

Space Race: An Interactive Digital Tool in the Classroom. Are You Ready? †

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Abstract: This document presents an interdisciplinary teaching experience based on Game-based Learning as an educational methodology complementary to the Flipped Classroom pedagogical approach in higher education. The tool used was the Space Race application integrated into the free Socrative software. A more active and meaningful learning has been promoted in the student with its implementation. Likewise, it has allowed the face-to-face classes to be energized, creating a relaxed atmosphere. The reflective and critical use of technological applications and mobile devices in the classroom has also been encouraged. The use of the Space Race has increased the participation of students in the classroom, their motivation and interest, collaborating in the development of skills and abilities. This tool has been very useful to obtain bidirectional teacher-student feedback in real time. As a result, a more cooperative, reflective and meaningful learning has been obtained.

Keywords: Space Race; blended-learning; game based-learning; gamification; Flipped Classroom; e-learning 2.0; smartphone; tablet; mobile devices; Socrative

1. Introduction

At present, new pedagogical approaches much more interactive have been integrated within the framework of Higher Education. In general, these approaches are associated with the use of mobile devices (smartphone and tablet) in the classroom, along with ICT tools and powerful applications that facilitate the development of the teaching strategy [1]. They allow incorporating to formal learning in the classroom 2.0 e-learning systems based on the theory of “connectivism” learning [2]; considered as informal learning in which interaction with other people enables many facets of life. These educational resources improve the progress of the different academic tasks of the students facilitating active-collaborative work. As a result, a more cooperative, reflective and meaningful learning is obtained. All these technologies also allow the integration of playful elements in the course of the teaching sessions. This educational trend is known as *Game-based Learning*. This type of learning activities increases the participation of students, promote their interactivity and competitiveness, facilitating the acquisition of knowledge in a fun and motivating way, creating a positive experience in the student [3,4]. All this favors the personalized attention of the student, the resolution of problems in groups, collaborative and cooperative methodologies in class and those based on projects. Definitively the teaching focused on the students (Problem-based Learning, Simulation-based Learning, Puzzle-based Learning, Blended-Learning, ...). Mobile devices have allowed access to multiple free digital applications facilitating the construction of knowledge and the acquisition of

skills and abilities very valued in the labor market. This document presents the Space Race tool and its use within the university classroom.

The main objective of the use of Space Race in the classroom is to enhance students' motivation, participation, and learning by incorporating gamification as an active complementary methodology in the university classroom. Other specific objectives are: dynamize the teaching-learning process by integrating technology and web tools that promote more active and meaningful learning in the classroom work; discuss and review on blended, flipped and cooperative teaching in line with *Game-based Learning*; integrate new active models as a complement to the *Flipped Classroom* pedagogical approach, enhance the reflexive and critical use of technological applications and mobile devices in the classroom, etc.

2. Materials and Methods

The Space Race resource used in the classroom is available within the Socrative digital teaching application. Socrative is an intelligent response system where the teacher can perform questions, contests and games, to which students can respond in real time from their mobile devices. Student responses are projected instantaneously on our device. Students can leave feedback on the activity by using the Exit Ticket resource [5,6]. The Space Race option allows incorporating gamification in the classroom, see Figure 1. This activity shows a diagram with the synchronized progress of an icon (rocket, spacecraft, bear, bicycle, etc.). For each correct answer the icon advances a position. In this way the students can verify their progress [3].

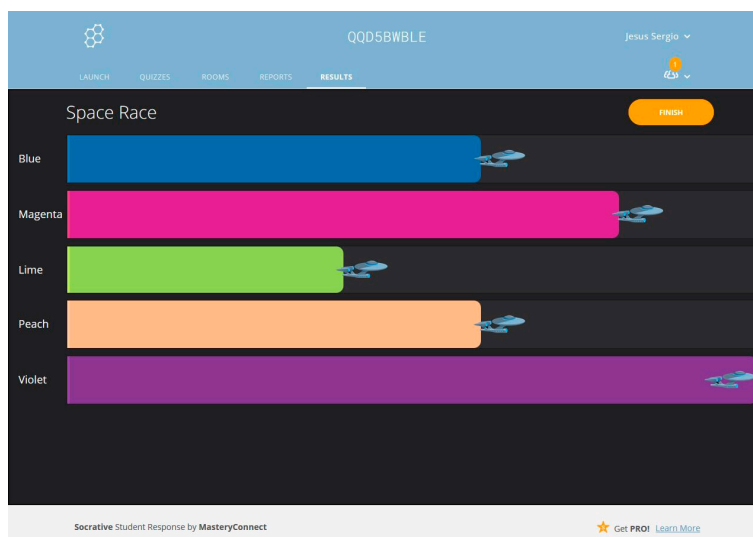


Figure 1. Use of the Space Race resource in the university classroom. Space Race competition developed through the Socrative application. This time the software assigns a different color to each team.

In order to obtain a plural information, we have approached the study of its use from an interdisciplinary perspective by teachers belonging to different areas of knowledge; specifically Engineering and Biomedicine from the academic year 2015–16 to the present at the University of Zaragoza. In both cases, Space Race has been used according to different methodological approaches. Sometimes students have participated individually and other times in groups. It has been tried to use to encourage the use of this tool in the classroom with a critical, reflective and ludic spirit. The proposal in this experience has been the use of the Space Race resource to support the implementation of the Game-based Learning (Gamification) strategy complementary to the pedagogical approach Flipped Classroom.

3. Results

The analysis of the use of Space Race resource reveals that:

- Facilitates the resolution of doubts about the assigned tasks that have been developed independently by the students outside the classroom according to the Flipped Classroom model.
- Allows monitoring the subject (student feedback), as well as the evolution of the teaching-learning process. Reveals those more difficult aspects for students. We can highlight concepts.
- Facilitates the continuous assessment and the verification of the progress of the students with respect to the subject.
- Gives fast and immediate information transmission through a game of competition. A lot of time is saved in the transmission of information in favor of personalized attention of the students.
- The dynamics generated in class invites the debate. In this way the face-to-face class goes from passive reception to active participation.

As a disadvantage we can point out that:

- The free version of the application does not allow to configure punctuation options or the time assigned to each question. You can only observe the relative position of the participants with the rest of the adversaries (Figure 1), so it is not suitable as an assessment system in real time.
- The tool allows students/groups to choose a specific color for their own equipment or it can be randomly assigned. This last option can falsify the results
- Mobile devices or the network itself can affect its effectiveness as assessment system.
- The free version only allows to compete between 20 students/groups, which is a limitation.

The impact caused to students has been evaluated through different qualitative surveys focused on the teaching methodology. Likert scale has been used. Some of the results obtained are shown in Table 1. There is not much difference in student outcomes for different applied contexts. An 83.33% of the students of the Design and Control of Power Converters course (Engineering Degree), ensure that the activities and academic tasks developed in the classroom are useful and effective. They also indicate that the use of the Space Race tool has allowed to acquire and assimilate the different concepts. Likewise, 91.67% of the students consider that the previous material provided by the teacher has been very helpful. More than 75% of students of Ocular Anatomy and Histology (Optical-Optometry Degree) considered that the Space Race is quite or very useful as a learning resource. It is clear that the new model provides more meaningful learning and its success is no coincidence.

Table 1. Analysis of the impact of ICT tools in the university classroom. Results of the student satisfaction survey, Likert scale: rating 1–7.

	Engineering Degree. Master in Renewable Energy	Optics and Optometry Degree
Learning is easier using ICT	6.0714	5.3265
I like to use ICT in class	6.5714	5.9184
Using applications/ICT generates a lot of stress	1.3571	1.7959
It is easy to learn to use these TIC's	6.4286	6.2857

4. Discussion

The experience is based on a research-action process in teaching staff; fostering collaborative work among the teachers involved. This implies a constant process of common reflection in continuous cycles of planning, implementation, analysis and reprogramming, as well as a complete evaluation process of the whole experience and review of the results. In both areas, the Flipped Classroom model is encouraged. This practice supposes a basic dynamic: the student works at home on content, exercises or any material that the teacher considers useful for later in the classroom to carry out activities that allow a discussion, clarification, assimilation and extension of such contents

[7]. Space Races has been used to dynamize classroom activities in the pedagogical approach Flipped Classroom. It is expected that the incorporation of Gamification (*Game-Based Learning*) as an active complementary methodology in the university classroom will provide a more active and interactive learning, and will increase the involvement, participation and motivation [8].

5. Conclusions

This document has presented an interdisciplinary teaching experience in Higher Education which has consisted of using the Space Race tool in different contexts. The *Space Race* application is a teaching resource that facilitates the implementation of the *Flipped Classroom* methodology. This tool has allowed to check the autonomous work done by the student inside and outside the classroom. It has also made it possible to dynamize the classroom sessions. At the same time a more active, critical and reflective learning has been promoted in the student. The interactive tool has been useful to structure and integrate the concepts and contents. In this way it has been possible to supervise the assimilation of concepts in real time. The development of competences, abilities and skills in students has also been improved. It has made possible to detect conceptual errors or dark points of the teaching disciplines. On the other hand, it presents a clear stimulating component, motivating and in certain playful conditions. The use of this tool as an evaluation system has presented small drawbacks and certain limitations. The experience shown here has been economically sustainable, efficient and transferable to other subjects, knowledge disciplines and degrees. Since the software used is free and the mobile devices used are the personal devices of students and teachers.

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