

**Child Language Doctoral Program (CLDP) 948 and
Educational Psychology (EPSY) 906:
Latent Trait Measurement and Structural Equation Models**

Instructor:	Dr. Lesa Hoffman	Website:	http://www.lesahoffman.com/CLDP948/index.html
Email:	Lesa@ku.edu	Phone:	(785) 864-0638
Room:	3049 Dole	Office:	3042 Dole
Time:	MW 1:15–2:30	Office Hours:	MW 2:30–4:00 in 3049 or 3042 Dole
GTA:	Jihong Zhang		
Email:	jihong.zhang@ku.edu	Office Hours:	Thursdays 1:00–4:00 in 3049 Dole

Schedule of Topics and Events:

The online syllabus at the web address provided above will always have the most current information.

Course Objectives, Materials, and Pre-Requisites:

This course will contemporary approaches to measurement, expanding from classical test theory into confirmatory factor models, item response models, and their use within structural equation models. In addition to the statistical models, the course will also focus on the measurement concepts behind these models and how they relate to each other with respect to scale construction and evaluation. Class time will be devoted primarily to lectures and examples. Lecture materials in .pdf format will be available for download at the website above the day prior to class, or else paper copies can be requested. Video recordings of the class lectures will also be available online, but are not intended to take the place of class attendance. Selected book chapters and journal articles will be assigned for each specific topic as needed; the initial list of readings below may be updated. Because the course will have an applied focus using *Mplus* software, instructor and GTA office hours will be held in the 3049 Dole computer lab, in which participants will have opportunities to work on assignments and receive immediate software assistance. Participants should be comfortable with the general linear model (analysis of variance, regression) prior to enrolling in this course.

Academic Honesty:

As a reminder, the University of Kansas has a formal policy on academic honesty. All assignments should be done individually without exception.

Accommodating Students with Disabilities:

Students with disabilities or who have other special needs are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation.

Course Requirements:

Participants will have the opportunity to earn **up to 100 total points** in this course. Up to **79 points** can be earned from submitting **6 homework assignments**. Up to **21 points** may be earned from submitting **7 outside-of-class quizzes**. Please note there will also be an opportunity to earn up to **3 points of extra credit** (labeled as homework 0; see the online syllabus for more information). There may be other opportunities to earn extra credit at the instructor's discretion.

Policy on Late Homework Assignments and Incompletes:

In order to be able to provide prompt feedback and class discussion of homework problems, **late homework assignments will incur a 3-point penalty**. However, extensions will be granted as needed for extenuating circumstances (e.g., conferences, family obligations) if requested **at least two weeks in advance of the due date**. **Late or incomplete outside-of-class quizzes will incur a 1-point penalty when submitted**. Finally, a final grade of "incomplete" will only be given in the event of dire circumstances and at the instructor's discretion. Homework assignments that involve individual writing will have the opportunity to be

revised ONCE to earn the maximum total points. Written assignments **must be at least ¾ complete to be accepted, and late revisions will incur a 1-point penalty**. No late points will be returned through the revision process. Please use “track changes” and retain all original instructor comments (unless otherwise instructed) so that I can easily see how your revisions address the comments.

Final grades will be determined by the *proportion* earned out of the total possible points:

>92 = A, 90–92 = A-, 87–89 = B+, 83–86 = B, 80–82 = B-, < 80 = C or no pass

Course Software:

Participants will need to have access to *Mplus* software, which is available in 3049 Dole or in the GIS and Data Lab in 425 Watson Library. Individual student licenses can also be purchased from www.statmodel.com (\$350 each; no expiration date).

Course Textbook:

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed). New York, NY: Guilford.

Other Course Readings (all available via "Course Documents" on Blackboard):

Asparouhov, T., & Muthén, B. (2010). Plausible values for latent variables using *Mplus*. Retrieved from <http://www.statmodel.com/download/Plausible.pdf>.

Bauer, D. J., & Hussong, A. M. (2009). Psychometric approaches for developing commensurate measures across independent studies: Traditional and new models. *Psychological Methods, 14*(2), 101-125.

Chen, F., F., West, S. G., & Sousa, K. H. (2006). A comparison of bifactor and second-order models of quality of life. *Multivariate Behavioral Research, 41*, 189-225.

Curran, P. J., Cole, V. T., Bauer, D. J., Rothenberg, A., & Hussong, A. M. (2018). Recovering predictor–criterion relations using covariate-informed factor score estimates. *Structural Equation Modeling*. Retrieved August 2018, <https://doi.org/10.1080/10705511.2018.1473773>.

Curran, P. J., McGinley, J. S., Bauer, D. J., Hussong, A. M., Burns, A., Chassin, L., Sher, K., & Zucker, R. (2014). A moderated nonlinear factor model for the development of commensurate measures in integrative data analysis. *Multivariate Behavioral Research, 49*(3), 214-231.

Davidson, C. A., Hoffman, L., & Spaulding, W. D. (2016). Schizotypal personality questionnaire – brief revised (updated): An update of norms, factor structure, and item content in a large non-clinical young adult sample. *Psychiatry Research, 238*, 345-355.

Edwards, M. C., & Wirth, R. J. (2009). Measurement and the study of change. *Research in Human Development, 62*(2-3), 74-96.

E&R: Embretson, S. E., & Reise, S. T. (2000). *Item response theory for psychologists*. Mahwah, NJ: Erlbaum.

Enders, C. K. (2010). *Applied missing data analysis*. New York, NY: Guilford.

Ferrando, P. J. (2009). Difficulty, discrimination, and information indices in the linear factor analysis model for continuous item responses. *Applied Psychological Measurement, 33*(1), 9-24.

Huggins-Manley, A. C., Algina, J. & Zhou, S. (2018). Models for semiordeed data to address not applicable responses in scale measurement. *Structural Equation Modeling, 25*(2), 230-243.

John, O. P., & Benet-Martinez, V. (2014). Measurement: Reliability, construct validation, and scale construction. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 473-503, 2nd ed.). New York, NY: Cambridge University Press.

MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis*. New York, NY: Routledge Academic.

Maydeu-Olivares, A. (2015). Evaluating the fit of IRT models. In S. P. Reise & D. A. Revicki (Eds.), *Handbook of item response theory modeling* (pp. 111-127). New York, NY: Taylor & Francis.

- Maydeu-Olivares, A., & Coffman, D. L. (2006). Random intercept item factor analysis. *Psychological Methods, 11*, 344-362.
- McNeish, D. (2017). Thanks coefficient alpha, we'll take it from here. *Psychological Methods*. Advance online publication. <http://dx.doi.org/10.1037/met0000144>
- McNeish, D., An J., & Hancock, G. R. (2018). The thorny relation between measurement quality and fit index cutoffs in latent variable models. *Journal of Personality Assessment*.
- McDonald, R. P. (1999). *Test theory: A unified treatment*. Mahwah, NJ: Erlbaum.
- Mungas, D., & Reed, B. R. (2000). Application of item response theory for development of a global functioning measure of dementia with linear measurement properties. *Statistics in Medicine, 19*, 1631-1644.
- Paek, I., Cui, M., Gübes, N. O., & Yang, Y. (2018). Estimation of an IRT model by Mplus for dichotomously scored responses under different estimation methods. *Educational and Psychological Measurement, 78*(4), 569-588.
- Preacher, K. J., & MacCallum, R. C. (2003). Repairing Tom Swift's electric factor analysis machine. *Understanding Statistics, 2*(1), 13-43.
- Reise, S. P. (2012). The rediscovery of bifactor measurement models. *Multivariate Behavioral Research, 47*, 667-696.
- Rijmen, F., Tuerlinckx, F., De Boeck, P., & Kuppens, P. (2003). A nonlinear mixed model framework for item response theory. *Psychological Methods, 8*(2), 185-205.
- Shi, D., Lee, T., & Maydeu-Olivares, A. (2018). Understanding the model size effect on SEM fit indices. *Educational and Psychological Measurement*.
- Tay, L., & Jebb, A. T. (2018). Establishing construct continua in construct validation: The process of continuum specification. *Advances in Methods and Practices in Psychological Science*, retrieved July 2018. <https://doi.org/10.1177/2515245918775707>.
- Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods, 3*(1), 4-69.
- Wirth, R. J., & Edwards, M. C. (2007). Item factor analysis: Current approaches and future directions. *Psychological Methods, 12*(1), 58-79.

Tentative Schedule of Events:

Week	Date	Topics	Readings
1	8/20	Course Introduction Lecture 1: Introduction to Latent Trait Measurement	John & Benet-Martinez (2014) Tay & Jeff (2018)
	8/22	Lecture 1, continued	Davidson et al. (2016)
	8/24	NO HOMEWORK DUE	
2	8/27	Lecture 2: Exploratory Factor Analysis and Principal Components Analysis	Brown ch. 2 Preacher & McCollum (2003)
	8/29	Lecture 3: Classical Test Theory for Scale Reliability and Validity	McDonald (1999) ch. 5-7
	8/31	HW0 DUE BY 11:59 PM ONLINE: 3 points extra credit for testing the homework system	
3	9/3	NO CLASS OR OFFICE HOURS	
	9/5	QUIZ 1 DUE BY 1:00 PM VIA BLACKBOARD Lecture 3, continued Example 3: Classical Items Analysis in SPSS and SAS	
	9/7	HW1 DUE BY 11:59 PM VIA BLACKBOARD: Background check for your instrument	
4	9/10	Lecture 4: Confirmatory Factor Analysis	Brown ch. 3-5
	9/12	Example 4: Confirmatory Factor Models in Mplus and SAS MIXED	Ferrando (2009)
	9/14	NO HOMEWORK DUE	
5	9/17	QUIZ 2 DUE BY 1:00 PM VIA BLACKBOARD Lecture 4 and Example 4, continued	McNeish et al. (2018) Shi et al. (2018)
	9/19	Lecture 4 and Example 4, continued	Enders (2010) ch. 3-5
	9/21	HW1 REVISION DUE BY 11:59 PM VIA BLACKBOARD	
6	9/24	Lecture 5: Latent Trait Measurement Models for Binary Responses	E & R (2000) ch. 3-4
	9/26	Lecture 5, continued	Mungas & Reed (2000)
	9/28	HW2 DUE BY 11:59 PM ONLINE: Practice with CFA	
7	10/1	Lecture 5, continued Example 5: Binary Item Response Models in Mplus	E & R ch. 7-8
	10/3	QUIZ 3 DUE BY 1:00 PM VIA BLACKBOARD Lecture 5 and Example 5, continued	Wirth & Edwards (2007) Paek et al. (2018)
	10/5	NO HOMEWORK DUE	
8	10/8	Lecture 5 and Example 5, continued	Maydeu-Olivares (2015)
	10/10	NO CLASS OR OFFICE HOURS	
	10/12	NO HOMEWORK DUE	
9	10/15	NO CLASS OR OFFICE HOURS	
	10/17	Lecture 6: Latent Trait Measurement Models for Other Item Responses Example 6a: Graded Response Models for Ordinal Responses in Mplus	E & R ch. 5 Huggins-Manley et al. (2017)
	10/19	HW3 DUE BY 11:59 PM VIA BLACKBOARD: CFA on your own data	

Week	Date	Topics	Readings
10	10/22	QUIZ 4 DUE BY 1:00 PM VIA BLACKBOARD Example 6b: Measurement Models for Other Non-Normal Outcomes in Mplus	Bauer & Hussong (2009)
	10/24	Lecture 6 and Example 6, continued	
	10/26	NO HOMEWORK DUE	
11	10/29	Lecture 7: Measurement Invariance in CFA and Differential Item Functioning in IRT/IFA	Brown ch. 7
	10/31	Example 7a: Multiple-Group Measurement Invariance in CFA using Mplus	Vandenberg & Lance (2000)
	11/2	HW4 DUE BY 11:59 PM ONLINE: Practice with IFA	
12	11/5	QUIZ 5 DUE BY 1:00 PM VIA BLACKBOARD Example 7a, continued Example 7b: Longitudinal Measurement Invariance in CFA using Mplus	Edwards & Wirth (2009)
	11/7	Lecture 7 continued, Example 7c: Multiple-Group Measurement Invariance in IFA using Mplus	Curran et al. (2014)
	11/9	HW3 REVISION DUE BY 11:59 PM VIA BLACKBOARD	
13	11/12	Lecture 8: Higher-Order and Method Factor Models	Brown ch. 8
	11/14	Example 8: Higher-Order CFA and IRT Models in Mplus	Maydeu-Olivares & Coffman (2006) Chen et al. (2006) Reise (2012)
	11/16	HW5 DUE BY 11:59 PM VIA BLACKBOARD: IFA on your own data	
14	11/19	NO CLASS (or office hours)	
	11/21	NO CLASS (or office hours)	
	11/23	NO HOMEWORK DUE	
15	11/26	QUIZ 6 DUE BY 1:00 PM VIA BLACKBOARD Lecture 9: Path Modeling and Structural Equation Modeling Example 9a: Path Modeling with Mediation in Mplus Example 9b: Path Modeling with Non-Normal Outcomes in Mplus	MacKinnon (2008) ch. 6
	11/28	Example 9c: Structural Equation Modeling in Mplus	Asparouhov & Muthén (2010)
	11/30	HW6 DUE BY 11:59 PM ONLINE: Practice with Measurement Invariance	
16	12/3	QUIZ 7 DUE BY 1:00 PM VIA BLACKBOARD Lecture 9, continued Example 9c: Structural Equation Modeling in Mplus	Curran et al. (2018)
	12/5	Course Evaluations Lecture 9 and Example 9c, continued	
	12/7	HW5 REVISION DUE BY 11:59 PM VIA BLACKBOARD	
17	12/12	All outstanding homework due by 11:59 PM	