

ADAPTATION OF A PROJECT OF TEACHING INNOVATION IN THE SUBJECT OF STATISTICS IN THE DEGREE OF AEROSPACE ENGINEERING IN TIMES OF COVID-19

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Abstract

The rapid spread of the SARSCoV-2 virus (COVID-19) in Spain caused a general lockdown of the population at home for 44 days. Due to this, lecturers had to design new learning strategies, adapted to the general lockdown, to deliver content and learning materials. The goal of this work is to describe and analyze the adaptation carried out in a teaching innovation project at the Statistics course at BSc. in Aerospace Engineering. The project involves students participating in project-based learning. The adaptation of the project-based learning activity aimed to tackle the obstacles and particularities of the lockdown period. A total of 118 students participated in the activities, with all of them positively evaluating the experience and adaptation carried out. 92.6% of the students considered that, after participating in the project, they improved their critical thinking and creativity. In addition, 88.8% suggested that their innovation skills improved. Overall, the students showed a high degree of engagement and motivation.

Keywords: Statistics, Innovation, project-based learning, aerospace engineering, COVID-19.

1 INTRODUCTION

The rapid spread of the SARSCoV-2 virus (COVID-19) in Spain caused the government to confine the population at home for 44 days. This official decree came into force at 00:00 hours on Sunday, March 13, and it was lightened as of April 28, when the plan to deconfine the citizens in four phases was announced.

During the lockdown, all of the educational institutions were forced to close, with face-to-face teaching being replaced with pure online teaching. Therefore, lecturers had to design new learning strategies to deliver contents online, as well as to adapt to the new general reality. This fact increased stress for many higher education lecturers to a high degree, while it was an opportunity to innovate the teaching-learning methodology for others.

This work aims to describe and analyze the adaptation of a teaching innovation project that involves project-based learning for a second-year course on Statistics for Aerospace Engineering students. More specifically, we study how the adaptation contributed to stimulate the learning process and the degree of engagement and participation of students, as well as to enhance the development of some general competencies such as creativity, critical thinking, and innovation.

2 METHODOLOGY

2.1 Course description

This research was carried out in a second-year course on Statistics that is taught as part of the BSc. in Aerospace Engineering syllabus at Universitat Politècnica de València. Particularly, the course took place between the end of January and late June during 2020.

2.2 Participants description

A total of 118 second-year students participated in the project activity. All of them participated as part of their involvement in the Statistics course.

2.3 Adaptation of the project-based activity

The project is structured into 5 laboratory sessions of two hours, as indicated in Table 1. Each session takes place after the concepts have been developed in the traditional lectures, and the understanding of general methods and concepts have been strengthened in the laboratories.

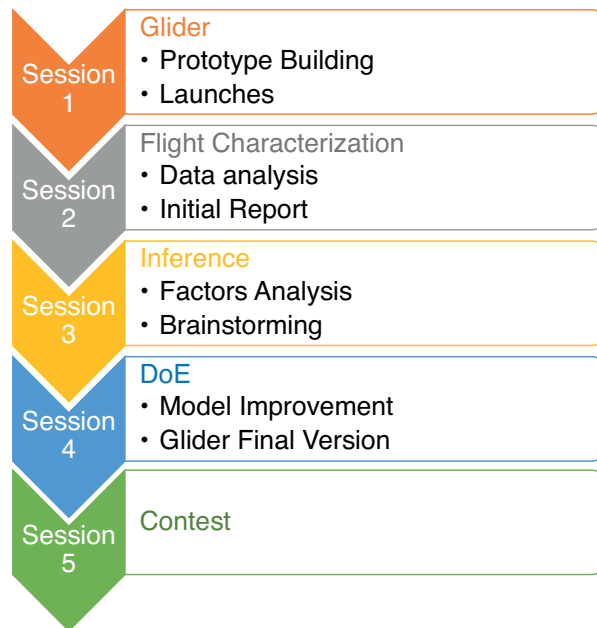


Figure 1. Structure of the project schedule.

The goal of the project-based activity is designing and building a cardboard/paper helicopter using some statistical tools delivered in the course, such as descriptive statistics, probability distributions, ANOVA, linear regression, and design of experiments. The students start from a shared prototype design, and then they work as a team to improve their designs through the aforementioned tools.

The adaptations carried out to the project-based activity due to the general lockdown period are described in Table 1.

Table 1. Changes produced in the teaching innovation project by COVID 19.

PLANNING BEFORE COVID	COVID ADAPTATION
Project development: Face-to-face	Project development: Microsoft Teams
Initial and final prototype: airplane	Initial and final prototype: helicopter
Methodology: Project-based Learning. Collaborative work	Methodology: Project-based Learning. Individual and collaborative work
Materials: Cardboard, adhesive tape, wood sticks, scissors, rulers	Materials: A4 paper sheets, scissors, rulers, and paperclip
Variables to improve: flight time and distance	Variables to improve: flight time
Final competition site: The faculty school	Final competition site: Microsoft Teams

As part of the final competition, lecturers measured the flight time of the prototypes using the streaming services provided in Microsoft Teams. Figure 2 shows the initial helicopter design that was provided to students for improvement.

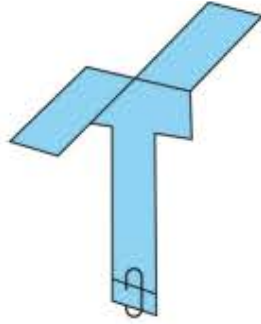


Figure 2. Initial helicopter design built by students.

2.4 Learning objectives

The general learning objectives set for the teaching innovation project were motivating and stimulating learning at the Statistics course, as well as acknowledging the importance of statistics in engineering degrees. These general learning objectives were refined into the following and more specific

- 1 Promote students' participation and engagement.
- 2 Initiate students into academic research.
- 3 Promote critical thinking.
- 4 Developing creativity and innovation
- 5 Enhance the use of new technologies as learning tools.

2.5 Results and analysis

A Google Form questionnaire was delivered to students to assess if the objectives set had been accomplished.

The FINCODA survey assessment tool was employed to assess to what degree the project-based activity had contributed to develop the general competencies of innovation, creativity, and critical thinking. Each question in the survey is built upon a 6 items Likert scale: *it worsened, it is the same as initially, it improved but just a little, it somewhat improved, it notably improved, it greatly improved* (i.e., *ha empeorado, es más o menos la misma que al principio, ha mejorado pero muy poco, ha mejorado algo, ha mejorado bastante, ha mejorado mucho*).

Apart from this, the degree of contribution and implication in the work carried out, the contribution of the project to the acquisition of statistical concepts, the degree of engagement, and the degree of satisfaction with the marks achieved in the project, and the degree of motivation of the students was recorded as part of the study. Finally, students assigned a numerical mark to the project activity, and they proposed ways to improve for future editions. Microsoft Excel was employed for the analysis of collected data.

3 RESULTS

3.1 Student satisfaction with the adaptation carried out

A 5-point Likert scale was employed to measure student satisfaction concerning the adaptation implemented to the project-based activity. No student was dissatisfied with the adaptations carried out. 59.3% of the students suggested that the adaptation was excellent, 29.8% that it was a good adaptation, and only 11.1% remained neutral. Most of the numerical marks assigned by students to the project-based activity ranged from 8 to 10.

3.2 Contribution to the development of general competencies

The analysis carried out on the FINCODA assessment tool suggested that 92.6% of the students perceived an improvement in their creativity and critical thinking, while 88.8% suggested that it also improved their innovation skills (see Figure 3).

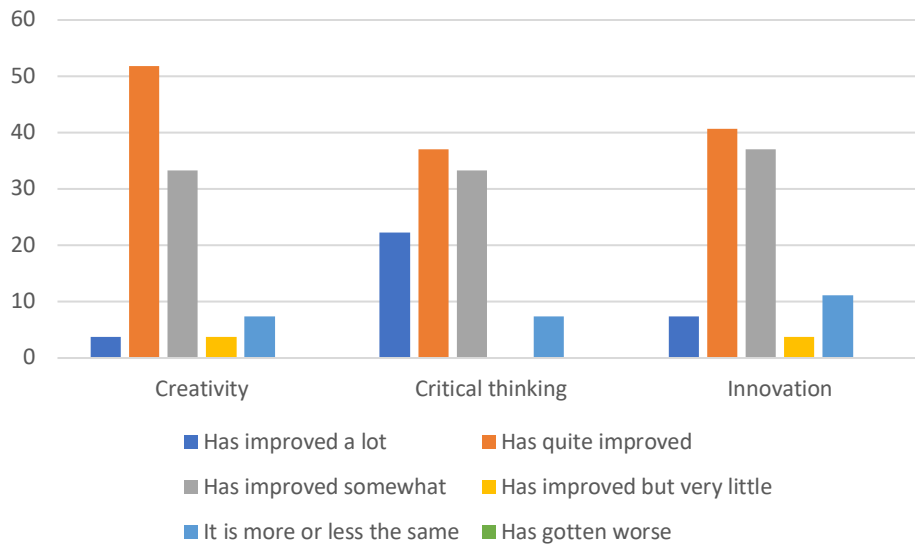


Figure 3. Contribution of the project-based activity to the development of general competencies.

All of the students (100%) acknowledged that the development of the project had helped them to better understand the importance of statistics in Aerospace Engineering. In addition to this, all of them also acknowledged that the project helped to better understand the concepts delivered in lectures and laboratories.

3.3 Degree of engagement and implication

To evaluate the degree of engagement and implication of students in the project work, students had to choose among a 5 point scale: *None, Low, Average, High, Very High* (i.e., *ninguno, bajo, medio, alto, muy alto*). 92.5% of the students chose the last two options when the degree of implication of students with the project activity was analyzed. Similarly, 100% of the students chose the last two options when describing their degree of motivation.

4 CONCLUSIONS

The SARS-CoV-2 (COVID-19) pandemic has allowed exploring and developing new teaching and learning methodologies in higher education. In this article, we have shown how the adaptation of a project-based learning activity to COVID-19 contributed to several desirable aspects despite the lockdown. These aspects include aspects such as students' engagement, motivation, satisfaction, and the development of general competencies such as creativity, innovation, and critical thinking. The results suggest that a positive impact was achieved on students and their learning.

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