

SC705: ADVANCED STATISTICS

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COURSE DESCRIPTION

This applied course is designed for graduate students with a prior background in statistics at the level of SC703: Multivariate Statistics (or its equivalent). This means that students should have considerable experience with multiple regression and an ability to conduct such analyses using some statistical software. The major topics of the course will include hierarchical linear modeling and structural equation modeling. We will use HLM 6 and LISREL 8.8 to perform the analyses.

The goals of the course are to develop the skills necessary to identify an appropriate technique, estimate models, and interpret results for independent research and to critically evaluate contemporary social research using advanced quantitative methods. The course will be applied in the sense that we will focus on estimating models and interpreting the results, rather than understanding in detail the mathematics behind the techniques. I hope that the course will provide you with a solid foundation in advanced quantitative methods, which is in high demand in many fields, both in and out of academia. For those of you in the Sociology Department, the course can also provide a foundation for the “Advanced Quantitative Methods” area examination.

COURSE POLICIES

For each topic in the course, I will give a lecture focusing on the reasoning behind the techniques and an interactive review of the syntax used to do the analyses as well as the generated output. Throughout that process, you will get a chance to practice conducting the analyses and interpreting the results. We will also discuss and critically evaluate published research based on the various techniques. Make sure that you carefully read these examples of published research before class and be prepared to discuss them. The course is based on an interactive relationship between the instructor and students, as well as on collaboration among the students. You are strongly encouraged to ask questions and discuss the material in class. I also encourage collaboration among the students. Please feel free to help each other when running analyses for assignments. However, everyone must turn in their own report and statistical output.

I also would like to stress that you are always welcome to come and see me with any additional questions. If I am not in my office, email is the best way to get in touch with me – I check my email very often. You are also welcome to call me either in my office or at home (any time between 9 AM and 10 PM); however, be prepared to leave your name and number if I am not available to pick up the phone. Also, please check the course website regularly: typically, each week I will post course notes for you to print out. And make sure to check your email, too – from time to time I may send some announcements.

Finally, a note on feedback. I would like to know how I could make this course experience as useful and interesting as possible. Therefore, every week in the end of class I will ask you to submit a sheet of paper with the date and at least one sentence of reaction to that class meeting, indicating what you learned, or something you liked or did not like, found interesting or controversial, found clear or too simplistic, or found confusing and in need of further (or better) explanation. You may also submit comments on the course in general.

REQUIRED MATERIALS:

Books:

The following books should be available for purchase at the BC bookstore. They are also placed on reserve at the library.

1. Luke, Douglas A. 2004. *Multilevel Modeling*. Thousand Oaks, CA: Sage Publications.
2. Kline, Rex B. 2005. *Principles and Practice of Structural Equation Modeling*. 2nd edition. New York: The Guilford Press.

Other readings:

Other required readings (listed below in the course outline) will be available on electronic reserve in the library: see <http://www.bc.edu/libraries/services/reserves/>

COURSE REQUIREMENTS AND GRADING:

There will be two assignments for the course, each worth 50% of your grade. Assignment 1 covers HLM, and assignment 2 covers SEM. These assignments will involve selecting a research question and variables, running analyses, and writing up the results like you would for a journal publication (including introduction, data and methods, and results sections). I will provide data, although you can use your own data if they are appropriate for the technique (see me in advance). My intention is that these assignments will assist in the completion of the advanced quantitative methods area exam in sociology and/or will facilitate your own independent research projects.

Each assignment will consist of two drafts, to be submitted electronically (by email or using MyFiles). If you turn in the first draft by the due date, I will comment on it, assign a temporary grade, and return it to you. At that point, we will also discuss the common problems and mistakes. You will then get a chance to submit a revised draft. If you are satisfied with your temporary grade, you do not need to revise the assignment – just let me know. This system will allow you to push yourself beyond your comfort level without worrying how it will affect your grade. For example, you might try to interpret some of the results not required for the assignment or you might decide to present the results in a more meaningful and perhaps less conventional way. The letter grades for the final drafts of your assignments will be determined as follows:

93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
60-79	C
0-59	F

COURSE OUTLINE.

September 6: Introduction to the Course and to Hierarchical Linear Modeling (HLM)

September 13: Two-level HLM Models

Luke, Douglas A. 2004. Chapters 1 and 2 (pp.1-15) in *Multilevel Modeling*. Sage.

Raudenbush, Stephen W. et al. 2004. Chapter 2 in *HLM 6: Hierarchical Linear and Nonlinear Modeling*. Scientific Software International, Inc.

September 20: HLM Model Building Strategies

Luke, Douglas A. 2004. Chapter 2 (pp.15-33) in *Multilevel Modeling*. Sage.

Raudenbush, Stephen W. et al. 2004. Chapter 12 in *HLM 6: Hierarchical Linear and Nonlinear Modeling*. Scientific Software International, Inc.

September 27: HLM Diagnostics

Luke, Douglas A. 2004. Chapter 2 (pp.33-53) in *Multilevel Modeling*. Sage.

Snijders, Tom A. B., and Roel J. Bosker. 1999. Chapter 9 from *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Thousand Oaks, CA: Sage.

Huffman, Matt L. 2004. "More Pay, More Inequality? The Influence of Average Wage Levels and the Racial Composition of Jobs on the Black-White Wage Gap." *Social Science Research*, 33, 498-520.

October 4: HLM Models for Categorical and Count Data

Luke, Douglas A. 2004. Chapter 3 (pp.53-58) in *Multilevel Modeling*. Sage.

Snijders, Tom A. B., and Roel J. Bosker. 1999. Chapter 14 from *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Thousand Oaks, CA: Sage.

Litwin, Kenneth J. 2004. "A Multilevel Multivariate Analysis of Factors Affecting Homicide Clearances." *Journal of Research in Crime and Delinquency*, 41, 327-351.

October 11: Three-Level Models and Growth Curve Modeling using HLM

*****Assignment 1 first draft due*****

Luke, Douglas A. 2004. Chapter 3 (pp.59-72) in *Multilevel Modeling*. Sage.

Baldwin, Scott A., and John P. Hoffmann. 2002. The Dynamics of Self-Esteem: A Growth-Curve Analysis. *Journal of Youth and Adolescence*, 31, 2, 101-113.

October 18: Introduction to Structural Equation Modeling (SEM) and LISREL

Kline, Rex B. 2005. Chapters 1-4 from *Principles and Practice of Structural Equation Modeling*. 2nd edition. New York: The Guilford Press.

Byrne, Barbara M. 1998. Using LISREL, PRELIS, and SIMPLIS. Chapter 2 (pp.43-87) from *Structural Equation Modeling with LISREL, PRELIS, and SIMPLIS*. Mahwah, NJ: Erlbaum.

October 25: Path Analysis

Kline, Rex B. 2005. Chapters 5-6 from *Principles and Practice of Structural Equation Modeling*. 2nd edition. New York: The Guilford Press.

Hochstetler, Andy, Daniel S. Murphy, and Ronald L. Simons. 2004. "Damaged Goods: Exploring Predictors of Distress in Prison Inmates." *Crime & Delinquency*, 50(3), 436-457.

November 1: Measurement Model and Confirmatory Factor Analysis

*****Assignment 1 final draft due*****

Kline, Rex B. 2005. Chapter 7 from *Principles and Practice of Structural Equation Modeling*. 2nd edition. New York: The Guilford Press.

Gouveia, Valdiney V., Miguel Clemente, and Pablo Espinosa. 2003. "The Horizontal and Vertical Attributes of Individualism and Collectivism in a Spanish Population." *The Journal of Social Psychology*, 4i(1), 43-63.

November 8: SEM with Latent Variables: Diagnostics and Model Building Strategies

Kline, Rex B. 2005. Chapter 8, 12 from *Principles and Practice of Structural Equation Modeling*. 2nd edition. New York: The Guilford Press.

Hoyle, Rick H. and Abigail T. Panter. 1995. "Writing about Structural Equation Models." Chapter 9 from Rick H. Hoyle (editor), *Structural Equation Modeling: Concepts, Issues, and Applications*. Thousand Oaks, CA: Sage Publications.

Beth A. Kotchick, Shannon Dorsey, and Laurie Heller. 2005. "Predictors of Parenting among African American Single Mothers: Personal and Contextual Factors." *Journal of Marriage and Family*, 67, 448-460.

November 15: Multigroup SEM

*****Assignment 2 first draft due*****

Kline, Rex B. 2005. Chapter 11 from *Principles and Practice of Structural Equation Modeling*. 2nd edition. New York: The Guilford Press.

Rick Kosterman, Kevin P. Haggerty, Richard Spoth, and Cleve Redmond. 2004. "Unique Influence of Mothers and Fathers on Their Children's Antisocial Behavior." *Journal of Marriage and Family*, 66, 762-778.

November 22: No class, Thanksgiving break

November 29: Mean Structures and Latent Growth Models

Kline, Rex B. 2005. Chapter 10 from *Principles and Practice of Structural Equation Modeling*. 2nd edition. New York: The Guilford Press.

Wright, John Paul, David E. Carter, and Francis T. Cullen. 2005. "A Life-Course Analysis of Military Service in Vietnam." *Journal of Research in Crime and Delinquency*, 42(1), 55-83.

December 6: Nonrecursive and Longitudinal SEM models

Kline, Rex B. 2005. Chapter 9 from *Principles and Practice of Structural Equation Modeling*. 2nd edition. New York: The Guilford Press.

Maruyama, Geoffrey M. 1998. Chapter 6 from *Basics of Structural Equation Modeling*. Thousand Oaks, CA: Sage Publications.

Johnson, L. M, Ronald L. Simons, Rand D. Conger. 2004. "Criminal Justice System Involvement and Continuity of Youth Crime: A Longitudinal Analysis." *Youth & Society*, 36, 3-29.

December 13: No class

*****Assignment 2 final draft due*****

ADDITIONAL RESOURCES

HLM:

- Anderton, Douglas L. and Deborah E. Sellers. 1989. A Brief Review of Contextual-Effect Models and Measurement. *Historical Methods*, 22, 3, pp. 106-115.
- Browne, William, and Jon Rasbach. 2004. Multilevel Modeling. Pp. 459-480 in Melissa Hardy and Alan Bryman (Eds.), *Handbook of Data Analysis*. Thousand Oaks, CA: Sage.
- DiPrete, Tomas A. and Jerry D. Forristal. 1994. Multilevel Models: Methods and Substance. *Annual Review of Sociology*, 20, pp. 331-357.
- Eversen, Gudmund R. 1991. *Contextual Analysis*. Newbury Park, CA: Sage Publications.
- Heck, Ronald and Scott Thomas. 2000. *An Introduction to Multilevel Modeling Techniques*. Mahwah, NJ: Erlbaum.
- Hedeker, Donald. 2004. An Introduction to Growth Modeling. Pp. 215-234 in David Kaplan (Ed.), *The Sage Handbook of Quantitative Methodology for the Social Sciences*. Thousand Oaks, CA: Sage.
- Hox, Joop. 2002. *Multilevel Analysis: Techniques and Applications*. Mahwah, NJ: Erlbaum.
- Kreft, Ita and Jan de Leeuw. 1998. *Introducing Multilevel Modeling*. London: Sage.
- Raudenbush, Stephen and Anthony Bryk. 2002. *Hierarchical Linear Models: Applications and Data Analysis Methods. 2nd edition*. Newbury Park, CA: Sage.
- Raudenbush, Stephen W. et al. 2004. *HLM 6: Hierarchical Linear and Nonlinear Modeling*. Scientific Software International, Inc.
- Singer, Judith D., & John B. Willett. 2003. *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. New York: Oxford University Press.
- Snijders, Tom A. B. and Roel J. Bosker. 1999. *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Thousand Oaks, CA: Sage.
- Wong, George Y. and William Mason. 1985. The Hierarchical Logistic Regression Model for Multilevel Analysis. *Journal of the American Statistical Association*, 80, 391, pp. 513-524.

SEM:

- Bollen, Kenneth A. 1989. *Structural Equations with Latent Variables*. NY: John Wiley & Sons.
- Byrne, Barbara. 1998. *Structural Equation Modeling with LISREL, PRELIS, and SIMPLIS: Basic Concepts, Applications, and Programming*. Mahwah, NJ: Erlbaum.
- Barbara M. Byrne. 2001. *Structural Equation Modeling With Amos: Basic Concepts, Applications, and Programming*. Mahwah, NJ: Erlbaum.
- Du Toit, M. and S. du Toit. 2001. *Interactive LISREL: User's Guide*. Lincolnwood, IL: Scientific Software International.
- Finkel, Steven E. 1995. *Causal Analysis with Panel Data*. Thousand Oaks, CA: Sage.
- Gao, Guang, and John Hipp. 2004. Longitudinal Analysis for Continuous Outcomes: random Effects Models and Latent Trajectory Models. Pp. 347-368 in Melissa Hardy and Alan Bryman (Eds.), *Handbook of Data Analysis*. Thousand Oaks, CA: Sage.
- Hayduk, Leslie. 1987. *Structural Equation Modeling with LISREL: Essentials and Advances*. Baltimore: The John Hopkins University Press.
- Hoyle, Rick H. (Editor). 1995. *Structural Equation Modeling: Concepts, Issues, and Applications*. Thousand Oaks, CA: Sage.
- Jöreskog, Karl G & Sörbom, Dag. 1996. *PRELIS 2 User's Reference Guide*. Scientific Software International, Inc.

- Jöreskog, Karl G & Sörbom, Dag. 1996. *LISREL 8 User's Reference Guide*. Scientific Software International, Inc.
- Jöreskog, K. G. and D. Sörbom. 1993. *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*. Hillsdale, NJ: Erlbaum.
- Kaplan, David. 2000. *Structural Equation Modeling: Foundations and Extensions*. Thousand Oaks, CA: Sage.
- Maruyama, Geoffrey M. 1998. *Basics of Structural Equation Modeling*. Thousand Oaks, CA: Sage.
- Muthén, Bengt. 2004. Latent Variable Analysis: Growth Mixture Modeling and Related Techniques for Longitudinal Data. Pp.345-368 in David Kaplan (Ed.), *The Sage Handbook of Quantitative Methodology for the Social Sciences*. Thousand Oaks, CA: Sage.
- Schumacker, Randall E. and George A. Marcoulides (eds.) 1998. *Interaction and Nonlinear Effects in Structural Equation Modeling*. Mahwah, NJ: Erlbaum.
- Ullman, Jodie B., and Peter Bentler. 2004. Structural Equation Modeling. Pp. 421-458 in in Melissa Hardy and Alan Bryman (Eds.), *Handbook of Data Analysis*. Thousand Oaks, CA: Sage.