UAB
Universitat Autònoma de Barcelona

2022/2023

Statistics and Psychometric Models

Code: 104881
ECTS Credits: 6

Degree	Type	Year	Semester
2503852 Applied Statistics	OT	4	2

Contact

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Use of Languages

Principal working language: catalan (cat)

Some groups entirely in English: No

Some groups entirely in Catalan: Yes

Some groups entirely in Spanish: No

Teachers

Eduardo Doval Dieguez

Maria Carme Viladrich Segués

Juan Martín Aliaga Ugarte

Jennifer Morata Serrano

Marina Bosque Prous

Eva Penelo Werner

Alfredo Pardo Garrido

Prerequisites

It is highly recommended to have acquired the competences worked on in the two previous methodological subjects: "Research Methods, Design and Techniques" and "Data Analysis". Therefore, students have to be able to understand and apply the methodology used for research in psychology, as well as basic descriptive and inferential data analysis techniques.

Objectives and Contextualisation

"Statistical and psychometric models" is taught in the second semester of the second year, after having completed the two previous subjects on methodology, through which the students must have acquired the foundations of research methodology and data analysis.

On the basis of these previous subjects, in the current subject students will now move on to more complex statistical models, of a multivariable nature, introducing analytical solutions to three common phenomena in psychological research: interaction between variables; statistical control of confusing variables; and reduction in the dimensionality of data.

The training objectives of this subject are:

1. To learn the concept of a statistical model as an approach to the multidimensionality of research in psychology.

2. To understand the relationship between the research design used and the corresponding data analysis.

3. To know when and how to apply data-reduction techniques.

At the end of the course, students must be able to:

1. Specify the statistical model appropriate to the objectives and hypotheses of psychological research when research design allows this.

2. Distinguish between models that respond to a predictive hypothesis and those that respond to an explanatory hypothesis.

3. If necessary, include interaction variables and/or adjustment variables in the model.

4. Decide on the need to keep terms of interaction and/or adjustment variables in the model.

5. Correctly estimate and interpret the coefficients of a regression model.

6. Delimit the main aspects to be diagnosed when validating the model.

7. Know how to apply a principal-components analysis to reduce data dimensionality; correctly determine the number of components retained; optimal rotation of the said components; and perform an adequate interpretation of their meaning.

8. Understand the statistical analysis carried out in research papers that use predictive or explanatory statistical models, or data-reduction models.

9. Know the basic statistical vocabulary in Catalan, Spanish and English.

10. Know the basic elements of statistical analysis software.

Competences

- Analyse data using statistical methods and techniques, working with data of different types.
- Correctly use a wide range of statistical software and programming languages, choosing the best one for each analysis, and adapting it to new necessities.
- Critically and rigorously assess one's own work as well as that of others.
- Formulate statistical hypotheses and develop strategies to confirm or refute them.
- Identify the usefulness of statistics in different areas of knowledge and apply it correctly in order to obtain relevant conclusions.
- Interpret results, draw conclusions and write up technical reports in the field of statistics.
- Make efficient use of the literature and digital resources to obtain information.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Use quality criteria to critically assess the work done.
- Work cooperatively in a multidisciplinary context, respecting the roles of the different members of the team.

Learning Outcomes

1. Analyse data corresponding to epidemiological studies or clinical trials.
2. Critically assess the work done on the basis of quality criteria.
3. Design and conduct hypothesis tests in the different fields of application studied.

4. Draw conclusions that are consistent with the experimental context specific to the discipline, based on the results obtained.
5. Draw up technical reports that clearly express the results and conclusions of the study using vocabulary specific to the field of application.
6. Interpret statistical results in applied contexts.
7. Justify the choice of method for each particular application context.
8. Make effective use of references and electronic resources to obtain information.
9. Reappraise one's own ideas and those of others through rigorous, critical reflection.
10. Recognize the importance of the statistical methods studied within each particular application.
11. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
12. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
13. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
14. Use different programmes, both open-source and commercial, associated with the different applied branches.
15. Work cooperatively in a multidisciplinary context, accepting and respecting the roles of the different team members.

Content

U1. Analysis of internal consistency
U2. Consistency or agreement
U3. Data reduction: one-dimensional principal components analysis
U4. Data reduction: multidimensional principal components analysis
U5. Data reduction: rotation
U6. Introduction to confirmatory factor analysis
U7. Models for continuous quantitative responses
U8. Categoric predictors
U9. Predictive models
U10. Explanatory models
U11. Model diagnosis and results publication
U12. Analysis of variance
U13. Overview of nonlinear models

Methodology

This course provides different activities based on active-learning methodologies that are centred on the student. This involves a "hybrid" approach in which we combine traditional teaching resources with other resources aimed at encouraging meaningful and cooperative learning.

N.B. The proposed teaching and assessment methodologies may experience some modifications as a result of the restrictions on face-to-face learning imposed by the health authorities. The teaching staff will use the Moodle classroom or the usual communication channel to specify whether the different directed and assessment activities are to be carried out on site or online, as instructed by the Faculty.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			

Practical classes (small groups): approach and resolution of different practical problems of investigation analysis	26	1.04	1, 9, 2, 3, 5, 4, 6, 7, 13, 11, 12, 10, 15, 14, 8
Theoretical classes: master class with multimedia support	19.5	0.78	9, 2, 4, 6, 7, 10, 8
Type: Supervised			
Supervision of the resolution of the practices carried out autonomously	7.5	0.3	1, 9, 2, 3, 5, 4, 6, 7, 13, 11, 12, 10, 15, 14, 8
Type: Autonomous			
Bibliographic and documentary consultations	7	0.28	9, 8
Monitoring and participation in discussion forums through the virtual campus	7.5	0.3	1, 9, 2, 3, 5, 4, 6, 7, 13, 11, 12, 10, 15, 14, 8
Practical review of the main analytical procedures of the course through the resolution of the practices	10	0.4	1, 9, 2, 3, 5, 4, 6, 7, 13, 11, 12, 10, 14
Reading the "Theory Schemes" for the preparation of theoretical classes	30	1.2	1, 9, 2, 3, 5, 4, 6, 7, 11, 12, 10, 14
Self-study: Completion of summaries, diagrams and conceptual maps	37.5	1.5	1, 9, 2, 3, 5, 4, 6, 7, 13, 11, 12, 10, 14

Assessment

EV1 and EV3 are performed in groups of two people. The writing must be totally original and not copied from other sources or groups. In order for an evidence to be evaluated, it will be necessary to have attended 2/3 of its practices in person. Students must report in the first two weeks of class, through an application integrated into the virtual campus, with whom they will form a partner to carry out the work. The weight of each of these evidences is 15%. These evidences will be delivered through the Campus Virtual.

The EV2 and EV4 (individual exams) consist of a set of approximately 20-25 multiple choice questions (three answer options, penalty for errors; two errors discount one correct, according to the usual criteria k-1). Students will be allowed to bring printed the material prepared by the teaching team as well as notes of the student's own elaboration. Electronic devices will not be available except for a calculator (not a mobile phone). At the decission of the teacher the students will have the statement and some Stata results tables a few hours before

At demand of the teaching staff, the grade obtained in each of the evidences may require an individual defense.

The responses to all the evaluation evidence must be original (writings detected from other sources or copied or plagiarized responses will not be accepted). A breach of this condition implies the nullification of the evidence. More than one non-compliance will suppose a final qualification of 0 in the subject (in application to the regulations on evaluation of the UAB and of the Psychology degree. These measures will be applied to all the people involved in the evaluation irregularity.

In order to pass the subject through continuous assessment, the following criteria must be meet: 1) The weighted sum of all the evidence must be equal to or greater than 5 points. 2) The average of EV2 and EV4 should be 4.5 or higher (on a scale of 0 to 10); otherwise the maximum grade in the course will be 4.5.

In accordance with the UAB regulations, students who have not passed the course and who meet: 1) have carried out evidence with a weight of at least 2/3 of the total and 2) have a continuous assessment mark 3.5 or higher, may be eligible for resit. The EV2 and/or EV4 can be recovered. The qualification of the recovered evidence will replace the previously obtained and the total qualification will be recalculated with the criteria

aforementioned.

A student who has submitted evidence of learning with a weight equal to or greater than 4 points (40%) will be recorded as 'evaluable'.

Second or subsequent enrollment students may opt for a single non-recoverable synthesis test that will consist of a face-to-face test that will cover the entire subject. Students interested must notify the coordination of the subject before the date of delivery of the first evidence.

Link to the guidelines for assessment of the faculty's degrees:
https://www.uab.cat/web/estudiar/graus/graus/avaluacions-1345722525858.html

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evidence 1: Delivery of the results of the analyses made autonomously of a practical problem related to units 1-6. It must be done in pairs (approx. 4-7 weeks)	15	0	0	1, 9, 2, 3, 5, 4, 6, 7, 13, 11, 12, 15, 14, 8
Evidence 2: Written evidence consisting of a set of multiple choice questions related to units 1-6, as well as to the Stata syntax that make the previous analysys (1st assessment period)	40	2.5	0.1	9, 2, 4, 6, 7, 11, 10, 14, 8
Evidence 3. Delivery of the results of the analyses carried out autonomously of a practical problem related to units 7-12. It must be done in pairs (approx. Weeks 13-15)	15	0	0	1, 9, 2, 3, 5, 4, 6, 7, 13, 11, 12, 15, 14, 8
Evidence 4: Writted evidence consisting of a set of multiple choice questions related to units 7-12, as well as to the Stata syntax that make the previous analysis (2nd assessment period)	40	2.5	0.1	9, 2, 4, 6, 7, 11, 10, 14, 8

Bibliography

Reference manuals:

Abad, F.J., Olea, J., Ponsoda, V. & García, C. (2011). *Medición en ciencias sociales y de la salud.* Madrid: Síntesis.

Kleinbaum, D.G., Kupper, L.L., Nizam, A., Muller, K. & Rosenberg, E.S. (2012). *Applied Regression Analysis and other Multivariable Methods.* (5ª ed.). Boston (MA): Cengage Learning, Inc.

Other references:

Domènech, J.M. & Granero, R. (2004). *Anàlisi de dades en Psicologia* (Vols. 1 i 2) (2ª Ed.). Barcelona: Signo.

Martínez Arias, R. (1995). *Psicometría: Teoría de los tests psicológicos y educativos.* Madrid: Síntesis.

Meltzoff, J. (2000). *Crítica a la investigación. Psicología y campos afines.* Madrid: Alianza Editorial. (Traducción del original de 1998).

Viladrich, M.C. & Doval, E. (Eds.) (2008). *Psicometria.* Barcelona: Edicions UOC.

Software

Stata from version 13