How to design powerful scientific experiments

Do you wish to know how to plan experiments to test hypothesis?

Are you interested in publishing that research in specialized journals?

The experimental design course is designed to learn how to develop an experimental plan supported on the factors you control in your data collection (univariate and multivariate). The factorial experimental design is one of the most powerful tools to collect data in a format that highly increases paper publication chances. The hypothesis statement is one of the key criteria used by journal editors and reviewers to assess the quality of the paper submitted for publication. It is mostly suitable for those unexperienced in the experimental design and for those aiming to use ANOVA (or equivalent) in their research analysis.

You will learn how to:

- develop an experimental design
- collect valid data through designed sampling
- apply it to scientific research
- understand and evaluate experimental outcomes
- analyse data from factorial designs
- efficiently communicate scientific results

The course is particularly suitable **for research** in which quantifiable data is obtained through the setup of experimental conditions. The course includes the opportunity to apply in class the experimental design to your own experiments.

Course Main Contents

- The experiment as a research method
- Experimental method and units
- Experimental planning
    - Sampling (data collection)
    - Statistical analysis
- The importance of statistics in the experimental context
- Components of the statistical test
    - Null hypothesis
    - Statistical test
    - Critical value for the null hypothesis (p-value)
- Experimental design
    - Treatments

- -Factors
  - -Controls
  - -Replication
  - -Randomness
  - -Scale
  - -Independence
  - -Sampling representativeness
  - -Crossed and nested designs
  - -Designs for environmental impact studies (BACI & Beyond-BACI)
- Analysis of experimental designs:
  - -Relations between variables (correlation & regression)
  - -Hypothesis tests (chi-square, ANOVA, MANOVA)
- Statistical power
- Transformations
- Statistical errors
- What information to present in the results
- Analysis of students own data or of given examples

Lecturer: Ana Silva (IST Researcher)

Duration: 20 hours

Course schedule: 10 to 18 november – 17h30 – 20h30 (every day)

Location: IST (Room to confirm)

Course Fee: IST students; Alumni = 100 €, Others = 200 €