**Course Objectives**

The goals of this course are to provide a survey of classical test theory and contemporary item response theory; explore applicability of psychometrics to psychological measurement; and use special statistical software in the analysis of psychometric problems. Throughout the course, models and methods will be introduced conceptually and will be illustrated using real and simulated data.

At the end of this class, students should have working knowledge of psychometric measurement and be able to competently apply and interpret such models in the analysis of their own research data.

**Course Requirements & Grading**

Students will read a contemporary text and various articles on the development and application of measurement models. They will complete eight structured data analysis assignments and submit brief written reports of results (5% each; 40% total). Using a problem and a dataset of their own choosing, students will design and carry out a psychometric analysis of data using measurement modeling. They will present their results in a seminar session of the class (15%), and they will report their results in a formal scientific paper following APA guidelines (45%). Presentations will be expected to be delivered synchronously. The paper should be about 10 pages of text with additional supporting tables and figures. It should include a brief description of the construct(s) to be measured and empirical evidence reflecting the quality of measure(s) being considered.

Final grade calculation: 40% exercises, 15% class presentation, 45% final paper.

**Instructor** Sean Lane

Room 1242 (Psychological Sciences Building)

Phone: 765-494-8323

Email: [seanlane@purdue.edu](mailto:seanlane@purdue.edu)

Office hours: M 11:30-12:30 or by appointment (virtually)

Zoom Room: <https://purdue-edu.zoom.us/j/2027930554>

**Teaching Assistant** Vera Du

Room 12xx (Psychological Sciences Building)

Email: [du182@purdue.edu](mailto:du182@purdue.edu)

Office hours: TR 3:00-4:00 or by appointment (virtually)

Zoom ID: 630 995 7539

**Time and Place** Lecture: M 9:30-11:20, synchronously-online with recordings posted after  
 Lab: TR, 2:00-3:00, synchronously-online with recordings posted after

**Prerequisites** Graduate coursework in ANOVA, regression, and multivariate statistics, or by permission.

**Text** Raykov, T. & Marcoulides, G. A. (2011). Introduction to Psychometric Theory. New York: Routledge.

**Brightspace** “Access the course via Purdue’s Brightspace learning management system. Begin with the Start Here tab, which describes how the course Brightspace is organized. It is strongly suggested that you explore and become familiar not only with the site navigation but with content and resources available for this course. See the Student Services widget on the campus homepage for resources such as Technology Help, Academic Help, Campus Resources, and Protect Purdue.”

**Other Methodological Readings (\*indicates assigned reading)**

1. Brennan, R. L. (2001). *Generalizability theory*. Second Edition. New York, NY: Springer.
2. Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York: Guilford Press.
3. \*Campbell, D. T. and Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, *56*, 81-105.
4. \*Cranford, J. A., Shrout, P. E., Iida, M., Rafaeli, E., Yip, T., & Bolger, N. (2006). A procedure for evaluating sensitivity to within-person change: Can mood measures in diary studies detect change reliably? *Personality and Social Psychology Bulletin*, *32*(7), 917-929.
5. Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Belmont, CA: Wadsworth.
6. Cronbach, L. J., Gleser, G. C., Nanda, H., & Rajaratnam, N. (1972). The dependability of behavioral measurements: Theory of generalizability for scores and profiles. New York: Wiley.
7. \*Cunningham, W. A., Preacher, K. J., & Banaji, M. R. (2001). Implicit attitude measures: Consistency, stability, and convergent validity. *Psychological Science*, *12*(2), 163-170.
8. Embretson, S. E. & Reise, S. P. (2000). *Item response theory for psychologists.* Mahwah, NJ: Erlbaum Publishers.
9. \*Geldhof, G. J., Preacher, K. J., & Zyphur, M. J. (2014). Reliability estimation in a multilevel confirmatory factor analysis framework. *Psychological Methods*, *19*(1), 72-91.
10. \*Gibbons, R. D., Bock, R. D., Hedeker, D., Weiss, D. J., Segawa, E., & Bhaumik, D. K. et al. (2007). Full-information item bifactor analysis of graded response data. *Applied Psychological Measurement*, *31*(1), 4-19.
11. \*Gregorich, S. E. (2006). Do self-report instruments allow meaningful comparisons across diverse population groups? Testing measurement invariance using the confirmatory factor analysis framework. *Medical Care. Special Issue: Measurement in a Multi-Ethnic Society*, *44*(11, Suppl 3; Supplement), S78-S94.
12. \*Kruglanski, A. W., Atash, M. N., DeGrada, E., Mannetti, L., Pierro, A., & Webster, D. M. (1997). Psychological theory testing versus psychometric nay-saying: Comment on Newberg et al.'s (1997) critique of the need for closure scale. *Journal of Personality and Social Psychology*, *73*(5), 1005-1016.
13. Lord, F. & Novick, M. (1968). *Statistical theories of mental test scores*. Reading, MA: Addison-Wesley.
14. \*McCrae, R. R., Zonderman, A. B., Costa, P. T., Jr., & Bond, M. H. (1996). Evaluating replicability of factors in the revised NEO personality inventory: Confirmatory factor analysis versus procrustes rotation. *Journal of Personality and Social Psychology*, *70*(3), 552-566.
15. McDonald, R. P. (1999) *Test Theory*. Mahwah, NJ: Erlbaum
16. \*Meijer, R. R., & Baneke, J. J. (2004). Analyzing psychopathology items: A case for nonparametric item response theory modeling. *Psychological Methods*, *9*(3), 354-368.
17. Millsap, R. E. (1995). The statistical analysis of method effects in multitrait-multimethod matrices. In *Personality Research, Methods, and Theory: A Festschrift Honoring Donald W. Fiske* (P. E. Shrout, & S. E. Fiske, editors) (pp. 93-110). Mahwah, NJ: Erlbaum.
18. \*Neuberg, S. L., Judice, T. N., & West, S. G. (1997). What the need for closure scale measures and what it does not: Toward differentiating among related epistemic motives. *Journal of Personality and Social Psychology*, *72*(6), 1396-1412.
19. \*Neuberg, S. L., West, S. G., Judice, T. N., & Thompson, M. M. (1997). On dimensionality, discriminant validity, and the role of psychometric analyses in personality theory and measurement: Reply to Kruglanski et al.'s (1997) defense of the need for closure scale. *Journal of Personality and Social Psychology*, *73*(5), 1017-1029.
20. \*Reise, S. P., & Waller, N. G. (2003). How many IRT parameters does it take to model psychopathology items? *Psychological Methods*, *8*(2), 164-184.
21. Reise, S. P., Moore, T. M., & Haviland, M. G. (2010). Bifactor models and rotations: Exploring the extent to which multidimensional data yield univocal scale scores. *Journal of Personality Assessment. Special Series: Integrating Personality, Psychopathology, and Psychotherapy using Interpersonal Assessment*, *92*(6), 544-559.
22. \*Reise, S. P., Widaman, K. F., & Pugh, R. H. (1993). Confirmatory factor analysis and item response theory: Two approaches for exploring measurement invariance. *Psychological Bulletin*, *114*, 552-566.
23. Shrout, P. E. (2002). Reliability. In M. T. Tsuang & M. Tohen (Eds.), *Textbook in Psychiatric Epidemiology* (second ed., pp. 131-148). New York: Wiley.
24. \*Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin, 86*, 420-428.
25. Smith, L. L. (2002). On the usefulness of item bias analysis to personality psychology. *Personality and Social Psychology Bulletin*, *28*(6), 754-763.
26. \*Smith, L. L., & Reise, S. P. (1998). Gender differences on negative affectivity: An IRT study of differential item functioning on the multidimensional personality questionnaire stress reaction scale. *Journal of Personality and Social Psychology*, *75*(5), 1350-1362.
27. \*Steinberg, L., & Thissen, D. (2006). Using effect sizes for research reporting: Examples using item response theory to analyze differential item functioning. *Psychological Methods*, *11*(4), 402-415.
28. \*Thissen, D., & Steinberg, L. (1988). Data analysis using item response theory. *Psychological Bulletin*, *104*(3), 385-395.

**Examples of Psychometric Analyses (\*indicates assigned reading)**

1. \*Fraley, R. C., Waller, N. G., & Brennan, K. A. (2000). An item response theory analysis of self-report measures of adult attachment. *Journal of Personality and Social Psychology*, *78*(2), 350-365.
2. \*Gray-Little, B., Williams, V. S. L., & Hancock, T. D. (1997). An item response theory analysis of the Rosenberg self-esteem scale. *Personality and Social Psychology Bulletin*, *23*(5), 443-451.
3. \*Oishi, S. (2006). The concept of life satisfaction across cultures: An IRT analysis. *Journal of Research in Personality*, *40*(4), 411-423.
4. \*Reise, S. P., Horan, W. P., & Blanchard, J. J. (2011). The challenges of fitting an item response theory model to the social anhedonia scale. *Journal of Personality Assessment*, *93*(3), 213-224.
5. Segura, S. L., & González-Romá, V. (2003). How do respondents construe ambiguous response formats of affect items? *Journal of Personality and Social Psychology*, *85*(5), 956-968.
6. \*Walton, K. E., Roberts, B. W., Krueger, R. F., Blonigen, D. M., & Hicks, B. M. (2008). Capturing abnormal personality with normal personality inventories: An item response theory approach. *Journal of Personality*, *76*(6), 1623-1648.
7. \*Woods, C. M., Oltmanns, T. F., & Turkheimer, E. (2009). Illustration of MIMIC-model DIF testing with the schedule for nonadaptive and adaptive personality. *Journal of Psychopathology and Behavioral Assessment*, *31*(4), 320-330.

**Policies**

* Attendance: This is an elective graduate class. If you do not want to be here, then drop the class. If you want to be here, come to class.
* Missing class: If you miss class or lab, it is your responsibility to know all material covered and find out what announcements have been made. Classmates are helpful.
* Assignments: Assignments are to be handed in on the specified date. There will be a penalty of 20% off for every day late (i.e. 1% of final grade for each day).
* Collaborating: You can, and are even encouraged to, collaborate on assignments. However, each student is responsible for handing in his/her own assignment in his/her own words/syntax. You cannot collaborate on the final project.
* Class materials: Presentations, data, and syntax/code (unless otherwise credited) are subject to the instructor’s copyright and should not be sold or shared without my permission. Similarly, please do not record me without my permission. If you need special accommodations, please see me at the onset and/or provide appropriate documentation.
* Purdue’s Honor Pledge: Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breeches of this value by either emailing [integrity@purdue.edu](mailto:integrity@purdue.edu) or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern. “As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.”

**COVID-19 Considerations (adapted from Purdue’s required policies)**

Students are not expected to attend class (virtually) if they are ill or otherwise unable to attend class. If they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus, students should stay home and contact the Protect Purdue Health Center (496-INFO).

In the current context of COVID-19, I will not consider synchronous attendance a factor in the final grades. However, timely completion of will be. Students should inform me of any conflict that can be anticipated and will affect the timely submission of an assignment.

Classroom engagement is extremely important and associated with your overall success in the course. The importance and value of course engagement and ways in which you can engage with the course content even if you are in quarantine or isolation, will be discussed at the beginning of the semester. Student survey data from Fall 2020 emphasized students’ views of in-person course opportunities as critical to their learning, engagement with faculty/TAs, and ability to interact with peers.

Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflicts, when advance notification to an instructor is not possible, the student should contact the instructor/instructional team as soon as possible by email, through Brightspace, or by phone. In cases of bereavement, quarantine, or isolation, the student or the student’s representative should contact the Office of the Dean of Students via [email](mailto:odos@purdue.edu%20?subject=Student%20Bereavement%20Needs) or phone at 765-494-1747. Our course Brightspace includes a link to the Dean of Students under ‘Campus Resources.’

If you must quarantine or isolate at any point in time during the semester, please reach out to me via email so that we can communicate about how you can continue to learn remotely. Work with the Protect Purdue Health Center (PPHC) to get documentation and support, including access to an Academic Case Manager who can provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Your Academic Case Manager can be reached at [acmg@purdue.edu](mailto:acmg@purdue.edu). Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation.

**Nondiscrimination Statement**

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue’s full Nondiscrimination Policy Statement is included in our course Brightspace under University Policies.

**Diversity & Inclusion**

This course, as with every course offered at Purdue, plays a part in creating and sustaining a welcoming campus where all students can excel. There are multiple initiatives within the psychology department and others supported by the university focused on this goal, and this course is designed to take advantage of those resources. Learning experiences and assignments address diversity and inclusion, not because they are “topics,” but because they address the diversity and existing disparities in the field, and are necessary to prepare students to be successful in a diverse, global environment.

**Accessibility**

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: [drc@purdue.edu](mailto:drc@purdue.edu) or by phone: 765-494-1247.

**CAPS Information**

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 and http://www.purdue.edu/caps/ during and after hours, on weekends and holidays, or through its counselors physically located in the Purdue University Student Health Center (PUSH) during business hours.

**Emergency Preparation**

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

**Disclaimer**

This syllabus is subject to change. You will be notified of any changes as far in advance as possible via an announcement on Brightspace.

**Schedule**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Week** | **Topic** | **Reading** | **Assignment due (TR by 5PM)** |
| 1 | 01/18/21 | MLK Day (no lecture) |  |  |
| 2 | 01/25/21 | Introductions, Measurement Issues, Math Review | RM 1-28; 12, 18, 19 |  |
| 3 | 02/02/21 | Classical Test Theory | RM 115-146 | Ex1: Expectations |
| 4 | 02/08/21 | Exploratory Factor Analysis | RM 37-60 | Ex2: Scale Reliability |
| 5 | 02/15/21 | Confirmatory Factor Analysis | RM 61-114, 14 | Ex3: EFA |
| 6 | 02/22/21 | Rater Reliability | RM 147-182; 24 | Ex4: CFA |
| 7 | 03/01/21 | Validity | RM 183-222; 7 |  |
| 8 | 03/08/21 | Generalizability Theory | RM 223-246 |  |
| 9 | 03/15/21 | Generalized Reliability | 4, 9 | **Project idea** |
| 10 | 03/22/21 | Item Response Theory | RM 247-304; 16, 20, 29-32,34 | Ex5: Rater Reliability, GT |
| 11 | 03/29/21 | Factorial Invariance | 10, 11 | Ex6: IRT |
| 12 | 04/05/21 | Differential Item Functioning | 26, 27, 35 | Ex7: IRT, Graded Responses |
| 13 | 04/12/21 | Multi-trait Multi-method Approaches | 3, 17 | Ex8: Invariance, DIF |
| 14 | 04/19/21 | Applications in the Literature |  | **Paper draft** |
| 15 | 04/26/21 | Project Presentations |  |  |
| 17 | 05/03/21 |  |  | **Final paper (on 5/4 by 5PM)** |

RM = Raykov & Marcoulides