



Modern Modeling Methods  
Conference

MAY 25–26, 2011



University of  
Connecticut

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Neag School of Education

# **2011 Modern Modeling Methods Conference**



Sponsored by the ***Educational Psychology Department*** and the ***Neag School of Education***, University of Connecticut

Special thanks go to Dr. H. Swaminathan, the chair of the Educational Psychology department, for his financial and moral support for this conference.

In addition, special thanks go to Joanne Roberge, Cheryl Lowe, Karen Rambo, Kelly O'Shea, Mariya Yukymenko, Kate Copeland, and conference services for providing administrative and logistical support for the conference.

Special thanks go to all of the keynote speakers and concurrent presenters for making this wonderful program possible.

Finally, thank you for coming and being a part of the first M<sup>3</sup> conference! I hope to see you all back in Storrs on May 22-23, 2012 for the second annual conference, where our keynoters will include Donald Rubin and Jack McArdle. Proposals for concurrent sessions will be due January 5, 2012, and can be submitted online at our website, [www.modeling.uconn.edu](http://www.modeling.uconn.edu)

D. Betsy McCoach, Ph.D.

2011 Chair, Modern Modeling Methods Conference

Associate Professor, Measurement, Evaluation, and Assessment Program

Educational Psychology Department, Neag School of Education, UCONN

# AGENDA

<b>Tuesday, May 24<sup>th</sup> – PRECONFERENCE WORKSHOP</b>		
<b><i>Bayesian Modeling Using MPLUS</i></b>		
<b>Bengt Muthen, Mplus</b>		
<a href="http://www.statmodel.com">www.statmodel.com</a>		
<b>8:00- 8:45 am</b>	Coffee and Registration	Gentry Atrium
<b>8:45 – 10:15 am</b>	Lecture	Gentry 131
<b>10:15-10:30</b>	Break	Gentry Atrium
<b>10:30-12:00</b>	Lecture	Gentry 131
<b>12:00-1:30</b>	Lunch (on your own)	
<b>1:30-3:00</b>	Lecture	Gentry 131
<b>3:00-3:15</b>	Break	Gentry Atrium
<b>3:15-5:00</b>	Lecture	Gentry 131

Wednesday, May 25 <sup>th</sup>		
<b>7:30- 8:30 am</b>	Continental Breakfast and Registration	Outside Castleman 212
<b>8:30 - 8:45 am</b>	Welcome	Castleman 212
<b>8:45 - 10:15 am</b>	Keynote Address 1 <b>Bengt Muthen-</b> <i>Modern Latent Variable Modeling Methods</i>	Castleman 212
<b>10:15 - 10:35 am</b>	Break	
<i>Concurrent Session 1</i> <b>10:35 am-12:00 pm</b>	<b>Tihomir Asparouhov</b> New Modeling Methods for Multilevel Data	Gentry 131
	<b>Combined Session:</b> <b>Ayrin Molefe:</b> Summer School Attendance in Milwaukee: Adjusting for Self-Selection Using Propensity Score Stratification and Marginal Mean Weighting Through Stratification <b>Christopher Rhoads:</b> The Implications of Contamination for Experimental Design in Education	Gentry 140
	<b>Combined Session:</b> <b>Karen Nylund-Gibson:</b> An Application of Multilevel Latent Class Analysis (MLCA): A Parametric and Nonparametric Approach <b>Emil Coman:</b> Identifying Peer-Network Clusters in a Community Sample with Limited Relational Data: Using Mixture Multilevel CFA to Recover Potential Groups of Peer Influence on Attitudes Toward Female Condoms	Gentry 201
	<b>Combined Session:</b> <b>Benjamin Kelcey, Joanne Carlisle, &amp; Dan Berebitsky:</b> Inferences on Instructional Practice Measured with Multiple Sources of Variation <b>Jennifer Koran:</b> Latent Growth Modeling Parameter Constraints with Categorical Indicators	Gentry 221
	<b>Combined Session:</b> <b>Kristina M. Jackson &amp; Kenneth J. Sher:</b> A Systematic Comparison of Trajectory Approaches: Comparing Longitudinal Phenotypes Based on Index of Alcohol Involvement and Number and Timing of Assessments <b>Jinbo Bi, Yu Wu, Howard Tennen, Stephen Armeli, Arun Abraham:</b> Identification of College Drinking Patterns with Associated Risk Factors via Statistical Feature Selection	Gentry 101
	<b>Combined Session:</b> <b>Jane Rogers, Hariharan Swaminathan, &amp; Rohini Sen</b> Assessing Factorial Invariance in Nonlinear Latent Variable Models <b>Hariharan Swaminathan &amp; Jane Rogers:</b> A Bayesian Procedure for the Estimation of Random Regression Coefficients in Multilevel Quantal Response Models	Gentry 144

<b>12:00 pm to 1:15 pm</b>	Lunch	Student Union Room 304
<i>Concurrent Session 2</i> <b>1:15 pm to 2:10 pm</b>	<p><b>Katherine Masyn</b>  Joint Latent Variable Models for Event Histories and Growth Processes</p> <p><b>Jay Magidson</b>  Rethinking Regression, Prediction and Variable Selection in the Presence of High Dimensional Data: Correlated Component Regression</p> <p><b>Ji Hoon Ryou &amp; Greg Welch</b>  Fitting the Generalized Fractional Polynomial Model Incorporated with the Generalized Additive Model into Non-Normal Longitudinal Data</p> <p><b>Phillip Wood &amp; Kristina Jackson</b>  Growth Models Compared as Structural Models: Rogers' Quiet Methodological Revolution Revisited</p> <p><b>Jennifer Rose, Lisa Dierker, Donald Hedeker, &amp; Robin Mermelstein</b>  Moderated Nonlinear Factor Analysis for Integrated Nicotine Dependence Data</p> <p><b>Combined Session:</b>  <b>Tania B. Huedo-Medina &amp; Blair T. Johnson:</b> Multilevel Structural Equation Meta-Analytic Modeling of Individual Studies  <b>Mijke Rhemtulla, Alexander M. Schoemann, &amp; Kristopher J. Preacher:</b> A Multilevel SEM Approach to Examine Dyadic Correlations</p> <p><b>Combined Session:</b>  <b>Ann A. O'Connell, Sandra J. Reed, Sui Huang, DeLeon L. Gray:</b> Assessing Model Fit for Ordinal Response Regression Models  <b>Xing Liu:</b> Using Generalized Ordinal Logistic Regression Models to Estimate Mathematics Proficiency</p>	Gentry 131  Gentry 144  Gentry 101  Gentry 140  Gentry 103  Gentry 221  Gentry 201
<b>2:10pm to 2:30 pm</b>	Break	

<p><i>Concurrent Session 3</i>  <b>2:30 pm to 3:25 pm</b></p>	<p><b>Sonya Sterba</b>  Parcel-Allocation Variability in Structural Equation Modeling: Implications for Interpreting Parcel-Solutions and Item- vs. Parcel-Solution Fit Differences</p> <p><b>Nicholas Myers, Soyeon Ahn, &amp; Ying Jin</b>  Exploratory Structural Equation Modeling or Confirmatory Factor Analysis for (Im)Perfect Validity Studies</p> <p><b>Thomas Ledermann, Siegfried Macho, &amp; David A. Kenny</b>  Assessing Mediation in Dyadic Data Using the Actor-Partner Interdependence Model</p> <p><b>Ann O’Connell, Sandra J. Reed, Weijia Ren, &amp; Jian Li</b> : Multilevel Models for Ordinal Response Data: Theory and Practice</p> <p><b>Combined Session:</b>  <b>Matthew McBee &amp; Samuel Field:</b> Biased Estimates of Treatment Effects Estimated via Propensity Score Matching when Matches are Inexact  <b>Matthew McBee &amp; John Sideris:</b> Cronbach’s Alpha and Test Item Difficulty: A Cautionary Note</p> <p><b>Combined Session:</b>  <b>Veronica Santelices:</b> The Importance of Contextual and Personal Variables in Explaining Teacher Quality: Evidence Using a Standards-Based, Standardized Measure of Teacher Performance  <b>Shaun Dougherty, Jennifer Jennings, &amp; Dan Koretz:</b> Modeling Accountability Gains: Evidence from New York City's School Progress Reports</p> <p><b>Combined Session:</b>  <b>David Greenberg &amp; Michael E. Ezell:</b> Criminal Careers: Discrete or Continuous?  <b>Holmes Finch:</b> A Mixture IRT Analysis of Risky Youth Behavior</p>	<p>Gentry 221</p> <p>Gentry 103</p> <p>Gentry 144</p> <p>Gentry 131</p> <p>Gentry 140</p> <p>Gentry 101</p> <p>Gentry 201</p>
<p><b>3:25 pm to 3:45 pm</b></p>	<p>Break</p>	
<p><b>3:45 pm to 5:00 pm</b></p>	<p>Keynote Address 2:  <b>Kenneth Bollen:</b> <i>Model Implied Instrumental Variables (MIIVs): An Alternative Approach to Latent Variables</i></p>	<p>Castleman 212</p>

<b>Poster Session and Reception- Gentry Atrium and 144/142</b>		
<p><i>Poster Session &amp; Reception</i> <b>5:00 pm to 7:00 pm</b></p>	<p><b>Sara K. Johnson:</b> Adapting the Actor-Partner Interdependence Model to Dyads Nested Within Organizations: The Example of Site-Based Youth Mentoring Programs</p> <p><b>Jihye Kam:</b> Changes in the Korean Wage Structure 1978-1998: Application of Quantile Regression</p> <p><b>Rohini Sen:</b> A Look at "Creativity in Graduate Research" Scales through Exploratory Structural Equation Modeling (ESEM)</p> <p><b>Katarzyna Wyka, JoAnn Difede, Jay Verkuile:</b> The structure and covariates of PTSD in a population of disaster workers – latent class analysis with covariates.</p> <p><b>Yeonsoo Yoo:</b> Longitudinal influence of maternal distress on young twins' negative mood representations: A structural equation model with interchangeable dyads</p> <p><b>Burcu Kaniskan:</b> The Performance of RMSEA in Models with ordinal measures</p>	<p><i>Gentry 144/142</i></p>

Thursday, May 26 <sup>th</sup>		
<b>7:30 am - 8:00 am</b>	Breakfast	Castleman 212
<b>8:00 am - 9:15 am</b>	Keynote Address 3: <b>Stephen Raudenbush</b>	Castleman 212
<b>9:15 am - 9:35 am</b>	Break	
<p><i>Concurrent Session 4</i> <b>9:35 am to 11:00 am</b></p>	<p><i>Symposium: <b>New Concepts in the Analysis of Incomplete Data</b></i>  <b>Ofer Harel</b>, Chair and Discussant  <i>Examining the robustness of fully synthetic data techniques for data with binary variables: <b>Gregory Mathews</b></i>  <i>Diagnostic Accuracy of a Binary Test with Two Types of Missing Values: <b>Jeffrey Stratton</b></i>  <i>Missing data techniques for multilevel data: Implications of model misspecification: <b>Anne Black</b></i></p>	Gentry 131
	<p><i>Symposium: <b>Recent Developments from the Methodology Center at Penn State</b></i>  <b>Bethany C. Bray</b>, Chair  <i>New Approaches for Expanded Latent Class Models: <b>Bethany C. Bray, Stephanie T. Lanza, Xianming Tan</b></i>  <i>Causal Mediation in the Presence of Post-Treatment Confounders, Baseline Moderators, and Non-Randomized Treatments: <b>Donna L. Coffman &amp; Daniel Almirall</b></i>  <i>Functional Data Mediation Analysis of Craving and Negative Affect in Smoking Cessation Data: <b>Jessica Trail, Kevin Timms, Megan Piper, Daniel Rivera, Linda M. Collins</b></i></p>	Gentry 144
	<p><b>Combined Session:</b>  <b>Charles Secolsky, Kris Krishnan, Eric Magaran, &amp; Kathleen Serafino:</b> Empirical and Cognitively-Based Judgmental Estimates of Item Difficulty Using Model-Fit Statistics in IRT and MIRT  <b>Tom Loeyes:</b> Disentangling Correlation Between Speed and Ability at the Subject Level and Between Intensity and Difficulty at the Item Level from Psycholinguistic Data: A Joint Modeling Approach</p>	Gentry 140
	<p><b>Combined Session:</b>  <b>Krista W. Ranby, Marcella H. Boynton, Scott H. Kollins, Joseph McClernon, Chongming Yang, &amp; Bernard Fuemmeler:</b> Examining ADHD Symptoms in a Nationally Representative US Sample using Factor Analysis, Latent Class Analysis, and Factor Mixture Modeling  <b>G. Leonard Burns, Mateu Servera, Urbano Lorenzo-Seva, Esther Cardo, Antoni Rodríguez-Fornells:</b> A Multiple Indicator Approach to the Multitrait by Multisource Matrix: Mothers', Fathers', and Teachers' Ratings of the ADHD and ODD Symptoms for Thai Adolescents and Spanish children</p>	Gentry 201



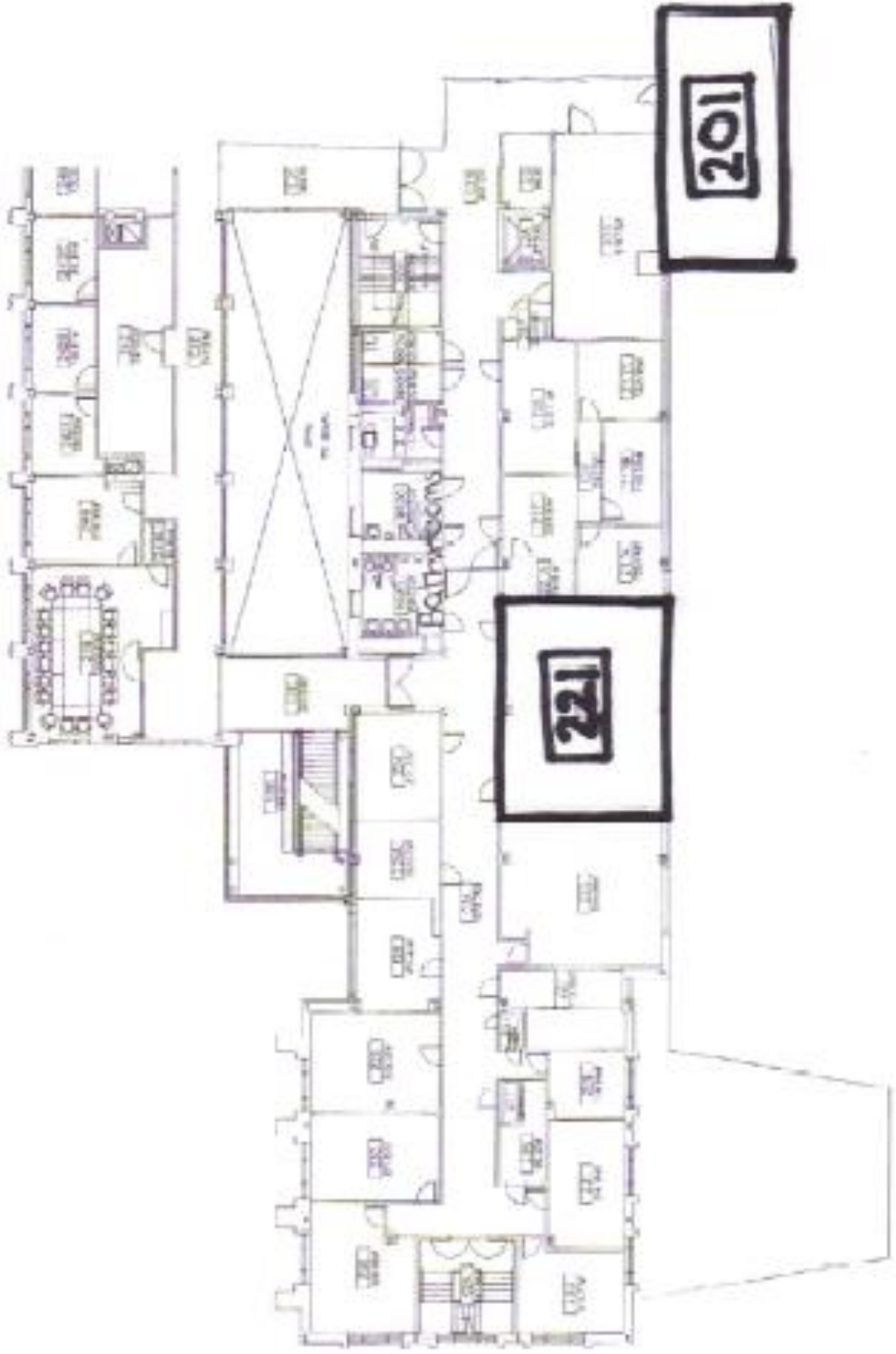
	<p><b>Combined Session:</b>  <b>Bethany Bell, Jason A. Schoeneberger, Grant B. Morgan, Min Zhu, John M. Ferron, &amp; Jeffrey D. Kromrey:</b> Hierarchical vs. Contextual Models: Sample Size, Model Complexity, and the 30/30 Rule  <b>George Leckie &amp; Chris Charlton:</b> Running MLwiN from within Stata: the runmlwin command</p>	Gentry 101
<b>11:20 am-12:30 pm</b>	<p>Keynote Address 4:  <b>David A. Kenny-</b> <i>Working with Underidentified Structural Equation Models</i></p>	<b>ITE C80</b>
<b>12:30 pm-1:45 pm</b>	Lunch	Student Union
<p><i>Concurrent Session 5</i>  <b>1:45 pm to 2:40 pm</b></p>	<p><b>Gregory Hancock &amp; Jeffrey Harring</b>  Using Phantom Variables in Structural Equation Modeling to Assess Model Sensitivity to External Misspecification</p>	Gentry 131
	<p><b>Ji Hoon Ryoo</b>  Longitudinal Model Selection of Statewide Achievement Tests at School Level by Using the Linear Mixed Model</p>	Gentry 140
	<p><b>Combined Session:</b>  <b>Karen Stamm, Deborah A. Riebe, Bryan J. Blissmer, Geoffrey W. Greene, Faith D. Lees, &amp; Phillip G. Clark:</b> Longitudinal Mixture Modeling of Exercise and Fruit and Vegetable Consumption Maintenance in Older Adults  <b>Cyr E. M'lan, Patricia Neafsey and Steve Walsh:</b> Markov Transitional Model for Not at Goal for Blood Pressure in Older Patients</p>	Gentry 103
	<p><b>Stephen Tueller &amp; Gitta Lubke</b>  Estimating Classification Accuracy for Latent Variable Mixture Models</p>	Gentry 101
	<p><b>David J. Francis, Tammy D. Tolar, &amp; Karla K. Stuebing</b>  The Language-Achievement Connection for English Language Learners</p>	Gentry 144
	<p><b>Combined Session:</b>  <b>Joseph Cappelleri &amp; Andrew G. Bushmakin:</b> Interrelationships of Sildenafil Treatment Effects on the Physiological and Psychosocial Aspects of Erectile Dysfunction: An Application of Structural Equation Modeling  <b>Nicole Judith Gilinsky:</b> Using Structural Equation Modeling to Model the Relationships Between Physical Activity and Academic Outcomes</p>	Gentry 201
<b>2:40-3:00 pm</b>	Break	
<b>3:00 pm to 4:30 pm</b>	<p>Keynote Address 5:  <b>Joshua Angrist-</b> <i>Instrumental Variables in Action: Sometimes You get What You Need</i></p>	Castleman 212

**GENTRY FLOOR MAP**

*Gentry First Floor*



# Gentry Second Floor



## KEYNOTE SPEAKERS

### Joshua Angrist, Ph.D.

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Joshua Angrist is the Ford Professor of Economics at MIT and a Research Associate in the NBER's programs on Children, Education, and Labor Studies. A dual U.S. and Israeli citizen, he taught at the Hebrew University of Jerusalem before coming to MIT. Angrist received his B.A. from Oberlin College in 1982 and also spent time as an undergraduate studying at the London School of Economics and as a Masters student at Hebrew University. He completed his Ph.D. in Economics at Princeton in 1989. His first academic job was as an Assistant Professor at Harvard from 1989-91. Angrist's research interests include the effects of school inputs and school organization on student achievement; the impact of education and social programs on the labor market; the effects of immigration, labor market regulation and institutions; and econometric methods for program and policy evaluation. Many of Angrist's papers use data from other countries, but he does not especially like to travel and prefers to get data in the mail. Angrist is a Fellow of the American Academy of Arts and Sciences, The Econometric Society, and has served on many editorial boards and as a Co-editor of the *Journal of Labor Economics*. He received an honorary doctorate from the University of St Gallen (Switzerland) in 2007 and is the author (with Steve Pischke) of *Mostly Harmless Economics: An Empiricist's Companion* (Princeton University Press, 2009). In addition to academic work and teaching at MIT, Angrist occasionally ventures abroad to teach an *Empirical Strategies* short course based on *Mostly Harmless Econometrics*.

### Kenneth Bollen, Ph.D.

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Kenneth A. Bollen is Director of the Odum Institute for Research in Social Science and the H.R. Immerwahr Distinguished Professor of Sociology at the University of North Carolina at Chapel Hill. He is a member of the Statistical Core and a Fellow of the Carolina Population Center and an adjunct professor of Statistics at UNC-Chapel Hill. Bollen completed his Ph.D. at Brown University in 1977. He was a research scientist at the General Motors Research Laboratories (1977-1982) and an assistant professor at Dartmouth College (1982-1985) before joining the UNC-Chapel Hill in 1985. Bollen has been an instructor at the Interuniversity Consortium for Political and Social Research (ICPSR) Summer Training Program in Quantitative Methods at the University of Michigan in Ann Arbor since 1980. Throughout the 2004-2005 academic year he was the leader of the SAMSI Program on Latent Variables in the Social Sciences. Ken Bollen was the Year 2000 recipient of the Lazarsfeld Award for Methodological Contributions in Sociology. The ISI named him among the World's Most Cited Authors in the Social Sciences. He is coauthor of *Latent Curve Models: A Structural Equations Approach* (with P. Curran, 2006, Wiley) and author of *Structural Equation Models with Latent Variables* (1989, Wiley) and of over 100 published papers. Bollen's primary areas of statistical research are structural equation models, measurement models, and latent growth curve models. In addition to his work at General Motors, Bollen has consulted for IBM, Proctor & Gamble, the UN Development Program, the US Agency for International Development, and others.

### **David A. Kenny, Ph.D.**

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University of Connecticut Board of Trustees and Alumni Distinguished Professor David A. Kenny earned his B.A. in 1968 from the University of California at Davis and his Ph.D. in 1972 from Northwestern University where he was the student of Donald T. Campbell. He joined the University of Connecticut in 1978 after 6 years at Harvard University. He has contributed both to the understanding of person perception and to the development of data analysis procedures for research conducted outside of the laboratory. Kenny pioneered the development of methods that allowed for the study of actual people. Among the questions he has investigated are factors that lead people to agree and disagree in their perceptions of others, accuracy of perceptions, and the degree to which persons know how others see them. To answer these questions, he has developed statistical models called the Social Relations Model and the Actor-Partner Interdependence Model. He has numerous publications and six books. His work is highly cited, with one of his papers having over two thousand citations.

### **Bengt O. Muthén, Ph.D.**

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Dr. Bengt O. Muthén (Ph.D., Statistics, Uppsala University) is Professor Emeritus at the Graduate School of Education & Information Studies at UCLA. He was the 1988-89 President of the Psychometric Society. Dr. Muthén is one of the developers of the Mplus computer program, which implements many of his statistical procedures. Dr. Muthén's research interests focus on the development of applied statistical methodology in areas of public health and education. Public health applications involve developmental studies in epidemiology and psychology while education applications concern achievement development. Methodological areas include latent variable modeling, analysis of individual differences in longitudinal data, preventive intervention studies, analysis of categorical data, multilevel modeling, and the development of statistical software.

### **Stephen Raudenbush, Ed.D.**

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Stephen Raudenbush, EdD is the Lewis-Sebring Distinguished Service Professor in the Department of Sociology at the University of Chicago and Chairman of the Committee on Education. He received an Ed.D in Policy Analysis and Evaluation Research in 1984 from Harvard University and was a professor in the School of Education at the University of Michigan from 1998 until 2005. He is a leading scholar on quantitative methods for studying child and youth development within social setting such as classrooms, schools, and neighborhoods. He is best known for his work on developing hierarchical linear models, with broad applications in the design and analysis of longitudinal and multilevel research. Raudenbush has been the Scientific Director of the Project on Human Development in Chicago Neighborhoods, an ambitious study of how family, neighborhood and school settings shape the academic learning, social development, mental health and exposure to violence of children growing up in Chicago. He is currently studying the development of literacy and math skills in early childhood with implications for instruction; and methods for assessing school and classroom quality. He is a member of the American Academy of Arts and Sciences and the recipient of the American Educational Research Association award for distinguished contributions to educational research.

## *Abstracts for the Concurrent Sessions*

### **Concurrent Session 1**

**Wednesday, May 25<sup>th</sup>**

**10:35 am – 12:00 pm**

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#### **New Modeling Methods for Multilevel Data**

*Tihomir Asparouhov*

*MPlus*

**Location: Gentry 131**

We describe a general two- and three-level structural equation model with categorical and continuous variables. Three different estimation methods are presented: the maximum-likelihood, the weighted least squares and the Bayesian method. Comparative advantages and disadvantages are considered for the different estimators. We describe several multilevel multiple-group structural models for a within-level and for a between-level grouping variable. We show how to use three-level modeling to estimate a new more flexible multiple-group two-level model when the grouping variable is on the within level. We also describe cross-classified structural equation models and present an application of this method for estimating a structural two-level model with survey data when the sampling method is not nested above the modeled clustering. Practical applications and simulation results are presented using Mplus.

#### **Summer School Attendance in Milwaukee: Adjusting for Self-Selection Using Propensity Score Stratification and Marginal Mean Weighting through Stratification**

*Ayrin Molefe*

**Location: Gentry 140**

There has been ample research done on the effect of summer school on academic performance. Many of these studies conclude that, in general, summer school attendance boosts achievement gains. However, since random assignment of students to summer school participation is generally politically and practically untenable, most of these studies employed pretest-posttest comparisons, or a nonequivalent-groups design with “imperfectly-matched” control groups, or in some cases, no matching at all, limiting the ability to draw reliable inferences. Our goal is to examine the effects of summer school enrollment on the reading and math scores of Milwaukee Public Schools students in grades 3 through 8 using propensity score stratification and marginal mean weighting through stratification to adjust for self-selection of students into the program, and multilevel modeling.

#### **The Implications of Contamination for Experimental Design in Education**

*Christopher Rhoads*

*Northwestern University*

**Location: Gentry 140**

Experimental designs that randomly assign entire clusters of individuals (e.g., schools, classrooms) to treatments are frequently advocated as a way of guarding against contamination of the estimated average causal effect of treatment. However, in the absence of contamination, experimental designs that randomly assign intact clusters to treatments are less efficient than designs that randomly assign individual units within clusters. I find

that for most parameter values of practical interest, the statistical power of a randomized block design remains higher than the power of a cluster randomized design even when contamination causes the effect size to decrease by as much as 10-60%. An extension of existing results to models with two levels of nesting (e.g. students within classrooms within schools) is discussed. Similar to the case with one level of nesting, a surprising amount of contamination can be tolerated and the blocked design will still be preferred.

### **An Application of Multilevel Latent Class Analysis (MLCA): A Parametric and Nonparametric Approach**

*Karen Nylund-Gibson*

*University of California – Santa Barbara*

**Location: Gentry 201**

Latent class analysis (LCA) is a statistical technique that identifies unobserved heterogeneous subgroups (i.e., latent classes) in a given population using a set of categorical or continuous indicators. Multilevel LCA (MLC; Muthén, & T. Asparouhov, 2009; Vermunt, 2008) is an extension of the traditional LCA model that allows researchers to model the latent classes while accounting for the non-independence of observations due to a clustering unit, but also allows for variation at the clustering unit to be modeled explicitly. This two-level approach to LCA is akin to traditional multilevel models—Level 1 LCA parameters are allowed to vary across Level 2 clustering units (e.g., classrooms, school sites, hospitals, etc.). This paper will describe the MLCA models and different specifications, demonstrate the use of MLCA in an application to study groups of sixth grade students based on their peer victimization experiences where the clustering unit is their classroom, and provide the Mplus syntax for all models considered.

### **Identifying Peer-Network Clusters in a Community Sample with Limited Relational Data: Using Mixture Multilevel CFA to Recover Potential Groups of Peer Influence on Attitudes Toward Female Condoms**

*Emil Coman*

*Institute for Community Research (Hartford, CT)*

**Location: Gentry 201**

We propose an exploratory method of assessing the between-groups level of a construct from individual level data that contains peer-network information between participants. We will use a multilevel mixture CFA analysis to identify real networks of peers in a community sample of women participants in a female condom acceptability study from Hartford CT, based on partial information regarding participants' links to a maximum of three other participants in the study (referral peer network). We will identify peer influence clusters in the sample based on limited information about their referral peers' actual level of FC attitudes, while investigating the multilevel measurement structure of the FC beliefs scale.

### **Inferences on Instructional Practice Measured with Multiple Sources of Variation**

*Benjamin Kelcey, Joanne Carlisle, and Dan Berebitsy*

*Wayne State University*

**Location: Gentry 221**

Recent research has developed multiple systems to chronicle enacted teaching. Such systems detail enacted teaching through the presence of targeted behavioral features

thought to reflect central dimensions of teaching. The expectation is that such systems will help draw valid inferences as to the nature of instruction across a year using a sample of lessons and days to uncover reliable evidence concerning the processes which drive teachers' contribution to students' growth. We outline the conceptualization and application of a framework that integrates item response theory and generalizability theory using a cross-classified mixed effects measurement model to measure such processes.

### **Toward Resolving the Discrimination-Censoring Paradox in Item Response Growth Models**

*Jennifer Koran*

*Southern Illinois University – Carbondale*

**Location: Gentry 221**

Item response growth models are a type of explanatory item response model. This class of models offers the promise of modeling individual growth directly from item response data. However, some preliminary research has found bias in the recovery of the parameter estimates of the two-parameter logistic item response growth model. Koran (2010) proposed a theory explaining the bias and suggestions for addressing the source of the bias. This paper presents research testing the effect of two of the proposed solutions on bias in the two-parameter logistic item response growth model.

### **A Systematic Comparison of Trajectory Approaches: Comparing Longitudinal Phenotypes Based on Index of Alcohol Involvement and Number and Timing of Assessments**

*Kristina M. Jackson and Kenneth J. Sher*

*Brown University*

**Location: Gentry 101**

The popularity of trajectory-based characterizations of developmental courses of alcohol involvement is growing rapidly. This paper summarizes two studies examining methodological factors affecting course shape and prevalence. Both used growth mixture models to identify trajectories during young adulthood using a 6-wave prospective sample. The first study evaluated whether trajectories based upon different indices of drinking tended to identify the same people. The second explored the extent to which number of measurement occasions altered the observed trajectories obtained. Findings suggest that researchers thoughtfully consider the nature of the phenomena being studied and the developmental period of interest when designing prospective studies.

### **Identification of College Drinking Patterns with Associated Risk Factors via Statistical Feature Selection**

*Jinbo Bi, Yu Wu, Howard Tennen, Stephen Armeli, and Arun Abraham*

*University of Connecticut – Computer Science and Engineering*

**Location: Gentry 101**

This article aims to explore advanced statistical feature selection and cluster analysis approaches to detect different drinking patterns and identify their associated risk factors. The statistical techniques are applied in a secondary analysis of a set of de-identified data of 574 students collected in one of the previous studies, at University of Connecticut NIAAA's Alcohol Research Center, where besides person-level measures, daily-level measures are collected for consecutively 30 days in an academic semester.



## **A Bayesian Procedure for the Estimation of Random Regression Coefficients in Multilevel Quantal Response Models**

*Hariharan Swaminathan and Jane Rogers*

*University of Connecticut*

***Location: Gentry 144***

Accurate estimation of random effects or random regression coefficients is critical in many applications. Current approaches for the estimation of these coefficients in multilevel models employ empirical Bayes (EB) procedures which depend on the point estimates of the variance components without taking into the uncertainty in these estimates. A full Bayesian approach which avoids this problem is developed in this paper by specifying priors for the variance components and obtaining a marginal posterior density of the random coefficients. This procedure is applied for the estimation of the random coefficients in multilevel models where the responses are discrete. Procedures for specifying the parameters of the prior distribution are described. It is shown through simulation studies that the Bayesian estimates are superior to the EB estimates in small samples and reasonably robust with respect to misspecification of priors. Applications of the procedure for the analysis of large scale assessment data are described.

## **Assessing Factorial Invariance in Nonlinear Latent Variable Models**

*Jane Rogers, Hariharan Swaminathan, and Rohini Sen*

*University of Connecticut*

***Location: Gentry 144***

A fundamental requirement for establishing the validity of an instrument is that its factorial structure remains invariant across subpopulations of interest. While the procedures for establishing factorial invariance are well established when the response data are continuous, the situation is markedly different when the response data are discrete. Examining factorial invariance in these cases by analyzing polychoric correlation matrices is less than satisfactory as there is no guarantee that these are positive definite. Multidimensional item response models provide a solution to this problem by modeling the relationship between discrete responses and continuous latent variables. However, multidimensional item response models are in their infancy and little or no research exists for examining factorial invariance. The purpose of this paper is to provide a Bayesian procedure for examining factorial invariance in multidimensional item response models using the Markov-Chain Monte-Carlo algorithm. The efficacy of this procedure is examined using simulation studies and compared with a non-Bayesian approach. An application of the procedure for examining differential item functioning is provided.

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**Joint Latent Variable Models for Event Histories and Growth Processes**

*Katherine Masyn*

*Harvard University*

**Location: Gentry 131**

In many longitudinal processes, there is an interplay between event histories and growth trajectories. By utilizing a joint model, the associations between the two processes be explicitly evaluated; in addition, the direct and indirect effects of covariates of each process can be explored. In this paper, we present, and illustrate with substantive data examples, joint model specifications in two of three primary categories: 1) exogenous influence models in which one of the two processes represents an exogenous source of variability for other; and 2) reciprocal influence models in which each process may influence the other at different intervals of time.

**Rethinking Regression, Prediction and Variable Selection in the Presence of High Dimensional Data: Correlated Component Regression**

*Jay Magidson*

*Statistical Innovations Inc.*

**Location: Gentry 144**

Recent advances with high-dimensional data show how reliable predictions can be attained from regression models even when the number of predictors exceeds the sample size. We introduce a promising new method called Correlated Component Regression (CCR), and a related step-down algorithm for reducing the number of predictors, provide insights into why CCR works, and compare its performance with stepwise regression based on data generated under traditional linear regression assumptions. The results suggest that a major reason that CCR works so well may be its high power to capture effects of suppressor variables when such variables are among the candidate predictors.

**Fitting the Generalized Fractional Polynomial Model Incorporated with the Generalized Additive Model into Non-Normal Longitudinal Data**

*Ji Hoon Ryoo and Greg Welch*

*University of Nebraska – Lincoln*

**Location: Gentry 101**

The purpose of this paper is to introduce the model selection procedure on the non-normal longitudinal data using generalized fractional polynomial model (GFPM) incorporated with the results of generalized additive model (GAM). For normal longitudinal data, the model selection using the fractional polynomial model (FPM) has been discussed in Long & Ryoo (2010). As shown in the paper, FPM can be modeled for asymmetric nonlinear trends and it has been shown that FPM is more parsimonious than the conventional polynomial model. Our goal of this paper is to show the flexibility and efficiency of GFPM with parsimoniousness compared with GCPM.

## **Growth Models Compared as Structural Models: Rogers' Quiet Methodological Revolution Revisited**

*Phillip Wood and Kristina Jackson*

*University of Missouri*

**Location: Gentry 140**

A variety of statistical models are often used in longitudinal data with continuously measured variables, raising questions about which model is most appropriate. In this presentation, the orthogonal, free-curve slope-intercept (FCSI) growth model with means is considered as a general model which includes, as special cases, many widely-used models such as the Factor Mean model (FM, McArdle & Epstein, 1987), Hierarchical Linear Models (HLM), Linear Factor analysis, Repeated Measures Manova, and Chronological Slope Intercept (SI) Growth models. Specifically, when expressed as structural equation models, each of these models are either directly covariance nested with the FCSI model or are covariance nested with an equivalently fitting rotated version of the model. Such model comparisons are illustrative of Roger's (2009) call for an increased emphasis on theory-driven model comparison and evaluation as a key element of statistical inference.

## **Moderated Nonlinear Factor Analysis for Integrated Nicotine Dependence Data**

*Jennifer Rose, Lisa Dierker, Donald Hedeker, and Robin Mermelstein*

*Wesleyan University*

**Location: Gentry 103**

This methodological illustration will describe an innovative method (Integrative Data Analysis: IDA) to pool data from two independent studies, and, using the pooled data, demonstrate a novel statistical method (Moderated Nonlinear Factor Analysis: MNLFA) in a psychometric evaluation of nicotine dependence (ND) symptoms drawn from three measures of ND. IDA is a method for pooling data sets despite differences in study populations, design, and measures, allowing more powerful and rigorous psychometric analysis than previous studies. MNLFA permits tests of invariance in ND symptom properties across studies and measures and as a function of categorical and continuous risk factors simultaneously.

## **Multilevel Structural Equation Meta-Analytic Modeling of Individual Studies**

*Tania B. Huedo-Medina and Blair T. Johnson*

*University of Connecticut*

**Location: Gentry 221**

There have been developed important levels of sophistication of the multilevel structural equation models providing many advantages to large databases with wide variety of variables. Despite the progress of this approach in the conventional use, there is not a model combining them to use with meta-analytical data. The purpose of the present study is to develop multilevel structural equation models for meta-analytic data. Monte Carlo simulated data will be presented to show under which particular conditions the parameter estimates are less biased and may reach better fit statistics. Interpretation and limitations will be discussed under different conditions.

### **A Multilevel SEM Approach to Examine Dyadic Correlations**

*Mijke Rhemtulla, Alexander M. Schoemann, and Kristopher J. Preacher*

*University of Kansas*

**Location: Gentry 221**

Social scientists frequently have reason to study variable relations at the level of dyads as well as at the level of individuals. Several techniques have been proposed to decompose a correlation into dyadic and individual components; however, these methods typically require several steps of estimation and can be cumbersome. The present proposal uses a multilevel SEM approach to elegantly and efficiently decompose variable relations into dyad-level and individual-level components, resulting in models with perfect fit, accurate standard errors, and precise estimates of each variable's intraclass correlation coefficient, as well as the correlations of interest.

### **Assessing Model Fit for Ordinal Response Regression Models**

*Ann A. O'Connell, Sandra J. Reed, Sui Huang, and DeLeon L. Gray*

*The Ohio State University*

**Location: Gentry 201**

Educational and behavioral researchers are often confronted with the analysis of discrete or non-normally distributed data which have been collected through a hierarchical or multilevel sampling design. Our presentation reviews the theory of generalized linear mixed models (GLMM) for the analysis of such data. In particular, we discuss methods available for fitting the multilevel ordinal model in several widely used statistical computing packages for multilevel analyses: HLM, SAS, STATA, SuperMix, and R. We will provide a brief demonstration of SuperMix (Hedeker, Gibbons, du Toit, & Cheng (2008), a relatively new package for multilevel analysis, using a subset of data from the Early Childhood Longitudinal Study – Kindergarten cohort (ECLS-K). Emphasis is placed on providing researchers with the theory and tools necessary for responsible analysis and interpretation of GLMMs particularly when outcomes are ordinal.

### **Using Generalized Ordinal Logistic Regression Models to Estimate Mathematics Proficiency**

*Xing Liu*

*Eastern Connecticut State University*

**Location: Gentry 201**

The most well-known model for estimating the ordinal dependent variable might be the proportional odds (PO) model. In this model, the effect of each predictor is assumed to be the same across the categories of the ordinal dependent variable. However, the assumption of proportional odds is often violated, since it is strongly affected by sample size and the number of covariate patterns. It is misleading and invalid to continue to interpret results if this assumption is not tenable. The purpose of this paper is to illustrate the use of generalized ordinal logistic regression models, which allow the effect of each explanatory variable to vary across different cut points, to predict mathematics proficiency levels using Stata, and compare the results of fitting the PO models and the generalized ordinal logistic regression models.

**Parcel-Allocation Variability in Structural Equation Modeling: Implications for Interpreting Parcel-Solutions and Item- vs. Parcel-Solution Fit Differences**

*Sonya Sterba*

*Vanderbilt University*

**Location: Gentry 221**

This talk will disseminate some new methodological developments on item parceling which lead to a critique of how parceling is currently employed in practice, and a critique of how differences in item- versus parcel-solutions are currently interpreted. Additionally, new software tools will be demonstrated which can ameliorate the unappreciated negative consequences of parceling.

**Exploratory Structural Equation Modeling or Confirmatory Factor Analysis for (Im)Perfect Validity Studies**

*Nicholas Myers, Soyeon Ahn, and Ying Jin*

*University of Miami*

**Location: Gentry 103**

The purpose of this study was to investigate the performance of exploratory structural equation modeling (ESEM) as compared to confirmatory factor analysis (CFA) under model-data conditions commonly encountered in validity studies in the social sciences. Model (CFA, ESEM geomin, ESEM target), N (100, 250, 500, 1000), and model misspecification (i.e., exact, close, approximate) were manipulated. When fit was at least close, CFA generally provided parameter estimates that had less signed and unsigned bias and better coverage than ESEM target; ESEM target generally outperformed ESEM geomin. When fit was approximate, neither coverage nor signed bias followed a clear pattern by Model.

**Assessing Mediation in Dyadic Data Using the Actor-Partner Interdependence Model**

*Thomas Ledermann, Siegfried Macho, and David A. Kenny*

*University of Connecticut*

**Location: Gentry 144**

Using an extended version of the actor-partner interdependence model (APIM) the estimation and testing of mediation is complex especially when dyad members are distinguishable (e.g., heterosexual couples). We show how the complexity of the APIM for mediation can be reduced by testing for dyadic patterns and indistinguishability of the effects when dyad members are theoretically distinguishable. Using Structural Equation Modeling, we demonstrate how specific mediating effects and contrasts among effects can be tested by phantom models that permit point and bootstrap interval estimates. We illustrate the assessment of mediation using data from heterosexual couples.

**Multilevel Models for Ordinal Response Data: Theory and Practice**

*Ann A. O'Connell, Sandra J. Reed, Weijia Ren, and Jian Li*

*The Ohio State University*

**Location: Gentry 131**

Ordinal regression models are being used with increasing frequency in education, health, and social/behavioral research. Despite this increase, however, there seems to be a lag in the use of strategies for assessing the quality of fit of these kinds of models. In this presentation, we review the use of ordinal regression and provide an overview of several approaches for assessing ordinal model adequacy. Two examples – from HIV prevention research and from education – are used to demonstrate these methods. We conclude with recommendations for researchers in terms of assessing ordinal model fit and for future research in this area.

### **Biased Estimates of Treatment Effects Estimated via Propensity Score Matching when Matches are Inexact**

*Matthew McBee and Samuel Field*

*University of North Carolina – Chapel Hill*

**Location: Gentry 140**

Propensity score matching (PSM) methods are rapidly increasing in popularity throughout the social sciences. PSM has been shown to yield unbiased estimates of treatment effects, but only when the matching of treated and control cases on the propensity score is exact. While it has long been known that inexact matching can produce significantly biased estimates of treatment effects, no literature of which we are aware provides an accessible explanation of the cause of the bias. This paper illustrates the bias both intuitively and analytically, and describes conditions under which the bias is absent. Using these insights, we propose a novel approach to bias correction.

### **Cronbach's Alpha and Test Item Difficulty: A Cautionary Note**

*Matthew McBee and John Sideris*

*University of North Carolina – Chapel Hill*

**Location: Gentry 140**

Cronbach's alpha is routinely computed in educational and psychological research. Unfortunately, it has shortcomings that should discourage its use as an isolated measure of reliability. Using simulation, this paper illustrates some shortcomings of alpha when applied tests composed of items with varying ranges of difficulty. When alpha is applied to dichotomously-scores items, alpha is highest for measures composed of items that have a narrow range of difficulties, and may be low when a wide range of item difficulties are present. For ordinal (e.g., Likert) responses, equivalent alphas may be obtained for instruments varying widely in the conditional standard error of measurement.

### **The Importance of Contextual and Personal Variables in Explaining Teacher Quality: Evidence Using a Standards-Based, Standardized Measure of Teacher Performance**

*Veronica Santelices*

*Catholic University of Chile*

**Location: Gentry 101**

This study examined personal and contextual variables related to the teaching performance of a sample of elementary public school teachers in Chile using hierarchical linear modeling. Teaching performance was measured by a national, standards-based, standardized system. We found that the individual teacher level accounts for the largest share of the variance and that more variance was attributable to differences between municipalities than to differences between schools. Characteristics such as teacher experience, certification of

excellence, type of initial training, teachers' self-efficacy perception and the educational expectations they hold for their students were significant predictors at the teacher level. The most important contextual variables are the number of certified teachers at school and the proportion of municipal income spent in education.

### **Modeling Accountability Gains: Evidence from New York City's School Progress Reports**

*Shaun Dougherty, Jennifer Jennings, and Dan Koretz  
Harvard Graduate School of Education*

**Location: Gentry 101**

Many studies of accountability systems assigning letter grades to schools conclude that accountability pressure increases students' achievement on standardized tests. Yet, no prior study has asked whether gains are evenly spread across skill and question types on state tests. We analyze a student-by-test item dataset for all New York City students to investigate how accountability pressure increases scores. We first construct novel measures of item predictability that enable us to decompose state tests into more and less predictable components. We then test the hypothesis that larger gains observed in schools facing accountability pressure are driven by performance on predictable components.

### **Criminal Careers: Discrete or Continuous?**

*David F. Greenberg and Michael E. Ezell  
New York University Sociology Department*

**Location: Gentry 201**

Numerous empirical studies of criminal careers have made use of finite mixture modeling to analyze sequences of events such as crimes or arrests. This approach represents a set of individual sequences with a finite number of discrete trajectories. Individuals are typically assigned to the trajectory that is most likely, given the distinctive pattern of that individuals' sequence. We use hierarchical nonlinear modeling techniques to determine whether individual crime trajectories can be classified meaningfully and usefully into a small number of mutually exclusive discrete trajectory classes. For this purpose we use arrest data for a large number of males released from the California Youth Authority in 1981 and 1986, and followed for several decades after release. The paper offers suggestions as to the use of finite mixture models when analyzing trajectory data.

### **A Mixture IRT Analysis of Risky Youth Behavior**

*Holmes Finch  
Ball State University*

**Location: Gentry 201**

This study involves the use of a mixture item response theory (mixIRT) model to find typologies of adolescents based on their propensity to be at-risk for dangerous sexual and substance use behaviors. In addition, class specific item discrimination values are used to identify behaviors best able to distinguish individuals within typologies based on their at-risk status. Results showed 4 at-risk subtypes, which are described in some detail. In addition, individual items are identified for each subgroup that can be used to identify those most at-risk. Both methodological and substantive implications of these results are discussed.

**Adapting the Actor-Partner Interdependence Model to Dyads Nested Within Organizations: The Example of Site-Based Youth Mentoring Programs**

*Sara K. Johnson*  
*University of Connecticut*  
**Location: Gentry 144/142**

I describe and illustrate an extension of the Actor-Partner Interdependence Model that can be used to analyze data from dyads nested within organizations. The intent is to provide researchers working in applied fields with a tutorial on how to answer the complex research questions addressed in such designs. In the presentation, I will describe the conceptual and methodological challenges involved in studying dyads nested within organizations, explain and illustrate an approach to analysis using an adaptation of the APIM, and provide suggestions for future research design and data collection to facilitate the appropriate and fruitful use of this approach.

**Changes in the Korean Wage Structure 1978-1998: Application of Quantile Regression**

*Jihye Kam*  
*Teachers College, Columbia University*  
**Location: Gentry 144/142**

This study uses recently developed techniques for quantile regression to analyze changes in the returns to education for male wage-earners, concentrating on cross-section applications. Using data from the Survey Report on Wage Structure (SRWS) from 1978 to 1998 in South Korea, the results show that returns to both education and experience are higher at lower quantiles, which completely differ from the worldwide previous studies. While the mean of wage differential between high school graduates and 4-year college graduates has declined, their standard deviation and differential among quantile .90 and quantile .10 have rose significantly. Consequently, the unobserved skill effects on wage within highly educated workers became more significant. Although the mean of unobserved skill had declined, the fact that the standard deviation and the differential between quantile .90 and quantile .10 had risen at higher quantile presents the significance of personal characteristics for skilled labors.

**A Look at "Creativity in Graduate Research" Scales through Exploratory Structural Equation Modeling (ESEM)**

*Rohini Sen*  
*University of Connecticut*  
**Location: Gentry 144/142**

The purpose of this study is to conduct exploratory analysis of a pilot creativity instrument using the recently proposed methods of exploratory structural equation models (ESEM). The creativity instrument was developed as a quantitative measure of the perceived supervisory support, creative self-efficacy and valuing creativity by graduate students enrolled in graduate programs in the United States. ESEM integrates the flexibility of an EFA approach with analyses that typically are conducted within a CFA framework. The ESEM



approach differs from the typical CFA approach in that all factor loadings are estimated, subject to constraints so that the model can be identified (Asparouhov & Muthen, 2009).

### **The Structure and Covariates of PTSD in a Population of Disaster Workers – Latent Class Analysis with Covariates**

*Katarzyna Wyka, JoAnn Difede, and Jay Verkuile*

*The Graduate Center, CUNY*

**Location: Gentry 144/142**

The objective of the study is to empirically examine the structure of Post Traumatic Stress Disorder (PTSD) in a population of non-rescue disaster workers deployed to the WTC site following the 9/11 attacks and to identify homogeneous groups that exhibit similar symptom endorsement. Furthermore, the study aims to investigate demographic and psychological covariates that predict group membership. The study employed the latent class analysis (LCA) which was performed on data coming from clinical interviews that used CAPS PTSD Scale, the golden standard measure in the assessment of PTSD. The results can inform PTSD prevention and treatment in non-rescue disaster workers.

### **Longitudinal Influence of Maternal Distress on Young Twins' Negative Mood Representations: A Structural Equation Model with Interchangeable Dyads**

*Yeonsoo Yoo*

*University of Connecticut*

**Location: Gentry 144/142**

Using structural equation modeling, this study examined the hypothesis that the long-term impacts of maternal distress on children's family negative moods were observable in features of their narrative representations. In a sample of 421 twin families, maternal distress was assessed at 14, 36 months, maternal sensitivity was assessed at 36 months and 5 years, and children's representations were assessed at 5 years of child age. Results showed maternal distress was predictive of maternal sensitivity and children's representations. Maternal sensitivity mediated the relation between maternal distress and children's family mood representations. The understanding of relations and interventional implications of these relationships are discussed.

### **The Performance of RMSEA in Models with Ordinal Measures**

*Burcu Kaniskan*

*University of Connecticut*

**Location: Gentry 144/142**

There has been no systematic investigation of use test of close fit of root mean squared error of approximation (RMSEA) as a measure of goodness-of-fit in structural equation models (SEM), Confirmatory Factor Analysis (CFA) and Latent Growth Curve Models (LGM) in models that have ordinal measures. Therefore, this present study will examine several Monte Carlo Simulation correctly specified LGMs or CFA models with varying df and sample size (N).

**New Concepts in the Analysis of Incomplete Data**

*Ofel Harel, Gregory Mathews, Jeffrey Stratton, and Anne Black*  
*University of Connecticut*

**Location: Gentry 131**

Missing data is a common complication in medical, psychological, sociological and public health research. Most of the time researchers tend to ignore this obvious difficulty. In this session, we will touch on few missing data problems. The three presentations will include (1) Examining the robustness of fully synthetic data techniques for data with binary variables; (2) Diagnostic accuracy of a binary test with two types of missing values; and (3) Missing data techniques for multilevel data: implications of model misspecification. A short discussion will follow.

**Recent Developments from The Methodology Center at Penn State: Advances in Finite Mixture Modeling, Causal Mediation, and Functional Data Analysis**

*Bethany C. Bray, Stephanie Lanza, Xianming Tan, Donna L. Coffman, Daniel Almirall, Jessica Trail, Kevin Timms, Megan Piper, Daniel Rivera, and Linda M. Collins*  
*Penn State*

**Location: Gentry 144**

This symposium will feature talks related to three different areas of research that are underway at the Center. In the first talk, Bethany Bray will describe a model-based approach for estimating the effect of latent class membership on a distal outcome. She also will propose an improved pseudo-class draws approach that reduces attenuation of the effects between latent class membership and other variables of interest. In the second talk, Donna Coffman will discuss an approach to causal mediation that employs marginal structural models with an inverse propensity of treatment weights estimator. Results of a simulation study show that, unlike use of a regression adjustment, this approach can yield unbiased estimates of mediation in the presence of post-treatment confounding, baseline moderators, and non-randomized treatments. In the final talk, Jessica Trail will present the use of functional data analysis to analyze data with many repeated observations per individual (i.e., intensive longitudinal data). Unlike traditional methods for analyzing longitudinal data, this approach imposes no parametric form of the outcome over time, and allows for time-varying effects of covariates.

**Empirical and Cognitively-Based Judgmental Estimates of Item Difficulty Using Model-Fit Statistics in IRT and MIRT**

*Charles Secolsky, County College of Morris, Kris Krishnan, Hudson County Community College, Eric Magaran, Rockland Community College, Kathleen Serafino, Executive Superintendent, Morris County Schools*

**Location: Gentry 140**

This paper set out to compare item difficulty parameters in IRT with judgmentally determined intrinsic-individual examinee difficulty based on recent cognitive science findings guided by the work of Sweller (2010). Item response functions (IRFs) were modeled using IRT response data and judgment data based on the “germaneness” or “non-germaneness” of item difficulty as perceived by examinees which were modeled separately

using MIRT and the fit of the two data plots were examined with respect to each of the models. The ultimate purpose of this research was to determine how closely each model fit both sets of data. In this way we can begin to understand how these two conceptualizations of item difficulty differ.

### **Disentangling Correlation between Speed and Ability at the Subject Level and between Intensity and Difficulty at the Item Level from Psycholinguistic Data: A Joint Modeling Approach**

*Tom Loeys*

*Ghent University – Belgium*

**Location: Gentry 140**

In the psycholinguistic literature, reaction times and accuracy can be analyzed separately using mixed (logistic) effects models with crossed random effects. Given the potential correlation between these 2 outcomes, a joint model may provide further insight. A Bayesian hierarchical framework is proposed that allows estimation of the correlation between time intensity and difficulty at the item level, and between speed and ability at the subject level. The framework is shown to be flexible in that reaction times can follow a (log) normal or (shifted) Weibull distribution. An example from a Dutch-English word recognition study illustrates the proposed method.

### **Examining ADHD Symptoms in a Nationally Representative US Sample using Factor Analysis, Latent Class Analysis, and Factor Mixture Modeling**

*Krista W. Ranby, Marcella H. Boynton, Scott H. Kollins, Joseph McClernon, Chongming Yang, and Bernard Fuemmeler*

*Duke University*

**Location: Gentry 201**

Attention-Deficit/Hyperactivity Disorder (ADHD) is a common childhood psychiatric disorder that is associated with significant impairments throughout the lifespan. Considerable recent work has examined the phenotypic structure of ADHD as a way to better understand the ways in which people experience the disorder. In an examination of a US population based sample of persons reporting on symptoms experienced between the ages of 5 and 12, we compared factor analysis, latent class analysis, and factor mixture modeling models to determine which underlying structure best fit the data. Overall fit statistics (e.g., AIC, BIC, adj-BIC, Lo-Mendell-Rubin test) were used to compare models within and across model subtypes. In data from both males and females, we found support for a 2 factor, 2 class structure. The 2 continuous factors represented inattentive and hyperactive dimensions on which people's symptom severity was heterogeneous. The 2 classes divided people into quantitatively distinct classes: a smaller affected class and a larger unaffected class. Class membership was significantly related to having received an ADHD diagnosis. Future research on outcomes related to ADHD may be informed through the use of FMM to distinguish quantitative and qualitative aspects of ADHD

## **A Multiple Indicator Approach to the Multitrait by Multisource Matrix: Mothers', Fathers' and Teachers' Ratings of the ADHD and ODD Symptoms for Thai Adolescents and Spanish Children**

*G. Leonard Burns, Mateu Servera, Urbano Lorenzo-Seva, Esther Cardo, Antoni Rodriguez-Fornells*

*Washington State University*

**Location: Gentry 201**

Exploratory CFA was used to model a multitrait (ADHD-Inattention, ADHD-Hyperactivity/Impulsivity, and Oppositional Defiant Disorder) by multisource (mothers, fathers, and teacher) matrix with multiple indicators in samples of Thai adolescents ( $n = 872$ ) and Spanish children ( $n = 1,749$ ). The results indicated convergent and discriminant validity for the individual symptoms, invariance of like-symptom loadings and thresholds between the three sources, significantly higher latent factor means for mothers and fathers than teachers, convergent and discriminant validity for the traits between mothers and fathers with small source effects, and much weaker convergent and discriminant validity for the traits between parents and teachers.

## **Hierarchical vs. Contextual Models: Sample Size, Model Complexity, and the 30/30 Rule**

*Bethany A. Bell, Jason A. Schoeneberger, Grant B. Morgan, Min Zhu, John M. Ferron, and Jeffrey D. Kromrey*

*University of South Carolina*

**Location: Gentry 101**

Much is still to be learned regarding small samples and hierarchical linear models (HLMs). Thus, in an effort to continue to expand our understanding of two-level HLMs under various sample size and other model conditions, Monte Carlo methods were used to examine convergence rates, parameter point and interval estimates, and both Type I error control and statistical power of tests associated with the effects (random and fixed) from two-level models and contextual, single-level OLS models. Outcomes were analyzed as a function of: level-1 sample size, level-2 sample size, intercept variance, slope variance, collinearity, model complexity, and analysis method.

## **Advanced Multilevel Modeling Using MLwiN (From Within Stata)**

*George Leckie and Chris Charlton*

*University of Maryland*

**Location: Gentry 101**

MLwiN is a software package for fitting multilevel models. MLwiN is used by over 7,000 users worldwide and has been cited over 2,000 times. In this talk we shall showcase some of the advanced modelling features of MLwiN and in particular demonstrate how MLwiN can now be run from within Stata using the `runmlwin` command. Our discussion will cover: (1) Estimation of multilevel models for continuous, binary, ordered categorical, unordered categorical and count data; (2) Fast estimation via classical and Bayesian methods; (3) Estimation of multilevel models for cross-classified and multiple membership non-hierarchical data structures; and (4) Estimation of multilevel multivariate response models, multilevel spatial models, multilevel measurement error models, multilevel multiple imputation models and multilevel factor models. This talk will be of interest to any researcher who works with multilevel models.

**Using Phantom Variables in Structural Equation Modeling to Assess Model Sensitivity to External Misspecification**

*Gregory R. Hancock and Jeffrey Harring*  
*University of Maryland*  
**Location: Gentry 131**

"External misspecifications," the omission of key variables from a structural model, can fundamentally alter the inferences one makes without such variables present. This paper presents two strategies for dealing with omitted variables, the first a fixed parameter approach incorporating the omitted variable into the model as a phantom variable where all associated parameter values are fixed, and the other a random parameter approach specifying prior distributions for all of the phantom variable's associated parameter values and utilizing Bayesian estimation. The argument is made that such external misspecification sensitivity analyses should become a routine part of measured and latent variable modeling.

**Longitudinal Model Selection of Statewide Achievement Tests at School Level by using the Linear Mixed Model**

*Ji Hoon Ryoo*  
*University of Nebraska – Lincoln*  
**Location: Gentry 140**

The model selection for longitudinal statewide test scores has been less paid attention though it is necessitated. One of the main reasons is the lack of understanding the model selection procedure when the longitudinal data include both static and dynamic predictors. This paper purports to provide a unified framework on model selection procedure with the linear mixed model (LMM) for longitudinal data including both static and dynamic predictors.

**Longitudinal Mixture Modeling of Exercise and Fruit and Vegetable Consumption Maintenance in Older Adults**

*Karen Stamm, Deborah A. Riebe, Bryan J. Blissmer, Geoffrey W. Greene, Faith D. Lees, and Phillip G. Clark*  
*University of Rhode Island*  
**Location: Gentry 103**

This study examined latent class growth analysis models of exercise and fruit and vegetable consumption maintenance in older adults. Models with one and two latent class variables were tested. The optimal model with one latent class variable had 6 classes. The optimal model with two latent class variables had an exercise latent class variable with 3 classes and a fruit and vegetable consumption latent class variable with 2 classes. In both models, the class with the highest membership had a declining trajectory of exercise maintenance and a high but slightly declining trajectory of fruit and vegetable consumption maintenance.

### **Markov Transitional Model for Not at Goal for Blood Pressure in Older Patients**

*Cyr E. M'lan, Patricia Neafsey, and Steve Walsh*

*University of Connecticut*

**Location: Gentry 103**

In this talk, we present results from a Markov transitional model applied to an e-health randomized controlled efficacy trial targeting older adults (age 60 and older) with hypertension. The goal of this randomized study was to reduce adverse reactions related to unsafe self-medication by intensively educating the patient about potential drug-to-drug interactions and adverse drug interactions, improve self-efficacy and medication adherence, achieve and maintain blood pressure readings below target values, and enhance patient-provider relationship.

### **Estimating Classification Accuracy for Latent Variable Mixture Models**

*Stephen Tueller and Gitta Lubke*

*RTI*

**Location: Gentry 101**

Latent variable mixture models (LVMM) are frequently used to classify participants. Classification in an LVMM is analogous to latent trait or ability estimation for factor analysis or item response models. Bayes' theorem serves to compute the posterior probability of each participant belonging to each class, and participants are assigned to the class with the highest posterior probability. Prior simulation studies, where true class is known, have shown that class assignment accuracy can be quite poor under many realistic data conditions. For applied settings, where true class is unknown, indicators of overall class assignment accuracy that are based on posterior probability extremity have been proposed (e.g., entropy, average class probabilities). The current work shows that interpreting estimated posterior probabilities that are near zero or one as an indication of accurate classification for a given participant  $i$  is unwarranted. Theoretical background is provided concerning the sources of sampling variation in the estimated individual posterior probabilities of participant  $i$ , which are uncertainty in parameter estimates and measurement error. We propose bootstrap methods to estimate standard errors and construct confidence intervals for the posterior probabilities of participant  $i$ . The methods are illustrated in a simulation study and using empirical data sets.

### **The Language-Achievement Connection for English Language Learners**

*David J. Francis, Tammy D. Tolar, and Karla K. Stuebing*

*University of Houston*

**Location: Gentry 144**

Latent class models are employed in combination with item response models to examine the link between language proficiency and content area achievement. The basic model attempts to determine if there is a class of limited English proficient students (ELL Class 1) for whom content area achievement tests function comparably to monolingual English speaking students (Class 0), as well as a second class of ELL students (ELL Class 2) for whom content area achievement tests do not function comparably. We hypothesized that the two classes of ELL students differ in English language development, such that the probability of membership in Class 1 increases as language proficiency increases. The model provides a means for empirically determining the probability that a content area achievement test will yield valid information about a student's knowledge in a content area.

Models were fit using data for mathematics, reading language arts, and language proficiency assessments from a statewide testing program currently in use under NCLB. We present results from analysis of Grade 4 data based on roughly 65,000 students, approximately 3,800 of which were designated as English Language Learners.

For both reading language arts and mathematics, students scoring at the first two levels of the language proficiency assessment were almost uniformly classified into ELL Class 2, whereas students scoring in the top two levels were split across ELL Class 1 and 2. Item discriminations were weaker for students in ELL Class 2 and item thresholds indicated that items were generally more difficult. Results are similar regardless of whether the model uses the sub-domain scores for reading, writing, speaking, and listening or the composite scaled score from the ELP assessment as the covariate(s) to predict class membership. For both reading and mathematics, students in the top two categories of ELP performance who were classified into ELL Class 1 tended to score more highly on the reading component of the ELP assessment relative to their performance on the writing, speaking, and listening components of the test than did similar students who were classified into ELL Class 2.

### **Interrelationships of Sildenafil Treatment Effects on the Physiological and Psychosocial Aspects of Erectile Dysfunction: An Application of Structural Equation Modeling**

*Joseph C. Cappelleri and Andrew G. Bushmakin*  
*Pfizer*

**Location: Gentry 201**

Structural equation modeling was used to study interrelationships of the following outcomes from a double-blind placebo-controlled trial of fixed-dose sildenafil 100 mg or 50 mg: Erection Hardness Score; the 15-item International Index of Erectile Function (IIEF), including item 4 (frequency of erection maintenance after penetration) and item 5 (difficulty of erection maintenance to intercourse completion); the Self-Esteem And Relationship questionnaire; and the question, "Do you feel anxious about your next attempt at sexual intercourse?"

### **Using Structural Equation Modeling to Model the Relationships between Physical Activity and Academic Outcomes**

*Nicole Judith Gilinsky*  
*Texas Tech University*

**Location: Gentry 201**

Physiological and psychological benefits of physical exercise have been well-documented (Craft, 2005; Etnier, et al., 1997; Pedersen & Saltin, 2006). Furthermore, compelling evidence exists for a positive relationship between exercise and favorable academic outcomes such as achievement test scores, school absences, and behavioral problems (Datar & Sturm, 2006; Grissom, 2005). The present study examined the relationships between physical activity, academic self-regulation, academic self-efficacy, and academic outcomes for college students using structural equation modeling. It was found that students engaging in frequent, moderate and/or high intensity physical activity show greater self-regulatory capabilities and academic self-efficacy as well as favorable academic outcomes.

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# Modern Modeling Methods Conference

May 22–23, 2012

University of Connecticut

The Modern Modeling Methods ( $M^3$ ) conference is an interdisciplinary conference designed to showcase the latest modeling methods and to present research related to these methodologies. Keynote speakers for the 2012 conference include **Donald Rubin** and **Jack McArdle**.

## Call for Papers– Proposals due January 5, 2012

The Modern Modeling Methods Conference ( $M^3$ ) will be held at the University of Connecticut on May 22–23, 2012. We are currently soliciting both methodological research papers and papers that illustrate methodological techniques in the area of modeling, broadly defined. Papers related to multilevel modeling, structural equation modeling, mixture modeling, and longitudinal modeling are especially encouraged. The deadline for submissions is **January 5, 2012**. Methodological research proposals should be no longer than 2000 words and should include purpose, background, methods, results, discussion, and significance. Methodological illustration papers should be no longer than 2000 words and should include a description of the methodology to be illustrated as well as an outline of the paper/talk. Please include a 100–150 word abstract to be used for the conference program.

For more information about the conference, or to submit a proposal, go to [www.modeling.uconn.edu](http://www.modeling.uconn.edu) . If you have questions, please email D. Betsy McCoach at [betsy.mccoach@uconn.edu](mailto:betsy.mccoach@uconn.edu) .

# **Graduate Program in Measurement, Evaluation and Assessment**

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