



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
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COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros
Informáticos

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000859 - Experimentation In Software Engineering

DEGREE PROGRAMME

10AZ - Master Universitario En Innovación Digital

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	103000859 - Experimentation In Software Engineering
No of credits	4.5 ECTS
Type	Optional/elective
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	10AZ - Master Universitario en Innovación Digital
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
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

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 *

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

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

6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Lecture: Course introduction Duration: 01:00 Lecture Lecture: What is empiricism Duration: 03:00 Lecture			
2	Lecture: What is an experiment Duration: 02:00 Lecture Brainstorming and group discussion of assignment Duration: 02:00 Additional activities			Discussion of assignment: what is an experiment Individual presentation Progressive assessment Presential Duration: 02:00
3	Quiz: What is an experiment Duration: 00:15 Additional activities Lecture: Basic elements of an experiment Duration: 01:45 Lecture Brainstorming and group discussion of assignment Duration: 02:00 Additional activities			Quiz: what is an experiment Online test Progressive assessment Presential Duration: 00:15 Discussion of assignment: basic elements of an experiment Individual presentation Progressive assessment Presential Duration: 02:00
4	Quiz: Basic elements of an experiment Duration: 00:15 Additional activities Lecture: Design strategies Duration: 01:45 Lecture Brainstorming and group discussion of assignment Duration: 02:00 Additional activities			Quiz: basic elements of an experiment Online test Progressive assessment Presential Duration: 00:15 Discussion of assignment: design strategies 1 Individual presentation Progressive assessment Presential Duration: 02:00
5	Quiz: Design strategies 1 Duration: 00:15 Additional activities Lecture: Design strategies Duration: 01:45 Lecture Brainstorming and group discussion of assignment			Quiz: design strategies 1 Online test Progressive assessment Presential Duration: 00:15 Discussion of assignment: design strategies 2 Individual presentation Progressive assessment

	Duration: 02:00 Additional activities			Presential Duration: 02:00
6	<p>Quiz: Design strategies 2 Duration: 00:15 Additional activities</p> <p>Lecture: With-in and between designs Duration: 01:45 Lecture</p> <p>Brainstorming and group discussion of assignment Duration: 02:00 Additional activities</p>			<p>Quiz: design strategies 2 Online test Progressive assessment Presential Duration: 00:15</p> <p>Discussion of assignment: with-in and between designs Individual presentation Progressive assessment Presential Duration: 02:00</p>
7	<p>Quiz: With-in and between designs Duration: 00:15 Additional activities</p> <p>Lecture: Design trade-offs Duration: 01:45 Lecture</p> <p>Brainstorming and group discussion of assignment Duration: 02:00 Additional activities</p>			<p>Quiz: with-in and between designs Online test Progressive assessment Presential Duration: 00:15</p> <p>Discussion of assignment: design trade-offs Individual presentation Progressive assessment Presential Duration: 02:00</p>
8	<p>Quiz: design trade-offs Duration: 00:15 Additional activities</p> <p>Lecture: Threats to validity Duration: 01:45 Lecture</p> <p>Brainstorming and group discussion of assignment Duration: 01:45 Additional activities</p> <p>Quiz: Validity threats Duration: 00:15 Additional activities</p>			<p>Quiz: design trade-offs Online test Progressive assessment Presential Duration: 00:15</p> <p>Discussion of assignment: validity threats Individual presentation Progressive assessment Presential Duration: 01:45</p> <p>Quiz: validity threats Online test Progressive assessment Presential Duration: 00:15</p>
9				<p>Submission of assignment Individual work Progressive assessment Not Presential Duration: 20:00</p>
10				
11				
12				
13				
14				

15				
16				
17				<p>Re-submission of assignment Individual work Global examination Not Presential Duration: 00:00</p> <p>Quizzes Online test Global examination Presential Duration: 02:00</p>

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.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Discussion of assignment: what is an experiment	Individual presentation	Face-to-face	02:00	5%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
3	Quiz: what is an experiment	Online test	Face-to-face	00:15	3.6%	0 / 10	CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09 CB06 CB07
3	Discussion of assignment: basic elements of an experiment	Individual presentation	Face-to-face	02:00	5%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
4	Quiz: basic elements of an experiment	Online test	Face-to-face	00:15	3.6%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09

4	Discussion of assignment: design strategies 1	Individual presentation	Face-to-face	02:00	5%	0 / 10	CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
5	Quiz: design strategies 1	Online test	Face-to-face	00:15	3.5%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
5	Discussion of assignment: design strategies 2	Individual presentation	Face-to-face	02:00	5%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
6	Quiz: design strategies 2	Online test	Face-to-face	00:15	3.5%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
6	Discussion of assignment: with-in and between designs	Individual presentation	Face-to-face	02:00	5%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
7	Quiz: with-in and between designs	Online test	Face-to-face	00:15	3.6%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09

7	Discussion of assignment: design trade-offs	Individual presentation	Face-to-face	02:00	5%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
8	Quiz: design trade-offs	Online test	Face-to-face	00:15	3.6%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
8	Discussion of assignment: validity threats	Individual presentation	Face-to-face	01:45	5%	0 / 10	CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
8	Quiz: validity threats	Online test	Face-to-face	00:15	3.6%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09
9	Submission of assignment	Individual work	No Presential	20:00	40%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
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17	Re-submission of assignment	Individual work	No Presential	00:00	40%	0 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07
17	Quizzes	Online test	Face-to-face	02:00	25%	0 / 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	65%	5 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07 CE-CD07 CE-CD09

7.2. Assessment criteria

Progressive evaluation period:

- The final grade will be calculated using a weighted average as above.
- Discussions are non-recoverable.

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 the assignment and/or re-take the quizzes. It is not possible to submit the assignment or re-take the quizzes if there was no previous submission during the progressive evaluation period or if the quizzes have not been previously taken. In no case can assignments that have a score equal to or greater than 5 be re-submitted. The score for the discussion will be taken from the progressive evaluation period.

Extraordinary evaluation:

When the overall score obtained by the student in the global evaluation period is less than 5, the student will have to take an exam. After two submission attempts (during the progressive evaluation period and global evaluation), if a student has not been able to pass the course, it means that the assignments-based mode is not suitable for them. Therefore, a different evaluation method should be used. The score for the discussion will be taken from the progressive evaluation period.

8. Teaching resources

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	

9. Other information

9.1. Other information about the subject

The course implements the following innovative teaching methodology (<https://innovacioneducativa.upm.es/guias-pdi>) in order to motivate and reinforce student learning:

- **Project-based learning:** The course assessment includes the completion of a project related to the planning of a real experiment in the area of Software Engineering.