

**Universidade do Minho**  
Escola de Engenharia

# Métodos Quantitativos e Qualitativos na Engenharia (M2QE)

-----

# Quantitative and Qualitative Methods in Engineering (QQME)



Guimarães, 2 de outubro de 2014  
Escola de Engenharia, Campus de Azurém

# Introduction

**Method:** the set of rational and systematic activities that promote the achievement of objectives, tracing the path to be followed by detecting possible errors and assisting in the decision making of the researcher.

(Lakatos and Marconi, 2001)

**Quantitative:** characterized by the use of quantification in terms of data acquisition and on their treatment by using statistical techniques.

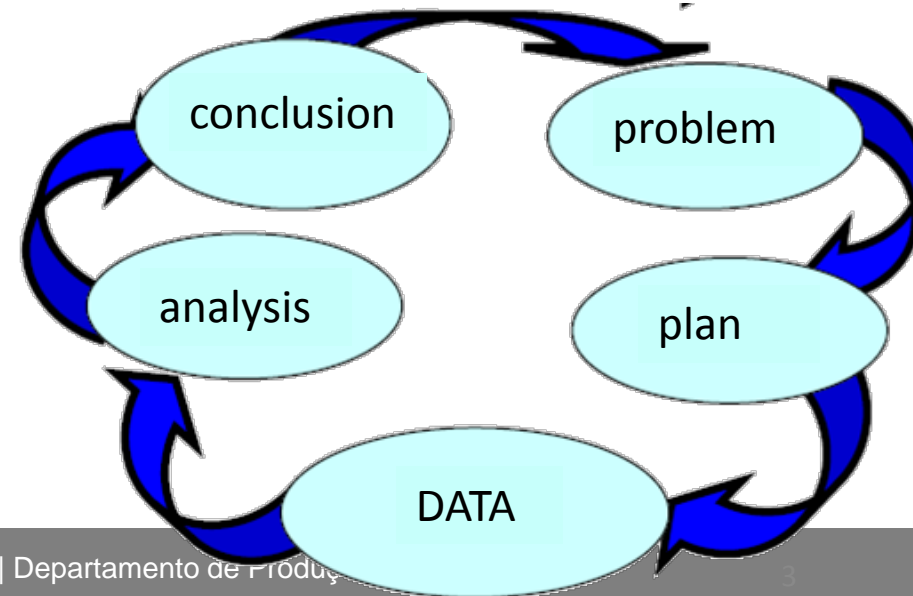
**Qualitative:** involves interpretive approaches and naturalistic affairs. The qualitative researcher studies the problem in their natural environment, trying to interpret phenomena, according to the meaning that people attribute to it.

(Denzin and Lincoln, 1994)

# Objective

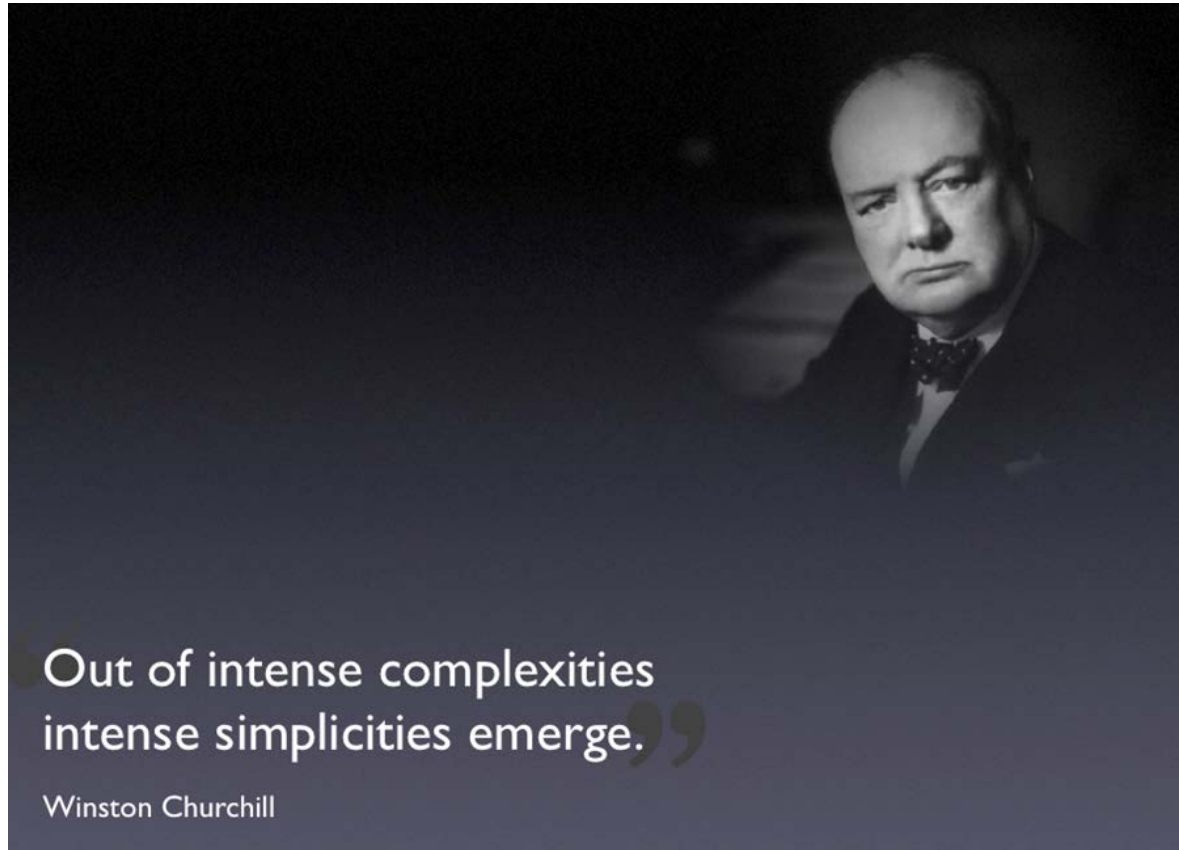
To give the students the opportunity to advance their knowledge and technical skills in their research to plan, implement, analyze and decide.

The approach of this curricular unit focuses on the procedures and techniques applied to research in Engineering.





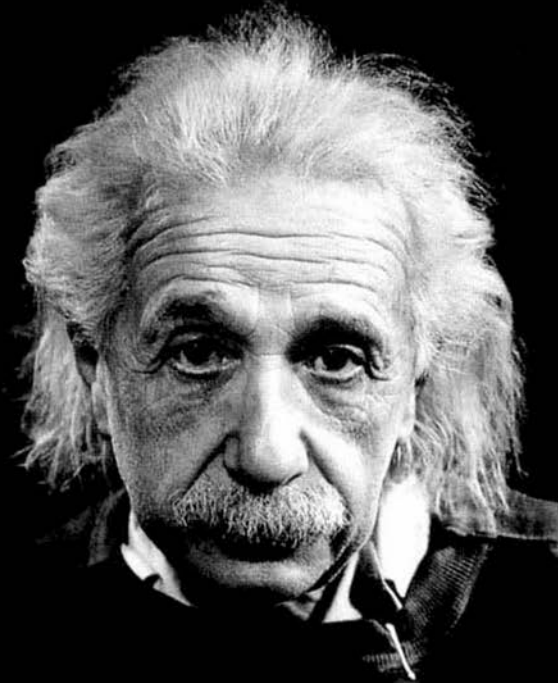
# Taking into account that...

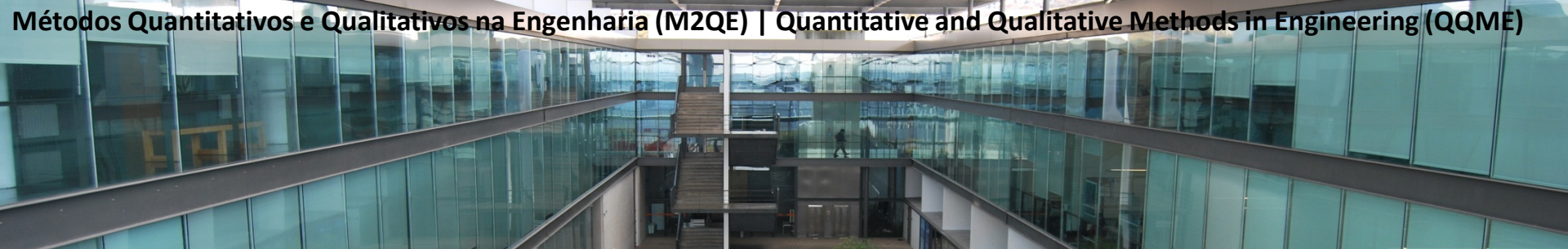


and...

“Everything should be made  
as simple as possible,  
but not simpler.”

Albert Einstein





We could use the statistics to help us to understand the variability of systems by data acquisition, analysis, and implementation of a solution in the context of decision-making processes.





# Learning outcomes

- To identify quantitative and qualitative data in the context of Engineering;
- To identify types of quantitative and qualitative research;
- To know the advantages and disadvantages of quantitative and qualitative methods;
- To decide the suitability of different methods;
- To know and use computer tools to support the analysis;
- To present and write the research results.

# Syllabus

- Block 1: Block for homogenization of knowledge in statistics and statistical inference
- Block 2: Techniques of design of experiments
- Block 3: Techniques of causality
- Block 4: Techniques for analyzing qualitative data



# Block 1: Block for homogenization of knowledge in statistics and statistical inference

- Basic statistical concepts
- Types of information and data sources
- Collection of primary data and secondary data (questionnaires, statistics INE)
- Presentation of data and results
- Definition of hypotheses, types of errors and estimation
- Using SPSS

# Block 2: Techniques of design of experiments

- Components and principles of experimental design
- Experiments with one factor
- Introduction to factorial design
- Techniques for parametric and non-parametric analysis
- Using SPSS in data analysis

# Block 3: Techniques of causality

- Statistical causality: Some historical considerations
- The language of potential outcomes. Correlation vs regression
- Techniques of analysis of cause-effect for quantitative and qualitative variables
- Using SPSS in data analysis



# Block 4: Techniques for analyzing qualitative data

- Framework for Qualitative Data Analysis. Relationship between qualitative and quantitative methods, limits of each approach and practical considerations
- Collection of qualitative data. Objectives and data collection techniques (case studies, interviews (unstructured, semi-structured, structured), questionnaires, life history, focus groups, projective techniques and participant observation)
- Techniques of qualitative analysis, data categorization and building typologies
- Introduction to the use of software in the analysis of qualitative data

# Methodology

- **TEACHING:**

Expository and active (active learning).

Participative exposure, group dynamics, self-assessment exercises and discussions among the participants, with the use of the statistical techniques and software.

- **EVALUATION:**

Group dynamics in the classroom (presentation and discussion of scientific papers in class); report (group work).

Individual oral presentation.

# Timetable

- Thursday from 9:00 to 12:00h



# Teaching Team



**Block 3**  
Ana Cristina Braga  
MSc in Probability and Statistics  
PhD in Applied Statistics  
Research in biostatistics, bioinformatics  
and applied statistics  
[acb@dps.uminho.pt](mailto:acb@dps.uminho.pt)



**Block 1**  
Cristina Rodrigues  
MSc in Management Science  
PhD in Numerical Methods and Statistics  
Current research interests: structural  
equation models, surveys and scale  
reliability  
[crodrigues@dps.uminho.pt](mailto:crodrigues@dps.uminho.pt)



**Block 4**  
Celina Pinto Leão  
MSc in Industrial Mathematics  
PhD in Engineering Science  
Current research interests: statistical  
techniques in engineering; new methodologies  
in learning process of numerical methods and  
statistics in engineering  
[cpl@dps.uminho.pt](mailto:cpl@dps.uminho.pt)



**Block 2**  
Lino Costa  
MSc in Informatics  
PhD in Numerical Methods and Statistics  
Research in optimization and applied  
statistics  
[lac@dps.uminho.pt](mailto:lac@dps.uminho.pt)

Contact: [acb@dps.uminho.pt](mailto:acb@dps.uminho.pt)

Métodos Quantitativos e Qualitativos na  
Engenharia (M2QE)  
Obrigado pela vossa atenção!

Thank for your attention!  
Quantitative and Qualitative Methods in  
Engineering (QQME)

Guimarães, 2 de outubro de 2014