

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**103000859 - Experimentation In Software Engineering**

### DEGREE PROGRAMME

**10AZ - Master Universitario En Innovación Digital**

### ACADEMIC YEAR & SEMESTER

**2023/24 - Semester 2**

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## 1. Description

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### 1.1. Subject details

<b>Name of the subject</b>	103000859 - Experimentation In Software Engineering
<b>No of credits</b>	4.5 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	First year
<b>Semester of tuition</b>	Semester 2
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10AZ - Master Universitario en Innovación Digital
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2023-24

## 2. Faculty

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### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Natalia Juristo Juzgado	5104	natalia.juristo@upm.es	Sin horario.
Sira Vegas Hernandez (Subject coordinator)	5105	sira.vegas@upm.es	Tu - 14:00 - 17:00 Th - 12:00 - 15:00

\* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

### 3. Prior knowledge recommended to take the subject

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#### 3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

#### 3.2. Other recommended learning outcomes

- Basic knowledge of statistics

### 4. Skills and learning outcomes \*

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#### 4.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CB08 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

CE-CD07 - Capacidad para diseñar y gestionar proyectos de ciencia de datos

CE-CD09 - Capacidad para explorar formas de utilizar nuevas herramientas y técnicas de ciencia de datos con una mentalidad empresarial para enfrentar los desafíos empresariales y organizativos con una mentalidad empresarial

CG01 - Que los estudiantes sean capaces de predecir y controlar la evolución de situaciones complejas mediante el desarrollo de nuevas e innovadoras metodologías de trabajo adaptadas al ámbito científico/investigador, tecnológico o profesional concreto, en general multidisciplinar, en el que se desarrolle su actividad.

CG02 - Que los estudiantes desarrollen la autonomía suficiente para participar en proyectos de investigación y colaboraciones científicas o tecnológicas dentro su ámbito temático explorando y generando nuevas ideas sistemáticamente, en contextos interdisciplinares y, en su caso, con una alta componente de transferencia del conocimiento.

CG03 - La capacidad de usar la lengua inglesa de manera competente, es decir, con capacitación para tareas complejas de trabajo y estudio.

CG07 - Capacidad de trabajar y comunicarse también en contextos internacionales.

## 4.2. Learning outcomes

RA56 - develop data science projects following a methodology

RA58 - Understand the application of the experimental paradigm in software engineering

RA59 - Design experiments in software engineering, including experimental replications

\* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

## 5. Brief description of the subject and syllabus

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### 5.1. Brief description of the subject

Software Engineering technologies are not being adequately evaluated. That is, professionals do not know for sure whether a technology is effective or not and, if so, cannot be sure how effective and applicable it is. This lack of proper evaluation undermines the ability of the industry to produce competitive quality software.

Experimental Software Engineering (ESE) is a discipline of Software Engineering that aims to produce reliable information for professionals about what technologies should be used in software development projects. ESE uses empirical studies (experiments, quasi-experiments, case studies, etc.) to evaluate the effectiveness of technologies for software development.

## 5.2. Syllabus

1. Introduction to Experimental Software Engineering
  - 1.1. Basics of experimentalism
  - 1.2. The scientific method
  - 1.3. Scientific rules: cause-effect relationships
  - 1.4. Scientific immaturity of software engineering
2. Laboratory and Experiment
  - 2.1. The concept of laboratory
  - 2.2. The concept of experiment
  - 2.3. A lab for software engineering
  - 2.4. An experiment for software engineering
3. Elements of an Experiment
  - 3.1. Response variables
  - 3.2. Factors and levels
  - 3.3. Types of empirical studies
4. Designing Experiments
  - 4.1. Types of variables
  - 4.2. Types of control
  - 4.3. Validity
5. Data analysis
  - 5.1. Basics of inferential statistics
  - 5.2. IBM SPSS: An overview
  - 5.3. Parametric tests for independent samples
  - 5.4. Parametric tests for related samples
  - 5.5. Non parametric tests

## 6. Schedule

### 6.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Chapter 1</b> Duration: 04:00 Lecture			
2	<b>Chapter 2</b> Duration: 02:00 Lecture  <b>Chapter 5</b> Duration: 02:00 Lecture			
3	<b>Chapter 3</b> Duration: 02:00 Problem-solving class  <b>Chapter 5</b> Duration: 02:00 Laboratory assignments			
4	<b>Chapter 3</b> Duration: 01:00 Lecture  <b>Chapter 3</b> Duration: 01:00 Problem-solving class  <b>Chapter 5</b> Duration: 02:00 Laboratory assignments			
5	<b>Brainstorming and group discussion of assignment 1</b> Duration: 02:00 Problem-solving class  <b>Chapter 5</b> Duration: 02:00 Laboratory assignments			
6	<b>Brainstorming and group discussion of assignment 1</b> Duration: 02:00 Problem-solving class  <b>Chapter 5</b> Duration: 02:00 Laboratory assignments			

7				<b>Submission and presentation of assignment 1</b> Group presentation Continuous assessment Presential Duration: 15:00
8	<b>Brainstorming and group discussion of assignment 2</b> Duration: 04:00 Problem-solving class			<b>Submission of assignment 2</b> Group work Continuous assessment Not Presential Duration: 10:00
9				
10				
11				
12				
13				
14				
15				
16				
17				<b>Re-submission and presentation of assignment 1</b> Group work Final examination Presential Duration: 15:00  <b>Re-submission of assignment 2</b> Group work Final examination Not Presential Duration: 00:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.



## 7. Activities and assessment criteria

### 7.1. Assessment activities

#### 7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Submission and presentation of assignment 1	Group presentation	Face-to-face	15:00	50%	5 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07
8	Submission of assignment 2	Group work	No Presential	10:00	50%	5 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD09

#### 7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Re-submission and presentation of assignment 1	Group work	Face-to-face	15:00	50%	5 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07
17	Re-submission of assignment 2	Group work	No Presential	00:00	50%	5 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD09

### 7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Extraordinary exam	Written test	Face-to-face	02:00	100%	5 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09

## 7.2. Assessment criteria

### Progressive evaluation period:

- Students will be evaluated using the assignments only.
- No examination will be made.
- The assessment of assignments will depend on the correctness of the results.
- Additionally, for assignment 1 the presentation made by the students will be taken into consideration.
- The final grade will be calculated using a weighted average (each assignment counts 50% of final score).

### Global evaluation:

When the overall score obtained by the student in the progressive evaluation period is smaller than 5, the student will have to re-submit (and/or present) those assignments that do not reach the minimum score required. It is not possible to submit assignments for which there is not a submission in the progressive evaluation period. In no case assignments that have a score equal or greater than 5 can be re-submitted.

### Extraordinary evaluation:

When the overall score obtained by the student in the global evaluation period is smaller than 5, the student will

have to perform an exam. After 2 submission trials (during progressive evaluation and global evaluation), if a student has not been able to pass the course, it means that the assignments mode is not suitable for him/her. Therefore, a different evaluation method should be used.

## 8. Teaching resources

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### 8.1. Teaching resources for the subject

Name	Type	Notes
Natalia Juristo, Ana Moreno. Basics of software engineering experimentation. Kluwer 2001	Bibliography	
Claes Wohlin et al. Experimentation in software engineering: an introduction. Kluwer 2000.	Bibliography	
Andy Field. Discovering Statistics Using IBM SPSS Statistics. Sage 2017.	Bibliography	
IBM SPSS	Equipment	