Psychometric Theory (6349)

The University of Texas at Arlington – Fall 2023

Syllabus

Instructor: Michelle Martín-Raugh	**Class Meetings:**
Office: LS 304	Tuesdays 2-4:50 PM
E-mail: michelle.martinraugh@uta.edu	
Office Hours: By appointment	

Required Textbook:

Furr, R. M (2021). *Psychometrics: An introduction* (4th edition). Thousand Oaks, CA: Sage Publications, Inc. [978-1071824078]

Course Objectives

The goal of this course is for you to develop a basic understanding of the fundamental concepts, methods, and principles of psychological measurement, so that you can critically evaluate the uses of tests and other psychological assessment procedures. Particular attention is paid to issues concerning validity and reliability. The first part of this course introduces the fundamental concepts of psychological measurement. The second part applies these concepts to the construction, interpretation, and use of measures of cognitive abilities, personality traits, and other constructs. The practical implications of assessing psychological individual differences in learning and work settings are emphasized throughout.

Student Learning Outcomes

By the end of the course, students should:

- Have a thorough understanding of proper test construction techniques and principles.
- Be able to develop psychological surveys/questionnaires/instruments used in basic and applied (research) settings.
- Be able to critically evaluate a variety of published psychological surveys/questionnaires/instruments used in basic and applied settings.
- Understand and be able to interpret more modern and advanced psychometric techniques (e.g., CFA) in the published literature.
- Have experience carrying out several applied psychometric analyses (e.g., constructing a test, conducting reliability and validity analyses).
- Have an appreciation for the role of professional judgment in applications of test theory.

Attendance Policy & Participation (5%)

Your presence in class and your active participation are essential aspects of this course. If you are unable to attend the scheduled lecture times, you should drop the course. You must have completed all reading assignments for a particular topic *before* we discuss the topic in class. This will allow you to get the most out of the course and give you the chance to clarify issues you may have found confusing in the readings.

In class, you should be prepared to discuss the ideas and concepts from the assigned readings, and to engage in thoughtful and respectful discussion of the questions submitted by yourself and your classmates based on the readings.

We will not have time to cover all of the material from the textbook and additional readings during class discussion, but you are still required to know the material from the readings for all exams.

Exams (50%)

There will be one take-home midterm (25%) and a final exam (25%) for this course (see Course Schedule). Exams will emphasize understanding of important terms and concepts as well as interpretation of results from statistical analyses. For each exam, one portion of the exam will be take-home, where you can use notes, computing programs, and the internet (50% of exam grade). This portion of the exam will be made available on the day the exam is listed in the syllabus and will be due at the start of the next class, one week later. Each exam will also include an oral component, where during our regularly scheduled class time you will each meet with me one-on-one to answer oral questions regarding course content (50% of exam grade). I will make the battery of possible exam questions available to you prior to the oral examination, and will ask each of you a subset of these questions.

Assignments (45%)

***In-Class Discussion Questions Based on Readings* (10%):**
Most weeks you will be asked to read book chapters and/or articles to facilitate learning, reflection, and discussion on a particular topic prior to coming to class, and will be asked to generate discussion questions for the class to guide our discussion at the start of each class. Discussion questions should be posted using the discussion post tool on Canvas. **You must post 3 engaging questions by midnight before the start of each class (5%).** Posts should only be as long as necessary to provide adequate context info for other class members to get the point. Be sure to provide enough context to ensure the class can interpret the meaning of your question. Even if you are absent for class, you are required to submit questions based on the readings by the deadlines; failure to do so will result in loss of points from your overall grade.

Each week, one or more of you will be designated as the class discussion leader (5%). We will assign discussion leaders at the beginning of the course, as the number of people leading each class discussion will depend on the number of people enrolled in the course. Class discussion leaders should decide which questions to focus on, and in what order, to provide an interesting and engaging discussion of the readings and material. Class discussions should last

45 minutes to one hour. Not being present for class the day you are assigned as discussion leader will result in an automatic 5% point reduction in your overall grade for the course; if you have an extenuating circumstance preventing you from attending class on the day you are designated as a discussion leader we can schedule a make-up day, provided there is enough time left in the course.

Activities and Exercises **(10%):**
Activities and exercises that we will start and sometimes complete in class will be graded (please submit on Canvas). Grades will be based on a check (thoroughly completed) or no check (incomplete, or not completed sufficiently accurately). Grades will be based upon the percentage of exercise assignments "thoroughly completed." **Some assignments will require access to SPSS or R.** You can **drop one activity/exercise** from being graded.

Psychological Scale Development Project and Report **(20%):**
The Psychological Scale Development Project and Report will require you to develop a new measure of a psychological construct (e.g., attitude, personality trait). Class members will be divided into teams (2-3 people per team). Each team will select a single construct for the development of the instrument. Each team will carefully define their construct. Students will develop items for the measure, and then the best items will be retained for administration and analysis. Additional steps include the administration of items to subject matter experts, pilot sampling, factor analysis, reliability analysis, and development of a proposed validation study. The specific details will depend somewhat on the nature of the project you choose. **Your team will need to meet with me to go over your planned project and the steps you plan to take by 9/19/23**. You will submit one final paper for your group.

Final papers are due by <u>11:59PM on Tuesday, 12/5/23</u> (submit on Canvas).

Group Presentation **(5%)**
Along with your paper, your group will prepare a brief oral presentation to be presented to your colleagues on **12/5/23** (order to be determined). Grading criteria for the presentation are clarity of presentation and ability to answer questions from the audience. Class members are expected to provide feedback and to ask questions during the presentations. The number of groups will determine the maximum amount of time for the presentations. I suggest you focus your presentation on a few key points (10 – 15 slides).

Late Assignments and Missing Exams

Assignments started in class, as noted in the course schedule within this syllabus, are due in completed form by the beginning of the next class. Non-completion of any assignment or exam by the specified date will result in a score of **zero** for that portion of your grade. When submitting an assignment in Canvas, make sure that you receive a confirmation indicating your assignment was submitted successfully. If you experience technical difficulties with the Canvas system, email your assignment to the instructor as an attachment before the deadline to receive full credit. Technical difficulties are not a valid excuse for submitting an assignment late.

Make-up assignments and exams are offered only when the student can provide written evidence of a university-related excuse or other unforeseen and exceptional circumstances. If for any reason you need to reschedule an exam, please provide two weeks' notice and obtain consent from the instructor. Rescheduled exams must be completed within one week of the initial exam date; otherwise, you will receive a score of **zero** for that exam. All exams will be rescheduled at the convenience of the instructor.

Academic Misconduct

All students are subject to the institution's [academic integrity policies](#). At the instructor's discretion, students who are suspected of cheating or plagiarism may be reported to the Office of the Dean of Students and may receive a zero for the assignment and/or a failing grade for the course.

Sharing Course Materials

You are not allowed to post materials from this course on the Internet (with the exception of Canvas submissions) or share course materials with anyone outside of this class (including other cohorts). This policy helps protect the integrity of the resources developed for this class and ensures an equal playing field for all students in future cohorts.

Grade Breakdown

This course is graded on an absolute scale. Grading will be based on the following components and their respective contributions toward your final grade.

	% Total Grade
Midterm Exam	25%
Final Exam	25%
Scale Development Paper	20%
Group Presentation	5%
Assignments	10%
Leading Class Discussion	5%
Discussion Questions Based on Readings	5%
Attendance & Participation	5%

Final letter grades will be assigned on an absolute scale, shown below:

90-100%	A
80-89%	B
70-79%	C
60-69%	D
< 60%	F

Course Schedule

This schedule will be followed as closely as possible, but is subject to change. Changes in assignments, readings and/or topics will be announced as far in advance as possible. Readings are due the day they are listed in the schedule. Assignments will be started in class they day they are listed in the syllabus and will be due on Canvas before the beginning of the following class.

WEEK	DATE	TOPICS	READINGS	ASSIGNMENTS	ACTIVITIES
1	8/22//23	Introduction			Introduction to course; Going over syllabus; assigning discussion leaders; taking personality measure
2	8/29/23	Statistics Review; History of Psychometrics	Furr 1, 3 (pp. 49-73) *No discussion questions due this week; will spend first part of class brainstorming project topics and forming teams	**Assignment 1:** Historical Figure Presentation (start in class, deliver mini presentation next class)	Brainstorm Project Topics/Form Groups; Pick historical figure in Psychometrics to learn more about; Go to UTA library to explore resources; work on 3-slides to share with class next class
3	9/5/23	Psychological Scaling; Test Specification	Furr 2 *No discussion questions due this week; will deliver historical figure presentations at the start of class	**Assignment 2:** Develop Test Blueprint	Share historical figure slides with class; Assignment: Develop test specifications for measure of Leadership.
4	9/12/23	Classical Test Theory; Reliability	Furr 5, 6 (pp. 181-216), 7 (pp. 237-262); Cortina (1993)	**Assignment 3:** Reliability Estimation Exercise	Reliability estimation exercise using 50-item IPIP data from first class.
5	9/19/23	Content Validity; Criterion-related Validity; Range Restriction	Furr 8; Lievens & Sackett (2012); Sireci (1998)	**Assignment 4:** Validation Study Design **Discuss plan for group projects with instructor**	Creating a High School teacher licensure test: What kind of validity data would you collect and how would you design your validity studies?
6	9/26/23	Construct Validity; Convergent/Divergent Validity	Furr 9; Colquitt et al. (2019); Messick (1995)	**Assignment 5:** Construct v. Method Variance Assignment	Construct v. Method Variance Assignment
7	10/3/23	Scale Development & Item Writing; Maximal vs. Typical Performance	Furr 10; Clark & Watson (2019); Hinkin (1998)	**Assignment 6:** Item Writing Exercise	Item writing exercise
8	10/10/23	Item Analysis; Scoring Tests	Furr 3 (pp. 74-95), 7 (pp. 263-278); Cortina et al. (2020)	**Assignment 7:** Item Analysis/Test Scoring Exercise	Item analysis and test scoring exercise
9	10/17/23	**Midterm Exam (in class)**			

10	10/24/23	Exploratory & Confirmatory Factor Analysis	Furr 4, 12; Fabrigar et al. (1999)	**Assignment 8:** Factor Analysis Exercise **Guest lecture from Jonathan Steinberg (EurekaFacts)** **SME ratings due by start of class**	Factor analysis demonstration and exercise
11	10/31/23	Test Bias; Interrater Reliability & Agreement	Furr 11; Meade & Fetzer (2009); McGraw & Wong (1996)	**Assignment 9:** Interrater Reliability Analysis	Interrater Reliability Exercise
12	11/7/23	Item Response Theory (IRT) I: IRT Basics	Furr 14; Additional readings TBD	**Guest lecture from Dr. Jacob Seybert (Roblox) and In-class activity**	Guest lecture from Dr. Jacob Seybert (Roblox) and In-class activity
13	11/14/23	Computer Adaptive Testing (CAT); Differential Item Functioning (DIF)	Stark et al. (2001); Zwick (2012)	**Assignment 10:** DIF Exercise	DIF Exercise
14	11/21/23	**NO CLASS** (Thanksgiving Week)			
15	11/28/23	**Final Exam**		**Final Exam Oral Portion** **Final Exam Take Home Portion Due 11/28/23 by 11:59PM (Submit on Canvas)**	
16	12/5/23	**Project Presentations**		**Final Paper Due 12/5/23 by 11:59PM (Submit on Canvas)**	

Institutional Information

UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the [Institutional Information](https://resources.uta.edu/provost/course-related-info/institutional-policies.php) page (https://resources.uta.edu/provost/course-related-info/institutional-policies.php) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

Additional Information

Face Covering Policy

The use of face coverings on campus is no longer mandatory. If a student needs accommodations to ensure social distancing in the classroom due to being at high risk they are encouraged to work directly with the Student Access and Resource Center to assist in these accommodations. If students need masks, they may obtain them at the Central Library, the E.H. Hereford University Center's front desk or in their department.

Attendance

At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator of student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I have established the following attendance policy:

Class attendance is mandatory, and I take attendance at the beginning of every class. Advanced notice is required when missing class whenever possible. If you miss a class, you will have until the end of the following class period to make up missed assignments. Discussion questions based on the readings will be due at the beginning of each class period as noted in the course schedule, regardless of whether you attend class or not. You may skip or drop the submission of questions once, for instance, if you miss class one day. However, makeup opportunities for missing exams and group presentations are only available under extreme circumstances.

However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to verify Federal Student Aid recipients' attendance in courses. UT Arlington instructors should be prepared to report the last date of

attendance as part of the final grading process. Specifically, when assigning a student a grade of F, faculty must report the last date a student attended their class based on evidence of academic engagement such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

Distance education courses require regular and substantive online interaction and participation. Students must participate in online course activities to demonstrate attendance; logging into an online class is not sufficient by itself to demonstrate attendance.

Emergency Exit Procedures

Should we experience an emergency event that requires evacuation of the building, students should exit the room and move toward the nearest exit, which can be found on a map posted in the classroom. When exiting the building during an emergency, do not take an elevator but use the stairwells instead. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Students are encouraged to subscribe to the MavAlert system that will send information in case of an emergency to their cell phones or email accounts. Anyone can subscribe at Emergency Communication System.

The English Writing Center (411LIBR)

The Writing Center offers **FREE** tutoring in 15-, 30-, 45-, and 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Register and make appointments online at the Writing Center (https://uta.mywconline.com). Classroom visits, workshops, and specialized services for graduate students and faculty are also available. Please see Writing Center: OWL for detailed information on all our programs and services.

The Library's 2nd floor Academic Plaza (http://library.uta.edu/academic-plaza) offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the library's hours of operation.

Librarian to Contact

Each academic unit has access to Librarians by Academic Subject that can assist students with research projects, tutorials on plagiarism and citation references as well as support with databases and course reserves.

Emergency Phone Numbers

In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. The non-emergency number 817-272-3381.

Library Information

Research or General Library Help

Ask for Help
- [Academic Plaza Consultation Services](library.uta.edu/academic-plaza) (library.uta.edu/academic-plaza)
- [Ask Us](ask.uta.edu/) (ask.uta.edu/)
- [Research Coaches](http://libguides.uta.edu/researchcoach) (http://libguides.uta.edu/researchcoach)

Resources
- [Library Tutorials](library.uta.edu/how-to) (library.uta.edu/how-to)
- [Subject and Course Research Guides](libguides.uta.edu) (libguides.uta.edu)
- [Librarians by Subject](library.uta.edu/subject-librarians) (library.uta.edu/subject-librarians)
- [A to Z List of Library Databases](libguides.uta.edu/az.php) (libguides.uta.edu/az.php)
- [Course Reserves](https://uta.summon.serialssolutions.com/#!/course_reserves) (https://uta.summon.serialssolutions.com/#!/course_reserves)
- [Study Room Reservations](openroom.uta.edu/) (openroom.uta.edu/)

Readings

Clark, L. A., & Watson, D. (2019). Constructing validity: New developments in creating objective measuring instruments. *Psychological Assessment*, *31*, 1412-1427.

Colquitt, J. A., Sabey, T. B., Rodell, J. B., & Hill, E. T. (2019). Content validation guidelines: Evaluation criteria for definitional correspondence and definitional distinctiveness. *Journal of Applied Psychology*, *104*, 1243-1265.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, *78*, 98-104.

Cortina, J. M., Sheng, Z., Keener, S. K., Keeler, K. R., Grubb, L. K., & Schmitt, N. (2020). From alpha to omega and beyond! A look at the past, present, and (possible) future of psychometric soundness in the Journal of Applied Psychology. *Journal of Applied Psychology*, *105*, 1351-1381.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, *4*, 272- 299.

Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational Research Methods*, *1*, 104-121.

Lievens, F., & Sackett, P. R. (2012). The validity of interpersonal skills assessment via situational judgment tests for predicting academic success and job performance. *Journal of Applied Psychology*, *97*(2), 460-469.

McGraw, K. O., & Wong, S. P. (1996). Forming inferences about some intraclass correlation coefficients. *Psychological Methods*, *1*, 30-46.

Meade, A. W., & Fetzer, M. (2009). Test bias, differential prediction, and a revised approach for determining the suitability of a predictor in a selection context.

Organizational Research Methods, *12*, 738-761.

Messick, S. (1995). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American Psychologist*, *50*, 741-749.

Sireci, S. G. (1998). The construct of content validity. *Social Indicators Research*, 83-117.

Stark, S., Chernyshenko, O. S., Chan, K. Y., Lee, W. C., & Drasgow, F. (2001). Effects of the testing situation on item responding: Cause for concern. *Journal of Applied Psychology*, *86*(5), 943-953.

Zwick, R. (2012). A review of ETS differential item functioning assessment procedures: Flagging rules, minimum sample size requirements, and criterion refinement. *ETS Research Report Series*, *2012*(1).

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