



Universidade do Minho  
Escola de Engenharia

# **RD4ST**

## **Research Designs for Science and Technology**

João Álvaro Carvalho  
jac@dsi.uminho.pt

2024/2025, 2<sup>nd</sup> Semester  
(23<sup>rd</sup> edition)

1

1



Universidade do Minho  
Escola de Engenharia

# **RD4ST**

## **Research Designs for Science and Technology**

Course presentation

2

2



Universidade do Minho  
Escola de Engenharia

# RD4ST Research Designs for Science and Technology

## Purpose

3

3

## Purpose

- Lay out a general view of issues related to research, development, engineering, design, innovation
- Discuss the several facets of a research pursuit
- Provide basis for the analysis of research reports (mainly journal and conference articles)
- Draw students' attention to fundamental questions about the validity of research

4

4



Universidade do Minho  
Escola de Engenharia

# RD4ST

## Research Designs for Science and Technology

### Learning Outcomes

5

5

## Learning outcomes

On course completion students are expected to be able of:

- explicating the differences between research activities and professional design (engineering or other) activities;
- explicating the difference between different types of scientific knowledge (science and technology);
- discussing the research design of a research pursuit, as described in a research article or in a doctoral thesis, addressing several *dimensions* that constrain a research design: *research mode*; *research rationale*; *research model*; *research methods*; *research techniques, procedures and tools*; *ethical issues*;
- explicating each of those *dimensions* and discussing the range of possibilities for each dimension.

6

6

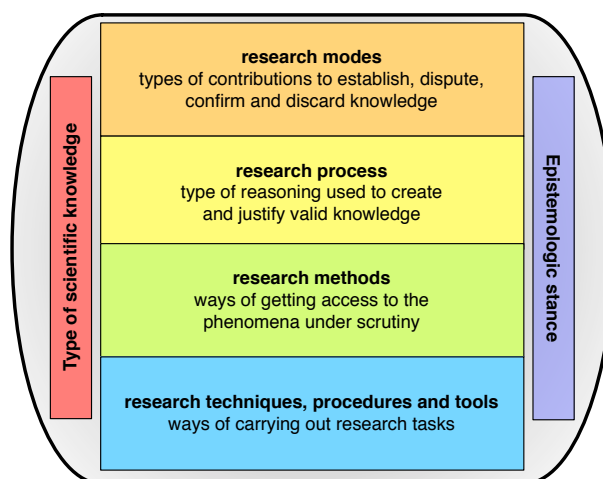
## Posits

- 1) The outcome of scientific research is new scientific knowledge (new knowledge that can be considered scientific because it has been validated according to scientific principles and criteria);
- 2) There are different types of scientific knowledge; a fundamental distinction is between:
  - *knowledge for understanding* (K4U) – *science* - and
  - *knowledge for a purpose* (K4P) - *technology*;
- 3) Engineering (or any other design profession/ occupation like medicine, management, architecture, ...) aims at solving world problems, applying the existing scientific knowledge (both science and technology);  
It doesn't aim at creating new scientific knowledge (this is the aim of scientific research);

7

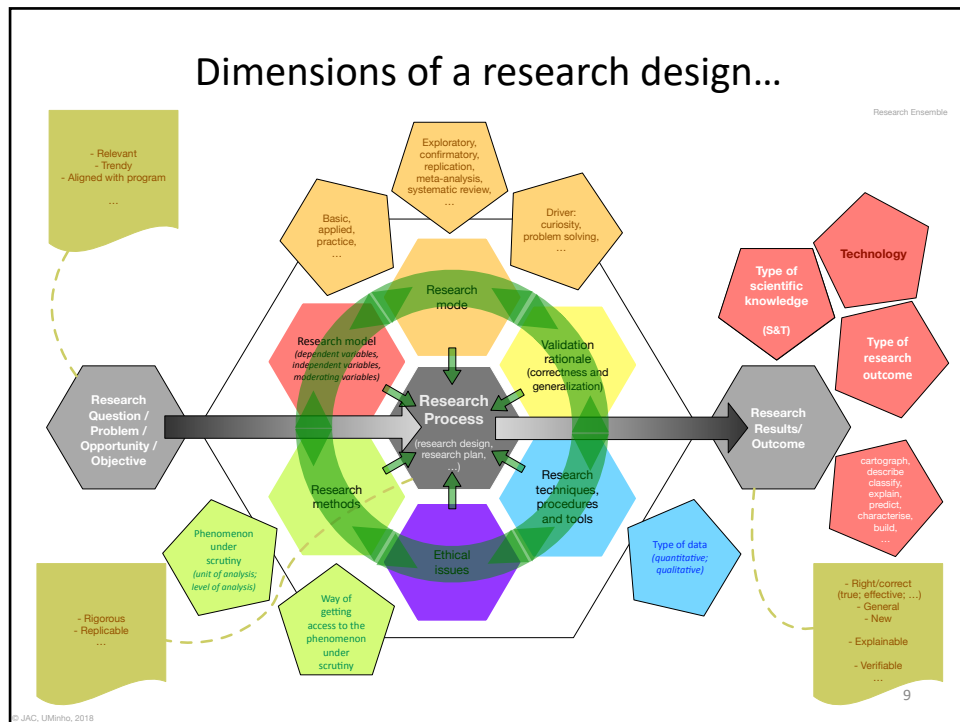
7

## Dimensions of a research design...



8

8



9



Universidade do Minho  
Escola de Engenharia

# RD4ST

## Research Designs for Science and Technology

### Syllabus

10

10

## Syllabus

- Research & Development activities and professional design (engineering or other) activities;
- Science and Technology;
- Dimensions that constrain a research design:
  - Research modes;
  - Research rationale;
  - Research methods;
  - Research techniques, procedures and tools;
  - Ethical issues;
  - Epistemological stances.

11

11



Universidade do Minho  
Escola de Engenharia

## RD4ST Research Designs for Science and Technology

Activities and classes

12

12

## Activities and Classes

- Seminar
- Sessions include
  - Presentations of themes, articles, homework requests,
  - Presentations of research articles chosen by students,
  - Group work for initial discussion of themes,
  - Debates involving the whole class.

13

13



Universidade do Minho  
Escola de Engenharia

## RD4ST Research Designs for Science and Technology

Course organization

14

14

## Course organization

- 5 credits (ECTS)
- 8 sessions with  $\pm 4$  hours of duration
- Assessment:
  - Active participation in seminar classes
    - Includes a presentation of one research article
  - Report
    - Research approaches and methods in the area of the student's doctoral work – analysis of 2 research articles chosen by the student;

15

15

## Classes 2024/2025 – 2<sup>nd</sup> Semester

- Wednesdays, 9h00 to 13h00
- Room 11-1.34, Azurém, Building 11 (Auditório do DSI)

- Calendar

February 12<sup>th</sup> - 1<sup>st</sup> session  
 May 7<sup>th</sup> - 8<sup>th</sup> and last session

- Language  
English

- Class size

Students are enrolled in a first come, first served basis

1	12-Feb
2	19-Feb
3	26-Feb
	05-Mar
4	12-Mar
	19-Mar
	26-Mar
	02-Apr
5	09-Apr
	16-Apr
6	23-Apr
7	30-Apr
8	07-May

16

16





Universidade do Minho  
Escola de Engenharia

# RD4ST Research Designs for Science and Technology

## Signing up

17

17

## Signing up for RD4ST

- Contact the secretariat of UMinho's Doctoral College

18

18