

EDP 380D-4: Psychometric Theory and Methods

Spring 2018 (Unique: 10185)

Time:	Tue, Thu 11:00am – 12:15pm	Location:	SZB 432
Instructor:	Hyeon-Ah Kang	Office:	SZB 538G
Email:	hkang@austin.utexas.edu	Hours:	Wed 3 – 4:00pm

Course Description

This course covers three broad topics in psychometrics: (a) classical test theory, (b) item response theory, and (c) factor analysis. The course integrates these topics to demonstrate the foundations of testing and assessment (reliability, validity, fairness). During the semester, you will learn about these topics from a theoretical perspective with an in-depth conceptual discussion of psychometric models, and also from an applied methodological perspective by way of applications of these models to real data using statistical analysis software.

Pre-requisites: EDP 380C 2 (Fundamental Statistics); EDP 380D 2 (Measurement and Evaluation)

Learning Goal

After completing this course, students will be able to:

- Discuss and apply the theoretical fundamentals of classical test theory;
- Describe item response theory models and their applications in measurement;
- Understand the similarities, differences, and links between classical test theory and modern test theory (item response theory);
- Discuss the foundations of testing (reliability, validity, fairness) and utilize psychometric modeling approaches to evaluate those foundations for specific tests;
- Understand and apply the basics of factor analysis and principal components analysis for purposes of test construction and validation.

There are many detailed learning objectives related to these broad learning goals that will be provided for each unit during the semester to help you focus on what is most important.

Required Textbooks and Materials

- **Textbook:** There are two textbooks required for this course. Reading assignments will be given based on these books on a weekly basis. It is your responsibility to complete the reading assignment for the following week in order to prepare for class.
 - i) Kline, T. (2005). *Psychological Testing: A Practical Approach to Design and Evaluation*. Sage Publications.
 - ii) Allen, M. J. & Yen, W. M. (1979). *Introduction to Measurement Theory*. Waveland Press. Inc.
- **Class Handouts:** Class materials, supplemental resources, announcements, and assignments will be posted on Canvas: <http://canvas.utexas.edu>. Class handouts used by the instructor will be made available to students the night before class (I update overheads to match class progress and thus cannot offer them any earlier). Please print them before coming to class.

- **Calculator:** You may be required to calculate statistics by hand to master the use (and interpretation) of the relevant formulae. Therefore, you will need your *own calculator* to perform relevant mathematical functions (such as taking the natural log, the exponent, square root, etc.) during class and exams. As you will need your calculator during exams, do not intend to share calculators or use your cell phone's calculator function/app.
- **Statistical Software:** Statistical software will be needed to complete assignments. We will use R (<https://www.r-project.org>) as a primary programming language. Although you are not required to use R for your assignments, it is to your advantage because this is what will be discussed in class and provided in course materials. If you use another statistical software program, then you are responsible for ensuring the correspondence between procedures and estimation techniques that are used.

Course Outline

L1. Intro to Measurement Kline, Ch.1 (pp. 1–4, 24–27), Ch.2 (pp. 29–35), Ch.3

L2. Statistics Review Kline, Ch.1 (pp. 4–24); A&Y, Ch.2

Quiz & Lab 1. *Basic Statistics*

L3. Classical Test Theory (CTT) Kline, Ch.5 (pp. 91–94); A&Y, Ch.3

L4. Reliability Kline, Ch.7; A&Y, Ch.4

L5. Validity Kline, Ch.9 (pp. 201–224), Ch.10 (pp. 286–287); A&Y, Ch.5

Lab 2. *Reliability & Validity*

Exam 1 (CTT, Reliability, Validity)

L6. Scaling Kline, Ch.2 (pp. 35–46); A&Y, Ch.8;

L7. Item Analysis Kline, Ch.5 (pp. 95–105); A&Y, Ch.6;

L8. Item Response Theory (IRT) Kline, Ch.6 (pp.107–128, 162–165)

Lab 3. *Item Analysis & IRT*

Exam 2 (Scaling, Item analysis, IRT)

L9. Factor Analysis (FA) Kline, Ch.10 (pp. 241–269)

L10. Test Bias & Fairness Kline, Ch.9 (pp. 224–233); A&Y, Ch.9 (pp. 193–200)

Lab 4. *FA & Differential item functioning*

Exam 3 (FA, Test bias/fairness)

Assessments

Your course grade will be a combination of your performance on *three* in-class exams (60%) and *four* psychometric analysis project assignments (40%). Note that *five* assignments will be offered, however only the *four highest* grades will count towards your final grade.

- **Exam Policies:** There will be three examinations. Exams will consist of conceptual, computational, and application questions. Students must bring a *calculator* to the exams. Exams are *not*

open-book, but you may use one 8.5" × 11" two-sided page of notes during the exam to reduce test anxiety (students will likely be much better prepared if they don't need to rely on it).

Exams cannot be made up unless your absence is excused via doctor's note or prior arrangement because of religious holiday observance. If the student becomes ill on the day of the exam, then it is the student's responsibility to re-schedule the exam. In the case of a religious holiday observance, University policy requires students to notify each of their instructors as far in advance of the absence as possible so that arrangements can be made.

· ***Psychometric Analysis Project Assignments:*** To ensure that you will attain the course learning goals, you will be required to demonstrate conceptual understanding of the major topics in the course by applying them to real data using statistical software. These assignments will provide you an opportunity to engage in "real-world" psychometric analysis that you might not otherwise encounter until your dissertation and/or other research.

For each major course concept, the assignments will require you to: (a) use R or some other statistical software to run required analyses, (b) provide a written summary of the variables of interest and numerical/graphical summaries of them, (c) describe the research question/problem and the statistical analysis to be conducted, (d) present the relevant output, and (e) provide an interpretation of the output and conclusions. Your response to most of these required tasks will be facilitated by guided questions. All assignments must be submitted as *APA style* reports. Please work alone on your data analysis project assignments.

A *printed copy* of your assignment is *due at the beginning of class on the due date* specified with the assignment. If a student cannot attend on the days when an assignment is due, then the student is responsible for notifying the instructor *in advance* and arranging timely delivery of the assignment. Only in exceptional circumstances (including a verifiable medical excuse) and only with prior permission from the instructor will students be able to hand in an assignment late. Without this permission, the student will be penalized for late work. For each 24-hour period that the assignment is delayed, 5% will be deducted from the assignment's score. There will be no exceptions to this penalty. If a student becomes ill on the day that an assignment is due, it is the student's responsibility to contact the instructor and to arrange delivery of the assignment by the time it is due. In this case, if the assignment is not complete, then the student will receive credit only for what was attempted. It is important to complete assignments before the day on which they are due.

Grading Policy

Your final course grade will be assigned based on the conversion from numeric course grade to letter grade as shown in the below table. Unless there was a computational error, grades will not be changed after the end of the semester.

	B ⁺	[87, 90)	C ⁺	[77, 80)	
A	[94, 100]	B	[84, 87)	C	[74, 77)
A ⁻	[90, 94)	B ⁻	[80, 84)	C ⁻	[70, 74)
				D	[65, 70)
				F	< 65

Class Expectations

· ***Attendance:*** You are responsible for *being present in class and for all materials* covered during class meetings. If you miss a class, it is your responsibility to obtain both notes and announcements from your fellow classmates and review them without regard to the reason for being missed. Frequent or unexcused absences and tardiness can adversely affect your grade.

- **Religious Holidays:** You must notify the instructor of a pending absence due to religious observance at least fourteen days in advance. If you must miss a class, a work assignment, or a presentation, you will be given an opportunity to complete the missed work within a reasonable time after the absence, provided that you have properly notified the instructor ahead.
- **Classroom Behavior:** This course requires your *full attention* in class. For that reason, I will restrict classroom use of laptop computers. You are free to bring your laptops to class, but they should only be open when we are working on statistical analyses. During lecture, please take notes using the class notes that I have posted on Canvas. They will be available the evening before class (by 11:00pm) so that you have ample time to print them. If you have an accommodation that requires the use of your laptop, please do let me know.

| Academic Integrity

Students are expected to abide by the University's honor code and maintain absolute integrity in scholastic work. All assignments must be completed with the utmost honesty, which includes acknowledging the contributions of other sources to your scholastic efforts, avoiding plagiarism, and completing assignments independently unless expressly authorized otherwise. Assignments containing any plagiarized material will not be accepted.

| Student Accommodations

The University of Texas at Austin provides upon request appropriate accommodations for qualified students with disabilities. For more information, please contact the Office of the Dean of Students at 471-6259, 471-4671 TTY. If they certify your needs, I will work with you to make appropriate arrangements.