing data, all)	(a) Conceptual overview (Kline 1; Tabachnick and Fidell 1-2; Mertler and Vannatta 1-2); (b) Review of correlation and regression (Kline 2; Tabachnick and Fidell 3, 5; Mertler and Vannatta 7; see also Tabachnick and Fidell 6-7, Mertler and Vannatta 4-6); (c) Data screening, missing data, reliability and validity (Kline 3; Tabachnick and Fidell 4; Carmines and Zeller; Allison; Mertler and Vannatta 3)
Jan 29	Luke 1 and Appendices; Snijders and Bosker 1-3 (in chapter 3, focus on pp. 13-30); (Tabachnick and Fidell 15.1-15.3).	Introduction to multilevel modeling: terminology; clustered samples and levels; aggregation and disaggregation ; intraclass correlation; design effects; reliability of aggregated variables; between groups, within groups, and multilevel regression
Feb 5	Luke 2; Snijders and Bosker 4-7 (also 15: software); Raudenbush et al. 1-2; (Tabachnick and Fidell 15.4-15.8).	The two-level model: random intercepts; random slopes; testing and model specification; explanatory power of the model; multilevel modeling software; HLM for the two-level model.
Feb 12	Luke 3; Snijders and Bosker 5.5, 14 Raudenbush et al. 3-6 [Luke (2008)] [Menard (2008a)]	(a) Three-level models (Luke 3; Snijders and Bosker 5.5; Raudenbush et al. 3-4). (b) Generalized multilevel modeling for discrete response variables (Luke 3, Snijders and Bosker 14, Raudenbush et al. 5-6).
Feb 19	Luke 3; Snijders and Bosker 12; [Luke (2008)] [Menard (2008a)]	Multilevel modeling of longitudinal data (Luke 3; Snijders and Bosker 12; Raudenbush et al. 1-4; Luke 2008; Menard 2008)
Feb 26	Kline 4; Raykov and Marcoulides 1-2; Muthen and Muthen 1-2; (Tabachnick and Fidell 13-14); (Mertler and Vannatta 8-9).	Overview of structural equation (SEM) models; overview of SEM software; mathematics of SEM models; methods of parameter estimation; identification; fit indices and modification indices; MPlus and LISREL syntax.
Mar 4	Kline 5-7; Raykov and Marcoulides 3-4; Muthen and Muthen 3-4; (Tabachnick and Fidell 13-14); (Mertler and Vannatta 9).	(a) Path analysis (Kline 5-6; Raykov and Marcoulides 3; Muthen and Muthen 3; Tabachnick and Fidell 14; Mertler and Vannatta 8) (b) Confirmatory Factor Analysis (Kline 7; Raykov and Marcoulides 4; Muthen and Muthen 4; Tabachnick and Fidell 13-14; Mertler and Vannatta 9)
Mar 11	NONE	ACJS MEETING (CINCINNATI)

Mar 18	Kline 8-9; Raykov and Marcoulides 5; Muthen and Muthen 5; (Tabachnick and Fidell 14)	Structural regression models, nonrecursive models.
Mar 25	Kline 10; Raykov and Marcoulides 6; Muthen and Muthen 6; [Stoolmiller (2008)]	Longitudinal analysis with structural equation models: latent change analysis.
Apr 1	Finkel (all); Muthen and Muthen 8; Greenberg (2008); Worrall (2008); Menard (2008b) Finkel (2008)	Longitudinal analysis with structural equation models: linear panel analysis; digression on pooled cross-sectional and time series fixed effects and random effects models.
Apr 8	Snijders and Bosker 11; Raudenbush et al. 10-12.	Additional topics in multilevel modeling: (a) Cross-classified random effect models (Snijders and Bosker 11; Raudenbush et al. 10-11); (b) Graphing data and models (Raudenbush et al. 12).
Apr 15	Snijders and Bosker 8-10, 13; Raudenbush et al. 7-9.	Advanced topics in multilevel modeling: (c) Hierarchical multivariate linear modeling (Snijders and Bosker 13; Raudenbush et al. 7-8); (d) Heteroscedasticity, assumptions, statistical power, diagnostics, design of multilevel model studies (Snijders and Bosker 8-10); (e) Latent variables, multiple imputation, v-known models (Raudenbush et al. 9).
Apr 22	Kline 11-13; Muthen and Muthen 7-10	Advanced topics in structural equation modeling: multi-sample SEM, problems in SEM, multilevel modeling with SEM, mixture modeling with SEM, Monte Carlo simulation studies.
Apr 29	–	Student presentations
May 6	–	Student presentations