PSY 509
Introduction to Classical and Modern Test Theory
Spring, 2022

GENERAL INFORMATION

Class Time:	Monday 9:05am-12:05pm	Class Location:	130 Moore Building
Zoom:	https://psu.zoom.us/j/96672211988?pwd=b29uMmtIS0hIMGI1aVJlKzBlaVd0UT09		
Zoom PW:	048833		

Instructor:	James M. LeBreton	Office Location:	632 Moore Building
E-mail:	james.lebreton@psu.edu	Office Hours:	By Appointment
Zoom:	https://psu.zoom.us/my/james.lebreton		

GTA:	Sydney Reichin	Office Location:	630 Moore Building
E-mail:	slr338@psu.edu	Office Hours:	Tu 1:00pm – 3:00pm via Zoom
Zoom:	https://psu.zoom.us/j/2423885471		

TEXT

Allen, M. J., & Yen, W. M. (1979). Introduction to measurement theory. Prospect Heights, IL: Waveland Press.

STATISTICAL SOFTWARE

R & RStudio. R and RStudio are free software packages that will serve as the primary software used in the course. If you are using a PSU computer from the CLA, you should be able to download and install a copy from the software center (Windows)/self service dock (Mac) if it is not already installed. If you are having trouble, you can contact the LA Helpdesk at techsupport@la.psu.edu. On personal computers, you can just download R (https://www.r-project.org) and RStudio (https://www.rstudio.com).

CLASS OBJECTIVES

This class is designed to provide doctoral students with an introductory treatment of classic and modern test theory (psychometrics). We will discuss classical and contemporary issues in light of both their theoretical and practical implications for psychologists. Topics will likely include: 1) Validity & Validation, 2) Test/Survey Construction, 3) Linear Combinations, 4) Classical Test Theory – Reliability, 5) Classical Test Theory – Item Analysis, 6) Exploratory Factor Analysis, 7) Confirmatory Factor Analysis, 8) Item Response Theory, 9) Item Response Theory – Item Analysis, 9) Generalizability Theory, and 10) Test Fairness & Bias.

This course has three goals:

1) To provide students with a broad **theoretical understanding** of psychometrics.

2) To provide students with the **applied skills** necessary to incorporate psychometric techniques into their research activities.

3) To provide students with a cursory treatment of the **mathematical foundations** of these topics so that the interested student has the requisite background to pursue advanced training in these areas.

CLASS PHILOSOPHY

This class is my opportunity to introduce you to the interesting and complex world of measurement and psychometrics. It is my personal mission to make sure that all of you walk away from this class capable of discussing in great depth the topics we cover. I expect everyone to be proactively involved in this educational and professional developmental opportunity. I will actively support and encourage an environment characterized as open, supportive, and fun. I will actively discourage an environment that is characterized as aggressive or hostile. I expect all of us to work together to create an environment that reinforces constructive criticism and feedback, accompanied with comments designed to guide everyone to a better understanding of the issues at hand. I would encourage all of you to think outside the box-- try to frame and address issues in innovative and creative ways. Finally, always be thinking about how the topics we discuss relate back to the research questions in each of your specialty areas. I am more than happy to meet with you individually to discuss or clarify how the ideas presented in class are germane to your research.

OVERVIEW OF COURSE FORMAT

This course is scheduled to meet three hours every week. During each class we will focus our discussion on a different topic. Because this course is an advanced survey course, emphasis is placed on students grasping issues at both the conceptual/theoretical level and the technical/operational level. The mathematics for the procedures we discuss will be introduced by not overly emphasized. I can recommend articles and books for those students seeking a more rigorous mathematical treatment of these topics.

Each week the class will be assigned a list of readings. Typically, the readings will consist of one or more book chapters and perhaps several articles. On rare occasions we will read a larger number of articles. An additional list of optional readings is available for students seeking supplementary information about that week's topic. I would encourage you to integrate any additional readings you believe are relevant to the topic at hand.

COURSE REQUIREMENTS

1) Midterm Quiz. One formal quiz will be given during the middle of the semester. I will provide you with more specifics once the semester gets started. However, the quiz will likely consist of identification, multiple choice, short answer, and/or essay questions.

2) Class Project (Assignments & Final Project). The second requirement consists of a written summary of your class project. For this project, students will be asked to: 1) identify a psychological construct, 2) develop items designed to measure this construct, 3) collect data on these items, 4) analyze these items using the procedures discussed during the semester, and 4) write up the results of this project using APA format. You will work incrementally on this project by completing a small number of assignments throughout the semester. A combination of these assignments + some additional analyses will comprise the "final project" that is due the last week of the semester. This project is roughly analogous to the method, results, and discussion sections of traditional journal articles.

   The purpose of this requirement is to provide you an opportunity to apply the theory and statistics we will cover during the semester and to strengthen your academic writing skills and familiarity with the APA style.

3) Attendance & Participation. Students are expected to be active members (both cognitively and verbally) of the class. Please be present, prepared, and on-time for each class. My discretion decides an excused absence (e.g., medical illness, family emergency, approved University absence). Unexcused absences (e.g., I over slept; I'm going on a vacation; I already bought my plane ticket to fly home at the end of the semester) are not acceptable and **will result in the drop of a letter grade**. I reserve the right to give pop quizzes over the

assigned material. These pop quiz scores, in conjunction with weekly attendance/participation, will be used to determine the final participation grade.

Participation is a function of (at least) the following:

- Oral Communication – Are your statements articulate and logically coherent?
- Technical Knowledge – Are you prepared for class? Are your descriptions conceptually clear?
- Activity – Are you actively participating in class discussion? Are you contributing not only in terms of quantity, but also in terms of quality to the discussion? Have you prepared to discuss your answers to out of class assignments?
- Civility – Are you treating the other members of the class with respect and courtesy? Are you allowing others the opportunity to share their thoughts or are you dominating the conversation?

INDIVIDUAL AND GROUP WORK

You are strongly encouraged to consider working in groups for the class project so that you benefit from collaborative learning. **Collaboration is not permitted on the quizzes**.

GRADES

Each requirement will contribute to your grade as noted below:

Midterm Quiz	30%
Project Assignments	30%
Final Project Write-Up	30%
Attendance & Participation	10%

Grades for each of the above components will be assigned using the following scale:

12 = A+	9 = B+	6 = C+	3 = D+	0 = F
11 = A	8 = B	5 = C	2 = D	
10 = A-	7 = B-	4 = C-	1 = D-	

Your final course grade is simply the weighted average of your two exams, research project, and lab homework. Scores are rounded "down" (e.g., a 10.6 is an A-).

ZOOM

In the event we need to transition to Zoom, keep in mind that this is a classroom environment and others should be treated with respect. Please keep your microphone muted unless you want to ask a question or interact with someone. If your microphone is not muted, the entire class will be able to hear what is going on in your environment. Also, *as an instructor, I personally like to see people's faces*. I know that as a participant, I am more involved when I have my camera on. I realize, however, that there are many reasons why you might not want to turn on your camera such as poor internet connection, joining via phone, or other privacy concerns. It is your choice as to whether you would like to have the camera on or not.

In the past when I have taught on Zoom, students found it helpful for me to record the sessions. Thus, video and audio recordings of class lectures will be part of the classroom activity. The video and audio recordings are used for educational uses/purposes and only may be made available to students presently enrolled in the class. For purposes where the recordings will be used in future class session/lectures, any type of identifying information will be adequately removed. At this point, I do not envision using these recordings again in the future.

EXTENDED ABSENCES

During your enrollment at Penn State, unforeseen challenges may arise. If you ever need to miss an extended amount of class in such a circumstance, please notify your professor so you can determine the best course of action to make up missed work. If your situation rises to a level of difficulty you cannot manage on your own with faculty support, reach out to the Student Care & Advocacy office by phone at (814-863-2020) or email them at StudentCare@psu.edu. Office hours are Monday-Friday, 8 a.m. to 5 p.m.

EDUCATIONAL EQUITY

Consistent with University Policy AD29, students who believe they have experienced or observed a hate crime, an act of intolerance, discrimination, or harassment that occurs at Penn State are urged to report these incidents as outlined on the University's Report Bias webpage: http://equity.psu.edu/reportbias/.

DISABILITY SERVICES

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. Student Disability Resources (SDR) website provides contact information for every Penn State campus (http://equity.psu.edu/sdr/disability-coordinator). For further information, please visit Student Disability Resources website (http://equity.psu.edu/student-disability-resources/).

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: See documentation guidelines (http://equity.psu.edu/sdr/guidelines). If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early as possible. You must follow this process for every semester that you request accommodations.

COUNSELING & PSYCHOLOGICAL SERVICES

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

Counseling and Psychological Services at University Park (CAPS)
(http://studentaffairs.psu.edu/counseling/): 814-863-0395

Counseling and Psychological Services at Commonwealth Campuses
(http://senate.psu.edu/faculty/counseling-services-at-commonwealth-campuses/)

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400
Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

ACADEMIC INTEGRITY

Students with questions about academic integrity should visit:
https://la.psu.edu/current-students/undergraduate-students/education/academic-integrity

Penn State defines academic integrity as "the pursuit of scholarly activity in an open, honest and responsible manner." (Senate Policy 49-20). Dishonesty of any kind will not be tolerated in this course. Dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without permission from the instructor or tampering with the academic work of other students. Students facing allegations of academic misconduct who drop the course will be returned and will be expected to complete course work and meet course deadlines until the allegations are dismissed and the drop is permitted. Students responsible for academic misconduct often receive academic sanctions, which can be severe, and put themselves at jeopardy for disciplinary sanctions assigned by the University's Office of Student Conduct (see Senate Policy G-9).

To avoid plagiarism in this course, always include an in-text citation that includes the author(s) last name(s) and the year the source was published at the end of any sentence/after any image that includes words, images, or ideas you found in a source, always included quoted text within quotation marks, and always include a reference for any source at the end of your paper (reference format will be discussed in class).

Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment by all members of the University community not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

Students MAY collaborate on any class assignments & the class project.

Students MAY NOT collaborate on any class quizzes.

If you have questions or require clarification about any aspect of the quizzes, please direct those inquires to James or the TA. If you have any questions about what constitutes appropriate or inappropriate collaboration, please ask James or the TA.

COVID-19

Please refer to the COVD-19 Dashboard for updates on masking policies, instructional-mode changes, etc.

COVID dashboard: https://virusinfo.psu.edu/covid-19-dashboard/

Penn State University requires everyone to wear a face mask in all university buildings, including classrooms, regardless of vaccination status. ALL STUDENTS MUST wear a mask appropriately (i.e., covering both your mouth and nose) while you are indoors on campus. This is to protect your health and safety as well as the health and safety of your classmates, instructor, and the university community. Anyone attending class without a mask will be asked to put one on or leave. Instructors may end class if anyone present refuses to appropriately wear a mask for the duration of class. Students who refuse to wear masks appropriately may face disciplinary action for Code of Conduct violations. If you feel you cannot wear a mask during class, please speak with your adviser immediately about your options for altering your schedule.

NATURAL OR UNNATURAL DISASTERS

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.

TENTATIVE COURSE SCHEDULE

Week	Date	Topic	Project Milestones
1	01/10/22	Topic 1: Syllabus, Intro, Stats Review (Allen & Yen: Chapters 1 & 2)	Phase #1 Assigned
2	01/17/22	**Martin Luther King Day – No Classes**	
3	01/24/22	Topic 2: Test Development & Validation (readings + Allen & Yen: Chapter 6)	**Phase #1 Due** • Thursday, Jan. 27 @ 5:00pm Phase #2 Assigned • Friday, Jan. 28 @ 5:00pm
4	01/31/22	Topic 3: Linear Combinations (Nunnally & Bernstein, Ch. 5)	**Phase #2 Due** • Friday, Feb. 4 @ 12:00pm
5	02/07/22	Topic 4: Classical True Score Theory (Allen & Yen: Chapter 3)	Phase #3 Assigned • Monday, Feb 7 @ 12:00pm
6	02/14/22	Topic 5: Reliability (Allen & Yen: Chapter 4)	**Phase #3 Due** • Monday, Feb14 @ 9:00am
7	02/21/22	Topic 6: Reliability & Item Analysis (Allen & Yen: Chapter 4 + readings)	Project Data Collection
8	02/28/22	Flex Week: Alternative Estimates of Reliability	Project Data Collection
9	03/07/22	**Spring Break – No Classes**	Project Data Collection
10	03/14/22	**In-Class Midterm Quiz**	**Midterm Quiz In-Class**
11	03/21/22	Factor Analysis	
12	03/28/22	Factor Analysis	
13	04/04/22	Factor Analysis	
14	04/11/22	Item Response Theory (Dichotomous Models)	**Phase #4 Due** • Tuesday, Apr 12 @ 9:00am
15	04/18/22	Item Response Theory (Item Information, Test Information, Test Construction)	
16	04/25/22	Flex Week: Reliability, Validity, Bias, and Fairness	~~**Final Project Due**~~ • ~~Friday, April 29 @ 5:00pm~~
17	05/02/22	Final Exam Week	**Final Project Due** • May, 5th @ 9:00am

READINGS

Readings will be assigned on a weekly basis.

Project Assignments/Phases

Phase 1 (Due: Thursday, January 27th by 5:00pm)

Your first assignment is to identify and define your focal construct. Working in groups of 2 or 4 people, you will need to decide on a construct you wish to study, generate a definition of this construct, and write a total of 20 items that you believe are appropriate for this construct.

1. **Defining the construct.** In a ***Microsoft Word*** file, provide a written definition of your construct. Consider the domain of behaviors that compose your construct, what your construct is and what it is not. Write up your definitions in paragraph form.
2. **Developing items**. In a ***Microsoft Excel*** file, write a total of 20 items, with a Likert-style response format (5-7 point scale preferable), that you believe tap into your construct. Consider the vocabulary level of your items and follow recommendations for writing effective items (avoid the use of jargon, double-barreled items, double negatives, etc.).

Send your construct definition and 20 items to Sydney by **January 27 @ 5:00pm**.

Phase 2 (Assigned: Friday Jan 28th @ 5:00pm; Due: Friday Feb 4th by 12 pm)

Your second assignment will be to conduct a content analysis of the class's combined item pool. Using the definitions and list of items provided by each group (to be distributed), ***work individually*** to match each item with the construct you think it best represents. Each item should only be assigned to a single construct. Instructions will be included when this assignment is distributed. Send your completed excel file to Sydney by **February 4 at 12pm.**

Phase 3 (Assigned: Monday, Feb 7th @ 12:00pm; Due: Monday February 14 @ 9:00am)

For your third assignment, you will need to review the results from the content analysis and as a group, decide whether any items can be removed or revised. You should aim to reduce your item pool to about 15 items. Send your final item pool to Sydney in a ***Microsoft Excel*** file by **February 14th at 9:00am**.

Phase 4 (Due: April 11, 2022)

Based on the items received following Assignment 3, we will combine all items and create a survey to be administered on-line. For your fourth assignment, you will need to examine these data and conduct an initial item analysis to determine whether your item pool can be reduced further. Please provide basic information about reliability, internal consistency, & item-total correlations. Examine whether the factor structure is consistent with your theoretical predictions and provide evidence (if necessary) for which items you would recommend revising or eliminating.

Final Project (Due: April 29, 2022)

The final project extends prior assignments by asking you to summarize your activities in the form of a scale development paper. The paper should be formatted per APA and include the following:

1) **Intro/Method**. Include a definition of your construct and describe the process by which you developed your initial item pool (Assignments 1-3)
2) **Results**. Describe the results of your examination of the data (Assignment 4) as well as any subsequent steps taken to obtain additional evidence of validity and reliability.
3) **Implications**. Summarize the utility of your new scale and next steps you might recommend in terms of further revisions and future research questions that could be addressed using your scale.
4) **Peer Evaluation**. Please complete the peer evaluation form and email it to me in a separate email.