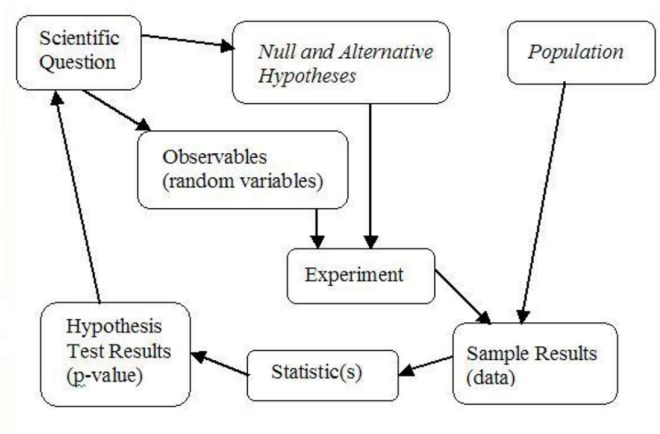
Introduction to Factorial experimental design:

collect your research data the right way

The factorial experimental design is one of the most powerful tools to collect data in a format that highly increases paper publication chances. The experimental design is based on the use of hypothesis that requires data collected in particular formats so as to prove or disprove the hypothesis through statistical analysis. 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. Our goal as researchers is always to actively design an experiment that has the best chance to produce meaningful, defensible evidence, rather than hoping that good statistical analysis may be able to correct for defects after the fact.



This is an introductory course designed to learn how to develop an experimental plan supported on the factorial framework and provide analysis solutions for univariate and multivariate datasets. The most general design types will be described. 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 earth sciences, environment, laboratorial tests and any other research area 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.

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