

Psychological Testing (with Practicum)

Course Syllabus

Instructor: Hau-Hung Yang

Course Information

Course Level: Undergraduate (upper level)
Credits: 3 credits (one semester; lecture + practicum)
Prerequisites: Introductory statistics for psychology
Software: R (packages: psych, mirt, lavaan, CTT)

Course Description

This course introduces the theory and practice of psychological testing and measurement. Students will learn the conceptual foundations of reliability and validity, the construction and evaluation of psychological tests, and the interpretation of test scores, spanning both classical test theory (CTT) and item response theory (IRT). The course integrates a hands-on **practicum**: in weekly lab sessions students administer, score, and analyze real and publicly available instruments, conduct item and reliability analyses in R, evaluate fairness across groups, and write professional test reports. Emphasis is placed on the responsible, ethical use of tests in research, educational, clinical, and health settings—an orientation well suited to a medical-university context.

Course Objectives

Upon completion of this course, students will be able to:

1. Explain the core concepts of measurement: constructs, operationalization, scales, and norms.
2. Estimate and interpret reliability (internal consistency, test–retest, inter-rater) and validity (content, criterion, construct) evidence.
3. Conduct item analysis (difficulty, discrimination, distractor analysis) under both CTT and IRT.
4. Administer, score, and interpret standardized tests following ethical and professional standards.

5. Evaluate measurement fairness, including differential item functioning (DIF) across groups.
6. Produce a clear, well-justified psychological test report from raw data.

Textbooks and References

- Furr, R. M. (2021). *Psychometrics: An Introduction* (4th ed.). SAGE. **[Primary textbook]**
- Cohen, R. J., Schneider, W. J., & Tobin, R. M. (2022). *Psychological Testing and Assessment* (10th ed.). McGraw-Hill.
- AERA, APA, & NCME (2014). *Standards for Educational and Psychological Testing*.
- de Ayala, R. J. (2022). *The Theory and Practice of Item Response Theory* (2nd ed.). Guilford. [Supplementary]

Assessment

Practicum lab assignments (administration, scoring, R analyses)	35%
Midterm examination	20%
Final examination	20%
Test-construction / test-report project (written + presentation)	20%
Participation and lab attendance	5%

Weekly Schedule (Lecture + Practicum)

Week	Topic (Lecture + <i>Practicum</i>)
1	Introduction to psychological measurement: constructs, scales, and the role of testing in research, education, and clinical/health settings
2	Types of tests and scales; norms, standardization, and standard scores. <i>Practicum: R and RStudio setup; reading and scoring a sample instrument</i>
3	Classical test theory: true score, error, and the reliability coefficient
4	Reliability I: internal consistency (Cronbach's α , McDonald's ω). <i>Practicum: reliability analysis in R with the psych package</i>
5	Reliability II: test-retest, parallel forms, inter-rater reliability; the standard error of measurement
6	Validity I: content and criterion-related validity. <i>Practicum: criterion validity with a real dataset</i>
7	Validity II: construct validity, convergent/discriminant evidence; introduction to factor analysis. <i>Practicum: exploratory factor analysis in R</i>
8	Item analysis under CTT: item difficulty, discrimination, and distractor analysis. <i>Practicum: item analysis lab</i>
9	<i>Midterm Examination</i>
10	Introduction to item response theory: the 1PL/2PL models and item characteristic curves
11	IRT item and test information; ability estimation. <i>Practicum: fitting an IRT model with mirt</i>
12	Test construction and item banking: blueprint, item writing, pilot testing, and item selection. <i>Practicum: building a short scale</i>
13	Test fairness and bias: differential item functioning (DIF). <i>Practicum: DIF detection in R</i>
14	Test administration, ethics, and professional standards; confidentiality and responsible score interpretation
15	Applications in clinical, health, and educational assessment; computerized and adaptive testing overview
16	Writing the psychological test report. <i>Practicum: drafting an individual test report</i>
17	Project presentations: test-construction / test-report projects
18	<i>Final Examination</i>

Practicum Project

Each student (or pair) will complete a term project that involves either (a) constructing and piloting a short psychological scale, or (b) evaluating an existing publicly available instrument. The written report (approximately 10–15 pages) should include the measurement goal and construct definition, item development or selection, reliability evidence, at least one form of validity evidence, item analysis (CTT and/or IRT), a fairness check where feasible, and a discussion of limitations and appropriate use. All analyses must be documented in reproducible R code, and results presented in Week 17.

Course Policies

- Practicum attendance is required; test materials and data must be handled ethically and confidentially.
- All lab work and the project must be submitted as reproducible R scripts or R Markdown documents.
- Late submissions incur a 10% penalty per day, up to three days.
- AI tools may be used for learning and coding assistance, but students must demonstrate independent understanding of the methods and cite any AI-assisted work.