INCLUSION OF THE "ESCAPE ROOM" EXPERIENCE AS A LEARNING METHODOLOGY IN LABORATORY PRACTICES

L. Quiles-Carrillo[1], E. Rayón[2], D. Garcia-Sanoguera[3], A. Calderón-Rodríguez[4], S. Rojas-Lema[5], O. Fenollar[6]*

[1] Dr. Grupo de Innovación de Prácticas Académicas, Universitat Politècnica de València, SPAIN
[2] Dr. Grupo de Innovación de Prácticas Académicas, Universitat Politècnica de València, SPAIN
[3] Dr. Grupo de Innovación de Prácticas Académicas, Universitat Politècnica de València, SPAIN
[4] Ms. Universidad de Alicante, SPAIN
[5] Ms. Grupo de Innovación de Prácticas Académicas, Universitat Politècnica de València, SPAIN
[6] Dr. Grupo de Innovación de Prácticas Académicas, Universitat Politècnica de València, SPAIN
*Corresponding author

Abstract

The implementation of these new methodologies in the field of laboratory practices is capable of attracting the attention of students, generating a great educational advantage. In this context, the authors have incorporated the escape room into the laboratory practices of a fourth-year subject of the mechanical engineering degree as a new methodology capable of improving the knowledge and curiosity of undergraduates. With this methodology, we obtain an improvement in the student's performance and involvement. In this sense, the final objective of the escape room has been modified, which is based on leaving a room from a series of tracks and challenges, in order to adapt it to laboratory practices. Following the dynamics of the search for clues and the use of logic to solve different challenges and problems, the students instead of leaving a room are able to complete the final report of the practices. During this process, students dynamically complete the contents of each practice by following different tracks, challenges and games, which provide them with the necessary information to move forward and effectively learn the most relevant knowledge.

The inclusion of these methodologies in laboratory practices has been progressively developed with the aim of analysing behaviour and opinion, as well as the results obtained by the students. The results obtained verify that these types of techniques are suitable for the incorporation of a greater number of transversal competences in the classrooms, directly improving the quality of learning in the classrooms and, consequently, the training of better professionals.

The incorporation of the escape room as a methodology within the formation of laboratory practices, allows undergraduates to learn in a dynamic and autonomous way the main concepts. This allows them to participate in their learning process, generating better feedback between their peers and the teacher. This experience provides applicable information in the teaching and learning processes that are developed in any university specialty. Student satisfaction and results have been evaluated in relation to the new method, obtaining good results and generating a significant improvement in the same reports with respect to previous years.

Keywords: Escape room, innovation, new methodologies, student motivation.

1 INTRODUCTION

For centuries, university studies have given human beings the ability to increase their knowledge in a specific area, in addition to developing certain innate skills such as the ability to think and reason. Nowadays, this type of studies must be able to give each individual the necessary tools to go out to the labour market with the greatest possible preparation, both from the technical point of view and from the point of view of social skills and leadership.

Conventional techniques such as master classes or classical laboratory practices provide a great deal of theoretical knowledge, but they are moving further and further away from students and new educational techniques. In this field, the aim is to use new techniques capable of attracting the attention of students, to improve knowledge, participation, decision-making or leadership, from an entertaining and dynamic point of view. In order to achieve this change, we intend to introduce a new technique such as the escape room within the laboratory practices with the aim of improving the retention of knowledge of students, in a dynamic and innovative way. Some authors as Montanes et. al (Montañés Muñoz, Balart, Sánchez Nacher, Quiles Carrillo, & Fombuena, 2017) have already commented in some occasions that “It is essential to replace the classical teaching systems with new educational practices in which the student body is not merely a receiver of the information and data presented by the teaching staff, but an active agent that intervenes in its own teaching-learning process.”. In this context, we intend to use the famous escapes rooms in order to adapt them to laboratory practices and thus work with new and innovative methodologies.

An "escape room" is a game experience where a group of people are challenged to leave a room by searching for clues, using reason and working as a team. By combining these three premises, each team focuses on reaching the end of its objective, which in the case of a traditional escape room, is the search for the key to leave the room. In academia, this process can be used to bring a wide range of possibilities and benefits. This experience can be part of a classroom management strategy in different ways, so much so that some consider it part of game based learning and others an experience of gamification due to elements such as autonomy, feedback or narrative. Other authors have also commented that the use of the escape room is a teaching/learning strategy to improve student learning as they work together to solve different problems and puzzles in order to reach a common goal. This practical approach to team learning requires the participation of students in a preset setting, promotes communication and collaboration among them, and uses critical thinking to solve a problem (Hermanns et al., 2017).

It is currently beginning to be implemented in the field of medicine, nursing and pharmacy. (Gómez-Urquiza et al., 2019; Kinio, Dufresne, Brandys, & Jetty, 2017) and in a computer science(Borrego, Fernández, Blanes, & Robles, 2017) with very good results. In this sense, authors as Eukel et al. (Eukel, Frenzel, & Cernusca, 2017) have incorporated educational games as an escape room to increase the knowledge of students in the pharmacy grade.. In this sense, these authors showed significant increases in knowledge of the students after the application of these type of methodology. In this context, statically significant result proved that this methodology offers a potential instructional benefit beyond its novelty. In this case, it is intended to directly apply the learning methodology based on the escape room in the laboratory practices of the engineering degree, to analyze how this type of students respond to this new trend.

At this point, it is increasingly appropriate to replace classical teaching models with the aim of enabling students to feel more integrated in their learning. This improvement in learning, generates the training of better professionals, able to return to society all the knowledge and values learned.

Therefore, it is intended to use this methodology to train students with a greater understanding of knowledge, able to think for themselves and with great teamwork capabilities, all from an ascending dynamic that makes them go further and further in their own knowledge in a very dynamic way. The application of these methodologies in laboratory practices is a great starting point for the improvement of one of the most important parts in all types of engineering, as it happens in medicine or nursing.

2 PRIMARY AIM

The incorporation of the escape room within the laboratory practices has as main objective to modify the dynamics and the method of teaching of the students. With this gamma-based methodology, students are able to dynamically solve the main problems derived from each practice, solving in a coordinated and cooperative way different puzzles that bring them closer with each step to the final objective of each laboratory practice. This process is accompanied by the direct supervision of the teacher and the help of different clues that facilitate the steps to be followed by each student. The incorporation of this type of

methodology allows the students' attention to be drawn, since it is based on a logical and dynamic game, generating a direct improvement in the interest and assimilated concepts.

From the incorporation of the escape room as a learning methodology, students are able to understand and analyse in greater depth the objective of each laboratory practice, obtaining a much more applied knowledge and favouring the transversal competences that are evaluated in the Universitat Politècnica de Valéncia (UPV). As mentioned above, within the Universitat Politècnica de València (UPV) there is a project aimed at orienting teaching practices towards higher education based on competences, in which 13 transversal competences have been established. Some of the transversal competences that are worked with this type of methodology are:

- Teamwork and leadership.
- Effective communication.
- Permanent learning.
- Understanding and integration.
- Time planning and management
- Application and critical thinking.
- Problem analysis and resolution.

This type of dynamic is capable of encouraging students to develop certain skills such as teamwork, problem analysis and resolution, leadership, collaboration and improved time management. All this so that the student works and improves the competences in a direct way trying to comply the objectives of the UPV and also serves as a real model when working in a real company.

The methodology to work and the steps to follow are approached from the beginning of the practices, where the teacher is in charge of explaining the operation and the details of all the tests and machinery. As the internships progress, students will become more capable of performing the internships autonomously in order to finally complete the objectives set, both individually and collectively.

3 METHODOLOGY

For the application of the methodology based on escape room in laboratory practices, it has been used the basis of operation of track location, puzzle solving and generation of ideas for their adaptation and implementation as a learning methodology. This type of methodology is designed to be applied on concepts and procedures difficult to understand by students with traditional processes, generating a dynamic and fun procedure.

For a correct learning process, it is intended to make a guide from clues so that students both individually and collectively move forward and learning step by step.

The practice in question is divided into different stations where each group must arrive preceded by the previous track. In each station, students can find puzzles, clues or ideas, each of them being different for the development of the methodology. The role of each of these stations is briefly explained below:

- **Puzzles:** These stations in laboratory practices focus on solving a problem related to the subject matter of the practice. In this station, it is intended that students are able to obtain from logic a value or relevant knowledge to complete the practice and continue with the methodology.
- **Clues:** In these stations, students can use the information obtained in the puzzles to obtain relevant knowledge from a series of clues that are included in each station.
- **Idea:** The stations known as "idea", are extra knowledge where hypotheses are raised for students to debate among themselves on a series of knowledge very related to practice. These types of stations do not have obligatory information for the continuity of the methodology, but give a very relevant help to improve their knowledge about the practice. Figure 1 shows the example of an idea station.

Figure 1: Checkpoint with idea on laboratory equipment.

Once the practice begins, each group of students is provided with a game script, which allows them to easily move between clues, which give them valuable information about the practice and the next procedure. From this point on, the students must be able to work and collaborate in a group in order to advance through the escape room. Keep in mind that, within each group, students must coordinate and organize themselves to perform different tasks and offer the group different points of view and concerns, which are vitally important to understand each season of the game and move on to the next.

Figure 2 shows an example of one of the first locations of a checkpoint, where students can collect the clue, read the information, and work to decipher the problem or puzzle that will lead them to the next one.

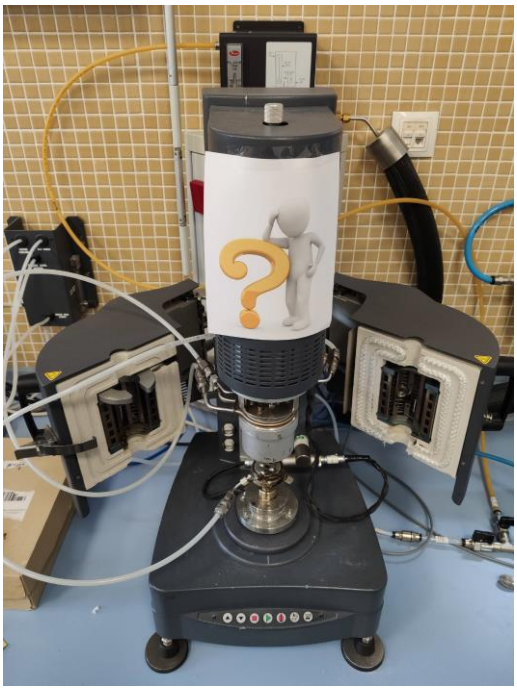

Figure 2: Control point with track on an oscillating rheometer.

Students can always ask the teacher for extra clues if they cannot continue or do not understand any of the problems or puzzles. All students can get the highest score at the end of the practice, but as a motivation,

the group that has required the least number of clues to complete the whole process and has reached the final goal of practice with the least number of clues from the teacher, gets an extra reward. In this way it is intended that students maintain an interest in the process of searching for clues and solving problems, always from a dynamic and educational perspective.

The most relevant thing when implementing this type of methodology is to get students to participate and collaborate with each other with the aim of creating a dynamic environment. Once they begin to work together and carry out the search and practice, the teacher, not having to worry about exposing the theoretical content, can assist each of the students in a more personal way and receive comments on how they progress in learning the contents of the subject. Likewise, due to the large number of students who currently suffer from some subjects, this type of methodology can offer a more direct treatment to students.

4 RESULTS

Due to the fact that it is a new implantation methodology, the quantitative data of the grades obtained by the students have not yet been compiled due to the fact that there are no definitive acts as of December 2019. For this reason, in order to evaluate the suitability of the technique, a qualitative survey has been carried out on the students who have participated during the implementation and carrying out of the practices with this technique.

In general, the evaluation obtained by the students has been very positive. During the development of the internships, a notable increase in the interest and motivation of the students has been observed. In addition to a better understanding on the part of the students of abstract concepts that with the previous methodology were difficult to assimilate.

As mentioned above, a qualitative opinion and real satisfaction survey was carried out on the implementation and final evaluations of this type of technique. The results appear in Table 1. A total of 28 students participated in the survey and were asked the following questions:

- Question 1: Did you find this work methodology interesting?
- Question 2: Would you like to have more subjects with this method?
- Question 3: Has it been difficult for you to make the reports with this technique?
- Question 4: Would you prefer to work individually on this methodology?
- Question 5: Do you think you have learned more knowledge than in conventional practice?
- Question 6: Are you bored with this methodology?
- Question 7: From 1 to 10, what grade do you give to the practices of the subject with this methodology?

Table 1. Survey values

	YES	**NO**
Question 1	94%	6%
Question 2	90%	10%
Question 3	89%	11%
Question 4	14%	86%
Question 5	88%	12%
Question 6	4%	96%
Question 7	Overall average: 8.9	

The qualitative data obtained reveal a high level of student satisfaction, both from the point of view of interest in the subject and an improvement in the possible knowledge acquired. Students have given this type of methodology an 8.9 out of 10 in their first year of implementation, which is a very good starting point for improvement in the following years.

In order to carry out a more exhaustive analysis, the improvement in the acquisition of knowledge and skills of the students will be reflected in the continuation of the subject in the following year, where it will be possible to analyse in greater depth the retention of concepts and procedures explained the previous year in a much more fluid way. In addition, it will be possible to quantitatively compare the results obtained by the students with those of previous years.

5 CONCLUSIONS

The incorporation of the escape room as a gamma-based methodology offers a number of benefits to the students' learning process. The results obtained from the incorporation of this methodology in the laboratory practices have been very positive both from an academic point of view and in the improvement of the student's satisfaction in relation to the subject.

In this context, the implementation of techniques that make students an active part of the learning process directly favours an improvement in the student's attitude and the reinforcement of transversal competences. In addition, thanks to this type of learning process, creativity, teamwork and self-sufficiency are encouraged in a very positive way, forming professionals capable of performing independently in any position.

In particular, the application of the escape room as a new methodology in this type of practice, provides some advantages to take into account when attracting the attention of students, improving the knowledge acquired and being a starting point for further innovation in relation to teaching practices.

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