GEORGE MASON UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT
EDUCATIONAL PSYCHOLOGY

EDRS 831
Structural Equation Modeling

Semester Year

Meeting Time/Days
Location
PROFESSOR(S):
Name:
Office phone
Office location
Office hours
Email address

COURSE DESCRIPTION:

A. Prerequisites: EDRS 811

B. Focusing on the development of knowledge and skills related to structural equation modeling and research applications in education, psychology, and related fields.

NATURE OF COURSE DELIVERY:

Lectures, large group discussion, in class activities, and individual/group assignments

LEARNER OUTCOMES:

This course is designed to enable students to:

- Identify techniques of path analysis and structural equation modeling that are appropriate for specified research questions and data.
- Understand concepts of path analysis and structural equation modeling.
- Test structural equation models for adequacy of identification and data fit using the computer program for statistical analysis with latent variable, Mplus (Muthén & Muthén, 2008) [1].
- Conduct confirmatory factor analysis via structural equation modeling using Mplus.
- Conduct structural equation analysis incorporating measurement models using Mplus.
- Analyze longitudinal data with linear structural equation models using Mplus
- Read and evaluate scientific articles as regards testing of causal relationships in education, psychology, and related fields.

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[1] Muthén, L. & Muthén, B. (2008). *Mplus user's guide*. Los Angeles, CA: Muthén & Muthén. (available also at: http://www.statmodel.com).

PROFESSIONAL STANDARDS:

The student outcomes are informed by the Standards for Reporting non Empirical Social Science Research in Publications of the American Educational Research Association (AERA; *Educational Researcher*, Vol. 35, No. 6, pp. 33–40). Those standards deemed most relevant to addressing the learning targets for the course are those that state that *educators will have the knowledge, skill and disposition to:*

1. Apply basic principles of research practices for addressing specific educational needs
2. Develop design and select methods of structural equation modeling appropriate for addressing targeted research question in education research and related fields
3. Evaluate the adequacy, data fit, and validity of structural equation models in the context of education and related fields
4. Conduct structural equation modeling using contemporary statistical software and interpret the results
5. Use research results to disseminate and advance understanding and knowledge related to theory and practice of education and related fields
6. Recognize and appropriately act against the unethical, illegal, and otherwise, inappropriate research methods and uses of structural equation modeling results.
7. Recognize the implications of educational research for social justice in schools and other professional organizations.
8. Discern critical issues related to the role of the research design in the framework of structural equation modeling for data-driven decision making in education and related fields.

REQUIRED TEXTS:

Raykov, T., & Marcoulides, G. A. (2006). *A First Course in Structural Equation Modeling* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum.

COURSE REQUIREMENTS, PERFORMANCE-BASED ASSESSMENT, AND EVALUATION CRITERIA:

A. Requirements

1. **In class/Homework Assignments (10%):** Students will be asked to work individually on homework assignments throughout the semester.

2. **Class Attendance and Participation (5%):** Students are required to attend all classes, to be on time, prepared, follow outlined procedures in case of absence, actively participate and support the members of the learning group and the members of the class. The scoring rubric for class attendance and participation in provided in Appendix 1.

3. **Midterm Examination (15%):** Students will take a midterm examination (closed books and notes) to demonstrate understanding and knowledge of course content covered to date of examination.

4. **Pilot Research Study (50%):** This course requires students to develop and conduct a pilot-research study related to using structural equation modeling and interpretation of results in the context of education research. This study is intended to reflect what you have learned from this course. It should be written in a way that one would submit for a national professional conference paper presentation. Other requirements for this course are designed to build up bases for the final pilot research proposal. Research papers must be handed in on time and must adhere to the APA Publication Manual Guidelines.

5. **Final Examination (20%):** Students will take a final examination (closed books and notes) to demonstrate understanding and knowledge of course content covered throughout the coursework.

This pilot research study will be divided into 4 sequential parts.

1. Identify broad topic of interest; conduct a literature review; discuss significance of the proposed study; state purpose and hypotheses.
2. Methods- describe sample; identify measures to test hypotheses; discuss procedures and design of the study.
3. Data collection.
4. Data analysis.
5. Write the results section.
6. Discussion and Conclusion.

The presentation of the final paper will take place the last day of class in a research paper format (APA style, see also guidelines posted on the AERA website, www.aera.net.org.) After completing the research study, reflect on that experience. What did you learn from it? How do you think course material helped you carry out the study? [**Scoring rubric** for the research paper is provided in Appendix 2].

B. Performance-based assessments

All of the student products specified under course requirements will require performance-based assessments guided by grading rubrics. The scoring rubrics associated with the assessment of (a) class attendance and participation and (b) pilot research project ate proposal development assignment is provided in Appendices 1 and 2, respectively.

C. Criteria for evaluation

There are 100 total points for the course, distributed among the homework assignments (10%), class attendance and participation (5%), midterm examination (25%), pilot research project (30%), and final examination (30%).

D. Grading scale

Letter grades will be assigned as follows:

A+	97.5 - 100%,	**A**	92.5 - 97.49%,	**A-**	89.5 - 92.49%,
B+	87.5 - 89.49%,	**B**	82.5 - 87.49%,	**B-**	79.5 - 82.49%,
C	70-79.49%, and				
F	below 70%				

COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT

Student Expectations

- Students must adhere to the guidelines of the George Mason University Honor Code [See http://academicintegrity.gmu.edu/honorcode/].
- Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See http://ods.gmu.edu/].
- Students must follow the university policy for Responsible Use of Computing [See http://universitypolicy.gmu.edu/1301gen.html].
- Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- Students are expected to exhibit professional behaviors and dispositions at all times.

Campus Resources

- The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See http://caps.gmu.edu/].
- The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing [See http://writingcenter.gmu.edu/].
- For additional information on the College of Education and Human Development, Graduate School of Education, please visit our website [See http://gse.gmu.edu/].

PROPOSED CLASS SCHEDULE

Session	Topic/Learning Experiences	Readings and Assignments
Session 1	Introduction to structural equation modeling (SEM) – nature, purpose, variables, scales, and related issues	**Text (Ch. 1), H1**
Session 2	Review of statistical concepts related to SEM	**DD (Ch. 11, 13), H2**
Session 3	Introduction to path analysis	**Text (Ch. 3), DD (Ch. 24), H3**
Session 4	Introduction to the computer program Mplus. Path analysis using Mplus.	**Text (Ch. 2, 3), H4**
Session 5	Confirmatory factor analysis	**Text (Ch. 4), DD(Ch. 24), H5**
Session 6	**Midterm Examination**	
Session 7	Factorial invariance groups and time	**Text (Ch. 5), DD(Ch. 24), H7**
Session 8	Structural regression models	**Text (Ch. 5), H8**
Session 9	Structured means modeling	**Text (Ch. 5), DD(Ch. 24), H9**
Session 10	Group code (MIMIC) modeling	**Text (Ch. 5), DD(Ch. 24), H10**
Session 11	Multilevel (hierarchical) linear modeling	**H11**
Session 12	Latent change analysis	**Text (Ch. 6), H12**
Session 13	Review and examples of structural equation modeling	**Text (Ch. 6), H13**
Session 14	**Project Presentations**	
Session 15	**Final Examination**	

Note: **Text** = Required text (Raykov & Maqrcoulides, 2006);
DD = Complimentary text: Dimiter Dimitrov (2008). *Quantitative research in education: Intermediate and advanced methods*. Oceanside, NY: Whittier Publications;
H = Handout from relevant sources.

APPENDIX 1

RUBRIC FOR PARTICIPATION AND ATTENDANCE

		LEVEL OF PERFORMANCE		
ELEMENT	**Distinguished (4-5 pts.)**	**Proficient (3 pts.)**	**Basic (2 pts.)**	**Unsatisfactory (1 or 0 pts.)**
Attendance & Participation	The student attends all classes, is on time, is prepared and follows outlined procedures in case of absence. The student actively participates and supports the members of the learning group and the members of the class.	The student attends all classes, is on time, is prepared and follows outlined procedures in case of absence; the student makes active contributions to the learning group and class.	The student is on time, prepared for class, participates in group and class discussions. The student attends all classes and if an absence occurs, the procedure outlined in this section of the syllabus is followed.	The student is late for class. Absences are not documented by following the procedures outlined in this section of the syllabus. The student is not prepared for class and does not actively participate in discussions.

APPENDIX 2

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RUBRIC FOR RESEARCH PAPER

GENERAL EVALUATION CRITERIA:

- Clarity and organization
- Comprehensiveness of content
- APA style

TOTAL SCORE: **MAX = 50 pts.**

Performance Elements	Quality Points
Introduction Section	**max = 9 points**
Statement of the nature and importance of the problem and literature review related to the issues.	**4-5 points:** The study problem is (a) relevant to the area of educational research, (b) described in a parsimonious and complete manner, (c) channeled towards the purpose of the study, and (d) embedded in a literature review on related theory and research.
	2-3 points: The study problem is relevant to the area of educational research and overall well described, but not channeled towards the purpose of the study or the literature review is not quite on target.
	0-1 points: The study problem is not relevant to the area of educational research and/or not clearly described, poorly channeled towards the purpose of the study, and not supported well by literature review.
Justification of the need for this study	**2 points:** The justification of the study is well described and stems from a necessity to fill up an existing gap in previous research on the topic or to conduct a replication study.
	0-1 points: The justification of the study is not well described and/or does not stem from a necessity to fill up an existing gap in previous research on the topic or to conduct a replication study.
Statement of the purpose of the study and related research questions.	**2 points:** The purpose of the study is connected to the statement of the problem and the research questions are properly described.
	0-1 points: The purpose of the study is not well connected to the statement of the problem and/or the research questions are not properly described.

Method Section	**max = 13 points**
Description of the study sample	**4 points:** Provided is clear, accurate, and complete description of the study sample — sampling method (random selection, volunteers, etc.), relevant demographic characteristics, sample size (total and by subgroups), and judgment about sample representativeness for the targeted population.
	2-3 points: Provided is relatively complete description of the study sample, with drawbacks related to the description of sampling method, relevant demographic characteristics, sample size, or sample representativeness.
	0-1 points: Provided is poor description of the study sample, with missing elements related to method of sampling, relevant demographic characteristics, and representativeness.
Description of the data (instruments, scales, and score reliability)	**2-3 points:** Provided is clear, accurate, and complete description of the data sources (e.g., assessment instruments, existing records, etc.), scoring rubrics, scales, and reliability of scores obtained for the study sample.
	0-1 points: Provided is incomplete (or lacking) description of data sources and there is no report on reliability estimates.
Description of the data collection method	**2 points:** Provided is clear, accurate, and complete description of the data collection method — e.g., existing students records or online data base.
	0-1 points: Provided is incomplete (or lacking) description of the data collection method.
Description of data analysis methods and procedures used to address the research questions in the project	**4 points:** Provided is clear, accurate, and complete description of *appropriate* data analysis methods and procedures used to address the research questions.
	2-3 points: Selected are *appropriate* methods and procedures of data analysis, with lack of sufficient clarity, accuracy, and/or completeness in description.
	0-1 points: Some (or all) of the selected data methods and procedures are *not appropriate* for addressing the project research questions.
Results Section	**max = 14 points**
	8 points: Provided is clear, accurate, and complete presentation of relevant results in APA style by

Within-text presentation of results obtained with the statistical data analysis for each research question	project research questions.
	6-7 points: Provided is clear, accurate, and complete presentation of relevant results by project research questions, with some deviations from the APA style.
	5-6 points: Presented are relevant results by project research questions, with some deviations from clarity, completeness, and the APA style.
	4-5 points: Presented are relevant results by project research questions, with some deviations from clarity, accuracy, completeness, and the APA style.
	2-3 points: Some results are irrelevant and/or there are problems with clarity, accuracy, completeness, and APA style.
	0-1 points: Some (or all) results are irrelevant and there are serious problems with clarity, accuracy, completeness, and APA style.
Presentation of tables	**2-3 points:** The tables include all necessary information presented in APA style**.**
	0-1 points: The tables do not include all necessary information and /or there APA style problems.
Presentation of figures	**2-3 points:** The figures are clear and provide relevant information in APA style.
	0-1 points: There are some (or serious) problems with clarity of the figures, their relevance, and/or APA style.
Discussion Section	**max = 14 points**
Conclusions drawn from the results, findings and implications for theory and/or practice	**8 points:** Provided is clear, accurate, and complete presentation of conclusions drawn from the study results, comparisons with findings in previous studies on the topic of interest, plausible explanations of the study findings, and implications for theory and/or practice.
	6-7 points: Provided is clear, accurate, and complete presentation of conclusions drawn from the study results, with minor problems in accuracy and/or sufficiency related to comparisons with findings in previous studies, plausible explanations of the study findings, implications for theory and/or practice, and APA style.
	5-6 points: The conclusions are drawn from the study results, but there are relatively serious problems in accuracy and/or sufficiency related to comparisons

	with findings in previous studies, plausible explanations of the study findings, implications for theory and/or practice, and APA style.
	4-5 points: Some conclusions are not well connected to the study results and there are relatively serious problems in accuracy and/or sufficiency related to comparisons with findings in previous studies, plausible explanations of the study findings, implications for theory and/or practice, and APA style.
	2-3 points: Some conclusions do not stem from the study results and there are serious problems in accuracy and/or sufficiency related to comparisons with findings in previous studies, plausible explanations of the study findings, implications for theory and/or practice, and APA style.
	0-1 points: The conclusions do not stem from the study results and there are serious problems in accuracy and/or sufficiency related to comparisons with findings in previous studies, plausible explanations of the study findings, implications for theory and/or practice, and APA style.
Limitations of the study	**2-3 points:** Provides is clear, accurate, and complete presentation of the limitations of the study, with implications for the study findings and their generalization.
	0-1 points: There are serious problems in clarity, accuracy, and completeness of the study limitations and their implications for the findings and their generalization.
Recommendations for future research	**2-3 points:** The recommendations for future research are clearly presented and stem from logical necessity for meaningful replications (e.g., to validate and/or generalize the findings) and/or further extensions of the study design and analyses.
	0-1 points: The recommendations for future research are *not* clearly presented and do not address the necessity for replications and/or further extensions.