Universidad Zaragoza

Year : 2020/21

25912 - Research methodology II

Syllabus Information

Academic Year: 2020/21
Subject: 25912 - Research methodology II
Faculty / School: 301 - Facultad de Ciencias Sociales y Humanas
Degree: 270 - Degree in Psychology
ECTS: 6.0
Year: 2
Semester: First Four-month period
Subject Type: Compulsory
Module: ---

1.General information

1.1.Aims of the course

The main objective of this subject is to introduce the student to the fundamentals of inferential statistics and to provide him/her with the necessary tools to solve problems that require the use of such statistics at the univariate level.

1.2.Context and importance of this course in the degree

The subject "Research Methodology II" is one of the three subjects linked to the "Methodology of Human Behavior Research" area of the Psychology Degree curriculum. This subject is mandatory and consists of 6 credits. It is taught in the first four-month period of the second year. While the subject "Research Methodology I" focuses on descriptive statistics, the subject "Research Methodology II" deals with inferential statistics.

1.3.Recommendations to take this course

To continue this subject without problems, it is necessary to have properly assimilated the subject "Methodology of Research I". In this subject you will work with various mathematical equations. However, the objective of this subject is not to memorize these equations, but to understand them and to know which of these equations should be applied according to the characteristics of the problem to be solved. Therefore, the greatest effort required by this subject is not that of memorization, but of understanding mathematical concepts.

2.Learning goals

2.1.Competences

This section includes the different competencies that will be developed in the subject. Some of the competencies listed here will not be fully developed, but only part of it.

General competencies

- Know the different research designs, the procedures for formulating and contrasting hypotheses and the interpretation of the results.

Specific competencies

- To assess and appreciate the contributions that scientific research provides to professional knowledge and practice.
- Analyze and interpret quantitative and qualitative data from research, reports and work in Psychology.
- Know the legal framework that regulates professional practice and conform to the ethical principles and the code of ethics of Psychology.
- To be able to gather and interpret relevant data to make judgments that include a reflection on relevant topics of a social, scientific or ethical nature.
- Acquire the skills needed to analyze situations, define problems, design elementary research, execute them, statistically analyze data, and correctly write a report.
- Know how to analyze and interpret the results of the evaluation.
- Know how to evaluate, analyze and interpret the results and the effectiveness of the actions themselves in any of the fields of Psychology.

Transversal competencies

- Know the most appropriate statistical foundations and computer applications for each job and specifically those necessary for professional development.
- Understand and be able to produce oral and written reports.

2.2.Learning goals

In order to pass this subject, the student must demonstrate the following results:

1. Know the different approximations about probability and make additions and probabilities products.
2. Differentiate between population and sample, as well as between parameter and statistic.
3. Identify the different types of functions of random variables.
4. Know the characteristics of the different types of sampling.
5. Know the properties, nomenclature, and conditions that result in the normal, *Student t*, *Pearson* X^2, Binomial, and *Snedecor F* distribution.
6. Set the confidential intervals of the mean, variance, and proportion.
7. Calculate the sample size needed to obtain a given precision for the estimation of mean, variance, and proportion.
8. Carry out contrasts of a mean, of two independent means (both when homocedasticity is assumed and when not), and of two related means.
9. Choose the appropriate type of statistical power analysis depending on the case.
10. Distinguish between different types of effect sizes and know how to interpret them.
11. Given a specific problem, identify the most appropriate type of ANOVA (either an ANOVA of a fully randomized factor or an ANOVA of a repeated measurement factor) to solve it.

2.3.Importance of learning goals

Statistics is a mathematical discipline used in Psychology as well as in other social sciences disciplines. Thanks to Statistics, Psychology is a discipline with a scientific basis. Although not all psychologists work as researchers, the way psychologists transmit new advances is through statistical language. That is why all psychologists should have statistical training. Likewise, not all published scientific papers have the same quality. Good training in statistics allows the psychologist to critically assess the quality of scientific work.

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The overall score of the subject will be obtained from two assessment: one from the theoretical part and the other from the practical part. The assessment of theoretical knowledge will be performed through a multiple response exam in a single exam. This exam will evaluate the conceptual contents worked in both the theoretical and practical classes. The score of this exam will be calculated taking into account correct answers due to chance: Score = Correct answers - (Incorrect answers / # Options - 1). On the other hand, the practical part will be the resolution of statistical problems. Problems will be similar exercises to those performed in the practical classes.
The overall score will be obtained by the sum of the theoretical part (60% of the final score) and the practical part (40% of the final score), as long as the score of both parties are equal to or greater than 50%. Otherwise, the final score will be the score for that part with the lowest score. Consequently, this subject can only be passed if both parts are passed.

The assessment is designed to be performed in person. However, if there are health security reasons that recommend it, it will be carried out in a non-in-person manner.
In this case, the assessment will be carried out online through interactive exercises that will be uploaded to Moodle platform. The time for the exercises will be limited. In order for students to become familiar with this new way of performing the exercises, interactive exercises will be uploaded to the Moodle platform that will be similar to those that will appear in the assessment.
A computer is required for interactive exercises. It is cautioned that they cannot be done via a smartphone or tablet for technical problems.
In case of not having the necessary technological means, the student must inform the coordinator of the degree and the teachers responsible for the subject. The student who does not have the necessary technological means will perform a global oral test by phone with the teacher.
Exam reviews will be conducted by video conference or phone.

For more information, refer to the Regulations on Learning Assessment Standards of the University of Zaragoza at the following link: https://zaguan.unizar.es/record/30538/files/norma_estudiantesEvaluacionAprendizaje_2010_original.pdf

To know the level of requirement of the subject, it is recommended to consult the success and performance rate of previous academic courses (in the section of surveys and results) at the following link:
https://estudios.unizar.es/estudio/ver?id=163&anyo_academico=2019

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The main methodology that will be used on the theoretical part of the course will be lectures, in which it will be explained different statistical concepts and the foundations of inferential statistics. While the main methodology to be used in the practical part will be the practices of problems and cases, in which different inferential statistical procedures will be carried out. Besides these methodologies described previously, students could make use of tutorials, as a way to solve doubts about the contents of the topics that are being developing in class.

4.2.Learning tasks

Learning activities will consist mainly of problem solving on univariate inferential statistics.

4.3.Syllabus

LESSON 1. Introduction

1. What is statistical analysis?
    1. Descriptive statistics
    2. Inferential statistics
2. Levels of inquiry
    1. Descriptive
    2. Relational
    3. Explanatory

LESSON 2. Introduction to probability

1. Definitions
    1. Elements
    2. Types of sampling space
2. Types of experiments
    1. Deterministic
    2. Random
3. Definition of probability
    1. Classic view or a priori
    2. Frequentist view or a posteriori
4. Conditional probability
5. Basic Theorems
    1. Addition theorem
    2. Product theorem

LESSON 3. Sampling

1. Basic concepts
    1. Population and parameter
    2. Sample and statistic
        1. Types of sampling
            1. Random sampling with replacement (Simple random sampling)
            2. Random sampling without replacement
            3. Other types of random sampling
                1. Systematic
                2. Stratified
                3. Clusters

LESSON 4. Sampling distributions

1. Basic concepts
    1. Deterministic and random experiment
    2. Random variable
    3. Probability function and distribution function
2. Sampling distribution
    1. Definition
    2. Example of sampling distribution
    3. Characterization of a sampling distribution
        1. Shape
        2. Mean
        3. Standard deviation (Standard error)

3. Sampling distribution of the mean (Normal curve and Student's t distribution)
    1. Central limit theorem
    2. Normal curve
        1. Normal curve properties
        2. Standardization of a variable
    3. Student t distribution
        1. Conditions that bring about a Student's t distribution
        2. Properties
    4. Sampling distribution of the variance (Pearson's X2 distribution)
        1. Conditions that bring about a Pearson's X2 distribution
        2. Properties
    5. Sampling distribution of the proportion (Binomial distribution)
        1. Conditions that bring about a Binomial distribution
        2. Properties
    6. Sampling distribution of two variances (Snedecor's F distribution)
        1. Conditions that bring about a Snedecor's F distribution
        2. Properties

LESSON 5. Parameters estimation
1. Point estimation
    1. Definition
    2. Properties of a good estimator
        1. Lack of bias
        2. Consistency
        3. Efficiency
        4. Sufficiency
    3. Confidence interval estimation
        1. Definition
        2. Definition of confidence level (1-?) and risk level (?)
        3. Relation between amplitude and confidence level
        4. Relation between amplitude and accuracy (Maximum error)
        5. Confidence interval estimation for the mean
            1. With a large sample
            2. With a small sample
        6. Confidence interval estimation for the variance
            1. Using X2
            2. Using normal approximation
        7. Confidence interval estimation for the proportion
            1. With a large sample
            2. With a small sample
    4. Accuracy and simple size
        1. For the mean
            1. With a large sample
            2. With a small sample
        2. For the variance
        3. For the proportion

LESSON 6. Contrasts hypothesis
1. Definition
2. Differences between scientific hypothesis and statistical hypothesis
3. Statistical hypotheses
    1. Null hypothesis
    2. Alternative hypothesis
4. Unilateral and bilateral hypothesis
5. Assumptions
6. Contrast statistics
7. Decision rule
    1. Rejection region (critical region)
    2. Acceptance region
8. Decision
    1. Meaning of rejecting a null hypothesis
    2. Meaning of rejecting an alternative hypothesis
9. Type error I, type error II, ? and ?

10. Three factors that ? depends on
    1. Distance that separates null hypothesis distribution from alternative hypothesis distribution
    2. Value of ?
    3. Size of standard error of sampling distribution
11. Critical level
    1. For unilateral contrast
    2. For bilateral contrast
12. Relation between interval estimation and contrast hypothesis

LESSON 7. Contrasts hypotheses for the mean
1. Contrasts hypotheses for one mean
    1. When we know population variance (Normal distribution)
    2. When we do not know population variance and the simple is small (Student's t distribution)
2. Contrasts hypotheses for two independent means
    1. Assuming equal variances
    2. Assuming different variances
3. Contrasts hypotheses for two related means
4. Effect size for contrast of the mean

LESSON 8. One-way analysis of variance
1. General linear model
2. Introduction to analysis of variance
    1. Models of ANOVA
    2. The logic behind the ANOVA
3. One-way ANOVA, fixed effects, completely random
    1. Data structure and notation
    2. The model
    3. Assumptions
    4. Contrast statistic
    5. Model summary
4. One-way ANOVA, fixed effects, repeated measures
    1. Data structure and notation
    2. The model
    3. Assumptions
    4. Contrast statistic
    5. Model summary
5. Fixed effects and random effects
6. Effect size measures

4.4.Course planning and calendar

The general planning of the student dedication, in funtion on the type of the activity, is the following:

- 60 hours in lectures in class
- 60 hours in problem solving tasks in class
- 30 hours in autonomous works (study hours at home)
- 2 hours in performing the exam

4.5.Bibliography and recommended resources

To access to the bibliography of the course, please, search the course in the library of Zaragoza University in the following link:http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=25912