

Advanced statistics

Course Instructors: Dr. Hui-Fang Chen

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Course credits: 3

Class time and venue: Thursday, 13:10 – 16:00, **Computer lab 215**

Office hours: By appointment

Course Descriptions

This **EMI course** is designed to develop both conceptual understanding and practical skills in selecting appropriate strategies and procedures for managing, analyzing, interpreting, and reporting quantitative data in psychological research. By the end of the course, students will be able to apply these methods independently in their own research projects. Throughout the semester, students will engage in extensive practice using diverse examples and tools to strengthen their statistical competence.

Learning Objectives

Upon successful completion of the course, students will be able to:

1. Identify and describe major methods for managing quantitative data in psychological research.
2. Apply appropriate statistical procedures to analyze quantitative data.
3. Interpret results from quantitative analyses accurately and critically.
4. Communicate research findings effectively in scholarly formats.

Textbook

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2018). *Multivariate data analysis* (8th ed.). Upper Saddle River, NJ: Prentice Hall.

Suggested readings

Bond, T. G., Yan, Z., & Heene, M. (2021). *Applying the Rasch model: Fundamental measurement in the human sciences* (4th ed.). New York: Routledge.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (7th ed.). Boston: Pearson.

Reminders

- 1) Academic honesty is central to the conduct of academic work. Students are expected to present their own work, give proper acknowledgement of other's work, including the correct use of quotation and page number for direct quotes of paragraphs, sentences and phrases, and honestly report for findings obtained. Students who commit an act of academic dishonesty which jeopardizes the integrity of the learning and assessment process may be liable to disciplinary actions.
- 2) Do not make or acquire illegal copies of the readings.

Tentative Weekly Schedule and Activities

Sessions	Date	Topics	Suggested readings	Learning Activities
1	Feb 26	Pre-test		Diagnostic test to assess baseline knowledge
2	Mar 5	Introduction to multivariate analysis and data screening	Hair et al., Ch1 & 2	Hands-on lab: data cleaning and screening
3	Mar 12	Multiple regression	Hair et al., Ch5	Practice exercises with real datasets; peer discussion on interpreting outputs.
4	Mar 19	Path analysis: mediation and moderation	Hair et al., Ch5	Lab activity: testing mediation/moderation models; case study critique.
5	Mar 26	Application of logistic regression: Rasch analysis I	Bond et al., Ch3; Hair et al., Ch8	Software demonstration of Rasch modeling.
6	Apr 2	Application of logistic regression: Rasch analysis II	Bond et al., Ch3; Hair et al., Ch8	Small-group problem-solving
7	Apr 9	Factor analysis I	Hair et al., Ch3	Lab: running EFA; interpreting factor loadings; group reflection on dimensionality.
8	Apr 16	Factor analysis II	Hair et al., Ch9	
9	Apr 23	Structural equation modeling (SEM)	Hair et al., Ch11 & 12	Guided SEM modeling exercise; critique of published SEM study.
10	Apr 30	Review and consultation		Q&A session; preparing for the mid-term
11	May 7	Mid-term exam (lab-based skills)		In-lab data analysis exam (open-book, individual).
12	May 14	Mid-term exam (written report submission)		Submission of the written report via course website.
13	May 21	MANOVA (Part I)	Hair et al., Ch6	Lab: running MANOVA; interpreting multivariate test statistics.
14	May 28	MANOVA (Part II)	Hair et al., Ch6	Case study analysis; peer critique of MANOVA applications.
15	June 4	Paper critique and presentation		Group presentations; peer-led discussion.
16	June 11	Paper critique and presentation		Continuation of group presentations; synthesis discussion.

Note: Weeks 17 and 18 are reserved for make-up classes.

Assessment

Paper critique and presentation (20%)

Students will work in groups of five to select, present, and critique a published article. Presentations should highlight methodological strengths and weaknesses, propose alternative approaches, and engage peers in discussion. (See Appendix I for detailed guidelines.)

Classroom participation and attending tutorial classes (15%)

Students are expected to read one to two assigned papers or chapters each week prior to class. Active participation in lectures and tutorials is required, including contributing to discussions and collaborative exercises.

Quizzes and homework (30%)

Several assignments (both in-class and take-home) and short quizzes will be administered during the semester. The **3** highest scores from homework and quizzes will be counted toward the final grade.

- Assignments must be submitted by the stated deadlines. Late submissions will not be accepted.
- No make-up quizzes will be provided.

Mid-term exam (35%)

The mid-term examination is a skill-based assessment requiring students to apply statistical methods and software learned in class to analyze datasets provided by the instructor.

- Part I (20%): Conduct data analyses in the computer lab **from 1:10 pm to 4:00 pm on May 7, 2026.**
- Part II (15%): Prepare a written report based on **Part I**. Reports must be submitted in Word format to the course website by **4:00 pm on May 14, 2026.**

The exam is open-book but strictly individual. Collaboration or discussion with classmates is prohibited and will be considered academic misconduct.

Appendix 1: Paper critique and presentation (details)

Duration for each Discussion Seminar: Around 25 mins

Expected components in each Discussion Seminar: Presentation & Discussion sessions

Recommended time frame (recommended only, you may or may not want to follow, so long as you can complete the entire seminar in 25 mins): 15 mins for Presentation & 10 mins for Discussion (including Q & A)

Presentation session: More like a one-way delivery

Discussion session: More interaction with the audience would be expected. The exact format for the discussion session is up to you. The goal is to engage the audience to think more deeply into your topic and to initiate some discussion. You may, for instance, lead a Q&A session and have some guiding questions prepared in advance, allow time for group discussions and ask feedback from others, or even show a short clip which is related to your topic to elicit some further thoughts and discussion etc.

Expectations and marking scheme

- 1) Present the chosen papers in a clear and easy-to-understand manner (e.g., the key issues and arguments raised by the author(s), some details of the methodology, general findings, and conclusion) **(30% of mark)**
- 2) Evaluate the strengths and weaknesses of the chosen studies, including its 1) methodology (e.g., whether the method is sound or not, and its suitability for the target issue), 2) theoretical significance, and 3) applied values **(30% of mark)**
- 3) Discuss whether and how the different research approaches can complement each other to enrich our understanding about the target issue **(30% of mark)**
- 4) Lead a discussion session in an interactive manner **(10% of mark)**

Item 1) above must be completed in the Presentation session

Items 2) and 3) can be included in the Presentation and/or Discussion session