

**Course Syllabus**  
**RPTS 678: Latent Variable Model Applications in the Leisure Sciences (3 credits)**  
**Fall– 2011**

**Instructor**

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Office hours are by appointment. Also, please feel free to call or email me anytime.

**Class time:** 12:40 to 3:50pm Wednesday, Room 410 AGLS

**Text**

Required:

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. Guildford Press: New York.  
The text has an accompanying website where you can download syntax related to his examples:  
<http://people.bu.edu/tabrown/cfabook.html>

Optional:

Byrne, B. M. (1998). *Structural equation modeling with LISREL, PRELIS, and SIMPLIS*. Mahwah, NJ:  
Lawrence Erlbaum Assoc.

Additional (good reading but not by any means compulsory... there are many good new SEM texts out now)

Bollen, K.A. (1989). *Structural equations with latent variables*. New York: Wiley. Available at the bookstore or used copies may be obtainable online. ISBN: 0-471-01171-1.

Kline, R. B. (2005). *Principles and practice of structural equation modeling (2<sup>nd</sup> ed.)*. Guildford Press: New York

Maruyama, G.M. (1998). *Basics of structural equation modeling*. Thousand Oaks, CA: Sage. ISBN: 0-8039-7409-4.

**Prerequisites**

STAT636 or STAT652 or approval of instructor.

**Overview**

This course is intended to introduce students to structural equation modeling (SEM). Structural equation modeling (sometimes referred to as covariance structural analysis) is a regression-based technique that incorporates elements of path analysis and confirmatory factor analysis. The goal of the class is to provide students with a background on conceptual issues, an application of the method, and insight on programming through LISREL.

**Outcome**

At the end of the course, students will have a solid, conceptual foundation of structural modeling issues, be able to analyze data using LISREL software, critically evaluate professional articles, and write-up SEM results. THIS COURSE SHOULD SERVE AS A PLATFORM FOR FURTHER ENQUIRY.

**Homework**

There will be eight homework assignments which will primarily consist of data analysis and write-ups of SEM problems using the student version of the statistical package LISREL. Some data preparation and descriptive analysis using SPSS and PRELIS will be required. The student ("demo") version of LISREL 8.7 can be downloaded from the following internet site: <http://www.ssicentral.com/lisrel/downloads.html>.

The demo version limits use (for structural equation models) to a maximum of 15 observed variables. Purchase of the LISREL users' manual is not required although recommended if you plan on using this technique for you dissertation and beyond.

**Grading**

Assignments: 1 – 2: 5points each = 10 points  
 6 – 8: 12 points each = 72 points

Final paper: 18 points

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Total=100 points

- A=90-100 points
- B=80-89.9 points
- C=70-79.9 points
- D=60-69.9 points
- F<60 points

**Other Resources**

There are several internet sites devoted to SEM that may be of use. Dave Kenny has a great website with introductory material on most SEM topics at <http://nw3.nai.net/~dakenny/causalm.htm>. Ed Rigdon has an excellent site that serves as a gateway to most of the SEM sites on the web at <http://www.gsu.edu/~mkteer/>. There is a SEM discussion list called SEMNET which you can subscribe to (I think it would be a great idea if everyone would subscribe during this term) through the following site <http://www.gsu.edu/~mkteer/semnet.html>. Finally, the LISREL website (<http://www.ssicentral.com/lisrel/index.html>)also has lots of example programs.

**Americans with Disabilities Act (ADA) Policy Statement**

The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the University Curriculum Committee by the Department of Student Life. The policy statement was forwarded to the Faculty Senate for information. The Americans with Disabilities Act (ADA) is a federal antidiscrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall or call 845-1637.

**Academic Integrity :Aggie Honor Code**

“An Aggie does not lie, cheat, or steal or tolerate those who do.”

Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the Texas A&M University community from the requirements or the processes of the Honor System. For additional information please visit: [www.tamu.edu/aggiehonor/](http://www.tamu.edu/aggiehonor/)

On all course work, assignments, and examinations at Texas A&M University, the following Honor Pledge shall be preprinted and signed by the student:

**“On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work.”**

Cheating encompasses the following:

1. The willful giving or receiving of an unauthorized, unfair, dishonest, or unscrupulous advantage in academic work over other students.
2. The above may be accomplished by any means whatsoever, including but not limited to the following: fraud; duress; deception; theft; trick; talking; signs; gestures; copying from another student; and the unauthorized use of study aids, memoranda, books, data, or other information.
3. Attempted cheating.

Plagiarism encompasses the following:

1. Presenting as one's own the words, the work, or the opinions of someone else without proper acknowledgment.
2. Borrowing the sequence of ideas, the arrangement of material, or the pattern of thought of someone else without proper acknowledgment.

Depending on the severity of the indiscretion, cheating and plagiarism may result in automatic course failure.

### **Comments on Learning Statistics**

Statistics of any kind can be a very difficult topic to learn. However, keeping in mind the following points on learning statistics should greatly facilitate your learning in this course.

- **It's not like math, it is like math.** Statistics is considerably different from mathematics. In fact, the math required for this course is no more complex than what is needed to balance a check book. Statistics is like mathematics, however, in that it must be practiced to be learned. One has to work on exercises, analyze different problems, and get experience with different analytic situations in order to absorb the information. The most productive learning occurs when you encounter problems running your models (and I promise that you will). Do not think that you can just read through the material and remember everything. You may need to reread and apply the material several times. *So, don't wait until the last minute!*
- **It's like a foreign language.** Statistics does (and SEM in particular), however, use a lot of symbols like Greek letters, and for this reason it is a bit like learning a foreign language. Think of the symbols as a foreign language vocabulary that has to be learned in order to understand the sentences.
- **It's like other courses.** In this course, there will also be a great deal of practical, conceptual, and other substantive information that will have to be learned; so, you will also have to read the text material, study concepts, and do some memorization like other substantive courses.
- **It's progressive.** Everything builds on everything else. Don't let any misunderstandings slip through the cracks, or it will snowball on you.
- **It's weird.** Statistics is a unique and unusual topic involving some very abstract and weird ideas. The peculiar nature of the subject makes the material can make the material difficult to learn and retain. Despite its seemingly abstract nature, statistics are extremely useful tools that will make you a highly skilled and valued researcher.

**Course Schedule/Readings**  
**RPTS 678: Latent variable Model Applications in the Leisure Sciences**  
**Fall 2011**

**Primary Text:** Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. Guildford Press: New York

**Week 1, August 31: Overview of SEM, SEM Assumptions, Scale Construction**

*Reading*

Byrne, Chapter 1, "Structural Equation Models: The Basics"  
Brown, Chapter 1, "Uses of Confirmatory factor Analysis"

*Additional*

Maruyama, Chapter 2, "History and logic of structural equation modeling"  
Bollen, Chapter 1, "Historical background"  
Bollen, Chapter 2, "Model Notation, Covariances, and Path Analysis"

Assignment 1: Conceptual factor analysis – due September 7

Assignment 2: Scale construction - due September 7

**Week 2, September 7: No class**

**Week 3, September 14: Exploratory Factor Analysis**

*Reading*

Brown, Chapter 2, "The Common Factor Model and Exploratory Factor Analysis"

*Additional*

Byrne, Chapter 3, "Application 1: Testing the factorial validity of a theoretical construct (first-order CFA model)"  
Maruyama, Chapter 7, "Introducing the logic of factor analysis and multiple indicators to path modeling"  
Bollen, Chapter 6, "Measurement models: The relation between latent and observed variables"

Assignment 3: Exploratory factor analysis with SPSS – due September 21

**Week 4, September 21: Confirmatory Factor Analysis I**

*Reading*

Brown, Chapter 3, "Introduction to CFA"  
Brown, Chapter 4, "Specification and Interpretation of CFA Models"

*Additional*

Byrne, Chapter 3, "Application 1: Testing the factorial validity of a theoretical construct (first-order CFA model)"  
Byrne, Chapter 4, "Testing the factorial validity of scores from a measuring instrument"

- Maruyama, Chapter 7, "Introducing the logic of factor analysis and multiple indicators to path modeling
- Bollen, Chapter 6, "Measurement models: The relation between latent and observed variables"
- Hurley, A.E. et al. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives. *Journal of Organizational Behavior, 18*, 667-683.
- Noar, S.M. (2003). The role of structural modeling in scale development. *Structural Equation Modeling, 10*, 622-647.
- Preacher, K.J., & MacCallum, R.C. (2003). Repairing Tom Swift's electric factor analysis machine. *Understanding Statistics, 2*, 13-43.

Assignment 4: Confirmatory factor analysis with LISREL – due September 28

### **Week 5, September 28: Confirmatory Factor Analysis II – Identification**

#### *Reading*

- Brown, Chapter 4, "Specification and Interpretation of CFA Models"
- Brown, Chapter 5, "CFA Model Revision and Comparison"

#### *Additional*

- Byrne, Chapter 3, "Testing the factorial validity of a theoretical construct"
- Newsom, J. T., & Schulz, R. (1996). Social support as a mediator in the relation between functional status and quality of life in older adults. *Psychology and Aging, 11*, 34-44.

Assignment 5: Testing model identification – due October 5

### **Week 6, October 5: Goodness of Fit Indices**

#### *Reading*

- Brown, Chapter 3, "Introduction to CFA"
- Jackson, D. L., Gillaspay, J. A., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological Methods, 14*, 6-23.

#### *Additional*

- Byrne, Chapter 3, "Testing the factorial validity of a theoretical construct"
- Maruyama, Chapter 10, "Logic of alternative models and significance tests"
- Tanaka, J.S. (1993). Multifaceted conceptions of fit in structural equation models. In K.A. Bollen, & J.S. Long (eds.), *Testing structural equation Models* (pp. 10-39). Newbury Park, CA: Sage.
- Hu, L.-T., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.

**Week 7, October 12: No class**

### **Week 8, October 19: Multiple Regression/Path Analysis: Manifest and Latent Models**

#### *Reading*

- Byrne, Chapter 7, "Testing the validity of a causal structure"

#### *Additional*

- Maruyama, Chapter 8, "Putting it all together: Latent variable structural equation modeling"  
 Chapter 19, "Structural Equation Models with Latent Variables," in Pedhazur, E.J.  
 (1997). *Multiple regression in behavioral research: Explanation and prediction (3<sup>rd</sup> Edition)*.  
 Fort Worth, TX: Harcourt Brace.
- Bentler, P.M., & Chou, C.-P. (1988). Practical issues in structural modeling. In J.S. Long (Ed.),  
*Common problems/proper solutions* (pp.161-192). Beverly Hills, CA: Sage.
- Hoyle, R.H., & Smith, G.T. (1994). Formulating clinical research hypotheses as structural equation  
 models: A conceptual overview. *Journal of Consulting and Clinical Psychology, 62*, 429-440.
- Kline, Chapter 6, "Details of path analysis"
- MacCullum, R.C., Roznowski, M., & Necowitz, L.B. (1992). Model modifications in covariance  
 structure analysis: The problem of capitalization on chance. *Psychological Bulletin, 111*, 490-  
 504.
- Tanaka, J.S., Panter, A.T., Winborne, W.C., & Huba, G.J. (1990). Theory testing in personality and  
 social psychology with structural equation models: A primer in 20 questions. In C. Hendrick,  
 & M.S. Clark (Eds.), *Review of personality and social psychology* (Vol 11, pp. 217-  
 241). Newbury Park, CA: Sage.

Assignment 6: Latent variable path analysis – due October 26

### **Week 9, October 26: Multiple Group CFA**

#### *Reading*

CFA with Equality Constraints, Multiple Groups, and Mean Structures

#### *Additional*

- Byrne, Chapter 8, "Testing for invariant factorial structure of a theoretical construct (first-order  
 CFA model)"
- Byrne, Chapter 9, "Testing for invariant factorial structure of scores from a measuring  
 instrument (first-order CFA model)"
- Maruyama, Chapter 11, "Variations on the basic latent variable structural equation  
 model". Cheung, G.W., & Rensvold, R.B. (1999). Testing factorial invariance across groups: A  
 reconceptualization and proposed new method. *Journal of Management, 25*, 1-27.
- McCallum, J., Mackinnon, A., Simons, L., & Simons, J. (1995). Measurement properties of the  
 Center for Epidemiological Studies Depression Scale: An Australian community study of aged  
 persons. *Journal of Gerontology: Social Sciences, 50B*, S182-S189.
- Scott-Lennox, J.A., & Lennox, R.D. (1995). Sex differences in social support and depression in  
 older low-income adults. In R. H. Hoyle (Ed.), *Structural equation modeling: Comments,  
 issues, and applications*. (pp. 199-216). Thousand Oaks, CA: Sage.

Assignment 7: Multiple group CFA – due November 2<sup>nd</sup>

### **Week 10, November 2<sup>nd</sup>: Multiple Group Path Analysis**

#### *Reading*

Byrne, Chapter 11, "Testing for invariant pattern of causal structure"

#### *Additional*

Maruyama, Chapter 11: "Variations in the basic latent variable structural equation model"

Kline, Chapter 11, "Multiple sample SEM"

Optional Assignment: Multiple groupSEM – due November 9

### **Week 11, November 9: Handling Missing Data and Non-Normal Data**

#### *Reading*

Brown, Chapter 9, "Data Issues in CFA: Missing, Non-Normal, and categorical Data"  
Graham, J. W., Cumsille, P. E., & Elek-Fisk, E. (2003). Methods for handling missing data. In J. A. Schinka, W. F. & Velicer (Eds.), *Handbook of psychology: Research methods in psychology* (pp. 87-115). John Wiley & Sons: New York.

#### *Additional for non-normality*

Finch, J.F., & West, S.G. (1997). The investigation of personality structure: Statistical models. *Journal of Research in Personality, 31*, 439-485.  
Muthen, B.O. (1993). Goodness of fit with categorical and other nonnormal variables. In K.A. Bollen, & J.S. Long (eds.), *Testing structural equation Models* (pp. 205-234). Newbury Park, CA: Sage.  
West, S. G., Finch, J. F., Curran, P. J. (1995). Structural equation models with nonnormal variables: Problems and remedies. In R. H. Hoyle (Ed.), *Structural equation modeling: Comments, issues, and applications*. (pp. 56-77). Thousand Oaks, CA: Sage.

Assignment 8: Model comparisons with complete and incomplete data – November 16

### **Week 12, November 16: Second-Order Models, Parceling & Non-Recursive Models**

#### *Reading*

Brown, Chapter 8, "Other Types of CFA Models: Higher-Order Factor Analysis, Scale Reliability, Evaluation, and Formative Indicators"

#### *Additional*

Bandalos, D.L. (2002). The effects of item parceling on Goodness-of-Fit and parameter estimate bias in structural equation modeling. *Structural Equation Modeling, 9*, 78-102.  
Bandalos, D.L., & Finney, S.J. (2001). Item parceling issues in structural equation modeling. In G.A. Marcoulides and R.E. Schumacker (Eds.), *New developments and techniques in structural equation modeling*. Lawrence Erlbaum Associates: London.  
Byrne, Chapter 5, "Testing the factorial validity of scores from a measuring instrument (second-order CFA model)"  
Kline, Chapter 9, "Non-recursive structural models"  
Maruyama, Chapter 6, "Recursive and longitudinal models: Where causality goes in more than one direction and where data are collected over time"

### **Week 12, November 30: Statistical Power & Sample Size**

#### *Reading*

Brown, Chapter 10, "Statistical Power & Sample Size"

#### *Additional*

MacCallum, R. C., Browne, M. W., & Sugawara, H.M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*, 130-149.  
Kline, Chapter 6, "Details of path analysis"

### **Week 12, November 30: Writing Up Modeling Results and Critiques of SEM**

#### *Reading*

Maruyama, Chapter 12, "Wrapping Up"

Kline, Chapter 9, "How to fool yourself with SEM"

Mueller, R.O. (1997). Structural equation modeling: Back to basics. *Structural Equation Modeling, 4*, 353-369.

Hoyle, R.H., & Panter, A.T. (1995). Writing about structural equation models. In R. H. Hoyle (Ed.), *Structural equation modeling: Comments, issues, and applications*. (pp. 56-77). Thousand Oaks, CA: Sage.

#### **Exam Week, Date TBA**

Final paper due.