EVALUATION OF AN INNOVATIVE VIRTUAL ESCAPE ROOM PILOT ACTIVITY TO ENHANCE STUDENT LEARNING EXPERIENCE IN VETERINARY PHARMACOLOGY

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Abstract

Gamification in university learning methodologies has a relatively recent application, one of the methods is the Escape room, considered an immersive learning environment, which promote learning through teamwork and problem solving [1]. The virtual Escape room adaptation is a simulation methodology to learn Pharmacology that aims to favours integration of knowledge and promotes lifelong learning. The main strategy for each Escape room case in Pharmacology was to use a relevant and challenging problem to provide a scaffold for the integration of previously taught pharmacological knowledge [2].

In this work, we have implemented virtual Escape room series of "case-scenario" of Pharmacology for the 3rd year of Veterinary students from Complutense University of Madrid as a complement to traditional lecture and laboratory based activities. We are working to extend this experience to other Faculties of the Complutense University, the University of Zaragoza and Peruvian universities that collaborate in the project such as Cayetano Heredia and Nacional de San Antonio Abad (Lima and Cusco, respectively in Peru).

Each Escape room case evaluated in this work was related to three main areas within the Pharmacology curriculum (autonomic Pharmacology, Central Nervous System Pharmacology and respiratory Pharmacology) selected as a pilot with the intention of extending it to other programme areas. Each activity were delivered immediately after teaching the corresponding lectures. Two big groups of 60-80 students each were enrolled in the activity by including it as an activity within the obligatory but free-choice (among other activities such as monographs) practical credits.

The students were provided one week after with the link to the Escape room case through the Pharmacology and Pharmacy subject webpage, Campus Virtual. At the end of each activity, every student had to fill through a Google forms questionnaire an assessment of the activity and an evaluation of the knowledge acquired. Additionally, four volunteer students have been assigned to give us more extensive feedback on each of the activities via email. The professors met with them in face-to-face sessions, each discussion session lasted for a maximum of one hour.

The student comments included the reports, the degree of participation and the survey results for these activities were assessed by a specifically designed survey. We can conclude that the Escape room activity is associated with a greater motivation as well as with enhanced abilities to solve pharmacological problems that require a holistic view across several subjects they have in the Veterinary curriculum and that is helpful in reinforcing lifelong learning.

Keywords: Escape room, Pharmacology, lifelong learning.

1 INTRODUCTION

The Complutense, Zaragoza and San Antonio Abad Universities as well as the Faculties of Veterinary through their respective quality departments encourage the teachers to evaluate curricula to ensure that competencies are addressed and students remain engaged in their learning process. With this objective, we work in a continual search for innovative ways to deliver or complement course content.

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The demographics of today's students include Millennials with diverse needs and expectations in comparison with precedent generations fact that encourages us to work in a variety of teaching methods to creating innovative and engaging learning experiences [3].

The Pharmacology has traditionally been taught using a lecture approach, some laboratory practices with occasional case studies where the students often struggle to learn drug names and mechanisms of action, calculate the medication dosages, and understand medication administration techniques. It is crucial that students learn the fundamental pharmacological concepts to deliver safe and effective care of veterinary patients. In an attempt to address these challenges, a novel approach to reviewing the fundamental concepts of Pharmacology was introduced in Pharmacology and Pharmacy subject in 3rd year of Veterinary degree at Complutense University using an escape room concept to facilitate learning about different sections of the programme.

The Escape room are gaining popularity as a strategy to problem solving, and cooperation in an entertainment approach. The goal for the students is work together or alone to solve pharmacological problems called case-scenario and find clues to open locks to escape from a virtual room.

2 METHODOLOGY

In this work, we have implemented virtual Escape room series of "case-scenario" of Pharmacology for the 3rd year of Veterinary students from Complutense University of Madrid as a complement to traditional lecture and laboratory based activities. We are working to extend this experience to other Faculties of the Complutense University, the University of Zaragoza and Peruvian universities that collaborate in the project such as Cayetano Heredia and National de San Antonio Abad (Lima and Cusco, respectively in Peru). We have also carried out a pilot case in the Escape Room modality with students with intellectual disabilities who are studying Animal Care course at the Complutense University.

We used the basic escape room concept on a virtual model by using a case-scenario with pharmacological questions to be solved where the answers able to open locked spaces or simply allow you to switch screens to the next level or question [Figure 1]. Undergraduate pharmacology students were divided into two big groups according to their turn of studies, although the evaluation of the results made in this work is based on all the students who participated.

2.1 The scenario and process

Each Escape room case evaluated in this work was related to three main areas within the Pharmacology curriculum (autonomic Pharmacology, Central Nervous System Pharmacology and respiratory Pharmacology) and were held immediately after teaching the corresponding lectures. Two groups of 60-80 students each were enrolled in the activity by including it as an activity within the obligatory but free-choice (among other activities such as monographs) practical credits.

Specifically, each of the cases was designed with Genially® as a pharmacological case-scenario in which different questions (about the drug used) were posed to the student so that, as he/she solved them appropriately, he/she could progress to the next levels [Figure 1]. The following activity levels or pages corresponded to the effects of the test drug on the different organs or tissues as well as any possible adverse effects. Access for students was posted one week after the lecture through a link to the Escape room case in the Pharmacology and Pharmacy subject webpage, Campus Virtual through Moddle.

Teachers created a case-scenario for each area of the curricula. The objective of the game was to be the veterinary who save the patient with the correct medicine in order to solve the pathophysiological alterations. The students were instructed to have a device (smartphone, tablet or computer) and specific verbal instructions on how-to play the game were given beginning with the objective, rules of the game, as well as some reminders throughout the resolution of the questions.

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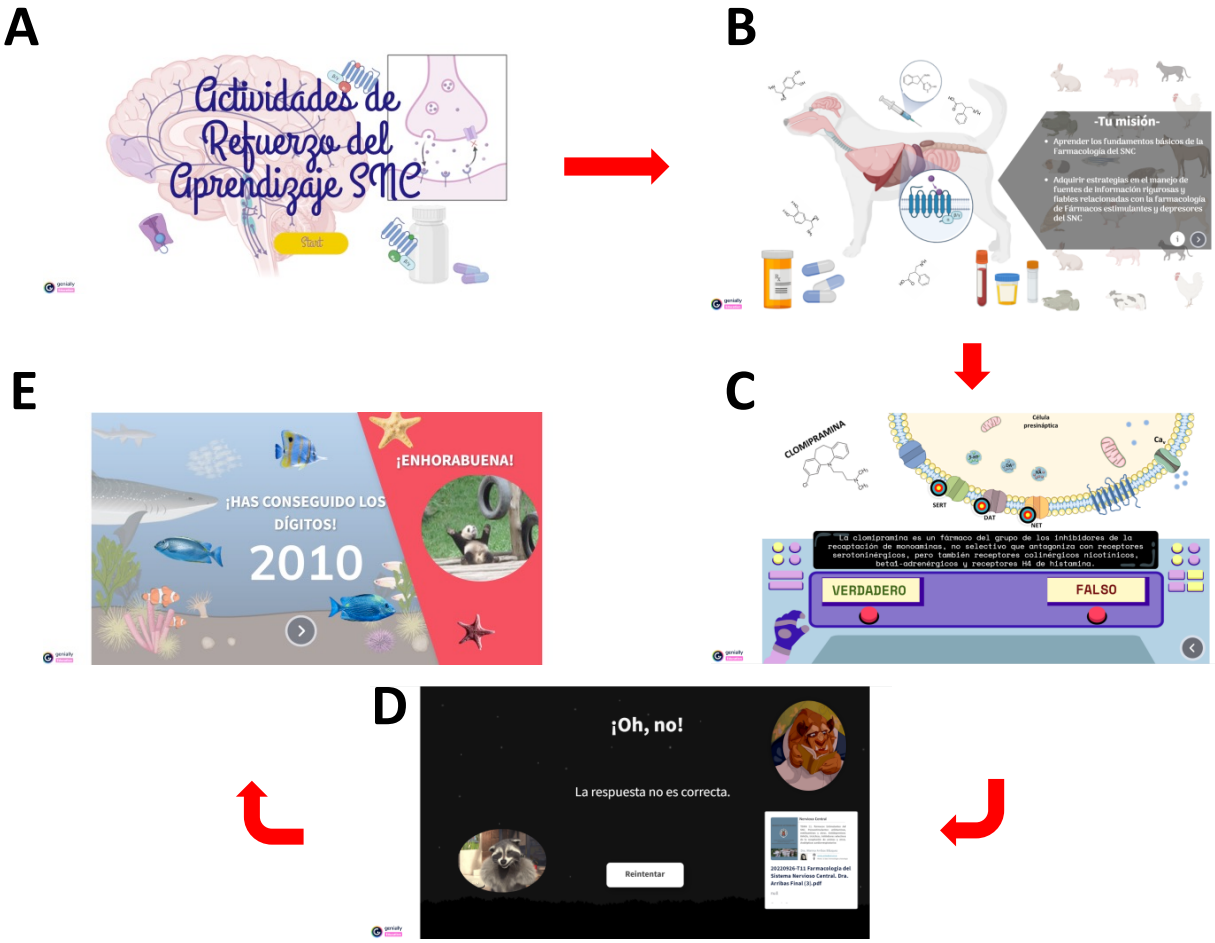

Figure 1. Escape room representative screens. ***A.*** *Cover image of the case on the central nervous system.* ***B.*** *Image of the case objectives named as "your mission".* ***C.*** *Some of the questions were as simple as choosing between true or false.* ***D.*** *If the answer chosen was incorrect, the option to revise is given, as well as the option, via a link, to access the specific place in the master class where the answer to the problem would be.* ***E.*** *Different codes with numbers or letters can be obtained to access the next level or screen.*

2.2 Data collection

After all students participated in the learning activity they were evaluated as it was previously awarded. At the end of each activity, every student had to fill through a Google forms questionnaire an assessment of the activity and an evaluation of the knowledge acquired. Some of questions were based on Eukel and colleagues work [4]. Additionally, throughout the process, we have worked with 4 volunteer undergraduate students who have been collecting information about the difficulties or opinions of their classmates in the classroom where they were solving the case in order to obtain more extensive feedback on each of the activities they made a short report and sent it to the teachers via e-mail. The teachers of the project met with them in face-to-face sessions, each discussion session lasted for a maximum of one hour.

2.3 Data analysis

Descriptive statistics (means, percentages) were entered into GraphPad (*version 9*, San Diego, USA) to analyze the data obtained in a Microsoft Excel® (Washington, USA) file from Google forms. The student comments with their evaluative criteria forms were read in order to describe the learning experience.

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3 RESULTS

3.1 Background

The advent of interactive adventure games, such as escape rooms for adult entertainment have been increasing in popularity across the world. Universities and faculties encouraged us to use a variety of teaching/learning strategies to engage veterinary students from diverse backgrounds. We consider the escape room as a teaching strategy as a framework in progress in the education for the purposes of providing interactive game-based learning experiences. The literature reflects that simulation is an effective learning modality to enhance long life learning that is gaining popularity as a strategy that fosters a deeper understanding of didactic content especially in pharmacology, the content of which is highly abstract for students who often fail to link the concepts of mechanism of action with the actual uses of drugs [1] [5].

Hermanns and colleagues (2018) from the University of Texas [2] consider that Escape room as an immersive learning games platform, as a novel learning concept for teachers and students. However, there is a very low quantity of published experiences description of this type of activity used in Pharmacology education. While simulation and games have been used in education, for example Xu (2016)[3] discussed a variety of teaching strategies used in nursing education, a literature review of different database report very few articles about using an escape room concept in veterinary Pharmacology subject.

The purpose of this study was to describe the use of a gaming strategy based on an escape room concept to help students learn about three important sections in a pharmacology course in Veterinary Degree. In this sense, this work has examined undergraduate students from UCM Veterinary Faculty who participated in a type of simulation through Escape room in virtual modality. Thus, according to the reports of the 4 students volunteers who participated as observers, it was described the transference of knowledge which is a goal of education. The game strategies have been used to engage students in a fun way as a means to enhance learning.

3.2 Student demographics. Engaging

The activities were offered to the students from the two groups of pharmacology course in the third year of Veterinary studies (n = 134). They carried out the activity during their free time out of class, although the time spent on the activity is considered as part of the activities included in the ECTS of the subject. Students who voluntarily consented to participate completed the satisfaction survey and evaluative test (n = 104; 77.6% response rate; Figure 2A). The majority of the students were female (n = 94; 90.4%; Figure 2B).

The majority of students (n = 89, 85.8%) felt that this was a valuable learning activity (Figure 2C). A large majority of the students (97 %) indicated that they learned from this activity and would like more of this concept learning for upcoming pharmacological content and appreciated the innovation from the normal lecture and laboratory practices format of classes. The students viewed this activity as a fun way to review and apply their knowledge of Pharmacology. Specifically, as a result of participating in the virtual escape room activity, the students indicated that their understanding of pharmacology was increased and allowed them to ‘think in an applicative way about pharmacology’.

When the students asked if they found the learning activity valuable, they mentioned that it was challenging but in a positive way and “cases have forced us to think in a different way.” Another commentary said: “I find these activities more productive and enjoyable than just reading notes or books.”

Students valued the opportunity to collaborate with their peers or small groups. This theme was articulated as the students answered the questions asked by the four student volunteers, “What was most memorable?” and “How do you think this activity has helped you the most?” Some students described as a memorable aspect the fact “to solve together a common goal”.

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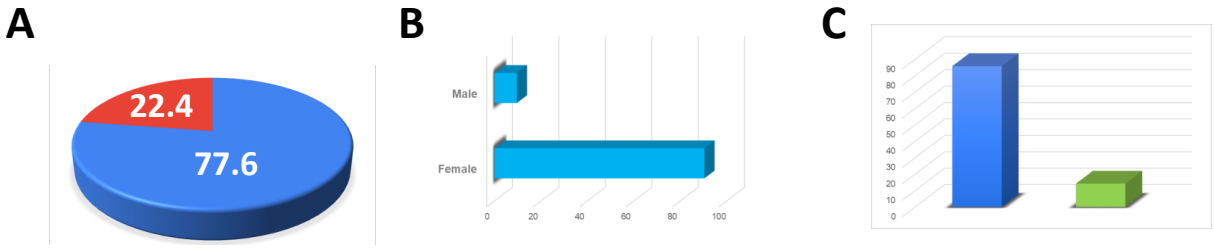

*Figure 2. Student demographics and engaging. **A.** Percentage of participation (104; 77.6%) of students of pharmacology course in the third year of Veterinary studies (n = 134). **B.** The majority of the students were female (n = 94; 90.4%). **C.** The majority of students (n = 89, 85.8%) felt that this was a valuable learning activity.*

3.3 Surveys and evaluation

Apart from the feedback that the student volunteers were able to collect from their peers, more student comments, the degree of participation and the results for these activities were obtained through surveys specifically designed in Google forms while the evaluation of learning was assessed through questionnaires designed in the virtual campus through Moodle.

The satisfaction survey had 4 main questions, as follows:

In relation to the interactive activity, please rate from 1 (very unsatisfactory) to 5 (very satisfactory) [Figure 3].

1 What extent did you enjoy learning pharmacology through escape room?
2 What extent do you find it useful to learn basic pharmacology concepts through this activity?
3 How difficult was the application (rate 1 if you found it easy and 5 if it was very difficult)?
4 Do you prefer to continue using traditional methods to reinforce learning?

The final question, related to the fact of preferring traditional classes and their methods, the students answered with 97% (101 out of 104) in favour of having innovative methods as a complement to the classes and laboratory practices as it induces them to think differently about pharmacological problems and they get a more real vision of their application in the clinic as well as their relationship with other subjects of the veterinary degree. Three preferred more of a traditional approach to learning, such as case studies or master classes. One student reported not benefitting from the activity, “The games at the university do not help me learn Pharmacology”. Likewise, students with intellectual disabilities (n = 12) in animal care course, who were offered the work of one of their items, showed full interest in the activity and demanded more similar activities.

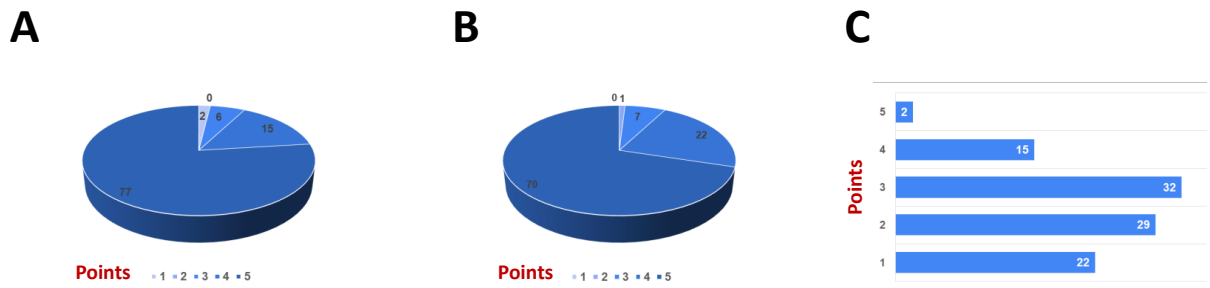

*Figure 3. Survey results. Percentage of satisfaction rating from 1 (very unsatisfactory) to 5 (very satisfactory) of students of pharmacology course in the third year of Veterinary studies (n = 104). The students were asked three main questions: **A.** What extent did you enjoy learning pharmacology through escape room? **B.** What extent do you find it useful to learn basic pharmacology concepts through this activity? And **C.** How difficult was the application (rate 1 if you found it easy and 5 if it was very difficult)?*

With regard to the assessment of the knowledge acquired, this was carried out by means of a Moodle form with traditional questions on the mechanisms of action and the beneficial and adverse effects of the drugs. Thus, 93 (89%) students obtained a score of 4-5 points out of 5, while 11 scored below, coinciding with the failure in the score with students who were not very convinced of the usefulness of the activity or had problems in following the procedures reflected in the instructions.

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3.4 Frustration

Some of the negative aspects that reported the students were that they feeling frustrated that they did not have enough time to complete the activity. This is congruent with feedback from four volunteers students who observed their colleagues all of the activities and sessions in all three case-scenario of the pharmacology activity. As the time was nearing to the end, students became increasingly anxious to solve the activity. This student expressed concern that the activity under pressure of time did not increase knowledge of pharmacology. In addition to the time constraints, students felt frustrated because they did not fully understand the instructions and needed more direction. Additionally, they felt like they did not know how to start the activity. Students wanted the teachers to provide them with more guidance and answers.

The four volunteers noted that while most of the student groups were actively communicating with each other, other students were working quietly with more of an individualized focus. While all of the groups were concentrated on the task some of them were interested in the rank of their evaluation.

3.5 Limitations

This study has several limitations. Any time you use a derivative of technology in a non-traditional way. This innovation limits the conclusions that we can extract from an activity because there are many variables which cannot be controlled. However, using technology in a new way is vital to growth, so a further limitation is a lack of historical documentation presenting the material in this new way.

Since knowledge and self-confidence were not measured, it is impossible to determine the efficacy of this escape room strategy in actually conveying information or building competence in participating veterinary students.

A final limitation may be the fact that the majority of the student participants were female also decreased generalizability beyond the target population although in the veterinary degree in Complutense University this proportion can be considered representative. However, some approximations could be made to see if gender could somehow influence the parameters evaluated.

4 CONCLUSIONS

We can conclude that the pilot Escape room activity is associated with a greater motivation as well as with enhanced abilities to solve pharmacological problems that require a holistic view across several subjects they have in the Veterinary curriculum and that is helpful in reinforcing lifelong learning.

This pilot study revealed important findings for us to consider before planning and conducting similar learning activities in other drug mechanisms or drugs from the curriculum in Pharmacology. We observed that students were engaged and recognized that this activity was a novel approach to learn and make decisions about pharmacological properties and adverse effects of the drugs. This innovative strategy appears to have the potential to benefit both the teachers and the students. Perhaps more students would have responded positively if the activity had been pre-tested with better instructions and more time for the completion of the activity, actions that would have helped decrease student frustration.

The work carried out to learning required students to be immersed in a scenario with greater facilities for the communication with each other to solve the problems.

We recommend this escape room strategy as a way for teachers that add some spark and innovation to a course which traditionally has a lot of reading and memorization and there is a real need for activities that are adapted to the technological learners who have grown up with virtual strategy games who need more dynamic work to achieve deeper and longer learning.

We do recommend that future studies be conducted to quantify the students' academic success, i.e., by making comparisons between students who have done the escape room activities and those who have not, looking at the degree of success obtained in the official exams of veterinary studies.

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