



Playful experience, learning perception, and motivation in a cooperative escape room activity in undergraduate nursing education: A mixed-methods study

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ABSTRACT

Background: Escape rooms are an innovative pedagogical approach based on problem-solving and focused on the student's autonomous learning competencies to resolve a realistic or fictitious situation. Assessment of students' perception of their own learning and motivation with this approach, and the qualitative description of escape rooms is limited.

Aims: To evaluate the gameful experience, learning perception, and motivation in cooperative learning among students participating in an escape room.

Sample: All sophomore nursing students enrolled in the subject 'History, Theory and Methods of Nursing II'.

Methods: A sequential explanatory mixed-methods design was employed. Quantitative data were collected through Gameful Experience Scale (GAMEX) and Cooperative Playful Learning Strategies (CMELAC) after the escape room activity. The qualitative phase involved thematic analysis of interviews to explore students' perceptions of the activity.

Results: Quantitative analysis revealed high enjoyment (4.64 ± 0.62 out of 6 points) and activation (4.34 ± 0.87 out of 6 points) scores, with significant correlations between GAMEX and CMELAC total scores ($r = 0.566$, $p < 0.001$). Qualitative themes highlighted camaraderie, fun, and applicability of learning as positive aspects, while limited resources and negative competitiveness were noted challenges. Integrated data showed that high GAMEX scores correlated with positive qualitative experiences.

Conclusions: The escape room activity was an effective educational tool, enhancing engagement, teamwork, and application of nursing concepts. While resource constraints and competitive elements posed challenges, the activity supported meaningful learning and active participation. This study underscores the potential of gamified strategies in nursing education, recommending further research on scalable adaptations and robust assessment of learning outcomes.

1. Introduction

During the last few decades, a major concern in university education has been the shift from a traditional approach to an educational paradigm focused on student activity (Chi & Wylie, 2014). Numerous authors (Kostiainen & Pöysä-Tarhonen, 2019) have proclaimed the need to create a more active and meaningful environment for university

students, creating a paradigm shift in favor of a curriculum that responds to the challenges of today's society, where the competence of learning to learn is favored. To this end, numerous strategies have emerged that aim to redesign the way teaching is approached in the university context (Gallegos et al., 2017; López-Belmonte et al., 2020).

Educational gamification is an innovative teaching method that has been gaining strength (Márquez-Hernández et al., 2019; Van Roy &

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Zaman, 2018) as a growing tool in recent years that uses game elements in non-playful contexts to make the experience feel like a game and engage users (Eppmann et al., 2018; Márquez-Hernández et al., 2019). Thus, interest in educational games is growing (Gómez-Urquiza et al., 2019) because, through motivation, students' attention and thinking can be captured in the classroom (López-Belmonte et al., 2020; Márquez-Hernández et al., 2019). In this context, playful and game-based strategies have emerged as effective didactic tools to promote student motivation, collaboration, and autonomy in learning (Ratinho & Martins, 2023). A playful experience in the university context refers to the pedagogical design that integrates elements of play (such as challenges, narratives, rewards, interaction and exploration) into academic activities, in order to enhance intrinsic motivation, active participation and deep learning. These experiences are not limited to the use of formal games, but incorporate a playful mindset that encourages creativity, collaboration, and problem-solving while maintaining academic rigor (Brown & Leigh, 2018; Whitton & Moseley, 2019)

One particularly relevant example is the escape room activity, whose pedagogical rationale lies in its capacity to foster cooperative learning through immersive and motivating challenges (Clarke et al., 2017). Escape rooms create a playful experience that stimulates intrinsic motivation by combining challenge, autonomy, and relatedness, which are core elements of self-determination theory (Khera et al., 2025). In cooperative settings, such as team-based escape rooms, students are encouraged to interact, negotiate, and build shared meaning while solving problems collaboratively (Cohen et al., 2020, pp. 1–18). These activities are especially effective in higher education for developing transversal competencies, as empirical research demonstrates their potential to increase engagement, teamwork, and meaningful learning. This approach aligns with constructivist theories of learning, which emphasize active participation, collaboration, and problem-solving (Chang et al., 2025; González-Fernández et al., 2022; Lee et al., 2025)

This innovative pedagogical approach is based on problem-solving and focuses on developing students' competencies for autonomous learning through the resolution of realistic or fictitious situations posed by the teacher. The task requires collaborative problem-solving, and students must reach a solution within a specific and limited time frame (Anguas-Gracia et al., 2021; López-Belmonte et al., 2020)

As a didactic game, the escape room incorporates a variety of game-based learning strategies, including time-bound challenges, narrative elements, and cooperative tasks, all of which create an immersive and stimulating educational experience (Kuo et al., 2022). When learners are immersed in this playful and dynamic environment, their intrinsic motivation and engagement tend to increase significantly, promoting deeper involvement in the learning process (Fotaris & Mastoras, 2022). Empirical evidence supports the use of gamified strategies in higher education to foster teamwork, critical thinking, and student autonomy—especially in disciplines that require the development of professional competencies, such as nursing (Gómez-Urquiza et al., 2019)

This type of serious games (Arnab et al., 2015) can be beneficial for clinical reasoning and decision-making (Johnsen et al., 2016, 2018), thus being useful and satisfactory for students (Márquez-Hernández et al., 2019), and complementary to traditional practice and training in other simulations (Lynch-Sauer et al., 2011; Sandoval-Hernández et al., 2023). Taking into account the benefits, different experiences have already been noted following the introduction of escape rooms in the university teaching context (Mateos et al., 2021; Quesada & Villa, 2024), and, specifically in the region of Andalusia (Spain), different approaches based on escape room activities have also been followed with nursing students (Gómez-Urquiza et al., 2019; Márquez-Hernández et al., 2019).

Recently, a pilot study was carried out at the Red Cross University Nursing Center, within the course 'History, Theories and Methods of Nursing II', a compulsory subject taught in the first semester of the second year of the Bachelor of Science in Nursing program, prior to students' first clinical placements (Fagundo-Rivera et al., 2024). The

learning goals of this university subject focus on nursing management methodologies, documentation systems, taxonomies, and organizational models of care, providing students with essential tools for their future professional roles. However, as a predominantly theoretical subject, students often encounter difficulties in transferring abstract knowledge to practical scenarios, especially in the absence of clinical experience.

That pilot study evaluated the participants' gameful experience through the Gameful Experience Scale (GAMEX) (Eppmann et al., 2018; Márquez-Hernández et al., 2019). However, other influential variables not previously analyzed could be assessed, such as university students' perception of their own learning and motivation in cooperative learning (Manzano-León et al., 2021). Furthermore, the qualitative description about the experience of escape room in previous studies is limited (Roman et al., 2020).

To address these challenges, this study explores whether the use of a playful, immersive, and team-based escape room activity can facilitate meaningful learning, enhance motivation, and promote the practical application of course content. To understand this educational strategy comprehensively, the investigation requires both quantitative measurements and qualitative deeper insights, allowing the lecturer to refine the design of the activity and determining whether the proposal has been truly successful and to what extent it has fostered meaningful learning.

This study was guided by the following research question: How did sophomore undergraduate nursing students perceive the gameful experience, learning, and motivation in cooperative learning during an escape room activity? In summary, the aim of this study was to measure and explain the gameful experience, the perception of learning and motivation in cooperative learning of sophomore undergraduate nursing students in an escape room activity in the university teaching context.

2. Materials and methods

2.1. Study design and participants

This study followed a sequential explanatory mixed-methods design, which is frequently defined by an initial phase of collecting and analyzing quantitative data, followed by a second phase focused on the collection and analysis of qualitative data informed by the results of the first phase, and the latter integration of both quantitative and qualitative data. This study had a quantitative predominance, and we followed a qualitative hermeneutic phenomenology approach (Creswell, 2009; Gadamer, 1977).

An escape room learning activity was implemented as part of a mandatory university course conducted at a Nursing University Centre in a southern Spanish city (Seville). The Escape Room consisted of ten stages based on the thematic content of the subject 'History, Theory and Methods of Nursing II'. This was a compulsory activity, included within the face-to-face seminars of this university course.

All sophomore nursing students enrolled in the course ($n = 115$) were invited to participate in the study. The sample was determined by following predefined eligibility criteria: inclusion criteria (being enrolled in the 'History, Theory and Methods of Nursing II' subject, and being over 18 years old) and exclusion criteria (having acute or uncontrolled chronic biopsychosocial health issues at the time of the intervention).

Although the activity was mandatory and attendance was compulsory, it did not contribute to the final grade of the subject. The course itself is compulsory, and therefore participation in the escape room was also obligatory, resulting in a 100 % participation rate. To ensure full attendance, the activity was scheduled well in advance and took place at the end of the academic calendar, once all theoretical classes had been completed. Additionally, the escape room session was held during regular university class hours to facilitate student participation.

It is important to note that the escape room was not used as a formal evaluative method, and the study did not aim to measure improvements

in academic performance. Instead, the focus was on assessing the students' experience with this innovative teaching method. For this reason, no grade was assigned based on the activity. Finally, alternative arrangements were in place for students who, for valid reasons, were unable to attend the escape room activity, ensuring that no participant was excluded from the study due to absence.

The study design was selected to align with its nature and objectives. Since the escape room was a scheduled compulsory educational activity embedded within the course, creating control or comparison groups, as typically required in randomized controlled trials or quasi-experimental designs (Aggarwal & Ranganathan, 2019), was not feasible as all students had equal access to the activity. Moreover, the goal was not to measure academic performance, but to explore students' subjective experiences with a specific teaching methodology. A sequential explanatory mixed-methods approach was therefore appropriate, as it allowed the initial quantitative findings to guide the focus of the subsequent qualitative phase. This sequencing ensured that interview questions and observations were grounded in the results of the surveys, highlighting areas of relevance such as enjoyment, teamwork, or motivation. In doing so, the design strengthened the depth and coherence of the analysis and enabled a richer integration between statistical trends and lived experiences, consistent with the principles of hermeneutic phenomenology and mixed-methods research (Creswell, 2009; Gadamer, 1977).

The quantitative and qualitative parts of the study were carried out by the same researchers between October and November 2024. To enhance the reporting of quantitative, qualitative, and mixed data, the study adhered to Creswell (Creswell, 1998, 2009; Creswell & Plano Clark, 2018) and Gadamer (Gadamer, 1977, 2010, pp. 1–495; Ormiston & Schrift, 1989) recommendations, and to checklists such as Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) (Des Jarlais et al., 2004), Consolidated Criteria for Reporting Qualitative Research (COREQ) (Tong et al., 2007), and Mixed Methods Appraisal Tool (MMAT) version 2018 (Hong et al., 2019), respectively.

2.2. Intervention implementation

The escape room consisted of ten stages based on the thematic content of the subject 'History, Theory and Methods of Nursing II' at the University of Seville. The activity lasted 2 h. All 115 students took part simultaneously in the escape room. To incorporate cooperative elements during the escape room activity, students were organized into groups and were required to solve the challenges by combining their individual knowledge as well as their strengths in gamified tasks involving logic, calculation, mental agility, and visual skills. This group work was essential, as each student could contribute specific abilities necessary to successfully overcome the diverse challenges presented. The cooperative strategy relied on the diversity of individual skills within the groups, enabling students to leverage their different cognitive and functional abilities to achieve shared objectives.

The escape room activity was implemented once during the academic year, at the end of the first semester, once all theoretical classes had concluded and before the final exam. This timing allowed the students to apply the full set of course contents in an integrative and practical manner. Although the escape room was a compulsory activity within the course, it did not influence the final grade. Participation in the activity was mandatory, and attendance reached 100 %. However, participation in the research component of the study was voluntary. Alternative resources were provided in case any student could not attend the escape room.

The teacher for the course served as the sole organizer and facilitator of the entire activity. For this reason, a single, well-organized space was selected to accommodate all participants simultaneously. Specifically, the activity was held in a large, versatile classroom with a capacity for 140 people, equipped with enough chairs for everyone to be seated. The room was rearranged into clusters of tables surrounded by chairs, allowing students to sit with their group, while ensuring there was

ample space for movement and sufficient distance between groups. All stages of the activity took place at these group tables. The professor was positioned on an elevated platform to oversee the entire room and monitor the groups and coordinate the activity effectively. Three other professors collaborated in the escape room as a contingency committee that managed any possible unexpected issues or disruptions.

The students formed their groups voluntarily, ensuring that all groups had an equal number of members. 14 groups were formed. Each group chose a name that represented them and selected a representative who would move around the classroom, while the remaining members stayed at their designated team area. The representative was responsible for going to the moderator's station to retrieve each of the ten tasks, submitting the answers, and verifying their correctness before going to the next. Although the term "test" was used previously, the challenges were not only academic assessments. They were designed to encourage logic, reasoning, and creative thinking and included crosswords, word searches, hieroglyphs, reading exercises, or calculations between other methods. The instructions for each stage were written on paper and hid in ten different envelopes. To solve them, pens were needed, and some activities required a computer or tablet with internet access to search for the answers. All groups participated simultaneously, so that, the verification of the answers was done electronically through a mobile application that gave the green light if the answers were correct, or red light if they were incorrect. The professor could monitor these answers.

The Escape Room began with a story, which served to establish the context of the situation against the clock that the students must solve in order to escape. Along the game, the students had three wild cards that could not be reused once activated; they could only be used once, and the professor had to record that the clue had been consumed. These wild cards were looking at the subject contents (through the online learning manager), searching on databases (via internet on laptops) and asking the professor.

There was a total time limit of 2 h to complete the activity, but no fixed time was assigned to each stage. Each group progressed at its own pace, and the game concluded when the first team completed all ten stages successfully. The rest of the groups worked through the challenges at their own rhythm until then.

The ten stages were created by the teacher coordinator of the subject and dealt with the contents and learning objectives of the university course. Stage one was a multiple-choice test about nursing theories and models. Stage two was a clinical case to find five alterations on Virginia Henderson's 'fundamental necessities'. Stage three was a mathematical problem about a medication dissolution. Stage four was a crossword about questionnaires and validated assessment scales (e.g., Norton, Lawton&Brody, or Hamilton). Stage five consisted of the identification of two nursing diagnoses (from NANDA International). Stage six was a relation task to build nursing objectives about five fictitious patients. For stage seven, it was necessary to look at the nursing outcomes from the nursing outcomes classification (NOC) to find a few indicators. Stage eight was a cryptogram puzzle about nursing interventions from the nursing interventions classification (NIC). Stage nine was a true/false test which must be solved by reading a Clinical Practice Guideline on blood cultures. And stage ten was a hieroglyph which combined NOC, NIC and critical thinking. After passing each test, a clue was obtained, and, by joining the 10 clues, the final code to win was formed. At the end of the game, all students received a symbolic prize for their participation, and the winning team received a gift.

Although the escape room was integrated into a mandatory university course, it was not used as a formal evaluative method, and no academic grade was assigned for participation or performance. The primary goal was to provide students with innovative and practical learning experience. The activity was designed for engagement and reinforcement of learning, rather than formal assessment. Evaluation of the intervention was conducted afterward through the university's regular communication channels, using mixed-methods tools to assess the students' perceptions of learning, motivation, and gameful

experience.

2.3. Quantitative data collection and analysis

The quantitative part of this study used a cross-sectional questionnaire made in Google Forms. The students accessed it after the escape room in October 2024, using their smartphones to scan a QR code. This questionnaire included sociodemographic variables (age, gender, and previous experiences in escape rooms), and outcomes related to students' experience in gamification and motivation in learning.

Students' experience in gamification was assessed using the Gameful Experience Scale (GAMEX), which has 27 items with 1–5 Likert-type response options (1 = strongly disagree, 5 = strongly agree) in its Spanish validated version (Márquez-Hernández et al., 2019). This scale is structured into 6 dimensions: Enjoyment (analyzes the degree of enjoyment of the user during the activity; formed by 6 items); Absorption (analyzes the power of abstraction from reality that the experience produces in participants as well as time-awareness or lack thereof during the experience; formed by 6 items), Creative Thinking (analyzes the development of creative thinking or creativity fostered by the experience, and the mastery or confidence that the user has in themselves during it; formed by 4 items), Activation (analyzes the level of activation that the user considers to have experienced during the activity; formed by 4 items), Absence of Negative Affect (analyzes whether users have manifested or felt negative emotions while playing; formed by 3 items), and Dominance (analyzes feelings about being in control of the situation; formed by 4 items). Higher scores, except in the Absence of Negative Affect category (measured inversely), meant a greater approach to the construct measured in each category. These dimensions showed high internal consistency, as indicated by Cronbach's α : Enjoyment ($\alpha = 0.96$); Absorption ($\alpha = 0.91$); Creative Thinking ($\alpha = 0.88$); Activation ($\alpha = 0.87$); Absence of Negative Affect ($\alpha = 0.85$); and Dominance ($\alpha = 0.84$).

Students' motivation in learning was assessed using the Cooperative Playful Learning Strategies (CMELAC) questionnaire, which has 16 items with 1–5 Likert-type response options (1 = strongly disagree, 5 = strongly agree) in its Spanish validated version (Manzano-León et al., 2021). This questionnaire is structured into 4 dimensions: Motivation (analyzes students' drive and interest in the tasks presented through gamified methods), Learning (analyzes the perceived improvement in knowledge and understanding resulting from playful strategies), Teamwork (analyzes the quality of collaborative efforts and interactions among peers during gamified activities), and Flow (analyzes the state of immersion and optimal engagement experienced during the activities). Higher scores represented a greater approach to the constructs measured in these categories. The questionnaire was subjected to rigorous validation processes, including a Confirmatory Factor Analysis (CFA), demonstrating its factorial structure, content validity, and internal consistency. Cronbach's α scores for each dimension exceeded 0.70, indicating strong reliability.

The rationale for choosing the GAMEX and CMELAC was that both instruments are validated in Spanish language, demonstrate strong psychometric properties, and comprehensively assess key constructs relevant to the study, such as the gameful experience and cooperative motivation in playful learning environments (Manzano-León et al., 2021; Márquez-Hernández et al., 2019).

The Kolmogorov-Smirnov normality test was carried out for all quantitative variables, as the sample was larger than 50 participants (Mishra et al., 2019). All variables followed a normal distribution. Sociodemographic variables were summarized using count and frequency (percentage) for categorical variables. Age was presented as a quantitative variable, so mean and standard deviation were calculated. Mean and standard deviation were calculated for all GAMEX dimensions and items, and for all CMELAC items. Pearson's correlation coefficient was used to assess the correlation among age, all GAMEX dimensions, and GAMEX and CMELAC total scores. All quantitative data analysis was

performed with SPSS version 19.0.1.0.

2.4. Gaining understanding and qualitative data analysis

The qualitative part of this study was made by a research team with previous experiences in quantitative, qualitative, and mixed methods designs; and with the escape room teaching methodology (Fagundo-Rivera et al., 2024; Romero-Castillo et al., 2024). It was composed by three people who identified as men, and a person who identifies as a woman. Two team members are registered nurses who hold a PhD in Health Sciences, and three of them have a MSc. None had previous relationships with the participants. All team members had similar pre-understandings that could influence their work, as a consequence of having conducted previous similar studies together (Fagundo-Rivera et al., 2024; Romero-Castillo et al., 2024): the positive impact of students' experience in learning, the usefulness of escape room as a teaching method, the importance of mixed methods studies, and the potential role of escape rooms and mixed-methods studies in assessing nursing competences.

In the qualitative part of this study, we followed a hermeneutic phenomenology approach, which is commonly used in nursing to define and interpret the essence of different lived experiences regarding different phenomena (Alsaigh & Coyne, 2021). We used hermeneutic phenomenology because this approach values the depth of meaning people give to their experiences, rather than how long the event lasts. Although the escape room activity lasted 2 h, it involved emotionally engaging, socially interactive, and cognitively stimulating situations that prompted reflective interpretation, which are qualities that are consistent with the notion of a lived experience in hermeneutic phenomenology (Gadamer, 1977, 2010, pp. 1–495). Following this approach, the qualitative data collection process was structured in two stages: gaining understanding through dialogue with the participants, and gaining understanding through dialogue with the text (Gadamer, 1977, 2010, pp. 1–495).

Therefore, we selected all participants from the quantitative phase who were willing to be interviewed in the qualitative phase. We interviewed students in November 2024 to gain understanding through dialogue with the participants (Gadamer, 1977, 2010, pp. 1–495). We conducted the interviews individually and using a semi-structured format, in the same classroom where the escape room took place, to facilitate stimulated recall (Calderhead, 1981); which was an approach consistent with hermeneutic phenomenology as it allowed each student to share their lived experiences with the learning activity. We did not record the interviews but noted down our observations and relevant codes during and after the sessions using a physical structured register (Supplementary 1). This decision was made to preserve the classroom environment where the escape room took place, fostering a sense of continuity that could support stimulated recall (Calderhead, 1981). Additionally, avoiding audio recording helped reduce potential discomfort or self-censorship, allowing students to express themselves more naturally (Rutakumwa et al., 2020; Seale et al., 2004, pp. 16–34). We constructed the questions used in the interviews after analyzing the initial quantitative data to integrate the quantitative and qualitative parts of the study, debating the purpose of the questions, independently reviewing the literature in databases to understand which frequently asked aspects related to the escape room aligned with the research approach, and carrying out a triangulation process to identify key themes, formulate open-ended questions, review their clarity, and avoid ambiguity (Creswell, 2009, 2014; Creswell & Plano Clark, 2018). We also provided further information on the interview process provided to enhance transparency and replicability (Supplementary 1).

We made an inductive thematic analysis to gain understanding through dialogue with the text (Gadamer, 1977), and to categorize students' answers into themes, subthemes, categories and subcategories. The process entailed meticulously analyzing the students' responses, identifying and highlighting specific words in the text that reflected key

ideas or concepts, conducting triangulation, and organizing these into categories that combined related ideas or thoughts. We thoroughly examined the complete dataset to verify the internal consistency of each theme, ensure clear distinctions between themes, and confirm that each theme accurately represented the data while comprehensively addressing all relevant responses (Vaismoradi et al., 2013). We achieved data saturation when we could not identify any new categories through thematic analysis (Rahimi & khatooni, 2024). We presented these findings using thematic maps and students' quotations, which were identified with participant number, gender and age. We also made a content analysis to quantify the frequency in which the students mentioned parts of the phenomenon that referred to a specific subtheme or category. We did not conduct a content analysis of the themes because its results would be the sum of the frequency of the previous embedded categories, and neither did to subcategories because they represented very specific details of a larger category. We performed all the qualitative data analysis with Microsoft Excel version 2311.

2.5. Integration of quantitative and qualitative data

Quantitative and qualitative data were further integrated following the approach described in various relevant sources (Creswell, 2009, 2014; Creswell & Plano Clark, 2018). Quantitative results were selected for students whose qualitative responses fell into categories with a frequency equal or higher than 10 (representing a quarter of the total participants in the qualitative part of the study) and/or into categories deemed qualitatively relevant by the research team. The mean and standard deviation of the total scores on the GAMEX and CMELAC scales were calculated for the students whose responses belonged to each category. Pearson's correlation coefficient was then applied to examine the relationship between the students' GAMEX and CMELAC total scores for each qualitative category that met the previously mentioned criteria. After the quantitative and qualitative data were analyzed and integrated, we described and interpreted the lived experience of sophomore undergraduate nursing students with the escape room learning methodology.

2.6. Ethical considerations

The study adhered to the ethical guidelines outlined in the Declaration of Helsinki. Professors from other subjects informed potentially eligible students that participation in this research was entirely voluntary, that they could withdraw at any time without facing any consequences, and that no benefits would be provided for taking part in the survey. Students were assured that all collected information would be treated confidentially and anonymously, with no repercussions, and solely used for the purpose of the study. Additionally, the professors explained the study protocol and its details, addressed any questions raised by the students, and provided them with a copy of the informed consent document to review, accept, and sign. The study received approval from the Research Ethics Committee of a Nursing University Center located in a southern Spanish city (CICR-2024-02).

3. Results

A total of 115 students participated in the study, most of whom were female (n = 92, 80 %), and the remaining were male (n = 23, 20 %). The mean age of participants was 21.70 ± 3.86 years. Regarding previous escape room experiences, the most part indicated no prior experience (n = 64, 55.7 %), and the remaining reported having prior experience (n = 51, 44.3 %) (Table 1). These students were divided into 14 groups with eight students each.

The results for the GAMEX dimensions showed that enjoyment scored 4.64 ± 0.624, absorption scored 4.11 ± 0.947, creative thinking scored 4.30 ± 0.770, activation scored 4.34 ± 0.869, absence of negative affect scored 1.94 ± 1.248, dominance scored 3.61 ± 0.987, and the

Table 1
Sociodemographic characteristics of participants.

		Count (n)	Count (%)
Gender	Male	23	20
	Female	92	80
	Non-binary	0	0
Previous escape room experiences	Yes	51	44.3
	No	64	55.7
		Mean	SD
Age		21.70	3.868

Note. Authors' own elaboration. SD: standard deviation.

total score was 3.97 ± 1.191. The results for each GAMEX scale item were also presented (Table 2).

The total score for the CMELAC scale was 4.32 ± 0.581. Participants reported high levels of enjoyment for the playful activity with a score of 4.39 ± 0.525, motivation with 4.35 ± 0.636, and an increase in their interest in the subject with 4.25 ± 0.619. They found the activity comforting and valuable with a score of 4.33 ± 0.558, and the game elements were reported as fun with 4.34 ± 0.544. Additionally, participants felt the activity improved their knowledge of the subject with a score of 4.37 ± 0.551. The results for each CMELAC scale item were also presented (Table 3).

The association of age, GAMEX and CMELAC scales scores indicated that enjoyment was strongly positively correlated with absorption (r = 0.559, p < 0.001), activation (r = 0.373, p < 0.001), and creative thinking (r = 0.441, p < 0.01), absorption showed significant positive correlations with activation (r = 0.533, p < 0.001) and creative thinking (r = 0.422, p < 0.01), total GAMEX demonstrated strong positive correlations with all its dimensions, including enjoyment (r = 0.602, p < 0.001), absorption (r = 0.798, p < 0.001), creative thinking (r = 0.671, p < 0.001), activation (r = 0.751, p < 0.001), and dominance (r = 0.656, p < 0.001), and total CMELAC was significantly correlated with total GAMEX (r = 0.566, p < 0.001) as well as with dimensions such as absorption (r = 0.396, p < 0.01), activation (r = 0.429, p < 0.01), and creative thinking (r = 0.414, p < 0.01), highlighting the strong interrelationships between the dimensions of the GAMEX and CMELAC scales, particularly for absorption and activation which consistently showed significant positive associations with other variables. The results of all the correlations among age, GAMEX and CMELAC scores were also presented (Table 4).

We conducted a total of 40 individual interviews when we achieved data saturation and classified our qualitative results into the themes 'Liked the most' and 'Liked the least'. We delineated the first one into subthemes such as 'Fun', 'Learning and remembering', 'Teamwork', 'Professor', 'Trials', and 'Positive competitiveness'. We divided the theme 'Liked the least' into subthemes like 'Bad mood', 'Negative competitiveness', 'Trials', and 'Limited resources'. We presented these classifications in two thematic maps (Figs. 1 and 2), and a summary of themes, subthemes, categories and subcategories (Table 5).

Each category was mentioned at different times during the interviews (Table 6). The category 'Camaraderie' from the 'Teamwork' subtheme was the most frequently mentioned (n = 23). The category 'Concepts' from the 'Learning and remembering' subtheme was the second most mentioned (n = 17), followed by Applicability, from the same subtheme (n = 13). 'Bad mood' and 'Limited resources' subthemes were mentioned (n = 11) as well as 'Professor' (n = 10); while 'Fun' and 'Positive competitiveness' subthemes were stated slightly less frequently (n = 8). 'Negative competitiveness' was the least mentioned subtheme (n = 7).

Total scores from GAMEX and CMELAC scales varied across students whose interviews included our qualitative categories. 'Fun' had the highest scores with GAMEX scoring 4.06 ± 0.35 and CMELAC scoring 4.66 ± 0.34, followed by 'Camaraderie' with scores of 4.05 ± 0.39 and 4.48 ± 0.45, respectively. 'Applicability' scored 4.02 ± 0.55 in GAMEX

Table 2
Description of GAMEX scale results.

	Count (n (%))					Mean (SD)
	1 (Strongly Disagree)	2 (Disagree)	3 (Neither Agreement Nor Disagreement)	4 (Agree)	5 (Totally Agree)	
Enjoyment						4.64 (0.624)
Dis1	N/A	N/A	2 (1.7)	29 (17.4)	93 (80.9)	4.79 (0.449)
Dis2	1 (0.9)	N/A	1 (0.9)	25 (21.7)	88 (76.5)	4.73 (0.567)
Dis3	N/A	N/A	1 (0.9)	30 (26.1)	84 (73.0)	4.72 (0.469)
Dis4	N/A	N/A	3 (2.6)	33 (28.7)	79 (68.7)	4.66 (0.528)
Dis5	N/A	N/A	N/A	22 (19.1)	93 (80.9)	4.81 (0.395)
Dis6	N/A	6 (5.2)	24 (20.9)	32 (27.8)	53 (46.1)	4.15 (0.929)
Absorption						4.11 (0.947)
Ab1	N/A	5 (4.3)	19 (16.5)	29 (25.2)	62 (53.9)	4.29 (0.896)
Ab2	N/A	7 (6.1)	23 (20.0)	33 (28.7)	52 (45.2)	4.13 (0.941)
Ab3	2 (1.7)	6 (5.2)	29 (25.2)	26 (31.3)	42 (36.5)	3.96 (0.995)
Ab4	N/A	6 (5.2)	26 (22.6)	40 (34.8)	43 (37.4)	4.04 (0.902)
Ab5	1 (0.9)	11 (9.6)	24 (20.9)	37 (32.2)	42 (36.5)	3.94 (1.020)
Ab6	1 (0.9)	5 (4.3)	10 (8.7)	39 (33.9)	60 (52.2)	4.32 (0.874)
Creative thinking						4.30 (0.770)
Pc1	N/A	1 (0.9)	16 (13.9)	44 (38.3)	54 (47.0)	4.31 (0.742)
Pc2	1 (0.9)	1 (0.9)	4 (3.5)	47 (40.9)	62 (53.9)	4.46 (0.692)
Pc3	N/A	2 (1.7)	18 (15.7)	43 (37.4)	52 (45.2)	4.26 (0.785)
Pc4	N/A	4 (3.5)	19 (16.5)	42 (36.5)	50 (43.5)	4.20 (0.840)
Activation						4.34 (0.869)
Act1	N/A	N/A	4 (3.5)	30 (26.1)	81 (70.4)	4.67 (0.542)
Act2	4 (3.5)	8 (7.0)	20 (17.4)	30 (26.1)	53 (46.1)	4.04 (1.111)
Act3	1 (0.9)	7 (6.1)	16 (13.9)	41 (35.7)	50 (43.5)	4.15 (0.939)
Act4	N/A	N/A	7 (6.1)	43 (37.4)	65 (56.5)	4.50 (0.612)
Absence of negative affect						1.94 (1.248)
Aa1	66 (57.4)	28 (24.3)	4 (3.5)	7 (6.1)	10 (8.7)	1.84 (1.275)
Aa2	59 (51.3)	34 (29.6)	10 (8.7)	5 (4.3)	7 (6.1)	1.84 (1.144)
Aa3	48 (41.7)	34 (29.6)	11 (9.6)	12 (10.4)	10 (8.7)	2.15 (1.306)
Dominance						3.61 (0.987)
Dom1	8 (7.0)	23 (20.0)	48 (41.7)	28 (24.3)	8 (7.0)	3.04 (1.003)
Dom2	5 (4.3)	9 (7.8)	27 (23.5)	54 (47.0)	20 (17.4)	3.65 (1.000)
Dom3	2 (1.7)	6 (5.2)	31 (27.0)	57 (49.6)	19 (16.5)	3.74 (0.859)
Dom4	1 (0.9)	6 (5.2)	14 (12.2)	64 (55.7)	30 (26.1)	4.01 (0.822)
Total score						3.97 (1.191)

Note. Authors' own elaboration. SD: standard deviation; N/A: No answer. Enjoyment: Dis1: Playing was fun; Dis2: I liked playing; Dis3: I really enjoyed playing; Dis4: My experience with the game was pleasant; Dis5: I think playing was very entertaining; Dis6: I would play this game for myself, not just when asked; Absorption: Ab1: Playing made me forget where I was; Ab2: I forgot about my immediate surroundings while playing; Ab3: After playing, I felt like returning to the 'real world' after a trip; Ab4: Playing 'took me away from everything'; Ab5: While playing, I was completely oblivious to everything around me; Ab6: While playing, I lost track of time; Creative thinking: Pc1: Playing sparked my imagination; Pc2: While playing, I felt creative; Pc3: While playing, I felt like I could explore things; Pc4: While playing, I felt adventurous; Activation: Act1: While playing, I felt active; Act2: While playing, I felt nervous; Act3: While playing, I felt frantic; Act4: While playing, I felt excited; Absence of negative affect: Aa1: While playing, I felt annoyed; Aa2: While playing, I felt hostile; Aa3: While playing, I felt frustrated; Dominance: Dom1: While playing, I felt dominant/I had the feeling of being in control; Dom2: While playing, I felt influential; Dom3: While playing, I felt autonomous; Dom4: While playing, I felt confident.

and 4.47 ± 0.39 in CMELAC, while 'Positive competitiveness' had moderate scores of 3.60 ± 0.48 and 4.07 ± 0.59 . 'Negative competitiveness' and 'Bad mood' showed lower GAMEX scores of 3.96 ± 0.58 and 3.92 ± 0.52 , but their CMELAC scores were higher at 4.30 ± 0.70 and 4.47 ± 0.44 , respectively. 'Limited resources' scored the lowest overall with GAMEX at 3.96 ± 0.54 and CMELAC at 4.20 ± 0.56 (Table 7).

There were notable correlations among GAMEX and CMELAC scales total scores of our qualitative categories. The GAMEX scale scores for 'Fun' showed a strong positive correlation with 'Camaraderie' ($r = 0.99$, $p < 0.001$), 'Applicability' ($r = 0.51$, $p < 0.001$), and 'Professor' ($r = 0.40$, $p = 0.01$). 'Negative competitiveness' showed moderate correlations with 'Professor' ($r = 0.55$, $p < 0.05$) and 'Limited resources' in the GAMEX scale ($r = 0.59$, $p < 0.05$). The CMELAC scores for 'Camaraderie' also demonstrated high positive correlations with 'Professor' ($r = 0.94$, $p < 0.001$), 'Fun' ($r = 0.89$, $p < 0.001$), and 'Applicability' ($r = 0.85$, $p < 0.001$). 'Limited resources' correlated with 'Applicability' ($r = 0.69$, $p < 0.001$) and 'Professor' ($r = 0.70$, $p < 0.001$) in the CMELAC

scale. GAMEX and CMELAC scales scores for 'Camaraderie' were highly correlated ($r = 0.87$, $p < 0.001$) (Table 8).

4. Discussion

This study utilized a mixed-methods approach to explore the learning experiences of 115 university students, integrating both quantitative and qualitative data. Therefore, it quantitatively measured and qualitatively provided understanding regarding the gameful experience, learning, and motivation in cooperative learning during an escape room activity. The results highlight a significant relationship between engagement, enjoyment, and learning outcomes in an educational escape room activity. Furthermore, the findings emphasize the value of promoting teamwork and creativity while managing resource constraints to enhance the activity's effectiveness. The students perceived the escape room as an enjoyable and interactive methodology, where they tackled various challenges using limited resources. This experience enabled them to learn and retain subject concepts, as well as

Table 3
Description of CMELAC scale results.

	Mean	SD
In general, I have enjoyed this playful activity	4.39	0.525
I would repeat these types of activities	4.41	0.544
I have felt motivated	4.35	0.636
I improved my knowledge of the subject	4.30	0.624
My interest in the subject has increased	4.25	0.619
This activity format has been appropriate to check my knowledge of the subject	4.37	0.551
Helped me identify my weaknesses in the subject	4.33	0.508
It helped me understand the content of the subject	4.29	0.542
With these types of activities I learn more than in traditional classes	4.32	0.539
I feel like I was able to connect with my teammates to learn	4.37	0.551
I learned from my classmates during the activity	4.34	0.544
I found the game elements fun	4.40	0.543
The game elements have motivated me to carry out the activity	4.35	0.547
While playing I was not aware of what was happening around me	4.17	0.748
I felt capable of carrying out the proposed activities	4.20	0.652
I found the activities comforting and valuable to me	4.33	0.558
Total score	4.32	0.581

Note. Authors' own elaboration. SD: standard deviation.

understand their application across different contexts.

Regarding the quantitative findings, the study employed the GAMEX and CMELAC scales to evaluate participants' perceptions of the escape room activity. The GAMEX scale revealed high levels of enjoyment, activation, and creative thinking, alongside low levels of negative affect. Similarly, the CMELAC scale showed high scores in enjoyment, motivation, and knowledge improvement.

These results suggest that intrinsic motivation, reflected in high levels of enjoyment, and camaraderie, fosters deeper engagement and enhances learning experiences (Y. Liu, Fang, et al., 2024). The strong correlation between GAMEX dimensions, such as absorption, activation and creative thinking, and CMELAC scores underlines the positive impact of intrinsic factors on knowledge retention and sustained interest in course content, thus highlighting the interconnected relationship between academic engagement and active learning outcomes (Alhawiti, 2023). Participants not only found these activities enjoyable but also valuable for understanding and applying nursing concepts. These findings suggest that well-designed educational tools combining intrinsic enjoyment and extrinsic objectives can enhance both immediate engagement and long-term interest in academic subjects (Ratinho & Martins, 2023).

Extrinsic motivation, facilitated by structured activities like escape rooms, also plays a crucial role, as the design of these educational,

Table 4
Correlations among age, GAMEX and CMELAC scores.

	Age	Enjoyment	Absorption	Creative thinking	Activation	Absence of negative affect	Dominance	Total GAMEX	Total CMELAC
Age	r	–							
Enjoyment	r	0.030	–						
	Sig.	0.750							
Absorption	r	–0.059	0.559**	–					
	Sig.	0.531	<0.001						
Creative thinking	r	0.015	0.441**	0.422**	–				
	Sig.	0.874	<0.001	<0.001					
Activation	r	–0.038	0.373**	0.533**	0.538**	–			
	Sig.	0.683	<0.001	<0.001	<0.001				
Absence of negative affect	r	–0.077	–0.164	–0.023	0.011	0.139	–		
	Sig.	0.413	0.080	0.806	0.903	0.137			
Dominance	r	–0.046	0.260**	0.374**	0.323**	0.379**	0.203*	–	
	Sig.	0.628	0.005	<0.001	<0.001	<0.001	0.030		
Total GAMEX	r	–0.055	0.620**	0.798**	0.671**	0.751**	0.322**	0.656**	–
	Sig.	0.560	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Total CMELAC	r	–0.047	0.384**	0.396**	0.414**	0.429**	0.136	0.449**	0.566**
	Sig.	0.615	<0.001	<0.001	<0.001	<0.001	0.146	<0.001	<0.001

Note. Authors' own elaboration. r: Pearson's correlation; **: Correlation is significant at 0.01; *: Correlation is significant at 0.05.

gamified practices enhances external incentives for participation and involvement (Ratinho & Martins, 2023; Shen et al., 2024). The perception of the utility and relevance of learning is a crucial motivational factor (Harackiewicz et al., 2016) and escape rooms, in particular, play a pivotal role in boosting student engagement and active participation by leveraging these motivations (Anguas-Gracia et al., 2021; Fagundo-Rivera et al., 2024). While intrinsic factors, like enjoyment and camaraderie, drive deeper commitment and knowledge retention (Y. Liu, Fang, et al., 2024), the structured design of escape rooms, incorporating teamwork and challenges, serves as an extrinsic motivator that encourages active involvement, reinforces participation, and aligns learning with professional goals (Guckian et al., 2020).

Additionally, forty interviews provided rich qualitative insights and in all qualitative categories the scores of GAMEX and CMELAC followed the same trend. Positive experiences revolved around 'Fun', 'Learning and remembering', 'Teamwork', 'Professor', 'Challenges' and 'Positive competitiveness'. In contrast, the presence of these challenges in the escape room included feelings of 'Bad mood', 'Negative competitiveness', and 'Limited resources to solve the puzzles'.

In this sense, it is necessary to emphasize that students felt both positive and negative sensations about competitiveness. These mixed feelings likely stem from the dual nature of competition. On one hand, positive competitiveness can drive motivation, foster teamwork, and encourage participants to perform at their best, creating a sense of achievement and camaraderie (DiMenichi & Tricomi, 2015). This aligns with our results where students valued teamwork and positive competitive dynamics. However, negative competitiveness may arise when the pressure to win overshadows collaboration, leading to stress, frustration, or conflicts among participants (C. Liu, Fang, et al., 2024). For health science students, whose education emphasizes cooperation and empathy, excessive competition might conflict with these values, explaining the contrasting sentiments (Kirsch & Spreckelsen, 2023).

Another relevant point is the value of the effort made by the professor in the development of the methodology. The university nursing students positively valued the teacher's effort in the development of the escape room because this methodology shows dedication and commitment to their learning. In a learning culture that prioritizes innovation and active engagement, the implementation of novel strategies, such as escape rooms, generates an engaging educational environment that facilitates the connection between theory and practice (Gómez-Urquiza et al., 2019). Group dynamics are key, as they promote collaboration, mutual support and a sense of camaraderie, essential elements in nursing education (Anguas-Gracia et al., 2021). In addition, the student-teacher relationship is strengthened, since students perceive the teacher not only as a transmitter of knowledge, but as a facilitator who

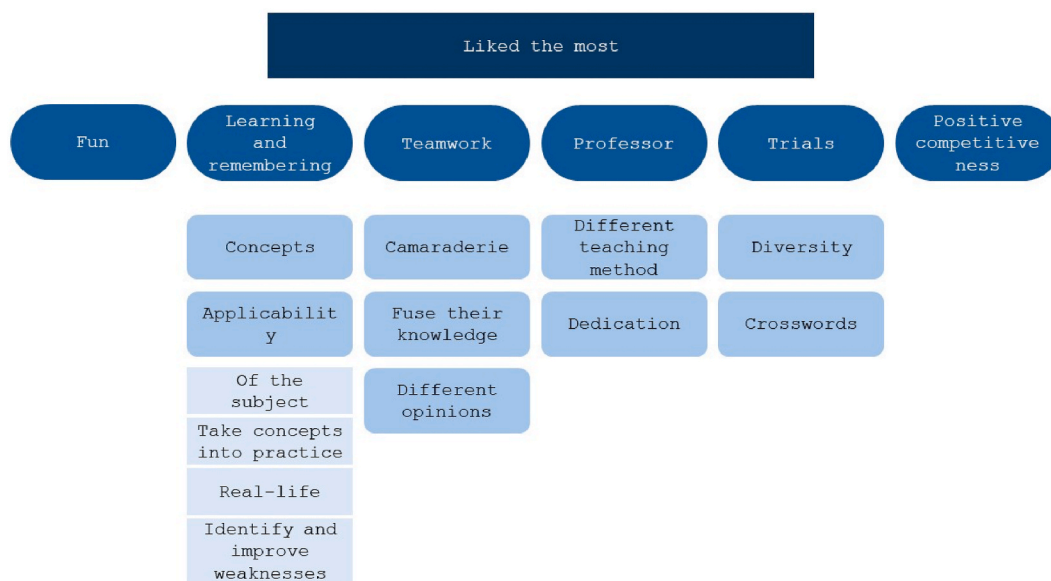


Fig. 1. 'Liked the most' thematic map
 Note. Authors' own elaboration.

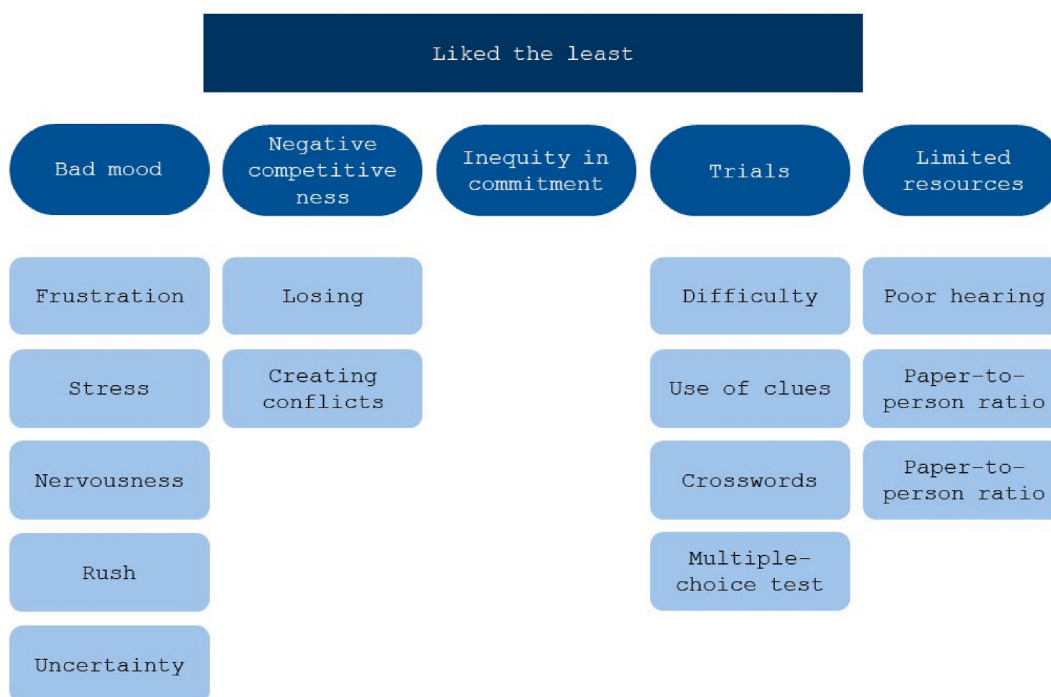


Fig. 2. 'Liked the least' thematic map
 Note. Authors' own elaboration.

understands their needs and motivates their active participation. This bond fosters trust and reinforces commitment, which contributes to activity success and meaningful learning (Hagenauer et al., 2023; X. Liu, 2024).

The integration of quantitative and qualitative data, provided in Tables 7 and 8 to strengthen the study, highlighted consistent trends. This is suggestive because the students who have highlighted the most positive opinions qualitatively, have also had positive scores in both questionnaires, which validates the qualitative and quantitative analyses in the mixed-methods design. This synergy promotes a perception of nursing education as both meaningful and practically relevant

(Fagundo-Rivera et al., 2024). The highest GAMEX and CMELAC scores were linked to the dimensions of 'Fun,' followed by 'Camaraderie' and 'Applicability.' Although 'Positive competitiveness' was less frequently mentioned, it still achieved moderate scores. Interestingly, themes with negative connotations, such as 'Negative competitiveness' and 'Bad mood,' received relatively low GAMEX scores but moderately high CMELAC scores, indicating that participants recognized value in the activity despite encountering challenges. In contrast, 'Limited resources' scored the lowest overall, reflecting its limited contribution to the participants' experience.

There were also notable correlations among the 'Professor'

Table 5
Summary of themes, subthemes, categories and subcategories.

Theme	Subtheme	Category	Subcategory	Code			
Liked the most	Fun	Learning and remembering	Concepts	'I found this activity very interesting because it allows us to approach the subject in a more fun and engaging way' (Student 98; female, 21 years old)			
				'It felt like a review of concepts from both last year and this year' (Student 85; female, 19 years old)			
	Applicability			Of the subject	'I have learned to better understand the usefulness of the subject' (Student 87; female, 19 years old)		
				Take concepts into practice	'What I liked the most is that you put the knowledge into practice' (Student 93; female, 21 years old)		
				Real-life	'I have identified content that is applicable to real life' (Student 89; male, 23 years old)		
	Teamwork			Identify and improve weaknesses	Camaraderie	'This experience also helps you identify your weaknesses and work on improving them' (Student 94; female, 23 years old)	
						'What I liked the most was the sense of camaraderie that develops when solving and overcoming each clue as a team' (Student 107; female, 20 years old)	
						'In this activity, we can fuse our knowledge' (Student 78; female, 19 years old)	
				Fuse their knowledge		Different opinions	'What motivated me the most was listening to my classmates' different opinions' (Student 96; female, 18 years old)
							'What I liked the most is that you broke away from what all the other teachers usually do' (Student 95; female, 18 years old)
Professor	Different teaching method						

Table 5 (continued)

Theme	Subtheme	Category	Subcategory	Code	
Liked the least	Bad mood	Frustration	Dedication	'What I liked the most was that the teachers took the time to plan this activity' (Student 105; female, 19 years old)	
			Diversity	'What I liked the most was the diversity of trials' (Student 114; male, 21 years old)	
			Crosswords	'What I liked the most were the crossword trials in the escape room story' (Student 102; female, 18 years old)	
			Positive competitiveness	'What I really liked the most was the competitiveness' (Student 108; male, 36 years old)	
			Stress	Stress	'I felt frustrated because, despite working together as a team and putting in a lot of effort, we ended up losing' (Student 116; female, 21 years old)
					'There was stress in some trials' (Student 82; female, 19 years old)
					Nervousness
			Rush	Rush	'There were times when, due to being in a rush, we wanted to go faster than was actually possible' (Student 106; female, 21 years old)
					Uncertainty
			Negative competitiveness	Negative competitiveness	Losing
Creating conflicts	'What I liked the least was creating conflicts' (Student 83; female, 18 years old)				
	Inequity in commitment			'In a large group, not all participants get equally	

(continued on next page)

Table 5 (continued)

Theme	Subtheme	Category	Subcategory	Code
				involved' (Student 89; male, 23 years old)
	Trials	Difficulty		'What I liked the least was the difficulty of some of the trials' (Student 91; male, 21 years old)
			Use of clues	'There were trials where I didn't know the answer, and we used the wildcards ... the laptop, notes, professor ... ' (Student 89; male, 23 years old)
		Crosswords		'What I liked the least were the crosswords' (Student 92; female, 22 years old)
			Multiple-choice test	'What I liked the least was the multiple-choice test; I think dynamic exercises work better for me to learn' (Student 102; female, 18 years old)
Limited resources	Limited resources	Poor hearing		'And what I liked the least was hearing people shouting because there was poor hearing in the classroom' (Student 95; female, 18 years old)
			Paper-to-person ratio	'We only had one sheet of paper per group, and there were many of us' (Student 100; woman, 19 years old)
		Lengthy	'I felt that the activity was a bit lengthy' (Student 98; woman, 21 years old)	

Note. Authors' own elaboration.

Table 6

Frequency of mentioned subthemes and categories.

Subtheme	Category	Count (n)
Fun		8
Learning and remembering	Concepts	17
	Applicability	13
Teamwork	Camaraderie	23
Professor		10
Positive competitiveness		8
Bad mood		11
Negative competitiveness		7
Limited resources		11

Note. Authors' own elaboration.

Table 7

GAMEX and CMELAC total scores for each qualitative category.

Qualitative category	Mean (SD)	
	GAMEX	CMELAC
(A) Fun	4.06 (0.35)	4.66 (0.34)
(B) Concepts	3.99 (0.40)	4.41 (0.44)
(C) Applicability	4.02 (0.55)	4.47 (0.38)
(D) Camaraderie	4.05 (0.39)	4.48 (0.45)
(E) Professor	4.12 (0.34)	4.59 (0.39)
(F) Diversity of trials	3.87 (0.22)	4.32 (0.25)
(G) Positive competitiveness	3.60 (0.48)	4.07 (0.59)
(H) Bad mood	3.92 (0.52)	4.47 (0.48)
(I) Negative competitiveness	3.96 (0.58)	4.30 (0.70)
(J) Limited resources	3.96 (0.54)	4.2 (0.56)

Note. Authors' own elaboration.

dimension and the GAMEX and CMELAC scales total scores, 'Teamwork' and 'Fun'. In this sense, the implication of the professor was highlighted by the students for the learning and remembering process, being related to the comprehension of the main concepts of the course and the applicability of knowledge. The impact of the professor in the active and practical learning has been already showed in the literature (Fagundo-Rivera et al., 2024; Gómez-Urquiza et al., 2019; Gómez-Urquiza, Hueso-Montoro et al., 2022; Gómez-Urquiza et al., 2022), and the use of escape rooms in the university has also been related to encouraging critical thinking, real-time decision-making, and problem-based learning, thus developing clinical and critical abilities in comparison to other more traditional methods, such as master classes or conventional simulations (Molina-Torres et al., 2021). About teamwork, it is widely known how students develop collaborative skills, effective communication and conflict resolution in an Escape Room environment (Zhang et al., 2018). However, as mentioned before, the influence of the teacher has also been related to some significant concepts, as 'Negative competitiveness' and 'Limited resources'. On the one hand, it is convenient to analyze the perceptions and receptivity of the students in terms of the methodology so that, far from being seen as a competition, it becomes a moment of exchange of ideas and a rewarding group experience. On the other hand, the limitation of resources gives rise to the use of creativity, since the resources that are available in universities must be used in an attempt to obtain the maximum efficiency from them. In this sense, it is worth noting the necessary preparation of the teacher to examine the challenges to face when designing and implementing this methodology, whereas the process is usually much easier for the teachers in subsequent experiences (Gómez-Urquiza et al., 2022).

4.1. Limitations

This study acknowledges several limitations related to the implementation and evaluation of the Escape Room methodology. Firstly, the implementation of an Escape Room requires careful consideration of logistical factors such as time, cost, space, and materials. These constraints can pose challenges to the feasibility of this approach.

Secondly, incorporating this methodology into academic programs with established curricula can be difficult. A notable limitation of this study is that the impact of the Escape Room on students' academic performance was not analyzed. Consequently, it was not possible to establish a direct link between the game-based experience and learning outcomes. Some researchers suggest the potential of using Escape Rooms as an assessment tool to evaluate knowledge acquisition or the reinforcement of competencies after the activity (Ghiamikeshtgar et al., 2024). However, the game-based experiences conducted so far have not been evaluated within a framework of reliability or validity specifically oriented toward assessment (Hursman et al., 2022).

Another important aspect to consider is whether the Escape Room design can be adapted to accommodate students with varying abilities and needs. These limitations highlight the need for further research to

Table 8
Correlations among GAMEX and CMELAC total scores for each qualitative category.

	Age	(GAMEX)A	(GAMEX)B	(GAMEX)C	(GAMEX)D	(GAMEX)E	(GAMEX)F	(GAMEX)G	(GAMEX)H	(GAMEX)I	(GAMEX)J	(CMELAC)A	(CMELAC)B	(CMELAC)C	(CMELAC)D	(CMELAC)E	(CMELAC)F	(CMELAC)G	(CMELAC)H	(CMELAC)I	(CMELAC)J	
Age	r	-																				
(GAMEX) A	r	-0.018	-																			
	Sig.	0.967																				
(GAMEX) B	r	-0.171	-0.310	-																		
	Sig.	0.512	0.456																			
(GAMEX) C	r	0.243	0.579	-0.153	-																	
	Sig.	0.403	0.132	0.601																		
(GAMEX) D	r	0.001	0.151	-0.063	0.090	-																
	Sig.	0.997	0.721	0.810	0.760																	
(GAMEX) E	r	0.243	0.643	-0.135	0.673	-0.084	-															
	Sig.	0.561	0.086	0.750	0.068	0.844																
(GAMEX) F	r	0.258	0.326	0.729	-0.466	0.863	-0.123	-														
	Sig.	0.742	0.674	0.271	0.534	0.137	0.877															
(GAMEX) G	r	-0.764*	0.218	-0.012	0.003	-0.167	0.018	-0.688	-													
	Sig.	0.027	0.605	0.977	0.995	0.692	0.967	0.312														
(GAMEX) H	r	0.473	-0.038	-0.006	-0.018	-0.011	-0.109	0.733	-0.727*	-												
	Sig.	0.142	0.928	0.986	0.958	0.975	0.797	0.267	0.041													
(GAMEX) I	r	-0.020	0.597	-0.485	0.035	-0.218	-0.244	0.222	0.031	0.450	-											
	Sig.	0.966	0.157	0.270	0.941	0.638	0.597	0.778	0.947	0.311												
(GAMEX) J	r	-0.118	-0.347	0.086	-0.161	-0.266	0.253	-0.023	-0.084	-0.195	-0.550	-										
	Sig.	0.729	0.399	0.801	0.636	0.429	0.546	0.977	0.843	0.565	0.201											
(CMELAC) A	r	0.275	0.691	0.010	0.446	0.366	0.729*	0.627	-0.059	-0.157	-0.125	-0.265	-									
	Sig.	0.510	0.058	0.981	0.268	0.373	0.040	0.373	0.890	0.711	0.790	0.525										
(CMELAC) B	r	-0.167	-0.377	0.863**	-0.386	-0.111	0.011	0.121	0.254	-0.277	-0.777*	0.394	-0.041	-								
	Sig.	0.522	0.358	<0.001	0.173	0.673	0.979	0.879	0.545	0.410	0.040	0.231	0.924									
(CMELAC) C	r	0.180	0.689	-0.091	0.768**	0.181	0.701	0.348	-0.152	-0.075	-0.091	-0.235	0.868**	-0.222	-							
	Sig.	0.539	0.059	0.758	0.001	0.535	0.053	0.652	0.719	0.826	0.845	0.487	0.005	0.446								
(CMELAC) D	r	0.083	-0.031	-0.002	0.328	0.855**	-0.057	0.949	-0.360	0.357	-0.294	-0.231	0.080	-0.190	0.206	-						
	Sig.	0.706	0.943	0.994	0.253	<0.001	0.893	0.051	0.380	0.281	0.523	0.494	0.850	0.466	0.479							
(CMELAC) E	r	0.029	0.222	-0.331	0.107	-0.670	0.602	-0.490	0.150	0.044	0.053	0.396	0.220	-0.063	-0.050	-0.691	-					
	Sig.	0.945	0.597	0.423	0.801	0.069	0.114	0.510	0.723	0.918	0.910	0.331	0.601	0.881	0.906	0.058						
(CMELAC) F	r	-0.830	0.316	0.360	-0.938	0.448	-0.738	0.292	0.421	-0.114	0.545	0.254	-0.400	0.728	-0.600	0.041	-0.178	-				
	Sig.	0.170	0.684	0.640	0.062	0.552	0.262	0.708	0.579	0.886	0.455	0.746	0.600	0.272	0.400	0.959	0.822					
(CMELAC) G	r	-0.816*	0.124	0.002	-0.238	-0.106	-0.080	-0.589	0.958**	-0.718*	0.014	-0.084	-0.038	0.323	-0.254	-0.454	0.177	0.542	-			
	Sig.	0.013	0.769	0.997	0.570	0.802	0.850	0.411	<0.001	0.045	0.976	0.843	0.930	0.435	0.543	0.259	0.675	0.458				
(CMELAC) H	r	0.329	-0.144	0.063	-0.012	-0.324	-0.170	0.344	-0.437	0.815**	0.378	-0.197	-0.165	-0.219	0.012	0.080	0.175	-0.427	-0.411	-		
	Sig.	0.324	0.733	0.853	0.971	0.330	0.688	0.656	0.279	0.002	0.404	0.562	0.697	0.517	0.973	0.814	0.679	0.573	0.312			
(CMELAC) I	r	0.182	0.553	-0.705	0.093	-0.305	-0.079	0.318	-0.204	0.456	0.915**	-0.552	0.057	-0.930**	0.052	-0.422	0.181	-0.186	-0.215	0.317	-	
	Sig.	0.697	0.198	0.077	0.843	0.506	0.866	0.682	0.661	0.304	0.004	0.199	0.903	0.002	0.912	0.345	0.697	0.814	0.643	0.489		
(CMELAC) J	r	-0.270	-0.637	0.007	-0.277	-0.416	-0.003	-0.466	0.087	-0.369	-0.705	0.847**	-0.453	0.418	-0.316	-0.387	0.289	0.030	0.108	-0.215	-0.630	-
	Sig.	0.422	0.090	0.983	0.410	0.203	0.994	0.534	0.838	0.264	0.077	<0.001	0.260	0.200	0.344	0.240	0.487	0.970	0.800	0.525	0.130	

Note. Authors' own elaboration. r: Pearson's correlation; **: Correlation is significant at 0.01; *: Correlation is significant at 0.05; A: Fun; B: Concepts; C: Applicability; D: Camaraderie; E: Professor; F: Diversity of traits; G: Positive competitiveness; H: Bad mood; I: Negative competitiveness; J: Limited resources.

optimize the application of Escape Rooms in educational contexts and to explore their potential for reliable assessment and inclusive design.

4.2. Future approach, innovative methodologies and strengths

A notable feature of the study is that the escape room activity provided an opportunity for all team members to feel equally significant and take on leadership roles, as the responsibility for guiding the group was distributed across various stages (Meljes et al., 2023). This dynamic allowed each member's unique abilities to be relevant and impactful at different points (Friedrich et al., 2019). In this regard, teams that excel are those that successfully integrate and utilize the diverse strengths of their members (Hursman et al., 2022). As a result, even though some participants may have more experience with gaming, others bring equally important skills, promoting mutual learning and cooperation (Meljes et al., 2023).

Moreover, this study provided further insight to determine whether students' motivation to engage with the subject matter increased after perceiving the practical and applicable aspects of the knowledge acquired. Our thematic analysis offered a deeper understanding of students' perceptions and attitudes following their participation in the escape room, and future research could benefit from employing these rigorous mixed methods.

There are also several challenges that should be addressed in subsequent studies. One critical issue is the evaluation of competencies and learning outcomes gained through the activity (Ghiamikeshgar et al., 2024). Beyond measuring participants' motivation and satisfaction, it is essential to create metrics that assess the success of skill acquisition. These metrics should also examine whether this method covers the same educational content as other traditional teaching strategies.

Finally, further exploration is needed to evaluate how this approach could be implemented on a broader scale in other areas of health education. This could involve developing interprofessional skills among students from different disciplines or within varied educational environments.

5. Conclusion

This study demonstrated the potential of escape room activities as an innovative educational tool in nursing education, effectively combining intrinsic and extrinsic motivation to enhance engagement and learning. The findings from both quantitative and qualitative analyses reveal high levels of enjoyment, motivation, and perceived learning among participants. The integration of gameful experiences with teamwork and problem-solving skills allowed students to solidify their understanding of nursing concepts while fostering camaraderie and creativity. These results highlight the importance of designing active learning strategies that bridge theoretical knowledge with practical applications, creating a meaningful and engaging learning environment. The integration of quantitative and qualitative data highlighted consistent trends. This was significant as the students who highlighted the most positive opinions qualitatively, also obtained positive scores in both questionnaires, which validates the qualitative and quantitative analyses in the design of mixed methods.

The insights gained from qualitative interviews further underscored the dual impact of positive and negative competitiveness within the activity. While positive competitiveness encouraged teamwork and stimulated motivation, negative aspects occasionally hindered collaboration. Resource limitations, though challenging, also inspired creative problem-solving among students. The active role of the professor as a facilitator was crucial in creating a supportive and dynamic learning atmosphere, reflecting the importance of instructor involvement in implementing gamified methodologies.

This study validates the efficacy of escape rooms as a complementary educational method, promoting critical thinking, collaborative skills, and real-time decision-making. Despite certain limitations, such as

resource constraints and variability in student competitiveness, the methodology offers significant advantages in cultivating active learning. Future research should explore scalable adaptations of this approach across diverse disciplines and educational contexts, with a focus on inclusive design and robust evaluation metrics for learning outcomes. These efforts will further enhance the integration of gamification into modern education.

CRedit authorship contribution statement

Javier Fagundo-Rivera: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Miguel Garrido-Bueno:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Rocío Romero-Castillo:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Methodology, Investigation, Formal analysis, Data curation. **Nadine Badillo-Sánchez:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Methodology, Investigation, Formal analysis, Data curation. **Pablo Fernández-León:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing statement

The authors declare no conflicts of interest. This study has not received funding.

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All authors have contributed intellectually to the work, have fulfilled the conditions of authorship and have approved their final version. The work is original and has not been previously published and is not being reviewed by any other journal. This manuscript complies with the ICMJE Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Papers in Medical Journals. This study was approved by the Research Ethics Committee of the Red Cross Nursing University Center (CICR-2024-02).

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.learninstruc.2025.102212>.

Data availability

Data will be made available on request.

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