

**THE PENNSYLVANIA STATE UNIVERSITY  
COLLEGE OF HEALTH AND HUMAN DEVELOPMENT  
DEPARTMENT OF BIOBEHAVIORAL HEALTH**

**BBH 597A: Biobehavioral Health Research Strategies Part II  
Spring 2015**

**Mon 5:30 – 8:00 p.m.  
BBH 104**

**Instructor**

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Office Hours: Monday 3:00 – 4:30 p.m. and by appointment

**Course Description:**

This course is a survey of latent variable statistical models. The course will focus on three general components that correspond to specific types of latent variable models: 1) continuous latent factors (e.g., exploratory and confirmatory factor analysis, and structural equation models); 2) categorical continuous factors (e.g., latent class analysis, latent profile analysis, latent transition analysis; 3) latent growth curve models. Throughout the semester, students will gain the conceptual background for these models and have the opportunity to apply these methods in practice.

**Course Objectives:**

A key objective of this course is for students to acquire the skills necessary for implementing statistical analyses. Emphasis will be placed on the linkage of substantive theories to statistical models by discussing how to formulate testable hypotheses, assess model assumptions, and interpret output from statistical software programs.

**Prerequisites:**

As the second part of a two-semester sequence, all students are expected to have successfully completed BBH 505.

**Required Texts:**

Byrne, B.M. (2012). *Structural Equation Modeling with Mplus: Basic concepts, applications, and programming*. New York, New York: Routledge.

Collins, L. M., & Lanza, S. T. (2010). *Latent class and latent transition analysis: With applications in the social, behavioral, and health sciences*. Hoboken, NJ: Wiley.

*Note: additional readings will be assigned based on topics covered in class and will be made available on the Angel website.*

### **General information:**

Class time will be spent in lecture, discussion, and software demonstrations. It is expected that students will have read the assigned readings listed for each class. Class materials, including PowerPoint slides, readings, and programming assignment materials, will be posted on ANGEL in advance of each class.

Note that the software used in this course will be a downloadable add-on procedure for SAS Version 9 for Windows, PROC LCA and Mplus. All students will be expected to have access to both of these software packages to complete homework and other written assignments.

- A free demonstration version of Mplus is available at the following website:  
<http://www.statmodel.com/demo.shtml>
- Students may register on the Methodology Center website to download a free version of Proc LCA: <http://methodology.psu.edu/downloads>

### **Assignments and Grading:**

The activities of this course are designed to provide students with scaffolded learning experiences that engage the student in the skills and activities required in the culture of academia (e.g., engaging in scholarly discourse and group discussion, critically evaluating research, conceiving of and conducting data analyses, interpreting statistics, writing up research reports, and scientific collaboration). Students' final grades will be determined by the following four components:

1. *Class participation and attendance* is EXPECTED. If you need to miss class, please contact the instructor beforehand. It is expected that students will actively contribute to class discussion of the readings.
2. *Article Reviews* (10 points each; 30 points total)

There will be three article reviews due throughout the semester. For this assignment, students will find a peer-reviewed journal article that uses each of the statistical techniques covered in class. Students are to write a review of the methods and results, focusing on the appropriateness of the technique, testing of assumptions, correct interpretation, and presentation of results. The purpose is to enable students to critically evaluate social science research in the peer-review process. Each article review is expected to be about 3 pages in length.

3. *Homework assignments* (20 points each; 120 points total)

The largest proportion of your grade will be taken from a series of homework assignments. There will be six of these assignments, approximately every other week, throughout the semester. These assignments will be used to provide students with hands-on experience and are designed to help you learn how to address research questions using latent variable models. These assignments will be due at the beginning of the class on the specified due date.

Assignments will include a number of different kinds of brief exercises. As the class progresses and students gain familiarity with the statistical software, students will be asked to conduct an analyses of a given data (provided by the instructor) using the methods described in class to answer a number of questions. Generally, the completed assignment will also include software scripts and relevant outputs (with important elements highlighted and/or commented upon).

**LATE ASSIGNMENTS AND OTHER REQUIREMENTS.**

It is the responsibility of the students to print out and turn in hard copies of all course assignments. Electronic versions will not be accepted. Note that all assignments (with the exception of the final project) are due at the **beginning of the class period on the specified date.** All assignments turned in after the class has begun will be penalized by an automatic reduction of 1 point per day. For example, an assignment turned in after the class session has begun will receive a 1-point deduction. An assignment turned in the following day will receive a 2-point deduction, and so forth.

**Grading:**

The final course grade is based on class attendance, the three article reviews, and the six homework assignments. The following grading scale will be used:

A	93-100	A-	90-92.9	B+	87-89.9
B	83-86.9	B-	80-82.9	C+	77-79.9
C	73-76.9	C-	70-72.9	D+	67-69.9
D	63-66.9	D-	60-62.9	F	< 60

**EMAIL:** Email is an effective and efficient method for communication in this course. Throughout the semester, email will be used to provide you with last minute, up-to-date, and important information regarding this course. Your PSU-assigned email account will be used for all course-related correspondence for several reasons, including: security, protection against viruses, ability to send large attachments, and availability of PSU webmail access (<http://webmail.psu.edu>). It is your responsibility to check your Penn State account regularly for course-related emails. If your PSU email is forwarded to an outside account, it is your responsibility to ensure that course emails and attachments are making it through to your account. Emails that are bounced back from AOL, Hotmail, Yahoo, and other outside ISP accounts will not be resent. Because of the difficulty with attachments and because email cannot be guaranteed to arrive in a timely manner, we will not accept assignments by email without prior approval. It is also important to note that I receive more than 100 emails each day and will make an effort to respond to your questions quickly. There will be times during the semester when responses might not always be made the same day messages are submitted. That said, if you do not receive a reply from me within 36 hours of submitting your message it is worth re-sending your note as it may have been misplaced. Be aware that messages that you send may be reviewed by PSU faculty other than the instructor.

**CELL PHONES:** The BBH 597 classroom is a cell-free environment. Please respect your peers by ensuring that your cell phones are off when you are in class.

**STATEMENT ON RELIGIOUS HOLIDAYS:** Students are reminded of Penn State's policy regarding students' requests for absence from class for the purpose of observing a religious holiday. The University Faculty Senate Policy on Class Attendance (42-47) states that instructors should provide, within reason, opportunity to make up work for students who are obligated to miss classes for legitimate reasons.

As further clarification, Academic Administrative Policy on Religious Holidays (R-4) states that while the University makes every effort to avoid conflicts with religious holidays, when conflicts are unavoidable, the policy is to try and make special arrangements for the student affected. In consultation with campus and community religious leaders, The Center for Ethics and Religious Affairs has compiled a listing of those holy days of the major world religions for which observance may require a students to depart from his or her normal routine at the University. Only those holy days that occur when classes are in session are included. This is not, therefore, an exhaustive list of all major holy days in each religious tradition. The list is available on the Web at [www.sa.psu.edu/cera/relhol.html](http://www.sa.psu.edu/cera/relhol.html).

**ACADEMIC DISHONESTY:** Academic dishonesty is a broad topic. The examples given here are not intended to be an exhaustive list, but are provided to give an idea of behaviors that will not be tolerated. The following statements describe Penn State Policies for what constitutes Academic Dishonesty, and for dealing with it when it occurs. If you have any question about what constitutes academic dishonesty, it is your responsibility to discuss the issue with the course instructor. The usual punishment for academic dishonesty is an "F" for the course or a lesser penalty if the alleged infraction is of a more minor.

Students should also be aware of the rules regarding plagiarism. It is recommended that PSU students visit the following sites:

1. <http://tlt.its.psu.edu/plagiarism/tutorial/cutpaste/>
2. <http://tlt.its.psu.edu/plagiarism/tutorial/>

**University Statement of Academic Integrity (Policy 48-20):**

Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts. Academic integrity includes a commitment not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

Please refer to the College of Health and Human Development Academic Integrity Policy and Procedures for further expectations that will be expected in this course:  
(<http://www.hhdev.psu.edu/policies/academicintegrity/procedures.html#statement>).

## Violations of Academic Integrity Policy

Violations of the University's Academic Integrity Policy include the following:

1. Cheating: using crib sheets of any kind, preprogrammed calculators or cell phones, use of notes during a closed book exam
2. Copying on tests: looking at other students' exams, copying with a plan with another student, passing notes during exams; exchanging exams with another student
3. Plagiarism: fabricating information or citations; copying from the Internet of submitting the work of others from journals, articles and papers, or books; submitting other students' papers as one's own. Any material, regardless of length, that is the work of somebody else and who is not given explicit credit by citation, submitted as one's own, is plagiarized material.
4. Tampering with work: changing one's own or another student's work; tampering with work either as a prank or to sabotage another's work
5. Acts of aiding and abetting: Facilitating academically dishonest work by others; unauthorized collaboration on work; permitting another to copy from one's exam; writing a paper for another; inappropriately collaborating on home assignments or exams without permission or when prohibited
6. Unauthorized possession: Buying or stealing of exams or other materials; failing to return exams on file or reviewed in class; selling exams; photocopying exams; any possession of an exam without the instructor's permission
7. Submitting previous work: Submitting a paper, case study, lab report, or any assignment that had been submitted for credit in a prior class without the knowledge and permission of the instructor
8. Ghosting or misrepresenting: Taking a quiz or exam or performing a class assignment in place of another student; having another student do the same in one's place; signing in as present in class for another student or having another student do the same in one's place
9. Altering exams: Changing incorrect answers and seeking favorable grade changes when instructor returns graded exams for in-class review and then collects them; asserting that the instructor make a mistake in grade. Other forms include changing the letter and/or numerical grade on a test.
10. Computer theft: Electronic theft of computer programs or other software, data, images, art, or text belonging to another.

## **Students with Disabilities**

The Office for Disability Services has suggested that this statement concerning students with disabilities be placed on syllabi.

Note to students with disabilities:

Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for modifications or reasonable accommodations in this course, contact the Office for Disability Services (ODS), located at 116 Boucke Building at 1-814-863-1807(V/TTY). For further information regarding ODS, please visit their web site at [www.equity.psu.edu/ods](http://www.equity.psu.edu/ods). Instructors should be notified as early in the semester as possible regarding the need for modification or reasonable accommodations.

More detailed information about students with disabilities can be found in the ODS Faculty Handbook at: <http://www.equity.psu.edu/ods/faculty/overview.asp>

## **DIVERSITY STATEMENT**

In our recent report summarizing our diversity-related activities, the College of HHD made the following statement:

*With our focus on the improvement of the quality of individuals' lives within their families and communities, the College of Health and Human Development naturally places the understanding of diversity in a central position in both its mission and vision. Through teaching, research, and outreach programs, we strive to communicate the importance of diversity to both College and community members. "Diversity" is broadly defined by the College as "human differences," including differences in age, social class, disability, race, ethnicity, immigrant status, gender, gender expression, religion, veteran status, and sexual orientation.*

## TENTATIVE COURSE SCHEDULE

### **PART I: CONTINUOUS LATENT FACTORS**

- Week 1, January 12
- Introduction to course & syllabus
  - Review of BBH 5015 (EFA, path analysis)
  - Brief introduction to Mplus

#### **READINGS:**

Byrne (2012): Chapter 1

Week 2, January 19      ***NO CLASS: Martin Luther King, Jr. Day***

Week 3, January 26      **Exploratory and Confirmatory Factor Analysis (EFA & CFA)**

#### **READINGS:**

- Byrne (2012): Chapters 2, 3
- Henson, R. K., & Roberts, J. K. (2006). Use of exploratory factor analysis in published research common errors and some comment on improved practice. *Educational and Psychological measurement, 66*(3), 393-416

Week 4, February 2      **Exploratory and Confirmatory Factor Analysis (EFA & CFA)**

#### **READINGS:**

- Byrne (2012): Chapters 3, 4, 5
- Schmitt, T. A. (2011). Current methodological considerations in exploratory and confirmatory factor analysis. *Journal of Psychoeducational Assessment, 29*(4), 304-321.
- Russell, D.W. (2002). In search of underlying dimensions: The use (and abuse) of factor analysis in Personality and Social Psychology Bulletin. *Personality and Social Psychology Bulletin, 28*, 1629-1646.

Week 5, February 9      **Structural Equation Modeling (SEM)**

#### **READINGS:**

- Byrne (2012): Chapter 6
- Tomarken, A. J., & Waller, N. G. (2005). Structural equation modeling: Strengths, limitations, and misconceptions. *Annu. Rev. Clin. Psychol., 1*, 31-65.

Week 6, February 16      **Structural Equation Modeling (SEM)**

#### **READINGS:**

- Byrne (2012): Chapters 7, 8, 9
- Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of Educational Research, 99*(6), 323-338.

Week 7, February 23

## **Structural Equation Modeling (SEM)**

### **READINGS:**

- Byrne (2012): Chapters 7, 8, 9
- Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of Educational Research*, 99(6), 323-338.

## **PART II: CATEGORICAL LATENT FACTORS**

Week 8, March 2

### **Latent Class Analysis (LCA)**

- The LCA mathematical model
- Latent class homogeneity and separation
- Brief SAS tutorial

### **READINGS:**

- Collins & Lanza (2010): Chapters 1, 2, 3
- Lanza, S. T., Bray, B. C., & Collins, L. M. (in press). An introduction to latent class and latent transition analysis. In J. A. Schinka, & W. F. Velicer (Eds.) *Handbook of psychology, 2<sup>nd</sup> edition: Vol 2. Research methods in psychology*. Hoboken, NJ: Wiley.
- Tein, J.Y., Coxe, S., & Cham, H. (2013). Statistical power to detect the correct number of classes in latent profile analysis. *Structural Equation Modeling*, 20, 640-657.

Week 9, March 9

### ***NO CLASS: Spring Break Holiday***

Week 10, March 16

### **Latent Class Analysis (LCA)**

- Model identification and starting values
- Model selection
- Multiple-groups LCA
- Measurement invariance across groups

### **READINGS:**

- Collins & Lanza (2010): Chapters, 4, 5
- Lanza, S. T., Collins, L. M., Lemmon, D. R., & Schafer, J. L. (2007). PROC LCA: A SAS procedure for latent class analysis. *Structural Equation Modeling*, 14(4), 671-694.
- Nylund, K. L., Asparouhov, T., & Muthen, B. O. (2007) Deciding on the Number of Classes in Latent Class Analysis and Growth Mixture Modeling: A Monte Carlo Simulation Study. *Structural Equation Modeling*, 14, 535-569.

Week 11, March 23

### **Latent Class Analysis (LCA)**

- Review of binary and multinomial logistic regression
- LCA with covariates
- LCA with distal covariates

### **READINGS:**



- Collins & Lanza (2010): Chapter 6
- Cleveland, M. J., Mallett, K. A., White, H. R., Turrisi, R., & Favero, S. (2013). Patterns of alcohol use and related consequences among non-college emerging adults. *Journal of Studies on Alcohol and Drugs*, 74, 84-93. PMID: PMC3517266
- Lanza, S. T., Savage, J., & Birch, L. (2010). Identification and prediction of latent classes of weight loss strategies among women. *Obesity*, 18(4), 833-840. PMID: PMC2847025

Week 12, March 30

### **Latent Profile Analysis (LPA)**

- Comparison of LPA to LCA and Factor Analysis (FA)
- The LPA mathematical model
- LPA with grouping variables, covariates, and distal outcomes

### **READINGS:**

- Pastor, Barron, Miller, & Davis (2007). A latent profile analysis of college students' achievement goal orientation. *Contemporary Educational Psychology*, 32, 8-47.
- Schwartz, S.E.O., Rhodes, J.E., Chan, C. S., & Herrera, C. (2011). The impact of school-based mentoring on youths with different relational profiles. *Developmental Psychology*, 47, 450-462.
- Stapleton, J., Turrisi, R., Hillhouse, J., Robinson, J., & Abar, B. (2010). A comparison of the efficacy of an appearance-focused skin cancer intervention within indoor tanner subgroups identified by latent profile analysis. *Journal of Behavioral Medicine*, 33, 181-190.

Week 13, April 6

### **Latent Transition Analysis (LTA)**

- LCA for repeated measures
- The LTA mathematical model
- Multiple-groups LTA
- LTA with covariates

### **READINGS:**

- Collins & Lanza (2010): Chapters 7, 8
- Lanza, S. T., & Collins, L. M. (2008). A new SAS procedure for latent transition analysis: Transitions in dating and sexual risk behavior. *Developmental Psychology*, 44(2), 446-456.
- Lanza, S. T., & Collins, L. M. (2006). A mixture model of discontinuous development in heavy drinking from ages 18 to 30: The role of college enrollment. *Journal of Studies on Alcohol*, 67, 552-561.
- Cleveland, M. J., Lanza, S. T., Ray, A. E., Turrisi, R., & Mallett, K. M. (2012). Transitions in first-year college student drinking behaviors: Does drinking latent class membership moderate the effects of parent- and peer-based intervention components? *Psychology of Addictive Behaviors*, 26, 440-450. PMID: PMC3413757

### **PART III: LATENT GROWTH CURVE ANALYSIS**

Week 14, April 13

- Introduction to latent growth curves
- Adding predictors to growth curves
- Dual process growth curve models
- Multiple groups

#### **READINGS:**

- Byrne (2012): Chapter 11
- Duncan, T.E., & Duncan, S.C. (2004). An introduction to latent growth curve modeling. *Behavior Therapy*, 35, 333-363.
- Duncan, S.C., Duncan, T.E., Biglan, A., & Ary, D. (1998). Contributions of the social context to the development of adolescent substance use: A multivariate latent growth modeling approach. *Drug and Alcohol Dependence*, 50, 57-71.
- Curran, P. J., & Hussong, A.M. (2003). The use of latent trajectory models in psychopathology research. *Journal of Abnormal Psychology*, 112, 526-544.

Week 15, April 20

- Extending latent growth curve models
- Group based trajectory models
- Growth mixture models

#### **READINGS:**

- Jung, T. & Wickrama, K.A.S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass*, 2, 302-317.
- Muthen, B., & Muthen, L.K. (2000). Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research*, 24, 882-891.
- Jones, B.L., & Nagin, D.S. (2007). Advances in group-based trajectory modeling and a SAS procedure for estimating them. *Sociological Methods & Research*, 35, 542-571.

Week 16, April 27

### **COURSE WRAP-UP AND FINAL DISCUSSION**

#### **Changes to this syllabus**

The instructor reserves the right to modify the course syllabus if necessary and will make formal announcements of these changes in class and provide written notices of changes via ANGEL email. Students are responsible for noting these changes.