PSY 333 – Principles of Psychometrics

Spring 2025 - Face to Face
Wednesdays, 6:00 pm – 8:50 pm
Newark Campus | Mechanical Engineering Bldg | Room 221

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Office Hours: 4-6 pm on Wednesdays or by appointment, email me to schedule!

Course Description
Measurement is at the heart of all science and of all applications of science. This is true for all areas of science, including the scientific study of human behavior. Behavioral research depends on the successful measurement of human behavior or of psychological attributes that are thought to affect that behavior. The scientific study of the quality of psychological measures is called psychometrics. Psychometrics is concerned with methods used to evaluate the quality of measurement tools, such as psychological tests, that are used in research and applied settings by psychologists and others interested in human behavior. This course will provide students an introduction and overview of research and theory in psychometrics. It will use a mixture of lectures and practical exercises using R language.

Textbook
R. Michael Furr (2022). Psychometrics: An introduction. 4th Edition. Sage. ISBN 1071824074

Pre-requisites
There are no pre-requisites.

Student Learning Outcomes
By the end of the course, students will be able to:

1. Summarize the importance of psychological testing.
2. Differentiate between observable behavior and unobservable psychological attributes.
3. Define what a psychological test is and some of the key differences and examples of psychological tests.
4. Summarize the importance of central tendency, variability, and distributions in statistics.
5. Explain why individual differences are fundamental to psychological measurement.
6. Describe how associations are made between variables.
7. Understand the different types of dimensionality tests and their implications for scoring and psychometric evaluation.
8. Explain how test developers use factor analysis to address the core questions in three-dimensionality tests.
9. Summarize the process of conducting an exploratory factor analysis.
10. Summarize different response biases and how they can potentially compromise the quality of psychological measurement.

Classes
Classes will revolve around book chapters, homework assignments and practical exercises using the statistical programming language R. No prior knowledge of R or other programming languages is required.

Although the classes will cover all textbook chapters, I expect you to read the textbook as it provides a much deeper analysis of the content. It is extremely important that you have the correct textbook as the course is structured around the text. Students who will find the time to read a few pages every day and can read the book front to back will be the most successful at this course.

R exercises will complement the theory of the book and lectures with applied skills. As most data science today is done with R and/or Python, this course provides a useful introduction to these languages. Exercises will be especially useful for people who do not have any prior knowledge of R and would like an introduction. People who are considering a career in data science or psychological research will benefit from these practical applications. However, some material can be difficult to understand even for very dedicated people. Please maintain a positive attitude and keep carrying on. At some point, I assure you it will click. Please, do come to see me during my office hours or after class when you have trouble.

I recommend regular attendance in class as learning together with others is the most important way to understand methods and concepts that to some can feel a bit dry. I encourage you, however, to find your own way of studying. I also expect everyone to show respect for the opinions of others.

Rules of behavior

1. *Respect*
   You must respect everyone. You should expect there to be disagreement. If you disagree with something that you see or hear please be considerate and constructive in how you critique someone else's ideas.
2. *Criticize ideas, not people.*
   We are here to train critical thinking. It is important that you respect people holding different beliefs, even if you think they are wrong. Instead, try to criticize the idea.
3. *Speak from your "I" voice - your own experience.*
   Share experiences and feelings, don't generalize.
4. *Embrace global perspectives.*
   Be open to other perspectives; possibilities come when we don't all agree. Each of us has our own biased beliefs. Openly discussing ideas with other people allows us to embrace a more global perspective.

Attendance Policy and Participation

I recommend you attend all classes and I expect you to have legitimate excuses for any classes missed. I also expect you to catch up on whatever you miss if you are absent for any reason.

You will receive a **class participation grade**, described in greater detail below. Failure to attend class or participate actively in course activities will negatively affect your grade for the course.

Makeup Policy

In the event of an unexcused absence, you will *not* have the opportunity to make up any graded assignments. If you show up late for an exam, you will *not* be given more time to complete the exam. All excused absences must be addressed via email to the Dean of Students office (doc@njit.edu). Your instructor is NOT the person to bring your medical certificates to and cannot determine whether a justification is valid or not. Please always contact the DoS office. When contacting the Dean of Students office, you can keep me in the loop by cc'ing my email.

Other Course Policies

I expect you to arrive on time to class and keep disruptions during class to a minimum. Please do bring a laptop to class as we will be using R on a regular basis.

Please do *not* use phones, tablets, and other similar devices to chat/text/or talk with family and friends during class.

Phone/tablet/laptop use is permitted in class only for class purposes (taking notes, Googling etc.). If you choose to use your device for purposes other than those related to the class, it is your loss. If you distract other students in doing so, it is their loss, as well. I expect you to respect your fellow classmates and your instructor enough not to distract yourselves and others. My policy is to treat each student as an adult until proven wrong.

The best way to contact me is via email/Canvas or to visit me during office hours. You can expect a reply within 48 hours. Notice that I do not check emails on the weekends. You are, of course, encouraged to ask questions before, during, or after class or schedule a time to meet.

NJIT Code on Academic Integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing, or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

You are expected to always abide by the NJIT University Code on Academic Integrity (for details, see: http://integrity.njit.edu/index.html). You must write and sign the following pledge on your exams:

> On my honor, I pledge that I have not violated the provisions of the NJIT University Code on Academic Integrity.

In the context of this course, unless group work is specifically authorized by me, all work should be completed on your own without any unauthorized aids.

Students with Disabilities

NJIT offers accommodations to students with disabilities. If you need some sort of academic accommodation, please contact Scott Janz, Associate Director of the Office of Accessibility Resources and Services, Kupfrian Hall 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the office authorizing student accommodations is required.

Basic Needs Security

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course, is urged to contact the Dean of Students for support. Furthermore, please notify the professor if you are comfortable in doing so.

Requirements and Grading

This course is graded according to the requirements specified and weighted below.

Class participation including R Markdown Files	20%
Quizzes (4 quizzes of 10% each)	40%
Group Project	40%

Class participation (20%): participation includes being attentive in class, possible occasional quizzes, in-class R exercises, attendance, and Canvas Discussion Forum/blog postings.

Class participation is 20% of your final grade. Actively participating in class, has several advantages:

- You will get a higher grade.
- You are making classes more interesting for yourself and your fellow classmates.
- You are memorizing content that will show up at the exam.

Home assignments

There will be no significant home assignments for this course. However, I strongly recommend you read one textbook chapter a week. Finding the time to read a few pages a day will make you successful at this course. Finding the time to read one chapter in the week before or after every class will give you a deep understanding of the material. On the contrary, if you try to study everything at once the night before the test, you will likely fail. The subject of this course can be quite difficult.

Exams

Monthly exams will consist of quizzes on Canvas. You have a limited amount of time to answer them, typically from Wednesday 10:01 to Friday 23:59. No retakes are allowed. If you miss the deadline, you will receive 0% for that quiz assignment. You have only one shot at it, so please be sure you have studied the material before starting the exam. Each quiz covers 3-4 chapters of your book. There are a total of 4 quizzes. Each quiz is worth 10% of your final grade for a total of 40%. Canvas will give you immediate feedback. If you have questions about the feedback, we can discuss it in class or during office hours.

Group project

Psychometrics is all about research. The best way to learn the subject is to try to create a psychological test yourself. With this group project you will team up in groups of 2-3 people and produce an original psychological test. You will be asked to create a battery of questions to measure a new psychological attribute of your choice. You will characterize its properties (e.g. dimensionality, reliability, validity etc.), collect data, and write a final report to present your findings to the rest of the class. The group project written report counts for 30% of your final grade.

R Markdown files

During the class we will learn the basics of R. There will be time during class dedicated to working with your group to advance your group project. You will use R to study your group project's psychological test. Each chapter and week will advance your understanding and analysis of your test. A final Markdown file and one data file for each group must be handed in by the last week of classes. The R Markdown file needs to compile and run without errors and must include a section for each chapter. This assignment counts for another 10% of your final grade.

All late submissions will be discounted by 50%. Submitting *something* on time is always better than submitting something slightly better too late or not submitting anything at all. I will try to provide as much feedback as needed. If you have questions about the feedback, we can discuss it in class or during office hours.

Deadlines

- Quizzes (40%):
  - Quiz 1: **February 5th -- 7th**
  - Quiz 2: **March 5th -- 7th**
  - Quiz 3: **26th March 26th -- 28th**
  - Quiz 4: **April 30th – May 2nd**
- Group project (40%):
  - Project Presentations on **April 30th and May 14th (if needed).**
  - The final written report should be submitted by **May 9th.**
  - The R Markdown file should be submitted by **May 9th.**
- Last Day to Withdraw from Classes: **April 7th, 2025.**

Grade scale

Letter and numerical grades are translatable on the following scale:

A = 90%+
B+ = 87-89.99%
B = 80-86.99%
C+ = 77-79.99%
C = 70-76.99%
D = 60-69.99%
F = 0-59.99%

Class Schedule

Week 1 – January 22nd, 2025: Psychometrics and the Importance of Psychological Measurement

Week 2 – January 29th, 2025: Scaling

Week 3 – February 5th, 2025: Differences, Consistency, and the Meaning of Test Scores – **QUIZ**

Week 4 – February 12th, 2025: Test Dimensionality and Factor Analysis

Week 5 – February 19th, 2025: Reliability: Conceptual Basis

Week 6 – February 26th, 2025: Empirical Estimates of Reliability

Week 7– March 5th, 2025: The Importance of Reliability – **QUIZ**

Week 8 – March 12th, 2025: Validity: Conceptual Basis

Week 9 – March 19th, 2025: No Class. Spring Break.

Week 10 – March 26th, 2025: Estimating and Evaluating Convergent and Discriminant Validity Evidence– **QUIZ**

Week 11 – April 2nd, 2025: Response Biases & Test Bias

Week 12 – April 9th, 2025: Confirmatory Factor Analysis

Week 13 – April 16th, 2025: Generalizability Theory

Week 14 – April 23rd, 2025: Item Response Theory and Rasch models – **QUIZ**

Week 15 – April 30th, 2025: Group Project Presentations (Virtual).

Week 16 – May 7th, 2025: No Class. Friday Classes Meet.

Week 17 – May 14th, 2025: Group Project Presentations (Virtual).

N.B. – Everything on the syllabus is subject to change. When changes are made, a new version or corresponding changes will be posted on the course Canvas site.

Learning Management System - Canvas
We will use Canvas as our main LMS. The statement from Canvas can be found here.
Refer to this link from the Office of Digital Learning for further materials.