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Preprint: Developing visible thinking and motivation through the curricular design of an Escape Room in Higher Education

Preprint: Desarrollar el pensamiento visible y la motivación a través del diseño curricular de un *Escape Room* en Educación Superior

Preprint: Desenvolver o pensamento e a motivação visíveis através do desenho curricular de uma Sala de Fuga no Ensino Superior

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Abstract: Introduction. The term escape room has undergone a notable evolution in recent years, extending its presence to areas not only recreational but also business or educational. The defining traits (overcoming obstacles, problem solving, teamwork, time management ...) have proven to be valid both in business and in education. In this paper, the focus of attention is placed on the quality of the pedagogical design of an escape room and its impact on the teaching-learning process of Higher Education students is analyzed. **Method**. For this, the pedagogical design of the game, its development and implementation are described. The

evaluation of the intervention is carried out by the 238 participating Higher Education students. **Results**. The results show that the pedagogical design of the escape room has a very positive impact on two fundamental aspects of the teaching-learning process: motivation and the type of cognitive processes that the student is forced to put into practice. **Conclusions**. The potential of the use of the escape room in pedagogical environments has a high educational potential, but it must be designed as a significant part of the syllabus, taking special care to avoid that it becomes a novel and motivating resource but that adds little value to the teaching-learning process.

Keywords: Escape Room, Higher Education, Educational Innovation, Motivation, Thinking.

Resumen: Introducción. El término *escape room* ha sufrido una notable evolución en los últimos años, extendiendo su presencia a ámbitos no sólo lúdicos sino empresariales o educativos. Los rasgos que lo definen (superación de obstáculos, resolución de problemas, trabajo en equipo, gestión del tiempo…) han demostrado tener vigencia tanto en la empresa como en la educación. En este *paper*, se pone el foco de atención en la calidad del diseño pedagógico de una sala de escape y se analiza su impacto en el proceso de enseñanza-aprendizaje del alumnado de Educación Superior. **Metodología**. Para ello, se describe el diseño pedagógico del juego, su desarrollo e implementación. La evaluación de la intervención la realizan los 238 estudiantes de Educación Superior participantes. **Resultados**. Los resultados muestran que el diseño pedagógico del *escape room* tiene una incidencia muy positiva en dos aspectos fundamentales del proceso de enseñanza-aprendizaje: la motivación y el tipo de procesos cognitivos que el estudiante se ve obligado a poner en práctica. **Conclusión**. El uso del *escape room* en entornos pedagógicos tiene un alto potencial educativo, pero debe diseñarse como parte significativa de la programación didáctica, poniendo especial cuidado en evitar que se convierta en un recurso novedoso y motivador pero que añada poco valor al proceso de enseñanza-aprendizaje.

Palabras clave: *Escape Room*, Educación Superior, Innovación Educativa, Motivación, Pensamiento.

Resumo: Introdução. O termo *escape room* sofreu uma evolução notável nos últimos anos, estendendo sua presença não apenas para as esferas recreativas, mas também empresarial ou educacional. Seus traços definidores (superação de obstáculos, resolução de problemas, trabalho em equipe, gerenciamento do tempo ...) têm se mostrado válidos tanto nos negócios quanto na educação. Neste artigo, o foco da atenção é colocado na qualidade do projeto pedagógico de uma sala de fuga e seu impacto no processo de ensino-aprendizagem de alunos do Ensino Superior é analisado. **Metodologia**. Para isso, descreve-se o desenho pedagógico do jogo, seu desenvolvimento e implementação. A avaliação da intervenção é realizada pelos 238 alunos participantes do ensino superior. **Resultados**. Os resultados mostram que o desenho pedagógico da escape room tem um impacto muito positivo em dois aspectos fundamentais do processo de ensino-aprendizagem: a motivação e o tipo de processos cognitivos que o aluno é obrigado a colocar em prática. **Conclusão**. O potencial de utilização da *escape room* em ambientes pedagógicos tem um elevado potencial educativo, mas deve ser concebida como parte significativa da programação didática, tendo especial cuidado para evitar que se torne um recurso inovador e motivador mas que agrega pouco valor ao processo de ensino-aprendendo.
Palavras-Chave: Sala de Fuga, Ensino Superior, Inovação Educacional, Motivação, Pensamento

Introduction

The term escape room has evolved from being known by a small group of people with a fairly defined profile (fans of role-playing games and video games) to become an expression with a presence in very different fields. From the media to leisure activities, through the workplace, it seems to have become a phenomenon

mostly known and accepted at the social level (Byrd, 2016; Clarke et al., 2017; Kroski, 2019; Zhang et al., 2018).

But what exactly is an escape room? And, above all, how relevant can its use be for teachers and other education experts? Is it a trivialization of the teaching-learning process or, on the contrary, the mechanics of the activity is based on valid and relevant pedagogical principles in the current educational context?

Theoretical framework

Definition

There are several variants as to what makes up an escape room and there is no full unanimity as to the characteristics that it must have; Surprisingly, an escape room (or room from which to escape) does not even necessarily imply an escape plan as the ultimate goal or the very existence of a physical room (Clare, 2015).

The term seems to have its origin in the environment of video games (Kroski, 2019) and refers to games in which the action takes place in a variety of closed environments (prisons, dungeons, mansions, laboratories ...) but always with a common goal: being able to escape from the place where the protagonist is locked by solving puzzles, riddles, logic problems, etc.

To do this, he has several clues at his disposal, some more obvious than others, which he must collect and interpret to achieve this objective. Normally, the degree of difficulty in solving problems follows an increasing order, so that the motivation of the participants remains constant throughout the whole process (Kroski, 2019).

However, as mentioned above, the term has been extended to other situations in which physically escaping from a room is not the objective, while

maintaining the resolution of problems and the gradual collection of clues as the main characteristic element. Finding an object, finding out a character's name or discovering a date can be the ultimate goal of the process. The process is the same, but using the term escape room in a more metaphorical way: the ignorance of what we are trying to discover is an imaginary space from which we want to escape through achievement and obtaining the answer.

Features

The definition of escape room varies depending on who uses the term and in what context it is applied, but nevertheless there are a number of characteristics that can be established as the most common features that make up an effective escape room (Borrego et al., 2017; Clare, 2015; Kalugin, 2019; Sierra Daza and Fernández-Sánchez, 2019):

- Suggestive environment: normally thematic, with a setting that not only fulfills the function of containing the necessary elements for the resolution of the problem, but also supports it.
- Puzzles with varying degrees of difficulty: usually in increasing order, in order to maintain motivation throughout the process.
- Race against time: the fact of having a limited time implies, in addition to a challenge component that affects motivation, the need to carry out adequate time management.
- Teamwork: related to the previous point, having a limited amount of time to solve the challenges forces the participants to divide the tasks to be solved, so that each and every one of them contributes to the final success or failure.
- Clues: the resolution of problems is derived from the sum and interpretation of various clues.
- Argument and history: the existence of a motivating and coherent narrative gives a sense of unity to the process.

- Main game and secondary games: in this sense, it is usually customary for the main plot to be complemented by a series of secondary plots or secondary problems to solve, with their own entity, but immersed in the general narrative.
- Misplaced objects: this is usually one of the most traditional resources when presenting the clues or the information required to solve the most immediate problem.
- Use of patterns, symbols, codes, etc.: the use of alternative forms of communication puts into operation cognitive processes related to information coding.

Escape rooms in business environments

Perhaps the business environment is the area to which the practice of escape rooms has extended more rapidly and, according to recent studies, its advantages are several: they promote logical thinking, critical thinking and problem solving; create a strong feeling of teamwork, avoiding an excess of competitiveness or a rivalry of a toxic nature; they allow for closer ties with colleagues in an environment that is not strictly professional; they do not imply a strong investment of money, unlike other activities aimed at creating team feelings; and, finally, being raised as a scaled challenge to solve, makes them fun and motivating.

In addition to the aforementioned reasons, Meehan (2019) highlights its beneficial effect in achieving effective communication in work teams, assuming roles aimed at overcoming a goal and, finally, assertiveness and empowerment derived from joint problem solving.

Escape rooms in educational environments

Interestingly, many of the arguments that reflect the benefits that the practice of escape rooms can have in the workplace and professional, are applicable to the world of education. Aspects such as the use of logical thinking, the need to work in

a team, the assumption of different roles within a group, etc. They are perfectly applicable to a learning environment.

More specifically, the following contributions from escape rooms to the teaching-learning process should be noted:

- Flexibility (Johnson, 2017): the very nature of the escape rooms makes any content, area, concept or material susceptible to being used. It is about designing the problems to be solved and the goal to reach using the elements of the area being worked on.
- Flexibility is extensible to the particular context in which it is applied (Nowco, 2016). It can be carried out as an inseparable part of the curriculum, as part of the teaching schedule but giving it an extracurricular character or even as a complementary activity outside the teaching schedule.
- They improve the retention of content and skills to be used, as reflected in a study carried out by researchers from the University of Granada (Gómez-Urquiza et al., 2018). Likewise, the participants highlighted the great motivational component that the escape room format contributed to learning.
- Another more recent study by the University of Ottawa (Kinio et al., 2019) has reached similar conclusions, highlighting the improvement in student satisfaction, participation and motivation.
- They give the student a leading role in the teaching-learning process (Johnson, 2017), also forcing him to assume responsibilities in decision-making and assess the different options he has when facing a problem.
- Improves the decoding of information of the participants, which affects a more efficient and effective problem solving (Hermanns et al., 2017; Ndulue et al., 2012).
- According to Kapp (2012), the use of mechanisms and environments typical of games (virtual or not), improves motivation, increases involvement and promotes problem solving and learning.

- Connect with the interests and concerns of the students; according to Nicholson (2013), providing the escape room with a narrative that connects with the sensitivity of those who participate in it, is an improvement in motivation and learning.
- Encourage curiosity in students, their desire to ask questions and their need to solve them, which, in turn, means they further expand their learning (Vörös & Sárközi, 2017).
- Wiemker, Elumir & Clare (2015) also highlight the improvement derived from the use of escape rooms in the following cognitive processes: search, observation, correlation, memorization, pattern recognition and thought structuring.
- Finally, the study conducted by Clarke et al. (2017) reflects the benefit of using the escape room format in terms of student interest and motivation, in this case in the field of Higher Level Education.

Although the benefits of the use of escape rooms in the educational field are increasingly extensive, most research focuses on measuring or analyzing the implications on cognitive or psychological aspects of students (Connolly, 2013).

Therefore, there is still a lack of scientific literature that deepens the quality of teaching that can be imparted by incorporating an escape room into the teaching-learning processes.

The main objective of the research presented in this study has been to find out the impact of the instructional design of an escape room in the teaching-learning process of students of Higher Education. That is, this study focuses on analyzing the kind of impact that the quality of teacher work and the curricular design of their praxis has on the perceptions of students.

Methodology

An educational intervention study has been carried out (Coll, 1993), which includes the design, implementation and evaluation of the instructional design of the escape room.

It is intended to answer the following research questions:

• RQ1: Does the use of escape rooms in a classroom context improve the degree of motivation shown by students?

• RQ2: Does the use of escape rooms in a classroom context imply the use of a greater variety of cognitive resources by students?

Instruments

To carry out this research, three instruments have been used:

The Latin American version of the SEEQ survey, Students' Evaluation of Educational Quality, devised by Marsh (1982) and Andrade-Abarca et al. (2018). It is an instrument for assessment and improvement of teaching. Through this questionnaire, the effectiveness of teaching is analyzed and in turn it highlights or / and detects what areas of improvement should be taken into account. The factors, Satisfaction towards learning, Enthusiasm, Organization, Personal attitude and Evaluation, are assessed on a scale of 28 Likert-type items with five response options (strongly disagree, disagree, neither agree nor disagree, agree and strongly agree).

A Google form: A form with open questions was designed to collect qualitative information of students regarding the cognitive processes used in escape and motivation. This form consisted of 10 items, all the questions being open. The aim was to avoid that participants were forced to choose among a limited number of possible answers; on the contrary, questions were designed with a broader and more comprehensive nature, which allowed them to connect with different points of view

and ways of focusing when answering. Of the 10 items, the first three refer to the type of cognitive processes used in performing the escape room. The next two show the degree of motivation achieved in its completion. The next two are related to the degree of autonomy with which they have managed to work. Finally, the last two items have to do with the type of teamwork they have performed throughout the test. The 10 items of the questionnaire are detailed in the following Table 1.

Table 1. Escape room EHU – Evaluating what has been learned

Cognitive processes	P1. What different types of thinking have you had to put into practice to solve the challenge? P2. To what extent have you encountered a new context in which to apply what you have learned? P3. What role has previously learned content played?
Motivation	M4. How did the challenge posed refer to your most immediate reality? M5. What possible different ways to overcome the challenge have you found?
Autonomy	A6. What degree of autonomy have you been forced to apply? A7. How have you planned the resolution of the challenge? A8. What have been the main and secondary goals of the challenge?
Teamwork	TE9. What degree of collaboration within the group has been necessary to solve the challenge? TE10. How have you defined the role of each group member?

Note: Own elaboration

The Teaching Unit itself: the proposed challenge was that participants discovered why it is necessary to evaluate in the teaching-learning process. For this, a series of didactic objectives were raised, all of them formulated in terms of competence, that is, including a content, a methodology and a transfer. For each of the objectives, three achievement indicators were defined, one for each integral part of the didactic objective. Thus, the skills could be worked in a global way.

The contents were classified as declarative, procedural and attitudinal.

The methodology included in the Didactic Unit is that of an educational escape room, with the characteristics previously mentioned in section 2 of this research, paying special attention to factors such as the environment, problem solving, time management, work team up…

Finally, the activities to be carried out by the participants were divided according to each of the phases of the Didactic Unit: Start Activities (presentation of the challenge), Process Activities (working with information and deepening), Final Activities (closing of problem solving) and Transfer Activities (application of what was learned in the context of each participant).

Participants

The sample is made up of university students from the University of the Basque Country / Euskal Herriko Unibertsitatea (UPV / EHU), specifically students from the Faculty of Education of Bilbao. All of them belong to 3 different degrees within the faculty: Infant Education, Primary Education and Social Education.

The total number of students who participated in the research is 238. By degrees, Social Education comparatively contributed with the largest number of participants, 114, or what is the same, 47% of the total. Infant Education contributed with 44 and Primary Education with 80 (17% and 36% respectively). Of the total, 180 participants were women (75%) and 58 were men (25%).

Finally, and in terms of age, 95% of the sample belonged to the age range between 18 and 25, while only 5% belonged to the age range between 26 and 32.

Procedure

Four phases were differentiated in the design, implementation and evaluation of the process:

PHASE 1. Pedagogical design

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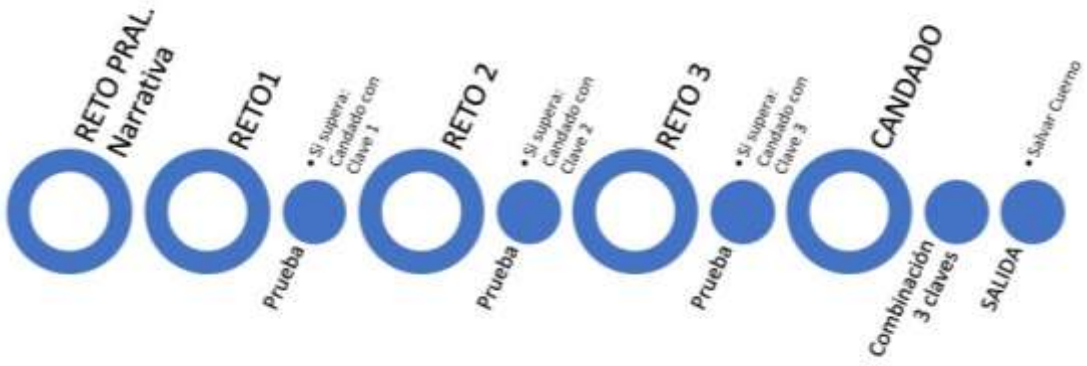
The pedagogical design, framed in a situation-problem context: a Didactic Unit was designed that allowed the work by competences and that reached the pedagogical objectives through a situation of integration.

The chosen context was the Faculty of Education and the main challenge, to open the lock that closes the door to save the Acoustic Horn of the Faculty (emblematic sculpture of the Faculty).

The main challenge was subdivided into three secondary challenges, in which the participants had to get a minimum score to get the combination that gave access to each of the safes of each challenge, three in total (see Figure 1).

In addition, environmental elements such as music and light were taken into account.

Figure 1. Game layout design



Note: Own elaboration

PHASE 2. Technical development

The activity was carried out with the application Genial.ly and comprised four rooms (Figure 2): 1) pre-game room: to present the story and explain the operation, 2) game room: game area itself with three challenges education to overcome

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cooperatively, 3) debriefing room: room for knowledge transfer, 4) monitoring room: for monitoring and support by teachers.

Figure 2. Main window of the Escape Room with access to the 4 rooms described.

Note: Own elaboration

PHASE 3. The implementation of the escape room

This research was carried out entirely over 4 months of the 2018-2019 academic year, more specifically from March to June.

The process began in March: the first step was the design of the escape room to be carried out by the students, taking into account the factors that would later be studied in the questionnaire and which have been previously described.

Subsequently, and within the same month, the necessary materials and resources were collected to prepare the escape room in its final format. Throughout the month of April it was implemented in the degrees of Infant Education and Social Education.

A month later, in May, it was implemented in the Primary Education degree.

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After data collection, the analysis of the results and subsequent conclusions took place in the month of June.

The duration of the escape room itself was a 120-minute session; previously, the dynamics and rules of the game had been explained to the participants.

PHASE 4. Evaluation of the intervention

For the evaluation of the escape room, information from three different sources was collected: The first was through the Debriefing Room (Figure 3). This space was created to understand what happened in the Game room, to collect the learning and realize the impact and meaning of each element of the game.

Figure 3. Debriefing Room

Note: Own elaboration.

On the other hand, the "Student Evaluation of Educational Quality" (SEEQ) questionnaire (Andrade-Abarca et al., 2018) was also completed. To collect information on 8 different aspects of teaching: Learning, Enthusiasm, Organization, Interaction with the group, Workload and difficulty, Exams / Tests, Relationship with the teacher and Escape Characteristics.

Through the Google form we wanted to highlight the extent to which the use of an escape room forces participants to put into practice cognitive processes of a higher nature. Faced with the type of processes that traditional education normally compels (memorization, reproduction…), it has been the aim of this research to show that this pedagogical proposal encourages students to put into practice another type of cognitive processes of a more complex nature: extrapolate, infer, synthesize ...

Results and Discussion

Quality evaluation of the curriculum design in the escape room

In the survey on the quality of the pedagogical design of the Escape Room, the results show that the students are quite satisfied in the 8 aspects evaluated on teaching taught through Escape. All values are close to score 4 (in a maximum of 5), highlighting the characteristics of the Escape and its organization as the best rated dimensions.

Table 2. Summary of the means and standard deviations in the dimensions of the SEEQ

Dimensions of the SEEQ	N	Mean	Dev. *Deviation*
Learning	238	3,74	,92
Enthusiasm	238	3,74	1,11
Organization	238	3,88	,85
Interaction with the group	238	3,72	1,05
Relationship with the teacher	238	3,81	1,08
Evaluation	238	3,66	,85
Difficulty of work	238	3,70	,92
Escape Features	238	3,93	,89

Note: Own elaboration.

Impact on level of motivation towards learning

The instruments for data collection reflect a significant increase in the level of motivation by students in the teaching-learning process. More specifically, the participants highlighted the motivational component that solving problems of

increasing complexity had involved. One student said that this approach had helped him "feel like moving forward with problems"; Another participant mentioned that the use of the escape room format had meant “a way of working much more fun than the traditional one”. Several participants insisted that this format implied "a more enjoyable way of working" and that learning not only was not impaired, but was reinforced because of a much more "motivating and suggestive" approach. Finally, a large majority of participants highlighted as elements that contributed to increase motivation the need to properly manage time (being forced to "prioritize some steps over others"), the setting (making them believe they lived "part of an adventure") and teamwork (allowing them to appreciate "the strengths of others" when solving problems).

Impact on the type of cognitive processes used

The analysis of the Didactic Unit used to carry out the escape room shows a substantial change in the type of cognitive processes involved in the performance and resolution of activities. The design of the unit detracts from the cognitive processes associated with traditional teaching (especially the memorization and reproduction of content) and gives more prominence to more complex processes such as relationship, synthesis, inference...

The organization of classroom work based on challenges implies a more creative, less linear and, above all, more complex type of thinking: having to put into practice what has been learned in new contexts, participants are forced to assimilate and internalize everything what they work with. This is a guarantee of deeper and lasting learning.

Conclusion and Future Work

In short, it can be concluded that the use of the escape room formula contributes positively to the teaching-learning process, since the most recent

evidence seems to indicate that it is a valuable resource and a great help in teaching, regardless of the scope or level (Clarke et al., 2017; Johnson, 2017).

More specifically, the results obtained reveal significant improvements in several areas such as the degree of motivation achieved with this didactic unit design; it is superior because, when classroom work is organized based on rewards, students become more involved (Kinio et al., 2019). On the other hand, this formula forces the student to put into practice cognitive processes of a higher nature, which go beyond the memory reproduction of contents; what is in line with a type of classroom work oriented to challenges and projects. It also implies a remarkable development of the social skills of the participants, since cooperative work is an indispensable requirement for solving the problem; if the activity is well designed, you should not be able to do it without the cooperation between the group members (Wiemker, Elumir & Clare, 2015). Finally, this way of working places the student at the center of the teaching-learning process, making him a true protagonist of it. In this sense, it implies a change of focus compared with the traditional balance between teacher and student (Nicholson, 2013).

Like any other tool with educational objectives, it must be carefully designed and structured so that it actually brings added value to the classroom work and for it to achieve deeper and lasting learning; it is not about converting the resource of an escape room into an end in itself, but rather in a means subject to learning objectives, to which one must devote the time required to be properly integrated into the planning of classroom work . It is of little use to plan the classroom work around an escape room if there has been no previous planning and reflection work about how this formula fits into the curricular context (Clare, 2015; Fred, 2016; Melendez, 2015).

Another possible limitation of this format that would be advisable to investigate is whether the correct balance between extrinsic and intrinsic motivation is achieved. An inadequate approach to the activity may result in the student's motivation having the sole origin of passing a series of tests or challenges of

increasing difficulty. Leaving aside the motivation for their own learning and for the nature of what they are studying. It would therefore be advisable to study the type of motivation generated in the participants and to what degree it is given.

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