BM-LEARNING EXPERIENCE
IN CARRYING OUT FINAL DEGREE PROJECTS

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In this work we want to show the adaptations that we have introduced in the way of developing an educational innovation project entitled "Design and Participation in Engineering" (UPM IE1920: 5803) highlighting the activities carried out in the two areas indicated b-learning and m-learning.
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Keywords:

• Educational Innovation
• m-learning and b-learning
• Final Degree Project
• Design SPRINT
• Technology readiness levels
• Design Thinking
• Collaborative Learning
INTRODUCTION

Engineering education is changing very fast.

The exponential development of new technologies has caused traditional teaching to be increasingly inefficient in the training of engineers. The modern engineer is a member of the team specialized in a technical area who has to collaborate in developing solutions with other specialists.

Engineers have to find solutions quickly and efficiently in changing environments. The final degree project is the most useful tool available in current study plans to develop these skills.
INTRODUCTION

The development of the end-of-degree project has to integrate three skills:

• Develop innovative solutions by bringing together different people in different technical areas.

• Introduce work methodologies oriented to productivity in the society of the XXI century.

• Focus your work proposals on society, both by developing interesting proposals for social and economic agents and for entrepreneurship.
METHODOLOGY

Innovative Proposal:
A project has to be an innovative and creative solution in which several areas of engineering techniques participate.

Productivity-oriented work methods
Teams have to explicitly formalize work methodologies and guide activities to increase productivity and the use of communication technologies.

Proposals aimed at submitting to entrepreneurship programs
The proposals of the final degree projects must be interesting for society and be in a situation of application in the coming years
Final Degree Project (FGP)

The FGP is a tool that aims to prepare the new training methodologies in engineering, and in particular in civil engineering.

The FGP is a fundamental element is the way to assess the activities of the End of Degree Project.

The COVID10 pandemic that we are suffering is being an incentive to change our teaching practices immediately and an incentive to innovate in training processes.
Webinar

Webinars allow seminars and conferences on the topics to be held virtually and also allow them to be preserved on video & audio platforms as YouTube, Vimeo or ivoox.

These seminars will be talks and debates of about 20 minutes to introduce the status of a technological topic and the possible orientations of the work to be carried out.

The talks will have the objective of opening areas of work and collaboration between students and teachers.
Topics Webinar

• Motorization of vehicles. Thermal, electrical and hybrid systems
• Autonomous driving. Industrial environment and urban environment
• Hyperlight transport. Diversity of low impact mobility alternatives
• The drone revolution
• Artificial Intelligence and Deep Learning applied to Civil Engineering
• Environmental Monitoring. Low cost detection systems.
• Engineering with mobiles. Use of mobiles in engineering
TOOLS

The tools are divided into three groups:

• Communication tools

• Productivity Tools

• Dissemination and Participation Tools.
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Webinar
Design SPRINT

Design SPRINT are agile work models that allow teams to form and develop content quickly and aimed at collaboration. The typical steps for the Design SPRINT application are as follows:

- **Understand**: Explain the relationships, alternatives and conflicts that exist
- **Define**: Expose the strategies to be used to find solutions
- **Diverge**: Open a wide framework of options to solve the problem
- **Decide**: Select a solution and plan work milestones
- **Prototype**: Implement the proposed solution (level determined by the activity)
- **Document and Disseminate**: Generate technical documentation and public information for the dissemination of the project.
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Design sprint

1st day

1º morning
Discussion of the topics and choice of one

2º afternoon
Outlining the project

2nd day

3º morning
Decide on the general work plan

4º afternoon
Implement the basic elements of the proposal

3rd day

5º morning
Documentation of the activities carried out

6º afternoon
Exhibition
TRL Technology readiness levels

Tool to mark the milestones of the work and determine the results obtained in relation to those foreseen in the work plan.

TRL are a standardized procedure for analyzing the degree of development of a technology.

The application we are using is slightly modified to adapt it to our environment but it is similar to the one used in the framework of European projects.

The method consists of three divisions: Idea, Prototyping and Validation. Each of these divisions have some subdivisions that we have modified in the following way
TRL (Technology readiness levels)

**IDEA**

- TRL 0: Idea
- TRL 1: Formulation of an idea
- TRL 2: Description of technologies
- TRL 3: Operational planning

**PROTOTYPING**

- TRL 4: Basic functionalities
- TRL 5: Functionality tests
- TRL 6: Integration of components
- TRL 7: Validation in the laboratory

**VALIDATION**

- TRL 8: Minimum Viable Product Validation
- TRL 9: Real Environment Testing
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Design Thinking

Based on Stanford d.school Design Thinking Process (https://dschool.stanford.edu)
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Competición de Creación de Empresas UPM
(https://www.upm.es/Investigacion/innovacion/CreacionEmpresas/Servicios/Competicion_Creacion_Empresas)
Results:

• Educational Innovation

• Final Degree Project

• ActúaUPM
RESULTS

The expected results of this approach to the activity are those indicated in the introduction:

• Adaptation of teaching programs to the current socio-economic reality and in particular the final degree project as a tool for preparing for the reality of work.

• Introduce the most current work methodologies such as collaborative tools and productivity-oriented methodologies

• Assessment of the work through the dissemination and the social and economic impact of the projects.
CONCLUSIONS

This project is an experience of educational innovation developed within the framework of the activities of the Polytechnic University of Madrid.

The main idea is the collaboration between different disciplines of engineering to develop activities with greater added value both for students who must get used to using more current tools and methodologies and for the society that offers projects more adapted to social needs and economical.

The project is integrated with another UPM activity which is the ActúaUPM entrepreneurship program and favors the creation of externalities of high educational and social value.
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questions
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THANK YOU

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