

Quantitative Research Methods

1. Synopsis

The four blocks on quantitative research methods build upon the foundation of quantitative research methods commonly covered in most undergraduate and postgraduate courses at a Master level. It aims to provide advanced training in quantitative research methods with topics designed for students in gaining a deeper understanding in the concepts and principles of quantitative methodologies, as well as to acquire advanced skills in research in education, social sciences, and humanities. Students will develop competence in quantitative techniques through hands-on practices in study design, data collection, and management, as well as the analysis and interpretation of data.

2. Course Intended Learning Outcomes (CILOs)

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

- CILO₁ Demonstrate knowledge and understanding of the principles and concepts of quantitative research methods in educational and social research;
- CILO₂ Systematically review and appraise methodological and statistical issues of published reports critically;
- CILO₃ Use different statistical software programs such as SPSS to manage and analyze research data;
- CILO₄ Present numerical and statistical information in a professional manner.

3. Content, CILOs and Teaching & Learning Activities

Course Content	CILOs	Suggested Teaching & Learning Activities
Introduction to Hypothesis Testing (Block 2)	CILO _{1,2,3,4}	Lecture; Computer Lab Tutorial (SPSS)
Power and Sample Size Determination (Block 2)	CILO _{1,2,3,4}	Lecture; Computer Lab Tutorial (G*Power)
Hypothesis Testing Applied to Means (Block 2)	CILO _{1,2,3,4}	Lecture; Computer Lab Tutorial (SPSS)
Correlation (Block 3)	CILO _{1,2,3,4}	Lecture; Computer Lab Tutorial (SPSS)
Multiple Regression (Block 3)	CILO _{1,2,3,4}	Lecture; Computer Lab Tutorial (SPSS)

Moderation and Mediation Analysis (Block 5)	<i>CILO</i> _{1,2,3,4}	Lecture; Computer Lab Tutorial (SPSS and <i>R</i>)
Structural Equation Modeling (Block 6)	<i>CILO</i> _{1,2,3,4}	Lecture; Computer Lab Tutorial (<i>R</i>)

4. Assessment

In each block, assessment will consist of two components, including a take-home exercise and a mini-research project (in the form of research poster). Together they are designed to assess each student's understanding of the topics discussed and their ability to apply the methods to address research questions.

Assessment Tasks	Weighting (%)	CILO
Take-home Exercise	40	<i>CILO</i> _{1,3,4}
Mini-Research Project	60	<i>CILO</i> _{1, 2,3,4}

5. Required Text(s)

Nil

6. Recommended Readings

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.

Beaujean, A. A. (2014). *Latent variable modeling using R: a step by step guide*. New York: Routledge.

Field, A. P. (2013). *Discovering statistics using IBM SPSS Statistics*. Los Angeles: Sage.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2015). *How to design and evaluate research in education* (9th ed.). McGraw-Hill Humanities/Social Sciences/Languages.

Gravetter, F. J. & Wallnau, L. B. (2017). *Statistics for the behavioral sciences* (10th ed.). Wadsworth Cengage Learning.

Grotenhuis, M. & Matthijssen, A. (2016). *Basic SPSS Tutorial*. Thousand Oaks, CA: Sage Publications.

Howell, D. C. (2013). *Statistical methods for psychology* (8th ed.). Wadsworth Cengage Learning.

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling*. (3rd ed.). New York: Guilford Press.

MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis*. New York, NY: Taylor & Francis Group.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Allyn & Bacon.

Raykov, T., Marcoulides, G. A. (2006). *A first course in structural equation modeling*. (2nd ed.). Lawrence Erlbaum Associates, Publishers.

7. Related Web Resources

Claremont Graduate University Web Interface for Statistics Education

- <http://wise.cgu.edu/>

Daniel Soper Statistics Calculators

- <http://www.danielsoper.com/statcalc/default.aspx>

G*Power: Statistical Power Analyses for Windows and Mac

- <http://www.gpower.hhu.de/>

IBM SPSS Software

- <https://www.ibm.com/analytics/us/en/technology/spss/>

John C. Pezullo Catalogue of Online Statistical Calculators and Texts

- <http://statpages.org/>

Package lavaan

- <http://lavaan.ugent.be/index.html>

StatSoft Electronic Statistics Textbook.

- <http://www.statsoft.com/textbook/>

The R Project for Statistical Computing

- <https://www.r-project.org/>

VassarStats Website for Statistical Computation

- <http://vassarstats.net/>

8. Related Journals

Applied Measurement in Education

Applied Statistics

Behavior Research Methods

Educational and Psychological Measurement

Multivariate Behavioral Research

Journal of Applied Statistics

Journal of Educational and Behavioral Statistics.

Journal of Psychoeducational Assessment

Journal of the American Statistical Association

Psychometrika

Psychological Assessment

Psychological Methods

Structural Equation Modeling

Block 2: Quantitative Research Methods I

This is the foundation block for students without any statistical background and are interested in quantitative research. This block will cover the logic of hypothesis testing and the basic concepts related to hypothesis testing such as confidence intervals, effect size, statistical errors and power. Simple statistical tests such as t-test and simple analysis of variance (ANOVA) will also be covered. Upon completion of this block, students will learn to use SPSS, a statistical software program to conduct simple data analysis.

Lecture	Topic
Lecture 1	Introduction to Hypothesis Testing
Lecture 2	Power and Sample Size Determination
Lecture 3	Hypothesis Testing Applied to Means I
Lecture 4	Hypothesis Testing Applied to Means II

Block 3: Quantitative Research Methods II

This block will cover statistical methods for describing and measuring the relationships among two or more variables. Topics such as correlation, simple regression, and multiple regression will be taught. Students who take this block should have the basic concepts in hypothesis testing and the basic skills in using SPSS. Students without any statistical background are advised to take Block 1: Quantitative Research Methods I before taking this block.

Lecture	Topic
Lecture 1	Correlation
Lecture 2	Multiple Regression I
Lecture 3	Multiple Regression II
Lecture 4	Multiple Regression III

Block 5: Quantitative Research Method III

Moderation and mediation models are two of the most commonly used statistical models for theory development in social sciences or behavioral research. This block will introduce different methods for conducting moderation and mediation analysis. More advanced topics on moderation and mediation analysis such as conditional path models will be discussed. Students who have not learnt multiple regression analysis should take Block 2: Quantitative Research Methods II before taking this block.

Lecture	Topic
Lecture 1	Moderation Analysis
Lecture 2	Mediation Analysis
Lecture 3	Path Analysis I
Lecture 4	Path Analysis II

Block 6: Quantitative Research Method IV

This block will cover structural equation modeling (SEM), an advanced statistical technique for examining the relationships of multiple factors. Basic concepts and skills in SEM will be discussed. Students will learn to use the lavaan package in R to conduct SEM analysis. Students who have not learnt multiple regression analysis should take Block 2: Quantitative Research Methods II before taking this block.

Lecture	Topic
Lecture 1	Structural Equation Modeling I
Lecture 2	Structural Equation Modeling II
Lecture 3	Structural Equation Modeling III
Lecture 4	Structural Equation Modeling IV