COURSE DATA

DATA SUBJECT

Code: 47009
Name: Biomedical Research
Cycle: Doctorate / Master's Degree
ECTS Credits: 3
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2280 - Master's Degree in Advanced Optometry and Vision Sciences	Facultat de Física	1	Second quarter
3144 - PhD in Optometry and Vision Sciences	Escola de Doctorat		Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2280 - Master's Degree in Advanced Optometry and Vision Sciences 3144 - PhD in Optometry and Vision Sciences	Materias Optativas	ELECTIVES

COORDINATION

ESTEVE TABOADA JOSE JUAN

SUMMARY

This course provides advanced knowledge in data analysis and interpretation of scientific results applied to the field of optometry and vision sciences. It delves into descriptive and inferential statistics and the resolution of real-life problems arising in clinical research. The approach is eminently applied, oriented toward data-driven decision-making within the biomedical context.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

It is recommended that applicants have previously completed the course "Introduction to Research" and

have basic knowledge of statistics and scientific methodology.

COMPETENCES / LEARNING OUTCOMES

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Act autonomously in learning, make informed decisions in different contexts, issue judgements based on experimentation and analysis and transfer knowledge to new situations.

Apply a rigorous method in the design phase of an experiment and in analysing data obtained during optometric research.

Apply quantitative and qualitative research methods to collect, analyse and interpret data related to optometry and eye health.

Be able to communicate effectively, both orally and in writing, adapting to the characteristics of the situation and audience.

Collaborate effectively in work teams, taking on responsibilities and leadership roles and contributing to collective improvement and development.

Contribute to the design, development and implementation of solutions that respond to social demands, considering the Sustainable Development Goals as a reference.

Convey scientific knowledge in the field of optometry.

Demonstrate critical and self-critical reasoning in the field of the degree, considering aspects such as professional ethics, moral value and the social implications of the different activities carried out.

Discuss and analyse experimental problems and research results in optometry.

Know and understand, within the area of the degree, inequalities based on sex and gender in society; integrate different needs and preferences based on sex and gender into the design of solutions and problem-solving.

Plan and carry out research projects that contribute to the production of knowledge in the field of optometry.

Plan biosanitary research in optics and optometry.

Propose creative and innovative solutions to complex situations or problems within the field of knowledge to respond to diverse professional and social needs.

Understand advanced statistical methods applied to clinical research in optometry.

Understand different statistical calculation software programmes.

DESCRIPTION OF CONTENTS

Topic 1. Fundamentals of Statistics in Biomedical Research

Introduction to key concepts in statistics applied to the health sciences: data types (qualitative and quantitative), measurement scales, differences between population and sample, parameters, and statistics. The concepts of sampling, randomness, and probability distribution are covered, including the most relevant distributions in practice.

Topic 2. Descriptive Analysis and Data Visualization

Exploration of qualitative and quantitative variables using measures of central tendency, dispersion, and shape. Graphical representation of data through tables, bar charts, histograms, frequency polygons, box plots, and other visual resources useful in clinical and scientific interpretation.

Topic 3. Statistical Inference I: Sampling Distribution and Confidence Interval Estimation

The concept of sampling distribution and the foundations of statistical inference are introduced. Confidence interval estimation for population parameters is studied, applying criteria of precision and confidence level.

Topic 4. Statistical Inference II: Hypothesis Testing

This course covers single-variable hypothesis testing, including the formulation of null and alternative hypotheses, type I and II errors, and statistical power. An introduction to parametric and nonparametric statistics is provided.

Topic 5. Normality Tests and Statistical Test Selection

Evaluation of data distribution using graphical methods (histograms, Q-Q plots) and formal tests (Kolmogorov-Smirnov, Shapiro-Wilk). The importance of these results in selecting the most appropriate statistical test for inferential analysis is analyzed.

Topic 6. Correlation and Linear Regression

Study of the relationship between variables using scatter plots, calculation of covariance, and Pearson and Spearman correlation coefficients. Simple linear regression analysis is covered: interpretation of the model, assumptions, coefficients, and assessment of the quality of fit. A critical reflection on correlation vs. causality is included.

Topic 7. Application to data analysis and interpretation of results in biomedical research

Application of statistical methods for the analysis of real-world data in the field of optometry and vision

sciences. Skills are developed to detect design errors and critically analyze research results. The distinction between statistical significance and clinical relevance is studied, as well as how to draw valid conclusions from published studies.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	17,50
Seminar	12,50
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	15,00
Independent study and work	25,00
Preparation of lessons	0,00
Preparation for assessment activities	5,00
Resolution of case studies	0,00
Total hours	**45,00**

TEACHING METHODOLOGY

The course combines lectures and seminars that aim to promote both knowledge acquisition and active student participation.

Lectures: These will teach the theoretical content of the subject. The use of audiovisual methodologies will be reinforced, providing clearer illustrations of the theoretical content and the examples to be developed. The various topics will be developed through the analysis of practical cases, using different work environments and spreadsheets (Excel, SPSS, PSPP, etc.).

Seminars: These will develop theoretical concepts in a practical way. Questionnaires and exercises based on the content taught will be presented, encouraging discussion and the practical application of the procedures studied.

EVALUATION

The assessment will be divided into two parts:

1) Non-recoverable continuous assessment activities (20% of the grade)

Students must complete and submit the proposed practical activities, using the virtual classroom and on the indicated dates. Since these are non-recoverable continuous assessment activities, the grade obtained for these activities in the first sitting will be carried over to the second sitting of the course.

2) Final theoretical-practical exam, with the same types of questions as those posed throughout the course (80%)

A comprehensive assessment test that combines theoretical questions and practical exercises, with the aim of assessing both conceptual knowledge and its application to real-life situations or problems related to the subject.

To pass the course, the student must obtain 5 points out of 10, adding both parts of the assessment (with no minimum score for each part).

REFERENCES

Basic references:

- Pardo A., Ruiz M.A., San Martín R. *Análisis de datos en ciencias sociales y de la salud I*. Síntesis; 2.ª ed., 2015. ISBN 978-8497566476.
- Pardo A., San Martín R. *Análisis de datos en ciencias sociales y de la salud II.* Síntesis; 2010. ISBN 978-8497567046.
- Moore D.S. *Estadística aplicada básica.* Antoni Bosch; 2.ª ed., 2010. ISBN 978-8495348043.

Complementary references:

- Quirk T.J. *Excel 2010 for Educational and Psychological Statistics: A Guide to Solving Practical Problems*. Springer New York; 2012. ISBN 978-1461420705.
- Vidakovic B. *Statistics for Bioengineering Sciences: With MATLAB and WinBUGS Support*. Springer New York; 2011. ISBN 978-1461403937. Disponible en línia a través de trobes.uv.es.