NURSING ESCAPE ROOM UAH: MOTIVATION TO LEARN IN THE BIOCHEMISTRY LABORATORY

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Abstract

In recent years, Escape Room-type games have gained popularity as a way to motivate students to become more actively involved in their learning. The overall objective of the proposed activity is to promote students' intrinsic motivation and, in turn, meaningful learning. For this purpose, we implemented the game in our laboratories. The first year students of the degree in Nursing participated in the *Nursing Escape Room UAH*. We chose a situation reviewed in the theoretical-practical contents of the Biochemistry subject they were studying. Our aim was to achieve significant learning through overcoming challenges and collaborative work. After the implementation of the activity, we assessed it. The participating students felt that the activity: i) had helped them to learn and understand the subject; ii) had been a fun and different experience when it came to understanding the content; iii) had been a motivating experience; and iv) they liked the fact that it was carried out in a team. In addition, these students obtained a higher average score and pass rate on the learning assessment test than those who had not participated in the game. The instructors involved also highlighted that the activity was a motivating and different way of learning and recommended its continuation. Altogether, we can conclude that the *Nursing Escape Room UAH* game has been a motivating experience in the Biochemistry laboratory for both students and instructors. We anticipate that the activity may improve the quality of the teaching-learning process.

Keywords: Biochemistry, Nursing, gamification, Escape Room, challenge-based learning.

1 INTRODUCTION

Motivation is a very important aspect of a student's performance. The main characteristics of motivation include the existence of a goal, personal initiative and affective-emotional load [1]. The type of motivation we intend to foster intrinsic motivation, which is closely linked to the concept of learning-centered goals and objectives.

One of the aspects that best captures the interest of students, while at the same time among the most neglected one, is the possibility of favouring experiences with the practical application of what is to be learnt. Promoting interrelation and involvement with reality is one of the most motivating elements [2-3]. For this purpose, experiences have been described that include gamification in the teaching-learning process of undergraduates [4-6]. Escape Room-type games have been shown to: i) motivate students to be actively involved in their learning and ii) allow the instructor to witness the process of reasoning and deduction employed by the students, which is of enormous value in the instructor's approach to teaching [5,6].

The overall objective of the proposed activity is to promote students' intrinsic motivation, reasoning, collaborative work and self-learning. In this sense, we are more specifically committed to the implementation of Escape Room-type games in Biochemistry laboratories.

2 METHODOLOGY

The activity was carried out by half of the Biochemistry students of the first year of the Nursing Degree at the UAH (n = 47), at the end of the practical period. The competition was among six teams, three of them (blue, yellow or blue) sharing each laboratory space. The scenario chosen for the *Nursing Escape Room UAH* was to solve a limit situation related to a health problem currently widespread in society, diabetes, establishing a maximum reference time for its completion. After the first test, the teams received the "escape kit" or box with different elements (ultraviolet light torch, red gel filter, symbol code, mirrors, etc.) that accompanied them throughout the activity. Each team was assigned an instructor who monitored the correct performance of the tests and wrote down time penalties if there were errors in

their execution or if they needed extra help to pass a test (Fig. 1). The team that managed to pass all the tests in the shortest time was the winning team.

Clues	Challenges	Features	Observations
#0	Scenario	Key in wooden magic box on a shelf of each table. Success: Unlock small lock. Pick up envelope with clue #1	
#1	Answer question Test Couple #1-Communication	Envelope placed in the white box (escape room kit) of each team. Test performance. Success: Teacher gives envelope with clue #2.	
#2	Answer question Find clue	Cold chamber envelopes. Choose the right method. Success: Envelope with clue #3 and puzzle piece (#6)	
#3	Find clue	Types of samples in white box. Success: Envelope with track #4 placed in side rack.	Make a change of Serum and Haemolysate tubes. Place on a shelf so that they do not notice the change.
#4	Test Couple #2-Manual dexterity	Pipette coded volumes. Success: Envelope with clue #5 and puzzle piece (#1) placed near pipette holders.	
#5	Find clue Test Couple #3-Calculation	Glucose determination apparatus (λ = 505 nm). Calculation of glucose concentration. Success: Envelope with clue #6 and puzzle piece (5) in locker with large padlock.	
#6	Answer question Find clue	Parameter in invisible ink. Types of samples on shelf (*) Success: Envelope with clue #7 and puzzle piece (#3) held by Luis, the lab technician.	Make a change of Serum and Haemolysate tubes. Place on a shelf so that they do not notice the change.
#7	Answer question Test Couple #4-Communication	Mirror image technique. Explanation of rationale. Success: Teacher will give the envelope with clue #8.	
#8	Find clue Test Couple #5-Calculation	Glycated Hb determination apparatus (λ = 415 nm). Calculation of % HbA1c. Success: Envelope with clue #9 and puzzle piece (#2) in the corresponding spectrophotometer.	
#9	Answer question Find clue	Visible parameter with transparent red gel filter. Types of samples on shelf (*) Success: Instructor will give envelope with clue #10 and puzzle piece (#8).	
#10	Test Couple #6-Communication	Explanation rationale. Success: Envelope with clue #11 and puzzle piece (#4) placed under test strip canister.	
#11	Test Couple #7-Calculation	Calculation. Success: Envelope with clue #12 and puzzle piece (#9) placed in laboratory bell.	
#12	Find clue	Parameter value in invisible ink. Success: Envelope with clue #13 and puzzle piece (#7) placed in bottle of distilled H_2O.	
#13	Test Couple #8-Communication Solve puzzle	Assemble the complete puzzle. Conclusion. Success: Teacher will give a key to a safe.	

Figure 1. Table summarising the challenges, their characteristics and observations to be taken into account. The challenges were related to the scenario (#0), glucose determination (#1-#5), assessment of glycated haemoglobin (#6-#8), assessment of ketone bodies (#9-#12) and the integration of them all (#13).

3 RESULTS

During the course of the *Nursing Escape Room UAH*, the instructors noticed that the students approached the tests (connecting clues and solving puzzles) with enthusiasm and great excitement. We observed: i) how they worked collaboratively, deepening the training of critical thinking; and ii) how they analysed, related and applied the concepts of Biochemistry to a real situation, in order to solve the challenges presented. We thought it paramount to perceive the process of reflection and discussion that they displayed. So we could better appreciate their weakness and strengths and, consequently, we will able to improve the teaching-learning process. Thus, we verified, for example, the difficulties and conceptual errors that they presented when performing the corresponding calculations for the preparation of solutions.

3.1 Assessment of the activity

Students and instructors carried out the evaluation of the activity. We prepared a Google form with different aspects listed in Table 1.

Table 1. Aspects to be valued (on a Likert-type scale) by the students and instructors.

The activity and …
The understanding of the subject matter
A different way of understanding content
A motivational experience
The adequacy of the time in which it is performed
The degree of difficulty
Team work
Study and review of contents
Recommendations for its further implementation

In addition, in this form we were interested in finding out what they considered the best and what aspects of the activity could be improved.

3.1.1 Evaluation of the activity by the students

The responses of the students who participated in the activity are shown in Fig. 2. Most of the students felt that the *Nursing Escape Room* had helped them understand the contents of the subject and had been a motivating experience. In addition, they considered that the degree of difficulty was medium, the execution time was adequate and they valued the collaborative teamwork very positively. It should be noted that most of them recommended that the activity should continue to be performed.

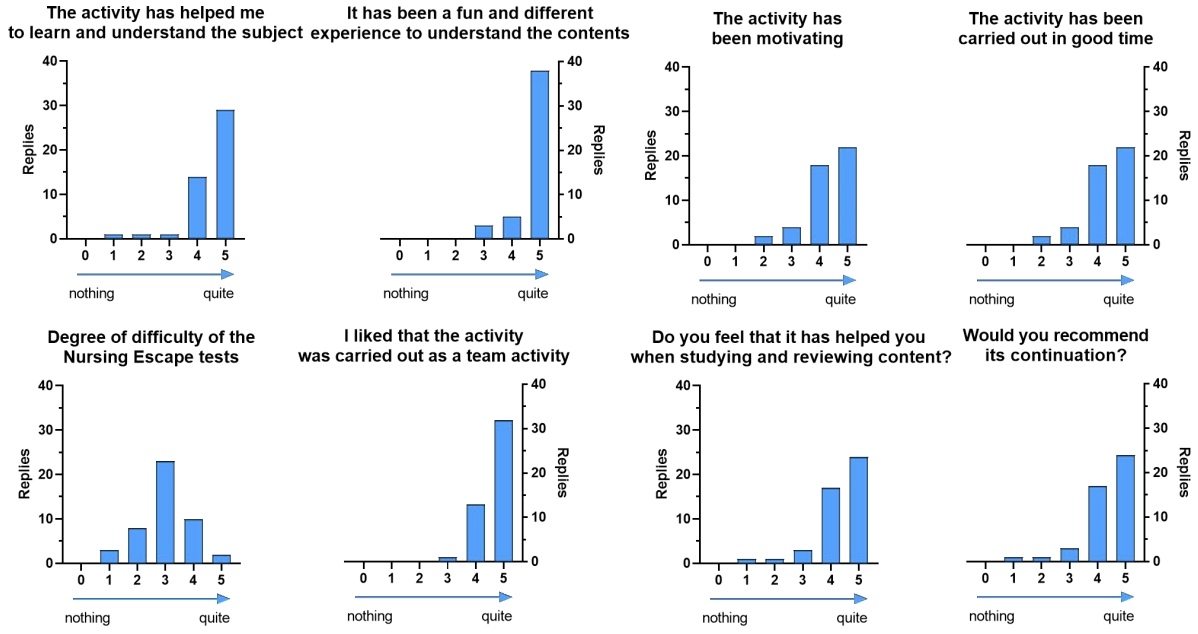

Figure 2. Results of the surveys carried out with students on different aspects of the activity performed.

Among the comments in the "Best" section, we found:

“That the envelopes were in more places than just the laboratory”

“To be able to understand the topics explained in class in a didactic and visual way”

“Learning in a fun way”

“The team attitude, the desire to do the tests in order to go to the next test”

“Using the pipettes and feeling that what you are doing has value”

“Teamwork”

“I really liked the one where you have to choose the light, search, go to the freezer, do the calculations and the result opens the lock”

“The number of tests and the distribution of the clues as well as being able to do it in a group”

“It was very enjoyable and motivating because for us it was like a game, but we were reviewing the contents almost without realising it”

“That you learn in a didactic way”

“Being able to compete and collaborate with the rest of the classmates”

“The realisation that you were able to explain what you had learnt, as well as having a good time during the tests”

“The tests and the number of people involved”

“It was hard work and it was entertaining. It was hard enough to have to think and not get bored but not so hard that you didn't know what to do all the time (10/10)”

“Working as a team and doing something fun and different at university”

“Making the reactions ourselves, the teamwork and the activity in general”

“I think that in general I found it a lot of fun and a very good way to learn”

“Especially for clarifying doubts and reviewing”

“Everything”

“The fact that it was a team activity and that each envelope was a test that could be done together and not individually, so that we could all help each other”

“It helps you to better understand the practical exercises that in the lab you had some doubts about”

“It is a different and entertaining activity to understand the different knowledge”

“It helps us to review and clarify concepts in a more didactic way”

“To do it in a group and to help each other”

“Making it practical. Looking for clues”

“Knowing that what we have learned is useful”

“Doing it in a dynamic, self-taught and fun way”

“To carry out the tests in teams”

“To be able to understand the reason for the determination of diabetes”

“To interact and learn at the same time”

“A very creative way to review everything we have learnt (very constructive)”

“Very dynamic, it is a different way of learning and interacting with each other”

“The escape room has been very useful now to better understand the concepts”

“The motivation of the instructors”

“Competing against your classmates and motivating you to remember the contents in a fun way”

“The locks and the tests to get out of the lab”

“The tests and their organisation were very original”

The comments in the section "What could be improved" included:

”Some pieces of the final puzzle did not fit together”

“I would remove the first test as it does not serve to learn much and only frustrated us and led us to check that the cards are in place because we waste time looking for them”

“More detailed explanation”

“Hide the clues better so we don't waste so much time”

“Smaller groups so that everyone can participate”

“Finding some other way of verifying that we have found the answer, because recording ourselves was a bit tedious”

“Maybe it would be good to extend the playing field to the whole Faculty of Medicine”

“The team could still be very big. I don´t know what to improve, as I have never done one myself”

“So it wasn't good because it was really great”

“The penalties”

“That the box of the first challenge is easier to open”

“The time in which it is carried out”

“To do it in smaller groups so that everyone can participate well”

“There were questions that were not correct or not understood (few)”

“I would make the groups smaller so that everyone in the group can participate more”

3.1.2 Evaluation of the activity by the instructors

The responses of the instructors who participated in the activity are shown in Fig. 3. Most of the instructors considered that the Nursing Escape Room was a motivating experience and helped the students to understand the contents of the subject. There was less consensus on the degree of difficulty of the challenges. Most of the instructors felt that the execution time was adequate. It should note that all of them recommended continuing with the activity.

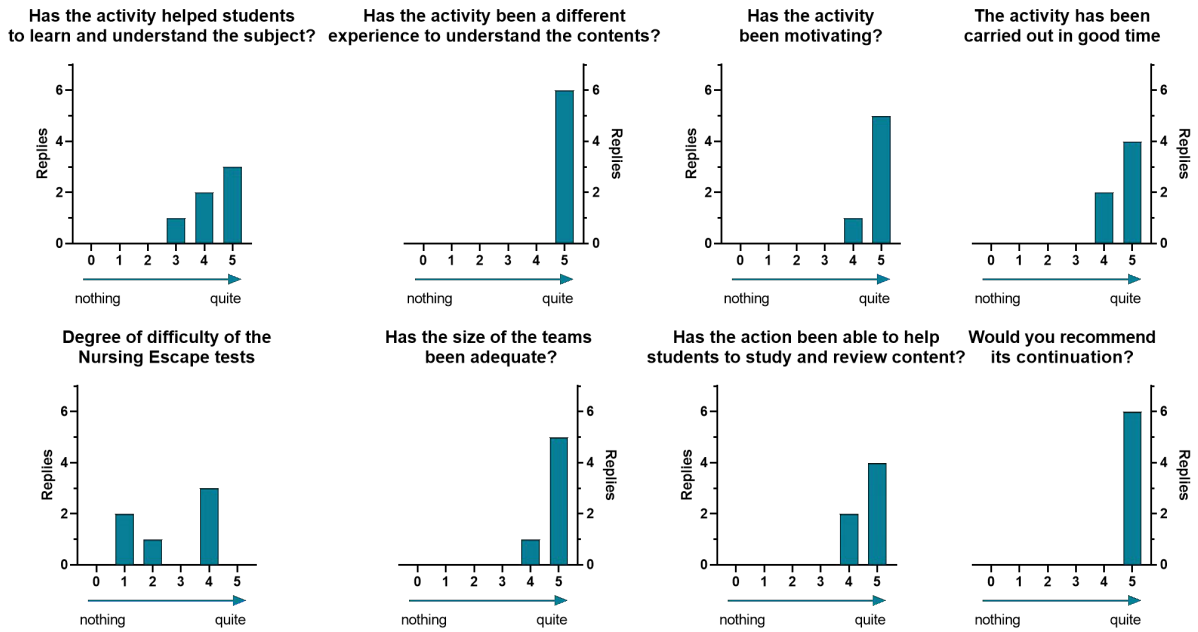

Figure 3. Results of the surveys carried out with the instructors on the aspects of the activity.

Among the comments in the "Best" section, we found:

“The students' interest in doing it and the usefulness of the activity to review the content of the practical work done”

“As it is an interactive activity, they are forced to think on the fly to solve a problem, something that they will later encounter in a real working environment, and it is a good way to train them, something that is not usually done at university”

“To discover how well prepared the students of the 1st Degree in Nursing are in biochemical concepts”

“Attending the reasoning process in each of the tests. Motivating experience for both instructors and students”

“Good surprise factor. Fun included in the learning process. Team work”

The comments found in the section "What could be improved" included:

“The students' answers have been cross-checked by the teachers and the explanations given by the students on those questions that required comments have been recorded. These explanations could probably also include an answer test to correlate the explanations of the different groups”

“They do not know how to do calculations and when they have to do them on the fly they get blocked. It is difficult for them to get out of this blockage by themselves. I don't know how this aspect could be improved”

“To have more time and sufficient teaching staff to carry out the activity in the whole group of the Nursing Degree and in other Degrees of the UAH”

“Extend the experience to the whole class. Improve the execution of some tests, e.g. the couple tests. Establish clear rules for the monitors”

“To remove the red puzzle that is not the same as the rest. To correct the symbol codes. To put student’s names on stickers. Calculations of concentrations with volumes, rethink. We need more people to record the activity”.

3.2 Evaluation of learning

Learning was assessed for all Biochemistry students, participants and non-participants in the Escape Room, one week after the activity was carried out. The learning outcomes in terms of the average score obtained are shown in Table 2.

The students who participated in the activity obtained a better score in the whole exam dealing on the contents of the practicals (7.000) than those students who had not participated in the Nursing Escape Room UAH (6.626).

Among the students who passed the whole test, the score achieved by participating students was higher (7.544) than that from those who did not participate (7.460). The number of participating students who passed was also higher (41 *vs.* 39). In addition, the score of students who did not pass the exam was higher (3.283) for those who had participated in the action compared to those who had not participated (2.556). The number of participating students who failed was lower (6 *vs.* 8).

Table 2. Learning assessment results.

			Participating Escape Room	
			NO	***YES***
Average Rating	Questions related to…	Escape Room	7.263 n = 47	**7.457** n = 47
		Escape Room plus other questions	6.626 n = 47	**7.000** n = 47
	Exams passed with…	Escape Room	**8.042** n = 40	7.943 **n = 42**
		Escape Room plus other questions	7.460 n = 39	**7.544** **n = 41**
	Exams failed with…	Escape Room	2.823 n = 8	**3.372** **n = 5**
		Escape Room plus other questions	2.556 n = 8	**3.283** **n = 6**

The learning outcomes of the Escape Room contents are shown in Table 3. Here, only questions related to the Escape Room are taking into account when calculating the score.

Percentage of students with scores between 5 and 6.9 and between 7 and 8.9 was higher for students who performed the escape room (12.8% *vs.* 14.9% and 40.8% *vs.* 53.2%, respectively). However, in the

case of students with the highest scores (between 9 and 10) their participation in the activity did not improve their results (29.8% *vs.* 21.3).

In addition, percentage of students who did not pass the test was lower for those who had participated in the Escape Room compared to those who had not participated in the activity (10.6% *vs.* 17%).

Table 3. Distribution of ratings considering only Nursing Escape Room UAH issues.

		Participating Escape Room			
		NO		***YES***	
		n	***(%)***	***n***	***(%)***
Range of ratings	< 5	8	17.0	5	**10.6**
	5.0 – 6.9	6	12.8	7	**14.9**
	7.0 – 8.9	19	40.4	25	**53.2**
	9.0 – 10.0	14	**29.8**	10	21.3

4 CONCLUSIONS

Although we found no statistically significant differences in the ratings resulting from the learning assessment, we consider that the activity, to some extent, has modified it. We believe that the learning can become meaningful in the medium/long term. We have not yet had the opportunity to evaluate this aspect.

With the results obtained, we must correct the mistakes made and, at the same time, take into account the "weaknesses" and "strengths" that our students presented. In this way, we can improve the quality of the teaching-learning process.

From this teaching strategy, we can conclude that gamification constitutes a constructive experience, taking advantage of all the benefits of implementing challenges in the educational environment. *Nursing Escape Room UAH* can contribute to improve the quality of face-to-face teaching, fostering intrinsic motivation in students.

ACKNOWLEDGEMENTS

This work is part of the project " UAHEV/1417-*Nursing Escape Room UAH*: motivation to learn in the biochemistry laboratory" and has been funded by the Vicerrectorado de Estrategia y Planificación of the Universidad de Alcalá (UAH), in the 2022-2023 call for Projects for the promotion of Innovation in the Teaching-Learning process.

We would like to thank Luis Cristobal García-Sánchez, technician of the Biochemistry and Molecular Biology Unit, for his collaboration in the development of the activity.

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