Special Topics: Instrument Development
NUR 991 Special Topics (3 credits)
Wednesday, 1:00-3:50 pm
C-388 Life Sciences (Bott Bldg.)
Spring 2015

Catalog Course Description: Special topics which supplement regularly-offered courses.

Additional Course Description: The major emphasis in this course is on introducing students to measurement issues involved in the scaling of multiple, fixed-response survey items. A substantial tradition in nursing research has focused on psycho-social variables, both as predictors and outcomes in health-related research. The construction of standardized scale measures that can be used in randomized clinical intervention studies poses numerous measurement problems involving their validity, reliability, sensitivity to meaningful differences in health states and stability over time and comparison groups. This course is designed to provide a strong conceptual understanding of classical test theory in psychometrics as well as modern approaches, such as item-response theory. Practical approaches to the detection of systematic measurement errors and response bias are a major theme. In addition, the approach to measurement in the psychometric tradition will be compared to and contrasted with the conceptualization of measurement error in medical and bio-physiological tests. Using two data sets from federally funded studies, the students will perform numerous data analysis tasks pertaining to the evaluation of several multi-item measurement instruments and will write short reports to interpret and evaluate the statistical output.

Course Objectives (Catalog): Individually determined depending on course content.

Additional Course Objectives:

At the end of this course, students will be able…

1. …to apply the concepts and logic underlying measurement procedures to the assessment of health-related human behaviors, attitudes and knowledge.
2. …to judge the adequacy of measurement procedures in published research articles.
3. …to perform statistical analyses to evaluate the reliability of selected measures.
4. …to perform exploratory factor analysis to extract uni-dimensional scales from standardized responses to multiple questions.
5. …be able to perform confirmatory factor analysis to confirm exploratory results on a second sample.
6. …be able to perform confirmatory factor analysis to confirm the stability of a measurement scale across repeated measures and in different groups of study subjects compared.
7. …to evaluate the impact of item non-response on measurement and scaling.
8. …articulate the differences in the measurement approaches of psychometrics and medical testing.
Course Faculty

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C-350 Bott Bldg.
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E-mail: Manfred.Stommel@hc.msu.edu (preferred mode of contact)
Office Hours: every Wednesday, 4:00-5:00 p.m.; other hours can be arranged in class or via e-mail; please, do not leave telephone message on my office phone, since such messages may not reach me in a timely fashion.

Instruction

This class will be held once weekly for three hours. Limited lecture time, extensive discussion, some student led presentations, homework involving data analysis using STATA 13, written reports on analysis outcomes.

Required Textbooks and Resources:

1. Required Textbooks.

2. Optional (Recommended) Textbooks.
   b) Tenko Raykov & George A. Marcoulides, Introduction to Psychometric Theory. New York, NY: Routledge; 2011. (*This is a statistically more advanced treatment.)

3. Additional Readings.


i) Additional readings will be assigned during the course.

4. Required Software.


This software offers all the statistical analysis tools needed in the course and is available for students at the above website.

If you are familiar with SAS 9.3, you may use it for homework, but you are responsible for producing the appropriate output. SPSS alone does not contain a confirmatory factor analysis routine, but would have to be supplemented with Amos. Again, you may use such alternative software to do the homework, but the instructor will not assist in software commands to produce the relevant output.

5. Data Sets:

In the course, we will make use of two data sets for exercise purposes. They are:

a) The POUCH Study, Principal Investigator: Claudia Holzman, PhD, Professor, Dept. of Epidemiology, Michigan State University; and

b) The Healthy Babies Study, Principal Investigator: Mildred Horodynski, PhD, Professor, College of Nursing, Michigan State University.

De-identified data sets in STATA format will be provided in the first week of class. Alternative software formats will be provided as requested.

**Course Evaluation**

Course requirements include the successful completion of a mid-term and a final exam, a course paper, and weekly exercises.

(1) The mid-term and final exams each are 90-minute proctored exams. They will include both multiple choice questions and short-answer questions. A calculator is required.
(2) Starting in Week 2, student will work on weekly assignments analyzing variables in the course data set. The assignments must be turned in one week later, at which time one student, chosen, on a rotating basis, will discuss the results/solutions and provide interpretations of the results. Grade feedback for individual assignments will be provided one week later.

(3) The course paper involves the evaluation of measurement procedures in two published research articles, which will be provided to the student in week 13. The evaluation paper shall be a methodological critique of the measurement procedures adopted by the researchers applying the measurement concepts learned in this course. The paper is not to exceed 10 pages and is due on the last day of class.

Course Grading Scale
The Michigan State University 4.0 grading system will be used to calculate final course grades.

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<tr>
<th>%</th>
<th>GRADING SCHEME</th>
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<tbody>
<tr>
<td>90-100%</td>
<td>4.0</td>
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<tr>
<td>85-89%</td>
<td>3.5</td>
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<tr>
<td>80-84%</td>
<td>3.0</td>
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<tr>
<td>≤ 79%</td>
<td>Not passing</td>
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<td>(Minimum passing grade)</td>
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Points will be rounded to the nearest whole numbers using the “0.5 rule.” Points at the ≥ 0.5 will be rounded up while those ≤ 0.5 will be rounded down to the nearest whole number.

Course grades are calculated in the following way:

• Proctored midterm and final exams: each 30% of the course grade.
• Weekly analysis assignments: 20% of the course grade.
• Course paper: 20% of the course grade.

Writing Requirements
The College of Nursing requires that students refer to a style manual when writing required papers and bibliographies. The reference format adopted by the College of Nursing is the Publication Manual of the American Psychological Association (most recent edition).

Professionalism
All graduate students at Michigan State University should be fully familiar with the Graduate Student Rights and Responsibilities Articles (published by the Graduate School; available at http://www.vps.msu.edu/SpLife/gradrights.htm); University guidelines for ethical research (published by the University Committee on Research Involving Human Subjects [UCRIHS]; available at http://www.msu.edu/user/ucrihs/); The MSU Guidelines for Integrity in Research and Creative Activities, http://grad.msu.edu/all/ris04activities.pdf and specific principles for informal conflict management, in the Graduate Student Resource Guide (published by the Graduate School; available at http://grad.msu.edu/conflict.htm).
The Graduate Student Rights and Responsibilities (GSRR) Articles address professional standards for graduate students as follows: “Each department/school and college shall communicate to graduate students, at the time of their first enrollment in a degree program or course in the unit, any specific codes of professional and academic standards covering the conduct expected of them.” (Article 2.4.7). “The graduate student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards” (Article 2.3.8).

In addition to meeting academic standards included in the Academic Progression Guidelines, students and faculty in the Doctoral Program in Nursing have shared responsibility for adherence to the professional standards referred to in the Doctoral Student Handbook of the CON.

Professional expectations are rooted in the maintenance of high quality working relationships with faculty, peers, research participants, staff, and all others with whom the graduate student interacts. Aspects of high quality working relationships that are addressed in the GSSR as shared faculty-student responsibilities include: mutual respect, understanding, and dedication to the education process (2.1.2); maintenance of a collegial atmosphere (2.3.7); and, mutual trust and civility (2.3.1.2).

Communication. Faculty can be reached through email or phone. Faculty response to email may take up to 3 days.

Late work: Students need prior approval to turn in assignments late. Late work without prior approval is subject to 2% per day.

Policies of Academic Integrity: Article 2.3.3 of the Academic Freedom Report states that "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." In addition, the College of Nursing adheres to the policies on academic honesty as specified in General Student Regulations 1.0, Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. (See Spartan Life: Student Handbook and Resource Guide and/or the MSU Web site: www.msu.edu.) Therefore, unless authorized by your instructor, you are expected to complete all course assignments, including homework, lab work, quizzes, tests and exams, without assistance from any source. You are expected to develop original work for this course; therefore, you may not submit course work you completed for another course to satisfy the requirements for this course. Also, you are not authorized to use the www.allmsu.com Web site to complete any course work in NUR 901. Students who violate MSU rules may receive a penalty grade, including--but not limited to--a failing grade on the assignment or in the course. Contact your instructor if you are unsure about the appropriateness of your course work. (See also http://www.msu.edu/unit/ombud/honestylinks.html).

Students engaged in scholarly activities (e.g. dissertation, scholarly projects) should follow the guidelines of scholarly writing as outlined in the Publication Manual of the American Psychological Association (most recent edition). Ethical principles ensure the accuracy of scientific and scholarly knowledge and protect intellectual rights. Principles include reporting of results, plagiarism, publication credit, sharing data, and copyright.
Research Misconduct and Questionable Research Practices within the college are defined consistently with the Interim University Document on Intellectual Integrity approved by the President of Michigan State University on August 5, 1994, and revised June 29, 1995. Refer to the CON Doctoral Student Handbook.

Accommodations for Students with Disabilities: Students with disabilities should contact the Resource Center for Persons with Disabilities to establish reasonable accommodations. For an appointment with a disability specialist, call 353-9642 (voice), 355-1293 (TTY), or visit MyProfile.rcpd.msu.edu.

Disruptive Behavior: Article 2.3.5 of the Academic Freedom Report (AFR) for students at Michigan State University states: "The student's behavior in the classroom shall be conducive to the teaching and learning process for all concerned." Article 2.3.10 of the AFR states that "The student has a right to scholarly relationships with faculty based on mutual trust and civility." General Student Regulation 5.02 states: "No student shall . . . interfere with the functions and services of the University (for example, but not limited to, classes . . .) such that the function or service is obstructed or disrupted. Students whose conduct adversely affects the learning environment in this classroom may be subject to disciplinary action through the Student Faculty Judiciary process.

Attendance: Students whose names do not appear on the official class list for this course may not attend this class. Students who fail to attend the first four class sessions or class by the fifth day of the semester, whichever occurs first, may be dropped from the course.

Effective conflict management/negotiation skills are essential for navigating the graduate school experience and maintaining high quality working relationships. Specific principles for conflict management/negotiation are addressed in the Graduate Student Resource Guide. Doctoral students are responsible for making concerted good faith efforts to resolve conflicts with others in a constructive and informal fashion, prior to proceeding to formal conflict resolution options, as consistent with the GSRR statement on informal conflict resolution (Article 5.3.2). Doctoral students who have specific questions or concerns about professional standards or conflict resolution issues should consult with their Major Professor, the Associate Dean for Research and Doctoral Programs, and/or the University Ombudsman for guidance, as appropriate.
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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Readings</th>
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| Week 1: | Introduction to Measurement:  
1/14 |  
- Operationalization of Concepts and Measurement  
- Data Collection versus Measurement  
- Measurement Rules and Standardization  
- General Sources of Error in Survey Data  
- Sources of Measurement Error |  
Furr & Bacharach: Ch. 1 & 2  
Fowler: Ch. 1, 2 & 5  
DeVellis: Ch. 1  
Stommel: Handouts |
| Week 2: | The Algebra of Statistical Description:  
1/21 |  
- Mean, Variance, Covariance, Correlation  
- Variances and Covariances of Linear Combinations  
- Z-Scores and Percentile Ranks  
- Hands-on Introduction to STATA (bring your laptop with the software) |  
Furr & Bacharach: Ch. 3  
Stommel: Hand-outs  
(Optional: Nunnally & Bernstein: Ch. 4 & 5) |
| Week 3: | Exploratory Factor Analysis (EFA) 1:  
1/28 |  
- Latent Variables  
- Dimensionality of Measurement Scales  
- Factor Analysis vs. Principal Component Analysis  
- EFA: Factor Extraction, Factor Loadings, Communality and Uniqueness Estimates  
- STATA Exercises |  
Furr & Bacharach: Ch. 4  
DeVellis: Ch. 2 & 6  
Stommel: Handouts  
(Optional: Nunnally & Bernstein: Ch. 11 & 12) |
| Week 4: | Exploratory Factor Analysis (EFA) 2:  
2/4 |  
- Factor Rotation  
- Factor Loadings and their Interpretation  
- Factor Correlations and their Interpretation  
- Variability of EFA Solutions across different samples  
- Sample Size Requirements for EFA  
- The Role of EFA in Scale Development  
- STATA Exercises |  
Furr & Bacharach: Ch. 4  
DeVellis: Ch. 2 & 6  
Stommel: Handouts  
(Optional: Nunnally & Bernstein: Ch. 11 & 12) |
| Week 5: | Measurement Error and Reliability  
2/11 |  
- The Concept of Reliability in Measurement  
- Sources of Measurement Error in Empirical Research  
- Types of Measurement Error  
- The Domain Sampling Model of Measurement Error  
- The Parallel Test Model of Reliability  
- STATA Exercises |  
Furr & Bacharach: Ch. 5  
DeVellis: Ch. 3  
Stommel: Hand-outs |
| Week 6: 2/18 | Empirical Assessment of Measurement Reliability 1:  
| | - Internal Consistency: Cronbach's Alpha, Kuder-Richardson  
| | - Inter-rater Reliability: Cohen's Kappa  
| | - Test-Retest Reliability: Correlation  
| | - Coefficient of Concordance W  
| | - STATA Exercises  
| | | Furr & Bacharach: Ch. 6  
| | | DeVellis: Ch. 3  
| | | Stommel: Handouts  
| | | Osburn, 2000  
| Week 7: 2/25 | Empirical Assessment of Measurement Reliability 2:  
| | - Analysis of Variance Approach to Reliability Assessment  
| | - Intra-Class Correlation  
| | - Short Introduction to Generalizability Theory  
| | - Strategies for Improving Measurement Reliability:  
| | - Reducing Errors in Data Collection & Data Entry  
| | - Test-Length & Reliability  
| | - Standardized Measurement  
| | - Norm-referenced Measurement  
| | - STATA Exercises  
| | | Furr & Bacharach: Ch. 7 & 12  
| | | DeVellis: Ch. 3 & 12  
| | | Fowler: Ch. 6 & 7  
| | | Burns, 1998  
| | | Lakes & Hoyt, 2009  
| | | Stommel: Handouts  
| Week 8: 3/4 | Review and Mid-term Exam (proctored)  
| | | Assignment of Course Paper  
| | | Spring break 3/9 - 3/13  
| Week 9: 3/18 | Measurement Validity 1:  
| | - The Concept of Measurement Validity  
| | - Types of Measurement Validity: Content, Face, Construct, Criterion Validity  
| | - Empirical Assessments of Validity  
| | - Predictive Validity  
| | - Discriminant & Convergent Validity  
| | - Validity Coefficients  
| | - Validation of Data Collection Methods  
| | - STATA Exercises  
| | | Furr & Bacharach: Ch. 8 & 9  
| | | DeVellis: Ch. 4  
| | | Fowler: Ch. 7  
| | | (Optional: Nunnally & Bernstein: Ch. 3)  
| Week 10: 3/25 | Confirmatory Factor Analysis (CFA) 1:  
| | - Exploratory (EFA) vs. Confirmatory Factor Analysis (CFA)  
| | - Confirmatory Factor Analysis: Testing Measurement Theories and Preliminary Factor Models from EFA  
| | - Components of a CFA Model  
| | - Goodness-of-Fit Measures  
| | - STATA Exercises  
| | | Furr & Bacharach: Ch. 12  
| | | DeVellis: Ch. 6  
| | | Stommel et al. 1992  
| | | Stommel: Handouts  
| | | (Optional: Nunnally & Bernstein: Ch. 13)  

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<th>Week</th>
<th>Confirmatory Factor Analysis (CFA) 2:</th>
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<td>11:</td>
<td>Measurement Invariance</td>
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<td>Comparison of Measurement Models across Populations</td>
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<td>4/1</td>
<td>Comparison of Measurement Models over Time</td>
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<td>STATA Exercises</td>
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<td>Furr &amp; Bacharach: Ch. 12</td>
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<td>DeVellis: Ch. 6</td>
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<td></td>
<td>Stommel et al. 1992</td>
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<td>Canady et al., 2009</td>
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<td>Stommel: Handouts</td>
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<td>(Optional: Nunnally &amp; Bernstein: Ch. 13)</td>
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<th>Week</th>
<th>Confirmatory Factor Analysis (CFA) 3:</th>
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<tr>
<td>12:</td>
<td>Measurement Invariance</td>
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<td>Comparison of Measurement Models over Time</td>
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<td>4/8</td>
<td>STATA Exercises</td>
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<td>Furr &amp; Bacharach: Ch. 12</td>
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<td>DeVellis: Ch. 6</td>
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<td></td>
<td>Stommel et al. 1992</td>
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<td>Stommel: Handouts</td>
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<td>(Optional: Nunnally &amp; Bernstein: Ch. 13)</td>
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<th>Week</th>
<th>Introduction to Item Response Theory:</th>
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<tr>
<td>13:</td>
<td>Item difficulty and Discrimination</td>
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<td>Item-Characteristic Curves</td>
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<td>4/15</td>
<td>One- and Two Parameter Models</td>
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<td>STATA Exercises</td>
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<td>Furr &amp; Bacharach: Ch. 14</td>
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<td></td>
<td>DeVellis: Ch. 7</td>
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<td>Stommel: Handouts</td>
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<tr>
<th>Week</th>
<th>Systematic Measurement Error:</th>
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<tr>
<td>14:</td>
<td>Response Bias</td>
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<tr>
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<td>Cultural Sensitivity in Self-report Measures</td>
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<tr>
<td>4/22</td>
<td>Social Desirability Response: Example of Self-Reported Height and Weight Measure</td>
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<td>Test Bias: Regression methods to detect test bias</td>
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<td></td>
<td>STATA Exercises</td>
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<tr>
<td></td>
<td>Non-Response Bias: Missing Data and Imputation Remedies</td>
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<tr>
<td></td>
<td>Furr &amp; Bacharach: Ch. 10 &amp; 11</td>
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<td>Paulhus, 2002</td>
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<td>Stommel &amp; Schoenborn, 2009</td>
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<td>Stommel &amp; Osier, 2013</td>
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<tr>
<th>Week</th>
<th>Evaluation of Bio-physiological Measures</th>
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<tr>
<td>15:</td>
<td>Reliability vs. Precision, Validity vs. Accuracy</td>
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<tr>
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<td>Criterion Validity vs.&quot;Gold Standards&quot;</td>
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<tr>
<td>4/29</td>
<td>Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value</td>
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<td>Receiver-Operating Curves</td>
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<td>Stommel: Handouts</td>
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<tr>
<th>Final Week 5/6</th>
<th>(Proctored) Final Exam</th>
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