

Psychology 6323
Spring 2023

Psychometrics

Instructor: Osvaldo F. Morera, PhD
Office: Room 212, Psychology Building
Phone 747-5417
Office hrs: Tuesdays and Thursdays from 8:35 – 9:35 and by appointment
Office hours will be held online and also in-person
Email: omorera@utep.edu
Lectures: 10:30 am – 11:50 am, PSYC 105
Textbooks: R.P. McDonald, *Test theory: a unified treatment*. Lawrence Erlbaum Associates, 1999.

There will also be readings, which will be distributed during class.

Reading 1: Selected chapters from Allen, M.J. & Yen, W.M. (1979). Introduction to Measurement Theory.

Reading 2: Sijtsma, K. (2009). On the use, misuse and very limited usefulness of coefficient alpha. *Psychometrika*, 74, 107-120.

Reading 2 Supplements:

Cortina, J.M. (1993). What is coefficient alpha? An examination of theory and applications.

Morera, O.F. & Stokes, S.M. (2016). Coefficient α as a measure of test score reliability: Review of Three Popular Misconceptions. *American Journal of Public Health*, 106, 458-461

Reading 3:

Selected chapters from Hambleton, R.K., Swaminathan, H. & Rogers, H. J. (1993). *Fundamentals of Item Response Theory*

Other Supplemental Readings

MacCallum, R.C., Widamin, K.F., Zhang, S. & Hong, S. (1999). Sample Size in Factor Analysis. *Psychological Methods*, 4, 84-99.

MacCallum, R.C., Browne, M.W., & Sugawara, H.M. (1996). Power Analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, 1, 130-149.

Kim, K.H. (2005) The Relation Among Fit Indexes, Power, and Sample Size in Structural Equation Modeling, *Structural Equation Modeling: A Multidisciplinary Journal*, 12:3, 368-390,

Course Objective/Learning Objective:

This course covers what is commonly referred to as classical test theory (theory of psychological measurement and theory of mental tests) and factor analysis. We will also cover factor analysis, multiple regression and modern test theory (item response theory).

The course is intended to provide you with the conceptual and technical skills needed to develop and evaluate psychological tests and measures. Moreover, this course will provide with the foundations for further study of measurement theory (i.e., an advanced course on Item Response Theory).

Course Prerequisites:

It is assumed that you have knowledge of statistics through correlation and regression.

Homework Assignments:

Homework problem sets will usually be distributed during class and due 1 to 2 weeks later (depending on the length of the assignment). There should be between 8 – 10 homework assignments throughout the semester. Late homework assignments **will not be accepted**. If computer output is required for the homework, include only the part which is necessary for the solution and edit out any irrelevant output. Computer packages that will be used are SPSS, as well as some other software that accompanies the course text.

Exams:

There will be one mid-term exam and a final exam. The midterm examination will cover material in the assigned readings, lectures and handouts up through Chapter 8 of the course text. The final examination will be comprehensive. The examinations will be closed-book and closed-notes, but will you be able to bring in a number of crib sheets to the exams. While the examinations are designed to be completed in the allotted time, I made arrangements to find another room such that you can have extra time to complete the final exam (if needed).

Evaluation:

Course grades will be based on points earned from the following sources:

Homework assignments	25%
Midterm exam	25%
Final exam	25%
Course project	25%

Although scores may be graded on a curve, I will grade no more conservatively than the following: 85% or above equals an A; scores between a 84% and a 70% equals a B; scores between a 69% and a 60% will equals a C; scores between a 59% and a 50% equals a D; scores that are less than 50% equals a F.

My “curving” consists of evaluating how you perform relative to everyone else in the class, while looking for gaps in the distribution to distinguish “A” students, “B” students and, if necessary, “C”, “D” and “F” students.

Covid19 Statement

Each person will be able to make their own decision concerning the use of a mask in class and in office hours. I ask that everyone’s decisions be respected. If you have covid, you must report it at covidaction@utep.edu

Course Project:

The course project is an important part of this course, and as such, is worth 25% of the grade. You will be required to work in a group (of no smaller than 2 people and no more than 4 people). The project is described in further detail on another handout. Feel free to provide me with input concerning who you would like to with, but I will ultimately determine the make-up of each group.

The course project grade will consist of two components. The first part will consist of evaluations of an initial project proposal (5 points) and a final project proposal (10 points). The last part will consist of a 75 point paper that your group will turn in at the end of the class. The project grade will be the sum of these three components and is worth 90 points.

Course Project Homework:

You will be required to make a class presentation (time permitting). This presentation would take place on **Thursday, April 27** and count as one of your homework assignments. All students **must** attend and participate in the class presentations. If there are many class projects, part of Tuesday April 25 may be devoted to class project presentations

Policy on Auditors

Student and faculty auditors are welcome in the class, as long as they complete the required university audit form. However, my first priority is to the students who are registered for the class. Students in the class get first dibs on seats in the class. In addition, if we were to ever wind up in the Room 105 and seating in the room becomes a problem, registered students get first dibs on the 4 machines with *Mplus*/LISREL. I also ask that auditors not submit any homework assignments or take any exams, as it is extra work on my part and the TA's part. If your attendance becomes sporadic, I expect that you will not slow down the class questions that were covered in prior lectures.

In short, your completion of the university audit form allows you the privilege of listening to the course material (and that is all). If your attendance requires additional time of my TA, additional time of myself or takes away from the learning experience from the registered students in the class, you should not audit this class.

Statistical Software

The course will use SPSS for many of the analyses. You should have access to SPSS in your labs and in Room 105 of the Psychology Building. I will also be using several macros that can be found on Dr. Andrew Hayes' website (www.afhayes.com or www.processmacro.org). You should make every attempt to ask your advisor to install the PROCESS macro on the computers in your lab. In addition, you should bookmark the following website (www.quantpsy.org), as we will be using several tools on this website.

While the course text has affiliated software, I will be relying more and more on *Mplus* software package (I may also show you LISREL 8.8). Class time will be devoted to learning the *Mplus* syntax language. An *Mplus* manual is available online at statmodel.com. *Mplus* is also syntax-based. Most students like *Mplus* syntax better than writing LISREL syntax. You'll probably have the option of using either LISREL or *Mplus* to complete your assignments, but I'll provide you with *Mplus* output on your examinations. *Mplus* and LISREL are available on a number of machine(s) in Room 105 throughout the semester. Finally, I will also use *Mplus* in some examples in class. Three of the computers that have *Mplus* on them in Room 105 have an "MPlus" tag on them and they are the 3 of the 4 computers closest to the door.

Course structure and requirements:

1. Students will be responsible for all material covered in lectures, class handouts and assigned readings. With regard to lectures, there is no such thing a stupid question (in most cases). If you have a question, someone else probably has that same question. Feel free to ask any questions.

2. Make-up exams will be given only under extraordinary circumstances, such as documented sickness, hospitalization or death of a family member (funeral card required). In some other cases, exceptions will be made if **advance notice of absence** is provided. *Note:* Leaving town to start your spring break early or your summer vacation early is not acceptable excuse to move your examination up, as it will rush me in making the examination.
3. Exams are closed books and closed notes. However, you will be allowed to use crib sheets (see accompanying handout). As you can bring in crib sheets to the exam, examinations truly designed to test your knowledge of the content area. While the exams are designed to be completed in the allotted time, you will have extra time to complete the final exam (if necessary). You can bring 2 crib sheets to the midterm and 4 crib sheets to the final examination.
4. A calculator is highly recommended. It should perform all basic mathematical operations and should have several memories.
5. There will be between 8 and 10 homework assignments. Many of the homework assignments will require the use of statistical software. We will use SPSS in this class. SPSS can be run on the machines in Room 105 of the Psychology Building. SPSS is also available by logging on to **my.apps.utep.edu**. MPlus is not available on my.apps.utep.edu
6. **Please turn off all pagers, beepers and other electronic devices before entering class.** They are a distraction to other students in the class and to the professor.
7. **Office Hours and Appointments:** If you have questions concerning the topics of this course, you can stop by to see me during my office hours or please do not hesitate to make an appointment to see me. If you stop by my office and you do not have an appointment to see me, I will ask you to schedule an appointment to see me and I will answer your question during that appointed time. This policy also applies to “questions that will only take a minute to answer.”
8. **Conduct of Graduate Students:** Students enrolled in this course are graduate students and I have certain expectations of graduate students. As you are pursuing an advanced professional degree, I expect that you will act in a professional manner. Asking for extensions on assignments because you are busy with other courses/projects/papers is not professional. In addition, I also expect that you will show respect to everyone in the class.
9. **Academic Misconduct:** The Department of Psychology follows the university policy on academic honesty that is published in the Undergraduate College-Academic Regulations and is available to all members of the University

community. Information on academic misconduct can be found at the following:

<http://studentaffairs.utep.edu/Default.aspx?tabid=4386>

<http://admin.utep.edu/Default.aspx?PageContentID=2084&tabid=30292>

This policy represents a core value of the University and all members of the university community are responsible for abiding by its tenets. Lack of knowledge of this policy is not an acceptable defense to any charge of academic dishonesty. The University has a responsibility to promote academic honesty and integrity and to develop procedures to deal effectively with instances of academic dishonesty. Students are responsible for the honest completion and representation of their own work, for the appropriate citation of sources and for respect of others' academic endeavors.

In other words, plagiarism, cheating and academic dishonesty will not be tolerated in this class. Plagiarism consists of using another person's ideas, words, or assistance, while failing to acknowledge this person. If you must submit someone else's work as if it were your own, you must acknowledge the original author/original source. If I suspect academic dishonesty, plagiarism, collusion, cheating, etc. on any class assignment or exam, I will forward suspected material to the Office of Student Conduct and Conflict Resolution.

10. Group work: There will be an emphasis on group work in this class. The class project is group-based and some of the homework assignments toward the end of the semester will also be group based. Academic dishonesty on a group assignment may jeopardize the entire group, even if the group is unaware of your actions. Moreover, it is assumed that group homework assignments will be completed by all members of the group. If an entire group turns in a homework assignment and one or more members does not contribute to the assignment, I reserve the right to assign non-contributing group members a score that reflects their contribution to the assignment.
11. Accommodations for Students with Disabilities: If you have an identified disability that may affect your performance in this class, please see the instructor (no later than the second class) or contact the Center for Accommodations and Support Services in Room 106 of the Student Union (phone 747-5148) such that provisions can be made to ensure that you have an equal opportunity to meet all the requirements of this course.
12. I have also assigned supplemental readings. You are responsible for reading these papers, as I may ask questions concerning these readings on homeworks and/or examinations. Additional readings may be added during the semester.

Important Dates to Remember

Wednesday, February 1

Census Day; Last day to drop course without
“W” appearing on transcript

Thursday, March 9

Midterm (in Room 105)

March 13 – March 17

Spring break

Thursday, March 30

Course drop deadline

Friday, March 31

Cesar Chavez Day (no UTEP classes)

Friday, April 7

Spring Reading Day (no UTEP classes)

Thursday, April 27

Class Project Presentation

Thursday, May 4

Last Day of our class

Friday, May 5

Paper due at 12 pm

Thursday, May 11

Cumulative Final Exam (1:00 pm – 3:45 pm)

Wednesday, May 17

Grades due to Records Office

Tentative Course Schedule

Date	Topic	Reading
1/17, 1/19	Course overview General introduction and the algebra of expectations	Chapter 1
1/19, 1/24	Items and item scores	Chapter 2
1/26, 1/31	Item and test statistics	Chapter 3
2/2	The concept of a scale	Chapter 4
2/7 - 2/9	Classical Test Theory	Chapter 5 & Reading 1
INITIAL PROJECT PROPOSAL, DUE 2/2		
2/14 - 2/16	Introduction to the Single General Factor Model Test homogeneity and reliability	Chapter 6 & Reading 2
2/21 - 2/23	Applications of Reliability	Chapter 7
FINAL PROJECT PROPOSAL, DUE 3/2		
2/28 - 3/30	Simple and Multiple Regression; Identification of Moderator/Mediator/Suppressor Variables Imputation of Missing Data	Notes and Chapter 8
3/9	MIDTERM EXAMINATION (Chapters 1- 7).	
3/14 - 3/16	SPRING BREAK (No class)	
4/4 - 4/6	The common factor model	Chapter 9
4/11 - 4/18	Validity	Chapter 10
4/20 – 4/27	Classical item analysis and group presentations	Chapter 11
5/2 - 5/4	Introduction to Item Response Theory	Chps 12 - 13 and Reading 3
FINAL PROJECT DUE, MAY 5 at 12:00 PM		
FINAL EXAMINATION THURSDAY MAY 11, 1:00 PM - 3:45 PM		

Brief description of each major course requirement, including each major assignment and examinations.

This is a tentative list, as it based on progress that we make as a class. Topics on homework assignments may be moved to the preceding or following homework assignment. Additional homework assignments may be assigned

Homework 1: Algebra of expectations

Homework 2: Measures of linear association among binary items; item writing example

Homework 3: Computation of observed score variance; Classical Test Theory problems

Homework 4: Confirmatory factor analysis on covariance and correlation matrices

Homework 5: Typical midterm problem assigned; generalizability theory

Midterm: Material from Homeworks 1 – 4 (or 1-5) to be covered, class materials from these lectures to be covered, material from textbook (Chapter 1 – 7) and readings to be covered.

Homework 6: Estimating true scores; reliability of difference scores

Homework 7: Multiple regression and regression diagnostics

Homework 8: Confirmatory factor analysis with more than one factor

Homework 9: Group project presentation

Homework 10: Multi-trait multi-method matrix via confirmatory factor analysis; exploratory factor analysis

Group Class presentation: The class presentation will allow your group to incorporate feedback from the class to aid submission of the final paper

Final paper: Data that your group collected throughout the semester will be written up as a paper that could be submitted for publication after the class has ended.

Cumulative final examination: Material from all homework assignments are fair game, class materials from all lectures are fair game, material covered from textbook and readings is fair game.