PSYC*7070, Course Outline: Fall 2024

General Information

This course is offered using the Face-to-Face format. The course has set day, time, and location of class.

Course Title: PSYCHOLOGICAL MEASUREMENT

Course Description:

Psychology 7070 covers measurement theory (classical test theory and item response theory), exploratory, and confirmatory factor analysis, and structural equation modeling. The course is designed for future practitioners and researchers. For future practitioners the course is intended to provide a background in psychometric methods that is necessary for the appropriate use of psychological tests and measures. For researchers, the course will illustrate the importance of taking measurement issues into account when conducting research as well as provide students with skills and knowledge to conduct a variety of useful psychometric analyses.

Credit Weight: .50

Academic Department (or campus): Psychology

Semester Offering: Winter

Class Schedule and Location: Monday, 2:30-5:20 pm, ANNU 002

Instructor Information

Instructor Name: Dr. Jeffrey Spence
Instructor Email: spencejr@uoguelph.ca
Office location and office hours: By appointment MCKN extension 4006

Learning Outcomes

1. History of measurement and psychometrics.
2. Develop an in-depth understanding of classical test theory.
3. Compute and appropriately interpret evidence for reliability and validity.
4. Understand and interpret item response theory analyses.
5. Understand how to properly interpret individual test scores and understand factors that influence their accuracy and validity.

6. Conduct and interpret exploratory factor analysis.
7. Conduct and interpret confirmatory factor analysis.
8. Acquire an introductory knowledge of structural equation modeling, including understanding model fit, model comparisons, model identification, and proper interpretation latent and structural models**.**
9. Understand how to fit and interpret more advanced confirmatory models.

Lecture Content:

You are responsible for all material presented in lectures, including any announcements. Order of topics covered may change.

- Week 1 (September 9): Introduction and course overview; What is psychometrics?
- Week 2 (September 16): Variance, covariance, correlation; Introduction to classical test theory and reliability
- Week 3 (September 23): Introduction to and foundations for confirmatory models
- Week 4 (September 30): Basic confirmatory models: How to run, fit, interpret, troubleshoot
- Week 0 (October 7): No class due to holiday.
- Week 5: (October 14) Advanced confirmatory models and Sample size planning; Alternatives to maximum likelihood for confirmatory models
- Week 6 (October 21): Open book Midterm (covering weeks 1-6)
- Week 7 (October 28): Introduction to exploratory models; Exploratory factor analysis; Decisions
- Week 8 (November 4): Numerical Example of an Exploratory Factor Analysis; Practical reliability
- Week 9 (November 11): Interpreting test scores and validity I
- Week 10 (November 18): Validity II
- Week 11 (November 25): Item response theory
- Week 12 (November 29): Make up class from holiday; Open book Midterm II (covering Weeks 7-12)

Course Assignments and Tests:

Assignments:

Assignments (20%): There will be 4 assignments throughout the term (each worth 5%). The assignments are intended to give you hands on experience applying the statistical techniques learned in the course. At the class session when the assignment is due, the assignments will be taken up in class. Please make two copies of your assignments: one copy to be turned in on Dropbox (on Courselink) prior to **beginning of class**, and the other copy to be retained by you to serve as a basis for class discussion. When turning in assignments it is important that the final product is **your own work**. These are NOT group assignments and must be completed individually. If you have any questions regarding this issue please ask the instructor or consult the University of Guelph's policy on cheating and academic misconduct.

Exams:

Take home Midterm Exam I (35%):

The midterm will be handed out during class time and will be based on all the material covered in lecture and in the assigned readings up to October 25, inclusive.

Take home Midterm Exam II (35%):

The midterm will be handed out during class time and will be based on all material covered in lecture and in the assigned readings from November 1 to November 29, inclusive.

Self-evaluation for participation/attendance (10%):

At the end of the term (by last day of class), students will provide a self-evaluation (out of 100) for how much they believe they contributed, attended, and participated. The instructor may increase the self-evaluation if it is perceived to be too low.

Assignment or Test	Due Date	Contribution to Final Mark (%)	Learning Outcomes Assessed
Take home Midterm I	**October 21**	**35**	**1,2,6,7,8**
Take home Midterm II	**November 29**	**35**	**1,2,3,4,5**
Assignments	**See schedule of dates**	**20**	**1-8**
Self-evaluation	**November 29**	**10**	

Course Resources

Recommended Texts:

Brown, T. A. (2015). *Confirmatory Factor Analysis for Applied Research*. New York, NY: The Guilford Press.

Kline, R. B. (2005). *Principles and practice of structural equation modeling*. New York, NY: The Guilford Press. [newer editions would also suffice]

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory (3rd edition).* New York, NY: McGraw-Hill Inc.

Other Resources:

Course Website: On CourseLink. This website will contain announcements, lecture notes, discussion, and other information pertinent to the course.

Course Policies

Grading Policies

All assignments will be graded in accordance with standards established by the University of Guelph. Graduate Grade interpretation

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time. Failure to turn in assignments at the scheduled time will result in a grade of 0 for that assignment. Late assignments and midterms will receive a penalty of 10% off per day

Please note that these policies are binding unless academic consideration is given to an individual student.

Course Policy regarding use of electronic devices and recording of lectures:

Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted, they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

University Policies

Academic Consideration

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact. See the academic calendar for information on regulations and procedures for

Academic Consideration:
Grounds for Academic Consideration

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring.

University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Graduate Calendar:

Illness
Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact Student Accessibility Services as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 54335 or email accessibility@uoguelph.ca or the Student Accessibility Services Website

Student Feedback Questionnaire

These questionnaires (formerly course evaluations) will be available to students during the last 2 weeks of the semester. Students will receive an email directly from the Student Feedback Administration system which will include a direct link to the questionnaire for this course. During this time, when a student goes to login to Courselink, a reminder will pop-up when a task is available to complete.
Student Feedback Questionnaire

Drop date

The last date to drop one-semester courses, without academic penalty, is Friday November 29, 2024. For regulations and procedures for Dropping Courses, see the Schedule of Dates in the Academic Calendar.

Instructors must provide meaningful and constructive feedback, at minimum 20% of the final course grade, prior to the 40th class day. For courses which are of shorter duration, 20% of the final grade must be provided two-thirds of the way through the course.

Current Graduate Calendar

SCHEDULE OF DATES

Please note. The content of this schedule and order of topics may change.

Week 1 (September 9): Introduction and Course Overview, What is Psychometrics?

Borsboom, D., Mellenbergh, G. J., & van Heerden, J. (2003). The theoretical status of latent variables. *Psychological Review, 110,* 203-219.

Week 2 (September 16): Variance, covariance, correlation; Introduction to classical test theory and reliability

Allen, M. J., & Yen, W. M. (1979). Classical true-score theory. In *Introduction to measurement theory* (pp. 56-65). Monterey, CA: Brooks/Cole.

Nunnally, J. C., & Bernstein, I. H. (1994). The theory of measurement error. In *Psychometric theory* (3rd edition). New York, NY: McGraw-Hill Inc.

Osterlind, S. J. (2006). Classical test theory. In *Modern measurement: Theory, principles, and applications of mental appraisal* (pp. 53-85). Columbus, OH: Pearson Merrill Prentice Hall.

Assignments:
Hand out: *Assignment 1* (**due on September 23**)

Week 3 (September 23): Introduction to and foundations for confirmatory models: Structural Equation Modeling Essentials

Lei, P. W., & Wu, Q. (2007). Introduction to structural equation modeling: Issues and practical considerations. *Educational Measurement: issues and practice*, *26*, 33-43.

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,* 323-338.

Assignments:
Due: *Assignment 1*

Week 4 (September 30): Confirmatory measurement models: How to run, fit, interpret, troubleshoot different confirmatory measurement models.

Graham, J. M. (2006). Congeneric and (essentially) tau-equivalent estimates of score reliability: What they are and how to use them. *Educational and Psychological Measurement, 66,* 930-944.

Jackson, D. L., Gillaspy Jr., J. A., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological Methods, 14,* 6-23.

Hand out: *Assignment 2* **(due on October 7)**

Week 5 (October 7): Advanced confirmatory models (multidimensional structures), sample size planning; Alternatives to maximum likelihood for confirmatory models

Brown, T. A. (2015). Statistical power and sample size (Chapter 10, pp. 380-399), In *Confirmatory Factor Analysis for Applied Research*. New York, NY: The Guilford Press.

Crede, M., & Harms, P. (2015). 25 years of higher-order confirmatory factor analysis in the organizational sciences: A critical review and developing of reporting recommendations. *Journal of Organizational Behavior, 36,* 845-872.

Edwards, J. R. (2001). Multidimensional constructs in organizational behavior research: An integrative analytic framework. *Organizational Research Methods, 4,* 144-192.

Assignments:
Due: *Assignment 2*

Week Ø (October 14): No class due to holiday

Week 6 (October 21): MIDTERM (Covering Week 1 to Week 6)

Week 7 (October 28): Alternatives to Latent variable models: Introduction to Causal-formative measurement

Bollen, K. A., & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin, 110,* 305-314.

Bollen, K., A., & Diamantopoulos, A. (2017). In defense of causal-formative indicators: A minority report. *Psychological Bulletin, 22,* 581-596.

Bollen, K. A., & Bauldry, S. (2011). Three Cs in measurement models: causal indicators, composite indicators, and covariates. *Psychological methods*, *16*(3), 265.

Week 8 (November 4): Introduction to exploratory models; Exploratory factor analysis; Decisions

Comrey, A. L., & Lee, H. B. (1992). Chapter 1: Introduction. In *A first course in factor analysis* (pp. 1-13). Hillsdale, NJ: Lawrence Earlbaum.

Comrey, A. L., & Lee, H. B. (1992). Chapter 8: Planning the standard design factor analysis. In *A first course in factor analysis* (pp. 205-228). Hillsdale, NJ: Lawrence Earlbaum.

Assignments:
Hand out: *Assignment 3* **(due November 11)**

Week 9 (November 11): Numerical Example of an Exploratory Factor Analysis; Machine learning and Principal Components.

Comrey, A. L., & Lee, H. B. (1992). Chapter 10: Interpretation and Application of Factor Analytic results. In *A first course in factor analysis* (pp. 240-262). Hillsdale, NJ: Lawrence Earlbaum.

Mirtaheri, S.L., & Shahbazian, R. (2022). Machine learning (Chapter 3), In Machine Learning:

Theory to Applications (1st ed.). CRC Press. https://doiorg.subzero.lib.uoguelph.ca/10.1201/9781003119258

Assignments:
Due: Assignment 3

Week 10 (November 18): Practical reliability, Interpreting test scores and validity, Multitrait-multimethod matrix in SEM

Borsboom, D., Mellenbergh, G. J., & van Heerden, J. (2004). The concept of validity. *Psychological Review, 111,* 1061-1071.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin, 56,* 81-105.

Brown, T. A. (2015). CFA of multitrait-multimethod matrices (Chapter 6, pp. 186-205), In *Confirmatory Factor Analysis for Applied Research*. New York, NY: The Guilford Press.

Assignments:
Hand out: *Assignment 4* **(due November 29)**

Week 11 (November 25): Item Response Theory

Edwards, M. C. (2009). An introduction to item response theory using the need for cognition scale. *Social and Personality Compass, 3/4,*507-529.

Raykov, T., Dimitrov, D. M., Marcoulides, G. A., & Harrison, M. (2019). On true score evaluation using item response theory modeling. *Educational and Psychological Measurement, 79,* 796-807.

Sadler, P., & Woody, E. Z. (2004). Four decades of group hypnosis scales: What does item-response theory tell us about what we've been measuring? *The International Journal of Clinical and Experimental Hypnosis, 52,* 132-158.

Assignments:
Due: *Assignment 4*

Week 12 (November 29): Midterm II (Covering Weeks 7-12)
