

Article

Educational Hall Escape: Increasing Motivation and Raising Emotions in Higher Education Students

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Abstract: Educational Escape Room is an innovative method used in classrooms to motivate students. This article describes a version of Educational Escape Room applied to undergraduate students. Specifically, this work presents an adaptation of the method called Educational Hall Escape, characterized by the resolution of challenges in a game-adapted room in which several student groups compete to finish the activity in the least amount of time. To date, the Educational Hall Escape method applied to the field of business economy has not been reported in the literature. The objective of the study is to analyze the influence of the Educational Hall Escape method on the learning processes and emotions of students during the activity and its impact on their motivation and the reinforcement their competences and knowledge. An experiment was designed in which the class was divided into a control group and an experimental group. To measure the impact of the experience in the students, two tools were used: an exam and the Gamefulquest survey. Despite the fact that the results obtained show that the students perceived the experience as a game, it improved their motivation and increased their proclivity to have an emotional bond with the subject, the academic results remained steady.

Keywords: gamification; serious games; game-based learning; escape room; motivation; higher education



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1. Introduction

Educational simulation based on games, objects, or dynamic processes, is a teaching tool that could enhance the understanding of the subject content since it opens up the comprehension of ideas and abstract concepts. Educative simulation is ideal for manipulating and modifying the learning process, depending on the educational needs of each moment, and it is useful in transporting us to a place and time that would be impossible to reach as a real experience in the classroom [1].

The use of innovative teaching methodologies based on games is increasingly employed in the classroom. Game-Based Learning (GBL) is a methodology centered on the educational potential of the games as an enabling tool to learn in a motivational, creative and participative form [2]. Escape Room is a learning strategy that is increasingly used, which promotes the motivation and commitment of the students to the learning process [3].

The present study aims to examine the emotions produced by an Educational Escape Room (EER) experience. The emotions in the activity deal with an early feeling of stress, followed by satisfaction as the students solve the challenges. The evolution of the feelings is related to the self-confidence students experience during the activities regardless of the results of the game (win/loss).

It specifically applies an EER variation, named Educational Hall Escape (EHE), consisting of the performance of the game by several student teams simultaneously in the same educational space (classroom) and in a competitive environment. EHE is a tool that

motivates, enhances and strengthens skills and knowledge dealing with the subject's topic, i.e., introduction to business.

Our goal consists of analyzing the appropriateness of a ludic activity and its acceptance by the students enrolled in a Marketing Degree. The principal aspects to consider when reproducing this model in different educational environments will be identified and detailed.

In order to achieve this objective, an educational research experiment was designed. The tool applied is an EHE. The class was split into control and experimental groups to assess the teaching impact. This experience is based on four research hypotheses:

Hypothesis 1 (H1). *Students enrolled in the EHE exhibit better academic results than students who were not.*

Hypothesis 2 (H2). *Students enrolled in the EHE felt the activity as a complete game experience in all its dimensions.*

Hypothesis 3 (H3). *Students enrolled in the EHE showed higher signs of motivation than those who were not.*

Hypothesis 4 (H4). *Students enrolled in the EHE felt more emotions during the activity than those who did not perform it.*

Throughout this article, a literature review on Educational Escape Rooms is conducted, in Section 2, to obtain a brief state of the art summary of its application. In Section 3, Methodology, presents the development of the experience and the obtained EHE methodology. Finally, the results are discussed and a conclusion from the experience is displayed.

2. Theoretical Background

2.1. "Serious Games" and "Gamification"

The use of game elements in education has been widely utilized since the beginning of the education system, mainly at preschool and primary school levels. Play in school has been taken on the normal characteristics and expectation of formal schooling [4]. It was a question of time for games to start being applied to higher education.

Concerning the subject the present study deals with, game theory found a natural place in economics [5]. The first application of gaming to economics dates back to Cournot (1838) [6], and several studies describing its application have been reported since then. This natural link between the game and the economic field results in an attractive arena for teaching methods. As McDonald expounds in his book "The Game of Business", business theory and its management can be understood as an oligopolistic game, where the player must face real world situations [7]. Thus, game-based learning techniques are applied worldwide to encourage students, irrespective of the level of education.

The methodology consisting of the use of the fundamentals and technology of games to understand real-life complexity has received several names, such as "simulation games", "serious games", "applied games", "persuasive games", and "gamification" [8]. The terms most commonly found in the literature when reporting an EER, as in the present study, are "serious games" and "gamification". Here, we underline the differences between them.

"Serious games" are based on complete games, with the entertainment component in the background and education-centered [9,10]. They have an explicit educational purpose and possess all game elements, such as specific rules, boundaries, procedures, players, objectives, and they also look like games despite their pedagogical aim [11,12]. "Simulations" are also considered "serious games", since they allow students to be introduced into different learning situations, complementing formal learning [10,13,14]. "Serious games" have enjoyment (or the game itself) as an intrinsic value, and an extrinsic value, consisting of the pursued goal which is the sake of beneficial consequences different from

the game's sake [8], that would be the learning process in the context of this study. Mayer also underlines the connection between game, emotions and learning in "serious games".

As a "serious game", "gamification" is one of the most referenced methods to enhance the motivation in the classrooms during recent decades, and it is defined as "The process of game-thinking and game mechanics to engage users and solve problems" [15]. Marczewski proposes different approaches to the application of games or their techniques within the so-called "game thinking", with a final purpose other than entertainment, "gamification" and "serious games" [14].

Although the origin of the term "gamification" is unknown, the first use of the term was in 2008 in the digital media industry [16], defined as "the use of game design elements in non-game contexts". The application of the "gamification" method to the teaching environment has been analyzed by several authors, and the elements mostly identified were identified: game mechanics, application type, education level, subject, implementation and obtained the results obtained by students [17].

2.2. Emotion

A number of recent studies state both negative and positive emotionally arousing events are better remembered than emotionally neutral events [18–20]. Thus, "Emotional memory is the result of storing the information that was accompanied by stressful factors through which the information is more easily fixed" [21].

The stimuli connected to emotions affecting an individual's feelings can persist in memory with higher intensity than those not linked to emotion [22]. Additionally, they can help with memory retention and the recall of information linked to those events or stimuli [23].

2.3. Educational Escape Rooms and Motivation

An Escape Room (ER) is a game in which a team of players cooperatively discover clues, solve puzzles, and accomplish tasks in one or more rooms in order to progress and accomplish a specific goal in a limited amount of time [24]. Escape Rooms are Live-Action Games that engage directly with the game world, and they match the learning environment of the classroom perfectly, as recent publications point out. Educational Escape Rooms (EER) propose challenges with educational approaches in which students are organized in teams to solve puzzles and challenges associated with the content of the curriculum in a limited time [25]. They offer more motivation and engagement than traditional educational games [26]. At the higher education level (high school and university) in which games are not often played in the classroom, ERs offer sophistication and novelty to teaching practices that students value and appreciate. The published EER experiences that are being applied worldwide at a university-/college-level report positive feedback from students.

The Escape Room activity is categorized either as "gamification" by some authors [3,27–31] or as "serious game" by others [9,32–36]. Both techniques, "serious game" and "gamification", share a main goal, i.e., to foster motivation and create engagement. Their differences are well described in the literature [8]. Furthermore, when applied to the education field, EER is also considered a problem-based learning (PBL), since its features are also included in the ER scenario: "ill-structured problem", "real-life" scenario, open-ended tasks, student autonomy and student collaboration [26].

The Escape Room is a tool that is being used in various fields including the disciplines known as STEM: science, technology, engineering and mathematics [37], as well as numerous and recent escape room experiences in health sciences [25,38,39]. However, despite the numerous studies reporting the application of game tools in Economics and Business fields, no Educational Escape Rooms are found in the literature.

The essential elements of an Escape Room are: (1) the escape rooms (one or several chained or multilinear rooms); (2) challenges, riddles or tasks (various elements whose resolution lead to the exit); (3) physical/online items (to solve tasks within the escape room); (4) game master (people in charge of guiding the participants if required, by offering

hints); (5) narrative (common thread of the game that relates all the challenges). In the Educational Escape Room, the design is simplified if the narrative does not act as a common thread that relates all the challenges; however, this is less immersive because the narrative itself motivates the player to live the experience [25].

The game master (GM) is the “big brother” of the ER activity, and EER’s game master is not the exception. The game master has to determine the balance of guidance during the game, and he/she conforms the guidance’s intensity by estimating the players’ skill level [40]. The game master’s skill is determined by the coincidence of the estimated time to solve the challenge with the reality.

The better the EER is designed, the less game-master implication is required. Frustration is the only negative feeling students could find during the performance of the EER, since students should be able to solve the challenges and puzzles. There are four facets a game-master must have to succeed in the EER performance. Firstly, the correct design of the challenges so that the time limit coincides with an appropriate amount of time for the level of ability of the students. Teachers should communicate with their students that the activity is going to be considered for the subject assessment, since it is important to encourage students to study and prepare for the activity [29]. Secondly, the story behind the game should engage the students and their choices should be linked to implications; making the players matter is key to designing a successful ER [26]. Thirdly, during the activity, the GM should gather the information regarding the timing and students’ attitudes, looking for features to improve the next EER’s design. Fourthly, the facet of guiding the students teams during the activity, to control the correct performance and to give hints or clues when needed. Generally, students prefer not to receive any guidance from the GM but instead become immersed in an auto-guided activity [40].

Motivation

Gaming encourages students to persist in the task and offers a type of learning context, two conditions which are essential for deep learning engagement. EER persuades students to think about the material in a new way, which suggests that the potential benefit of ER goes beyond a mere novelty factor [41].

In general, traditional teaching methodologies such as simple exposure of content on a blackboard, through lessons, PowerPoint presentations and textbooks alone do not motivate today’s students, who are Millennials or belong to Generation Z, to engage in a topic. Since Millennial students yearn for active engagement and they are motivated by achievement and affiliation, designing EER challenges becomes a highly compelling activity, which increases their interest on the subject [28,42,43].

A review of the recent literature shows that the main positive effect of EER consists of the increase in the motivation of students [26,27,29,40,44]. Nevertheless, further benefits are identified:

- Commitment and participation of students in the subject [44];
- Enhancing group cohesion, commitment, activation, and absence of a negative effect during the teaching and learning process [44];
- Encouraging teamwork, facilitating communication, and promoting professionalism [34];
- Engaging students in their learning environment, and encouraging collaboration, leadership and social skill set development [28];
- Encouraging students to get to know each other [45].

Due to EER’s high intrinsic motivation for learning, several authors invite other disciplines to apply it [40,44,46]. Compared to traditional teaching methods, students feel engaged in problem solving, they are focused on their main goal, and they aim to succeed, which requires to successfully communicate with the rest of the team, as well as collaborate and use their social skills.

In order to encourage students to review the course material before the EER performance, including the activity as a part of the subject’s assessment is a key factor [28,29].

3. Methodology

The study was carried out in the 2019–2020 academic year among 56 students enrolled in the subject “Introduction to Business” as part of the Marketing Degree, during six weeks in November–December.

The objective of the subject is to provide the student with a vision of the reality in which the business world operates and also to ease the students into understanding and analysis of the management task as a role to play in their future professional career. The assessment system of the subject consists of continuous evaluation (20%), plus a final theoretical exam (40%) and a practical exam (40%).

The subject is taught mainly via face-to-face teaching in class. However, theoretical materials and other practical tests are found in a university online learning platform. The online site used was Moodle, a Learning Management System (LMS).

A special end of semester session was organized in order to strengthen knowledge, motivate students and to generate emotions, bringing better knowledge retention. The class was split into two groups, control and experimental. The second group was introduced to an Educational Hall Escape (EHE), while the control group worked on the same topics, having to resolve the same exercises, but delivered with ordinary format in plain text. Both groups were required to use the same practical knowledge learnt in class during previous weeks. The educational objective of the activity performed, both in the control and experimental groups, was to reinforce specific knowledge of the subject, working on aspects such as emotion and motivation in the experimental group.

3.1. Educational Hall Escape

The study used the application of an Educational Hall Escape (EHE), a version of the standard educational escape room games [26]. This nomenclature does not exist in past scientific literature; however, it is used to differentiate from traditional commercial escape room dynamics. Aspects that they have in common are the fact they are carried out in a locked space, and the narrative flowing through a chain of puzzle/riddles to solve. The aim is to solve the riddles to win the game, not escaping from the room itself.

In the proposed EHE, students had to solve several consecutive conundrums without leaving the room by being quicker than the rest of the teams within a given set time.

The puzzles followed a theme that connected and gave consistency to the whole practice, and they were linked to the subject syllabus. Riddles had to be solved not solely by acquired subject knowledge but also by applying observation, ingenuity and teamwork.

Figure 1 shows the design and order of the activities that shape the EHE. It contains eight puzzles; six of them (from 2 to 7) have an educational objective linked to specific contents of the subject, as indicated in the figure. The other two puzzles (1 and 8) are the ones used to start the EHE and to end it. In addition, some complementary playful tests are collected that support the narrative of the EHE in elliptical form within Figure 1.

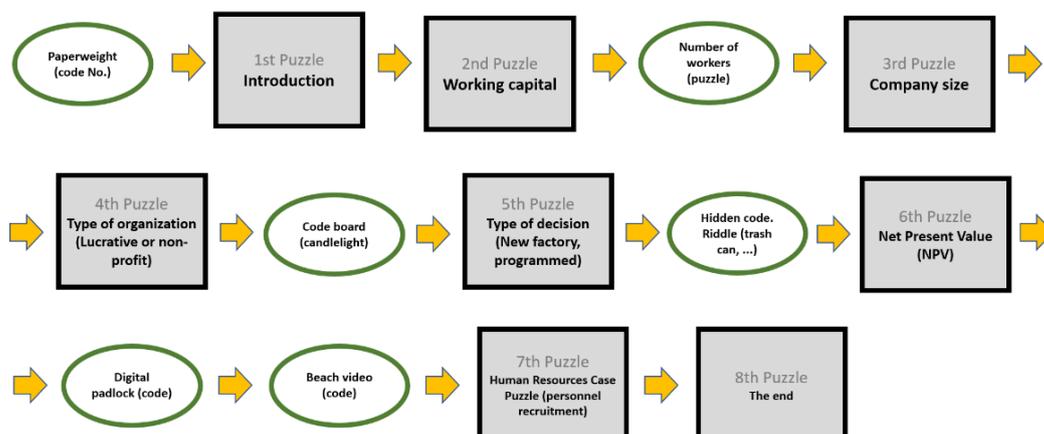


Figure 1. Organization and content of the different activities carried out in the EHE.

In terms of narrative, the chosen theme was appropriate for the student profiles as it was replicable in future learning. Students were given a job offer from an important multinational company to replace the current management team, due to retirement.

For those students who took part in the EHE, the experience started with the viewing of a short introductory video where the lecturers presented the plot, instructions and rules [47]. The quickest team in solving the riddles would be the winner and they would be hired as the company's new management team. Once the video was shown, a countdown was launch displaying the remaining time of the game.

The supporting test (Figure 1—ellipses) starts with a riddle which is hidden in a paperweight. Students must introduce the answer of the riddle into the digital platform to start the game. In addition, other tests were developed and completed during the activity, such as physical puzzles, codes that should be decrypted, riddles hidden into physical objects in the room (Figure 2), a digital padlock in a web and a video which hides a code inside of the narrative.



Figure 2. Examples of tests performed at the EHE.

3.2. Physical Organization

Two separate classrooms were booked in different locations to prevent any interference between both groups; one for the control group and a second one for the EHE group. The day before the activity, the students from both groups were told individually the time and location they had to go to.

The control group attended the usual classroom with the traditional master class layout. The control group was divided into five groups, each of which had five or six members. Each group was given a unique paper document with the activity description in the form of written questions. The questions, in terms of subject content, were identical to the riddles the second group had to solve. However, the dynamics of the activity differed, eliminating time pressure and narrative, both in the texts and in the questions from the whole practice. They did not visualize the introductory video and the lecture was presented as a traditional practical lecture, without games or emotions.

The experimental group attended a side classroom, smaller than standard lecture rooms and with a versatile layout. The room was decorated to create ambience and gain engagement from the students/players. The room had five stations, one for each team.

Each team had few physical elements required to solve some of the challenges in the EHE (such as conundrums or keys placed strategically in some objects inside the room). Each team had a laptop with access to the university virtual learning site where the challenges were found. Along with these, some accessories needed for the activity such as a paperweight with a code, a list of companies with additional information, a sheet with codes, a puzzle and other objects not intended to distract the participants' attention. The lecturers took the role of game master by being available to the teams as required.

The maximum duration of the activity was 50 min. The winning team would be the one that completed the activity the quickest.

3.3. Virtual Organization

The control group did not have access to the university learning online platform during the activity. The experimental group had access to the university online learning platform (Moodle) during the exercise so they could register the solutions to the challenges. This allowed them to have feedback on their progress and let lecturers monitor their movements and results for the study.

The Moodle tool "lessons" was used to implement the virtual side of the EHE. This tool allows the creation of sequential pages with content or questions and to branch out itineraries. In order to create separate records for each team, within the initial lesson and from the first challenge, each team followed a customized itinerary.

Across the respective itineraries' pages, the information needed to solve the challenges was becoming available once feedback was received for correct answers. Questions were used to check the content of the lessons had been absorbed by the students and had two formats: multiple-choice or numeric. In the multiple-choice questions, students had to select the correct answer from a list of 15 items to be able to pass to the next question. For each mistaken answer, the page went back to the original list rearranged, in order to prevent aleatory choices. In addition, a digital locker was used for one of the challenges, directing correct responses to a YouTube video with a hint to move forward.

Figure 3 shows the EHE Moodle design of one of the teams' itineraries. The other ones followed the same structure.

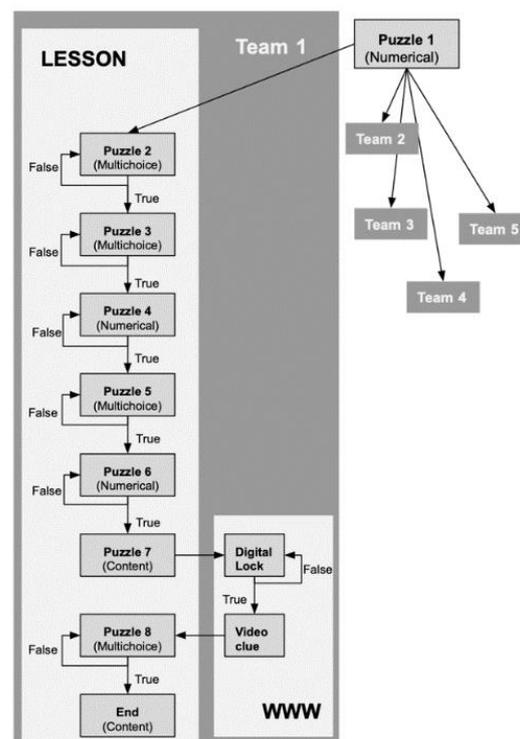


Figure 3. EHE design (lesson) in Moodle.

During the activity, students were allowed to consult their personal notes.

3.4. Study Design

3.4.1. Participants

For the design and validation of the activity, the class was divided into two groups, each of 28 students, created randomly, with a total of 56 participants. One group was experimental, and the second group was the control. Randomly, students were grouped into teams of five and six participants and subsequently assigned to the two main groups of study.

3.4.2. Procedure

The experimental group had an hour and a half, and the control group had an hour and twenty-five minutes to carry out the EHE. Both groups spent the last twenty minutes completing a questionnaire about the session held in Moodle. Time organization is shown in Figure 4.

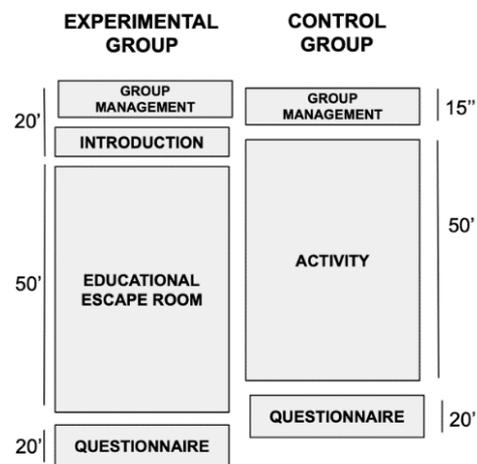


Figure 4. Temporal organization of the experiment.

In terms of analyzing the results and validation of the hypothesis, the study used three tools. Firstly, an exam carried out two weeks post-study. The exam consisted of a 20-question test, where students had to select answers from a four-item list and a penalty for incorrect answers. Seven of the questions were very similar for both the control group and the group taking the EHE. The idea was to verify the knowledge retention in both groups.

The second analytical tool, used to measure aspects such as motivation and emotion, was the Gameful Experience Questionnaire, Gamefulquest [48], based on 56 items organized in seven categories (Accomplishment, Challenge, Competition, Guided, Immersion, Playfulness and Social experience). This questionnaire measured the individual user's game experience in systems, here the EHE.

4. Results

Statistical analysis was performed using the computing environment R [49] and in particular the R-Likert library [50], for the questionnaire data.

4.1. Testing Hypothesis H1

In order to check whether the learning is greater for those students who enrolled in the EHE experience when compared to those who did not (Hypothesis H1), we consider the final evaluation of the subject. Figure 5a shows boxplots of final evaluation results for both control and experimental groups and a parametric t-test was performed showing that there were no significant differences between Control and Experimental groups (p -value = 0.3433).

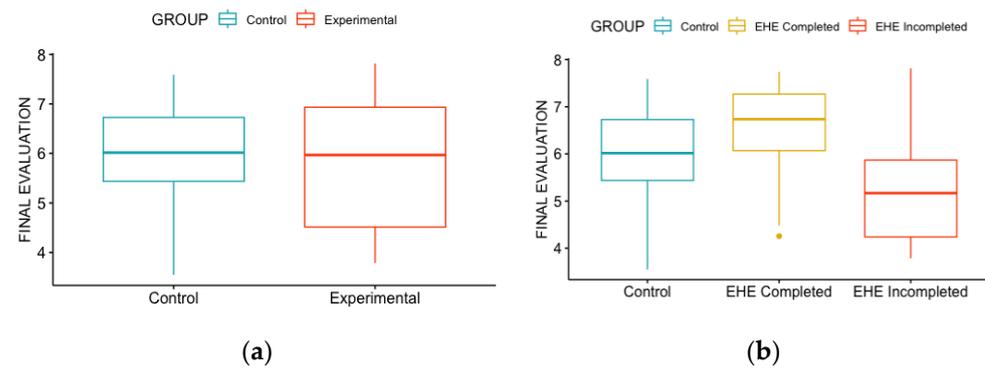


Figure 5. (a) Boxplots of final evaluation results for both Control and Experimental groups; and (b) Boxplots of final evaluation results for Control and EHE Completed and EHE Not completed groups.

We also considered whether students participating in the EHE completed the experiment or not. Again, Figure 5b shows differences in the final evaluation between control/completed EHE and not completed EHE students. An analytical analysis shows that there are no significant differences between the three groups (p -value = 0.167) and when considering groups two by two, we observed that the students not completing the EHE experience differ from the other two groups. Table 1 shows numerical summaries of final evaluation for the different groups considered (Control, Experimental, EHE Completed and EHE Not Completed).

Table 1. Numerical summaries of final evaluation for the different groups considered (Control, Experimental, EHE completed and EHE Not Completed): minimum (Min), 1st quantile (Q1), median (Med), Mean, 33rd quantile (Q3), maximum (Max) and standard deviation (SD)).

	Min	Q1	Med	Mean	Q3	Max	SD
Control	3.548	5.436	6.016	6.050	6.728	7.588	1.032
Experimental (EHE)	3.788	4.514	5.968	5.839	6.934	7.816	1.350
EHE Completed	4.256	6.068	6.736	6.386	7.268	7.740	1.257
EHE Incompleted	3.788	4.240	5.168	5.291	5.868	7.816	1.272

4.2. Testing Hypothesis H2

As mentioned above, after the EHE experience, students responded to a questionnaire based on 56 questions. The Gamefulquest [48] and the 56 questions are arranged in seven well-known dimensions: Accomplishment, Challenge, Competition, Guided, Immersion, Playfulness and Social Experience. A seven-point Likert-type scale was used for each question, ranging from “(1) strongly disagree” to “(7) strongly agree.”

Out of the total of 56 students, only 47 students completed both the questionnaire and the evaluation process, 25 from the Control group and 22 from the experimental group (12 of which completed the experience and 10 did not).

For each of the 56 questions, we analyzed whether there were significant differences between the control and the hall escape groups (Hypothesis H2). To do this, we used both graphical and inferential methods. Whether a parametric or nonparametric test should be employed, for analyzing questionnaire data, has been somehow controversial. Many authors argue that for such discrete ordinal variables, a nonparametric test should be used. However, other authors argue that parametric tests are more robust and could also be employed for Likert data under some premises such as normality assumptions not being violated; see for instance Sullivan et al. [51].

After checking normality for each of the 56 different questions of the questionnaire, employing both graphical inspection (Q–Q plots) and two normality tests (the Kolmogorov–Smirnov test and the Shapiro–Wilk’s W test) we concluded that nonparametric Mann–

Whitney tests would be better used here and, therefore, Mann–Whitney tests were employed for testing significant differences between control and experimental groups in each one of the 56 questionnaire responses. Only 16 out of the 56 Mann–Whitney tests developed seem to be not significant (p -values > 0.05), which allows us to conclude that responses from students who took part in the EHE experiment differ markedly from those who did not take part in the gaming experience along with the seven dimensions of the questionnaire.

4.3. Testing Hypotheses H3 and H4

Apart from the seven dimensions considered in the Gamefulquest questionnaire, in this research we are especially interested in two particular aspects, namely motivation and emotion. Out of the 56 questions, we identified 13 questions related to emotion (Hypothesis H3) and 13 related to motivation (Hypothesis H4). Figures 6 and 7 present results of the questionnaire for the questions related to motivation and emotion, respectively.

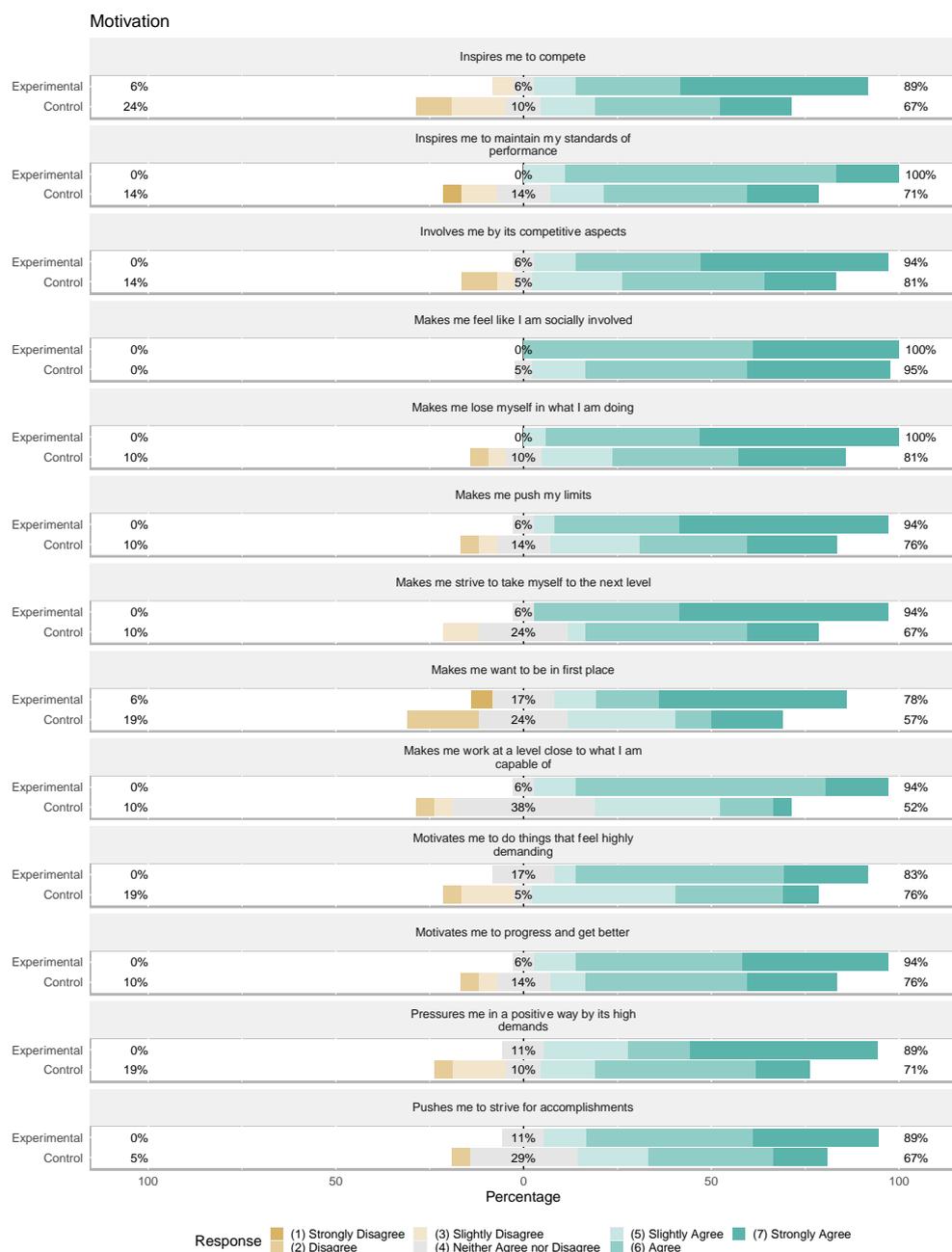


Figure 6. Questionnaire questions related to motivation.

All these 26 questions show significant differences between the Escape Room and control students, i.e., p -values < 0.05 in the corresponding Mann–Whitney tests.

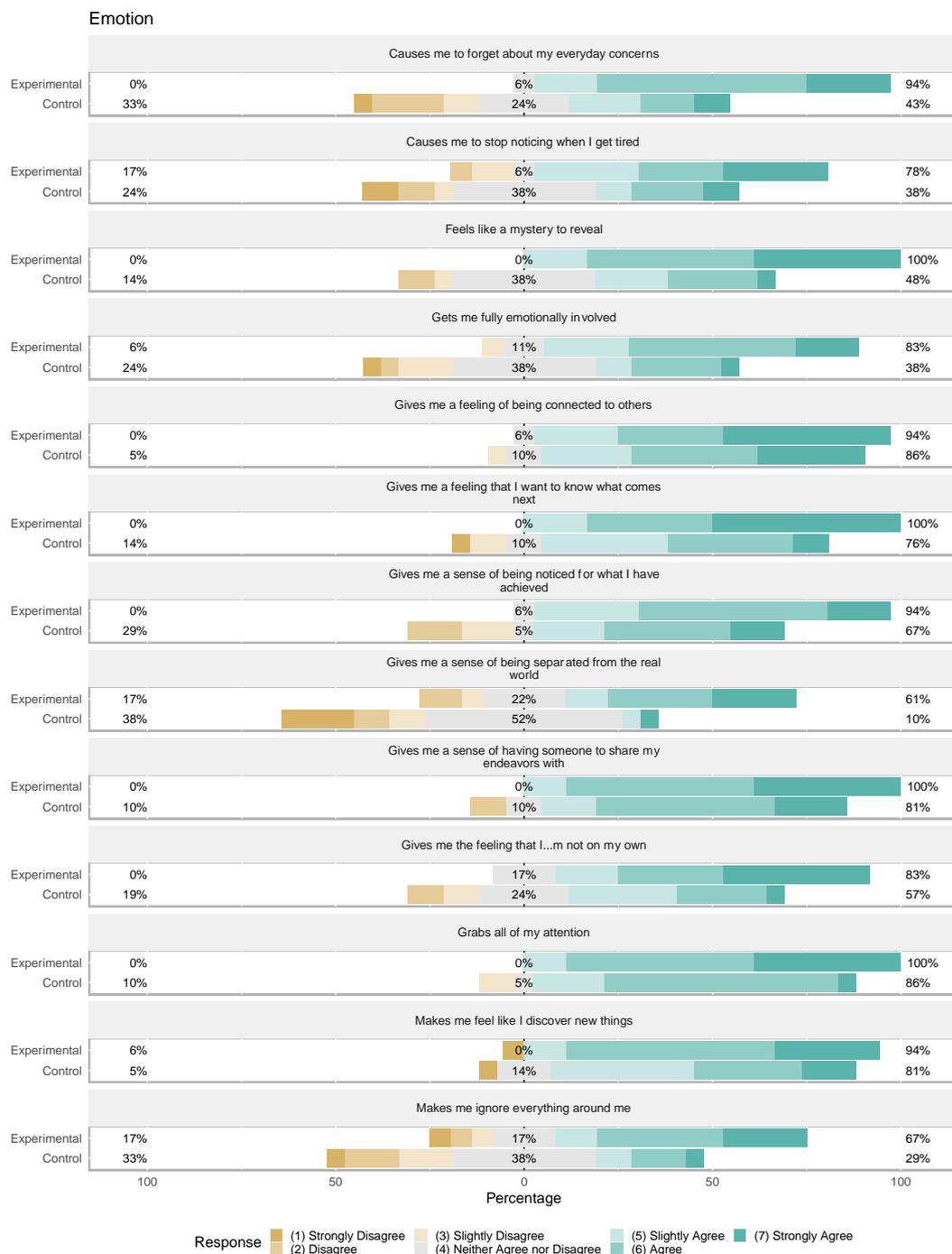


Figure 7. Questionnaire questions related to emotion.

For the sake of completeness, and in order to define a quantitative variable measuring the Motivation and Emotion aspects of interest, we calculated the mean responses of those questionnaire items already identified as motivation or emotion questions. As expected, these two variables show significant differences between escape room and control students. Here, we use parametric t-test after checking normality premises are met (again using Q–Q plots and the Kolmogorov–Smirnov test and the Shapiro–Wilk’s test). Boxplots presented in Figure 8a,b, showing graphical evidence and statistical test conclude that questionnaire

responses are higher for experimental than control students with p -values < 0.001 for both motivation and emotion.

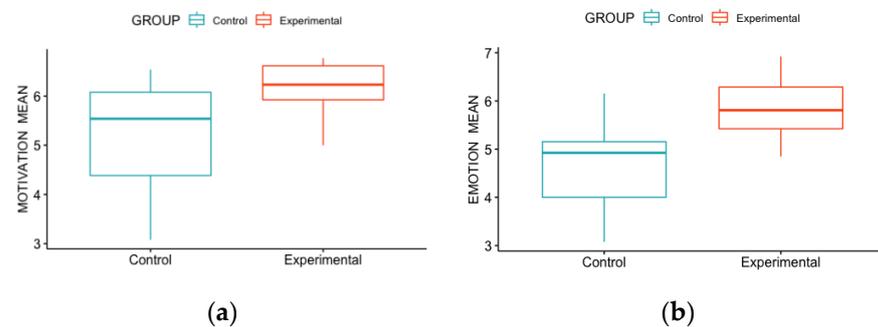


Figure 8. (a) Boxplot showing graphical evidence that the motivation questionnaire responses are higher for the experimental than the control group; and (b) Boxplot showing graphical evidence that the emotion questionnaire responses are higher for the experimental than the control group.

For the sake of completeness, Tables 2 and 3 show summary statistics for the mean responses of those questionnaire items identified as motivation or emotion questions.

Table 2. Numerical summaries for the mean responses of those questionnaire items identified as motivation for control and experimental groups: minimum (Min), 1st quantile (Q1), median (Med), Mean, 33rd quantile (Q3), maximum (Max) and standard deviation (SD)).

	Min	Q1	Med	Mean	Q3	Max	SD
Control	3.077	4.385	5.538	5.253	6.077	6.538	1.062
Experimental	5.000	5.923	6.231	6.176	6.615	6.769	0.522

Table 3. Numerical summaries for the mean responses of those questionnaire items identified as emotion for control and experimental groups: minimum (Min), 1st quantile (Q1), median (Med), Mean, 33rd quantile (Q3), maximum (Max) and standard deviation (SD)).

	Min	Q1	Med	Mean	Q3	Max	SD
Control	3.077	4.000	4.923	4.692	5.154	6.154	0.772
Experimental	4.846	5.423	5.808	5.829	6.288	6.923	0.553

5. Discussion and Conclusions

The research design is based on four hypotheses and their rejection and validation are shown. In addition, the Educational Hall Escape experience presented is easy to adapt, not only in higher education and business economics fields, but also in other subjects, disciplines and educational levels.

When dealing with EHE configuration and results, it is important to analyze the participants' progress and register their activity.

Several EHE aspects could be assessed by analyzing the results of the students, such as the level and puzzle adaptation, or the allotted time. To obtain this information, a virtual space in Moodle registered, monitored and recorded the students activity. This type of virtual resource offers the possibility of sending automatic feedback to students, to guide them during the process, either when the answer is correct or not, and determine whether or not they have to repeat the puzzle. Thus, a physical and a digital duality is conferred upon the experience, by combining tests with touchable elements, giving a more realistic context to the narrative, with other digital resources.

Teachers should pay attention to every event taking place inside the room and in the different teams in order to avoid a loss of motivation and to keep the students focused on

the main goal of the objective of the activity, which is to generate emotions. In order to be able to do this, a minimum of two teachers must participate in the EHE and one of them must become the game master. Other studies in the literature underline the role of the game master during the performance of EER [40,52], since this figure offers extra guidance.

The first defined hypothesis deals with the improvement of the learning process of the experimental group that performed the EHE. In H1, it is stated that this group would achieve better results than the control group. The experiment looked for the students' emotional stimulation to improve their knowledge retention and memory. A number of recent studies state both negative and positive emotionally arousing events are better remembered than emotionally neutral events [18–20]. Thus, "Emotional memory is the result of storing the information that was accompanied by stressful factors through which the information is more easily fixed" [21]. The results, shown in Figure 5a,b, reject the hypothesis. Despite the fact that the exam results are slightly better for those who successfully finished the EHE, there is no statistical significance. The students who did not finish the EHE achieved worse results, but these are not significant. Thus, it is confirmed that applying this strategy does not worsen students' learning results when the experimental group is compared to the control group, provided that students finish the activity. It is of interest to recall here that the gaming experience took place in just a 2 h session and therefore we could not expect this to have a significant effect upon the whole evaluation of the semester. This lack of positive academic results is found in similar Educational Escape Room experiences reported in the literature [45,52,53].

The second hypothesis (H2) tries to answer whether EHE participants felt the game in all its dimensions, following the seven emotions once defined by Högberg et al. (2019) in a designed and validated questionnaire [48]. As a result, a remarkable game perfection difference was measured between the experimental and the control groups. It is clear from the outcome the appropriate design of the experimental activity strengthens the feelings generated by games, such as the motivation and the emotions that this research fosters. Despite the fact that there are other questionnaires, such as the one proposed by Hou and Chou [54] or GAMEX [55], that measure a number between two and five dimensions, they share the same goal, which is getting to know the game experience.

The last two hypotheses deal with two aspects that are key to this work, i.e., motivation (H3) and emotion (H4). As expected, the experimental group exhibits significantly better results for both cases, summarized in Figure 8a,b boxplots.

Using Escape Room as an educational strategy to foster student motivation is widely proposed in the literature [40,44,55], since it engages the students and maintains their attention.

Educational Hall Escape is based on the Educational Escape Room, providing two important extras:

- the existence of several teams competing to achieve the same challenge at the same time and place; and
- the condition of leaving the room as the final goal is eliminated.

Thus, the possibilities of this strategy for working on more skills than EER are slightly higher provided that the main features of it are kept, such as the room, the puzzles and the narrative.

Even though here it was demonstrated that the learning is not improved by the EHE, due to its brief application, the motivation of the students and their emotions increased notably. This fact can be used to engage the students with the subject.

The study presented here shows an experience that can be easily replicated in other fields, producing a positive impact on the motivation of the students who participate in the experiment, i.e., EHE, instead of the traditional class. The main limitation of this research is the lack of academic results linked to emotions, even though the motivation increases, as previously mentioned. From the results and detected limitations, future work is proposed to take advantage of the motivation improvement during these types of games, in which the students become involved in the subject, by re-scheduling the activity to the start of the term. Hence, these types of strategies would be recommended for the beginning of the

course, as a reason for introducing students to the topic and contents. On the other hand, since the proposed activity is generic, focused on reviewing some concepts, we propose changing the main educational objective by focusing it on the learning of new concepts. The new objective not only would imply a support to understand already seen concepts, but also look at new ones, at the time that an active and autonomous attitude of the student is obtained. This type of activity would replace the classic classroom teaching method at times.

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