AN ESCAPE ROOM AS AN IMPLEMENTATION OF GAMIFICATION MATERIAL FOR LEARNING PHARMACOLOGY

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Abstract

There has always been a need for engaging assessments in online learning environments, though the COVID-19 pandemic further emphasized this need [1]. The rise of technologies, especially video games, has contributed to the use of elements of these environments in other areas. To this end, gamification is the use of game techniques in non-game contexts and their application in methodologies in the learning process, the purpose of which is to attract and strengthen the attention of students, the formation of cognitive interest, the desire to solve problems, increase motivation, and further modify external motivation into internal [2].

Gamification in higher education is a relatively recent application, one of the methods, online educational role-playing games that teachers and students can play in class are escape rooms and breakout games. Escape rooms and breakout games are considered immersive learning environments, which promote learning through teamwork and problem-solving [3]. The premise of an escape room is a teaching/learning strategy to help students, in consolidating fundamental concepts and basic procedures for professional development and at the same time, teach important skills to deal with stressful situations under time pressures in a fun and enjoyable way. The implementation of this type of resource presents a new experience with pharmacology students of the Degree in Veterinary of Universidad Complutense de Madrid (Spain) with an international group of students from different universities such as Zaragoza (UNIZAR, Spain) and Cayetano Heredia and Nacional de San Antonio Abad (Lima and Cusco, Perú). The virtual escape room consisted of 6 tracks (elaborate by Genially®) related to the theoretical contents (Central Nervous System, Autonomous Nervous System, etc…) of the Pharmacology and Pharmacy subject using clues involving specific objectives to “escape” from the room before they run out of time. Specifically, 104 students aged between 21 and 24 and 11 professors participated. After the activity, feedback on the experience of inserting gamification elements into the learning process of the subject was discussed.

The virtual escape room is available at the following link:
https://view.genial.ly/633d82133555c700187c6452/interactive-content-actividades-de-refuerzo-del-aprendizaje-snc

Keywords: Gamification, Escape room, Pharmacology.

1 INTRODUCTION

If the students’ academic performance can be improved, the teacher must take responsibility and change the model that has existed up to now. This model is basically unidirectional, from teacher to student. In addition, it does not support collaboration or reflection on the teaching process. Thus, we must offer the possibility of adapting to new forms of inquiry, the diversity of the classroom, the reality of the educational context and the continuous training of teachers and students. In this context, social transformation requires a change in the educational system that must begin with teacher training itself. Active methodologies, as defined by López (2005) [4], are "an interactive process based on teacher-student, student-student, teacher-teacher, student-teaching material and student-medium communication that promotes the responsible involvement of students and leads to the satisfaction and mutual enrichment of teachers and students". These methodologies are supported by a mix of computer resources, multimedia resources,

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telematic activities, and telecommunications and media services. This mix allows, in an interdisciplinary way, teachers and students to work with a varied range of resources with resources which they can achieve their objectives in formal and informal contexts, face-to-face, and distance learning while developing their digital competence or literacy.

Gamification is a relatively current phenomenon with different definitions that have evolved over time (Table 1). It is the use of game techniques in non-game contexts and their application in methodologies in the learning process, the purpose of which is to attract and strengthen the attention of students, the formation of cognitive interest, the desire to solve problems, increase motivation, and further modify external motivation into internal [4]. Originally Nick Pelling (2011) [5] described gamification as a process of changing the interface to make electronic transactions more fun and game-like, but later it was expanded with the emphasis on using game elements in a non-gaming environment to improve user engagement and experience.

Table 1. Definitions of Gamification.

(Pelling, 2011)	"Applying game-like accelerated user interface design to make electronic transactions both enjoyable and fast."
(Burke, 2012)	"The use of game mechanics and game design techniques in non-game contexts to design behaviors, develop skills or to engage people in innovation."
(Werbach, 2014)	"The process of making activities more game-like."

Similarly, to the approach to innovation, the relationship between gamification and innovation is two-fold: gamification is regarded as an innovative approach in certain areas, for example, education [6].

This project arose to liven up and innovate the learning of Pharmacology, which is traditionally characterized by memorization and assimilation of many complex and abstract concepts. Our educational community should take advantage of the information available on the web and new media related to educational technology to improve the academic performance of Veterinary Pharmacology students. The teaching of Pharmacology lends itself very well to the use of cooperative learning since this subject is at the interface between the basic disciplines (Anatomy, Physiology, Biology, Biochemistry...) and the clinical disciplines (Pathological Anatomy, Surgery...) of the different Health Sciences degrees (Medicine, Veterinary Medicine, Pharmacy...), thus allowing an integration of the knowledge learned in the different subjects taken. One way of effectively integrating the basic and clinical aspects, and facilitating their deep learning (cooperative, interactive...) was the elaboration of problem-scenarios ("escape rooms") that allowed, after learning the theoretical knowledge, the analysis of the multiple real circumstances that condition the choice of the best pharmacological treatment (clues, solving puzzles, etc.) in situations where they performed the analysis and self-learning. The general objective of this project was to contribute to the significant and deep learning of Pharmacology in the subjects of Pharmacology of the Faculty of Veterinary Medicine of the UCM and other participating universities such as the University of Zaragoza (UNIZAR), Cayetano Heredia University (UPCH, Lima) and the National University of San Antonio Abad (UNSAAC, Cusco) through the implementation of a new way of teaching, the use of a multidisciplinary Escape Room as an educational tool to increase student motivation, separating the selection of content from the mere academic definition or strictly scientific content, to establish objectives that optimize the acquisition of skills through the use of resources provided by the Internet, allowing to extend beyond the face-to-face or physical meeting the communication between each of the subjects, overcoming the spatial and temporal limitations. [7].

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 lectures.

Implementation of this strategy in Pharmacology in the project has considered different elements defined by Werbach and Hunter (2012) [8] to guarantee its success:

1 Defining the objectives by making the understanding of the basic concepts of Pharmacology more attractive and entertaining using virtual environments that help greater self-learning, commitment, and satisfaction of the student. Many of the problems that the participating students will face

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promote a different way of thinking with respect to the abstract concept of Pharmacology, which is important to encourage creativity and innovation.

2 Enhancing the knowledge (theoretical-practical), attitudes (autonomous learning...), and skills (networking, multidisciplinary...) of the students. To promote multidisciplinary and multicultural work with the incorporation of students from the Faculties of Medicine and Science (UNIZAR), Pharmacy and Veterinary Medicine (Peruvian Universities).

3 Clearly identify the most complex sections for students within the programs of Pharmacology subjects to design activities relevant to their interests or real needs.

4 Establish the design of the activity cycles, defining the gamification system (game mechanics, order of events, interaction).

The phases and activities proposed for the development of the previously defined objectives were as follows:

2.1 Planning and elaboration phase of the teaching activities

Through meetings with the participants in the project, a retrospective analysis of the most complex sections for the students was carried out. In this phase, the faculty members of the Project of the Department of Pharmacology of the Faculty of Veterinary Medicine of the UCM analyzed the grades obtained by the students in each of the sections of the subject of Pharmacology and Pharmacy with the aim of identifying and editing a list of topics that would be adapted to the Escape Room.

Once the possible topics were defined, the work of the entire multidisciplinary team continued in order to establish the elements and tests to be performed within each learning module, the basic rules of the game and the sequences of development of the activities. In addition, the number and type of tests to be performed (riddles, puzzles, formulas, digital lock picking...), the number of clues, as well as the possible start and end dates for the execution of the project were established.

For the development of the pharmacological scenarios, Genially® was used as an online tool to create all types of visual and interactive content easily and quickly, for individual or team use. For the verification of the initial version and the proposal of project themes, we had the collaboration of undergraduate students; as well as master's and PhD students, with whom we established the design, the duration of the tests, as well as the initial assessment of the activity and correction of the incidences found throughout the process of the pilot version (Fig. 1).

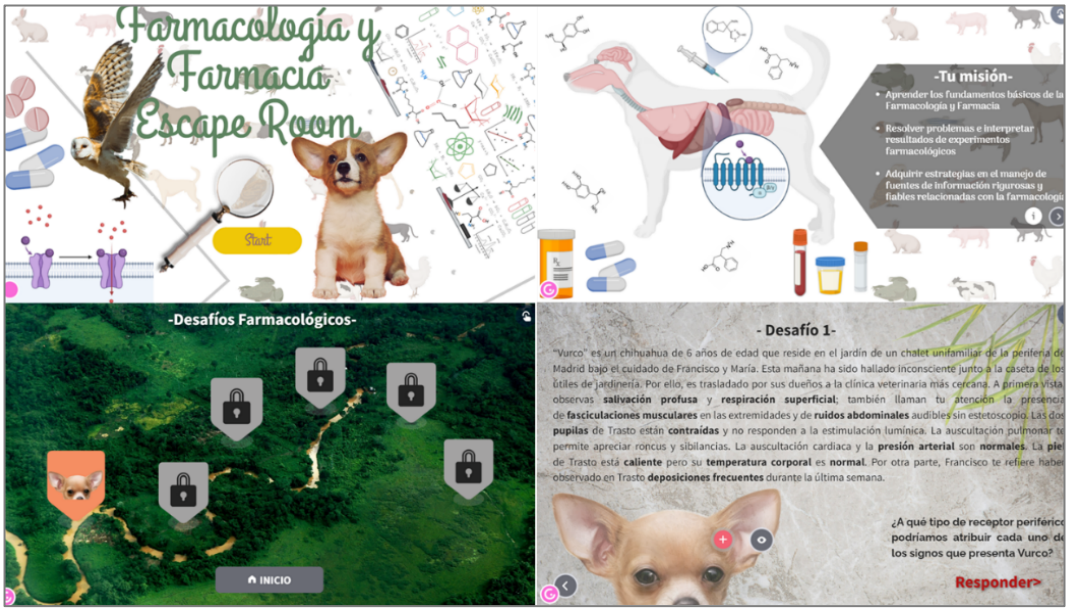

Figure 1. Escape room design. Graphic representation of one of the cases used in the virtual escape room. It began with the cover page and the presentation of different sources of information. Then, visualization of the different stages to overcome and the beginning of the first clinical case to be developed.

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2.2 Escape Room implementation phase

The realization of the activity was included within the methodology of directed work type of the subjects of Pharmacology in the Degree of Veterinary Medicine, which had voluntary participation of the third-year students of the subjects of Pharmacology. To encourage students to participate in the project, it was advertised both on the faculty bulletin board and through the virtual campus Moodle, which is a free online learning system that allows teachers to create an online course portal (Fig. 2).

Figure 2. Announcement of project participation used for posting on bulletin boards and virtual environments to encourage student participation

The student working groups were divided into a maximum of 4 members. Each group entered a "virtual escape room" according to the previously established schedule with a test/enigma to be solved, in synchronization with the teaching of the different theoretical or practical sections of the Pharmacology subjects. As usual in these Escape Room dynamics, students had a maximum time of 45 minutes to obtain the resolution of the problem posed, in the form of a code that allowed them to "escape" and unlock the next level. We established basic levels accessible to all groups and more advanced levels for those groups with higher scores, using them as an incentive to obtain a diploma of recognition for the work done.

3 RESULTS

The use of educational technology will only be successful if it also shapes the evaluation process. For the evaluation of resources, three main criteria will be considered: pedagogical three main criteria will be considered: pedagogical, technical, and functional. In this topic we have also mentioned mobile learning and how mobile learning can be and how it can take advantage of a large number of existing applications to assess student learning with new technologies (e-evaluation), with the use of rubrics and virtual feedback.

This project has been included in the following priority lines:

1 Innovation of open educational resources and virtual teaching.

2 Training of university teachers for the acquisition of competencies in the field of distance education and self-learning.

3 Internationalization of university teaching. The project contemplated the participation of Peruvian universities to create a multicultural group.

4 Promote an inclusive, accessible, diverse university focused on the objectives of the 2030 agenda for sustainable development. The platform was accessible to students with specific educational support needs that are referred from the office for the inclusion of people with diversity.

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A meeting between the members of the project was organized once a month to follow up on the development of the activity. At the end of the activity, an anonymous satisfaction survey was sent to the participating students to determine their emotional experience, as well as their personal evaluation of the use of the new teaching tool. The preliminary results were very positive, although they were aware that lectures are essential for learning the subject, they emphasized the use of this type of active methodologies as a reinforcement of learning and as a way of reviewing the contents for the exam. With all the material collected and analyzed, an edited material will be prepared in digital format, with sections according to the common pharmacological topics following the teaching programs of the Pharmacology subjects of the participating Universities. All this will allow the continuity of the project in successive courses, extending and updating the available material.

When asked to describe the best aspect of the escape room experience, one student reported, “it has helped me to implement what I have studied in the theoretical classes in a more practical way with clinical cases.” Another student shared ‘‘through the support of videos and images, it has been easier to memorize the mechanism of action of different drugs used in veterinary medicine.’’

4 DISCUSSION AND CONCLUSIONS

Gamification as an activity provided with game elements or thoughts induces the release of dopamine, a central neurotransmitter associated with attention and concentration, as well as movement, memory, and learning. With the development of this project, we wanted to integrate, connect, and understand the different problems related to the scenarios linked to pharmacology from a very broad perspective. Students were able to connect their pharmacological knowledge with those of a biochemical, and physiological nature and make projections to possible future cases in subjects of the following courses in which they see tangible applicability of the concepts learned in Pharmacology.

By making the proposed material available online, including interactive activities, the direct online learning capabilities were reinforced.

This work shows the analysis of an escape room experience with students of Pharmacology of the Degree in Veterinary Medicine. The results obtained allow us to know the students' assessment of the escape room intervention and inform us about the learning process, mediated by mobile technologies, achieved by the participants in this study. Thus, this escape room experience has been interesting for the students, who value it as rewarding.

At the same time, the escape room application has promoted different types of emotions, highlighting fun, motivation, and anxiety about solving the proposed enigma.

In this sense, some authors point out that gamification promotes the motivation of university students, allowing them to work on the contents of transversal subjects present in university degrees [9], [10], [11]. Thus, the potential offered by the escape room lies in its motivation, the promotion of active learning and its educational usefulness for working on values and skills in different educational contexts. As in other studies, there is agreement on the idea that, through this type of game, learning a specific subject can be facilitated in a motivating way [9], [12].

More research is needed to delve deeper into the teaching-learning processes promoted by game-based learning methodology and the application of gamification. At the same time, the preference and predisposition of students for this type of active methodologies mediated by technologies, and the improvement in their motivation, with the consequent commitment to their own learning, stand out.

However, some studies published on the subject also warn of the risk that some students, unaccustomed to working within a time limit and in competition with others, may feel marginalised or frustrated.

If we want to avoid this nervousness, it is advisable to always consider the number of missions and challenges we set, as well as their difficulty. The more difficult the tests are, the easier it is for students to become frustrated, and the game loses interest and motivation. Being too easy does not guarantee success either, as it can be boring and too easy to overcome.

The teacher must analyse the group, their interests, and the theme in which the escape room is to be used, create an engaging story, choose the right environment in which it will take place, pre-test and offer help during the virtual game so that they can progress.

The experience allows students to enter a parallel world, where they can consolidate content and deal with it in a different way. This increases motivation and interest in the subject [13].

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It is therefore highly recommended to try it out, starting with something simple that breaks the monotony of the classroom and allows us to observe the reaction of the students.

It is important to note that, although its direct impact on learning outcomes has not yet been demonstrated, it has had an impact on students' motivation, thus indirectly influencing the results.

The results also showed an improvement in motivation to improve learning, although on the contrary it reduced students' preferences for cooperative work.

In conclusion, gamification still shows potential but, on the one hand, it requires much more work from the teacher than expected and, on the other hand, it is still necessary to continue to carry out objective evaluations that allow us to measure which elements of gamification have an objective influence on learning.

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