

Meta-Analysis of the Effect of the Escape Room Teaching Method on Nursing Education

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Abstract: *Objectives:* A meta-analysis was conducted to systematically evaluate the effect of the escape room teaching method on nursing education. *Methods:* We searched PubMed, Medline, Web of Science, CNKI, VIP, and Wanfang databases, with a search time frame from the first day of database establishment to October 2022. Two researchers evaluated the quality of the obtained literature and extracted the data. The RevMan5.4 software was used for meta-analysis. *Results:* A total of 7 studies involving 1487 nursing students were included. Compared with the control group, the escape room teaching method improved the professional performance of nursing students [standardized mean difference (SMD) = 0.98, 95% confidence interval (CI; 0.38,1.59), $P < 0.0001$]. The critical thinking ability of nursing students was enhanced [mean difference (MD) = 12.64, 95% CI (7.91,17.37), $P < 0.0001$], and the investment level of nursing students in learning was improved [MD = 4.18, 95% CI (1.74,6.62), $P < 0.0001$]. *Conclusion:* The escape room teaching method can improve nursing students' professional performance, critical thinking ability, and learning engagement level. There is no significant difference in the impact of nursing teaching satisfaction, and there is still a lack of data support. This paper is limited by the quality and quantity of included literature, and more high-quality studies are still needed to further demonstrate the above conclusions.

Keywords: Escape room; Nursing education; Meta-analysis

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1. Introduction

Nurses play a crucial role in the medical field, performing vital clinical tasks such as monitoring patient conditions, administering medications, providing health education, and collaborating in rescue efforts. Therefore, nursing students must possess a strong theoretical foundation and proficient operational skills. Nursing education plays a crucial role in training nursing personnel, as highlighted in the publication "Modernization of Education in China 2035". To foster students' innovative spirit and practical skills, it is recommended to adopt innovative training methods such as heuristics, inquiry, participation, and cooperation ^[1]. The escape room is a form of gamification ^[2,3], where participants are placed in a closed room and given time constraints to solve a mystery by discovering a series of clues to escape the locked room. The escape room teaching method combines theory, practice, and special space layout with professional knowledge as the clue ^[4]. The escape room teaching method has been widely used in many aspects of emergency nursing ^[5], infectious disease knowledge education ^[6], community nursing ^[7], and so on. Currently, the research on utilizing the escape room teaching method in nursing education is still in the

early stages of development^[8,9]. The potential benefits of using the escape room teaching method in nursing education warrant further exploration. This meta-analysis evaluated its effectiveness and can serve as a reference for future nursing education and the escape room teaching method.

2. Materials and methods

2.1. Literature search strategy

This study conducted a literature search on the application of the escape room teaching method in nursing education, retrieving randomized controlled studies and quasi-experimental studies from various databases such as PubMed, Medline, Web of Science, CNKI, VIP, and Wanfang. The retrieval period spanned from the establishment of the databases to October 2022. The literature search was conducted by combining subject words and free words. The search terms in Chinese were “escape or secret room” and “nursing education or nursing teaching or nursing”, meanwhile the search term used was “room escape OR escape the room” AND “education, nursing OR nursing education OR education, nursing OR nursing education”. The search strategy was based on the use of PubMed, as shown in **Figure 1**.

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#1 (room escape[Title/Abstract]) OR (escape the room[Title/Abstract])
#2 "Education, Nursing"[Mesh]
#3 ((Nursing Education[Title/Abstract]) OR (Educations, Nursing[Title/Abstract])) OR
(Nursing Educations[Title/Abstract])
#4 #2 OR #3
#5 #1 AND #4
```

Figure 1. PubMed database retrieval strategy

2.2. Criteria for inclusion and exclusion of documents

Inclusion criteria included:

- (1) Research object, nursing students, interns, and regular students aged 18–30;
- (2) Intervention measure: the experimental group mainly accepted the teaching methods of the escape room, including online meetings, interactive games, and other content; The control group received traditional teaching methods, such as syllabus, lectures, situational cases, etc., or could be a logic escape room (logic test, the procedure is the same as the test group).
- (3) Study design: randomized controlled trials or quasi-experimental studies.
- (4) Outcome index: achievement, teaching style satisfaction, critical thinking, level of engagement in learning.

Exclusion criteria included incomplete data or unavailable full text, as well as non-Chinese and English literature.

2.3. Literature quality evaluation

The quality of the literature included in the study was evaluated by two researchers independently. In case of any disagreement, a third party was consulted and a decision was made after the discussion. The Bias Risk Assessment tool in the Cochrane Handbook of Systematic Evaluators 5.1 was used to analyze the quality of the included studies^[10]. The study evaluated several factors such as generation of random sequences, assignment hiding, subject and investigator blindness, outcome evaluation blindness, outcome data integrity, selective reporting, and other sources of bias to determine the possibility of bias. The study receives a Grade A rating and has a minimal chance of bias if all these criteria are met. The likelihood of bias is moderate if the product achieves some of the aforementioned quality standards and receives a Grade B rating. If it doesn't match any of the aforementioned standards for quality, it receives a Grade C rating and is highly to be biased.

2.4. Bibliographic screening and data extraction

The search results are loaded into Endnote X9, where two researchers each read the titles and abstracts in preparation for selection. To ascertain whether the qualified literature satisfies the inclusion and exclusion requirements, the entire text is read. Any objections will be resolved through conversation or outside assistance after being cross-checked. From the chosen literature, the two researchers extracted the materials and data in turn. If there were any objections during the cross-check, they were addressed during the discussion or with the help of a third party. The first author, publication year, sample sizes of the experimental group and control group, study participants, intervention measures and control contents, evaluation scale, and outcome indicators were the key components of the extracted data.

2.5. Statistical methods

The meta-analysis was carried out with Revman5.4. The heterogeneity of the included studies was assessed using the Q test and the I^2 statistic. There is low study heterogeneity if $P > 0.1$ and $I^2 < 50\%$, hence the fixed-effect model should be chosen for meta-analysis. If $P < 0.1$ and $I^2 > 50\%$, there is significant heterogeneity among the studies. The sources of heterogeneity were analyzed, and sensitivity analysis was used to eliminate the included references one by one. If heterogeneity still existed, the random effects model was used for meta-analysis.

3. Results

3.1. Literature search results

A total of 152 pieces of literature were initially screened (including 10 CNKI, 7 Wanfang databases, 6 VIP databases, 53 PubMed, 61 Web of Science, and 15 Medline). 65 duplicates were excluded, 72 titles and abstracts were excluded, 15 full texts were read, and 8 were excluded (including 4 self-before-and-after comparisons and 4 qualitative studies), as shown in **Figure 2**.

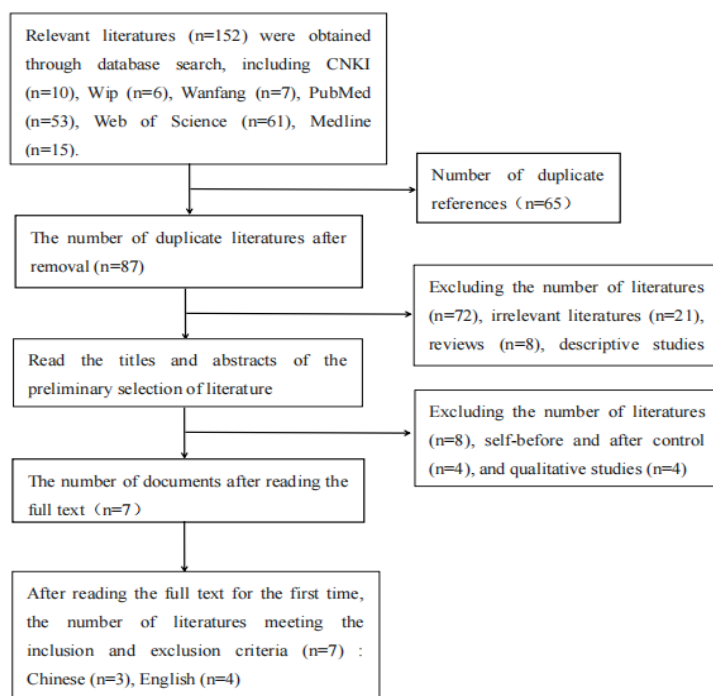


Figure 2. Literature screening flow chart

3.2. Basic characteristics of the included literature and methodological quality evaluation

The basic characteristics of the included literature are shown in **Table 1**. Due to the particularity of the

object of this study and the intervention measures, it is difficult to achieve the blind method. Therefore, the included literature is rated as having a high risk of bias, and the quality grade of the 7 included literature is Grade B.

Table 1. Basic features of the included literature

Author	Year of publication	Sample size		Research object	Intervention content		Evaluation scale	Outcome index
		T	C		T	C		
Peng Zhixian ^[11]	2022	98	98	Nursing student	Traditional teaching + Escape room	Traditional teaching	1. Self-directed rating scale 2. Nursing teaching satisfaction questionnaire	(1), (2)
Li Yuxin ^[12]	2022	48	48	Nursing intern	Outline teaching + Escape room	Outline teaching	1. CTDI_CV 2. Learning engagement questionnaire	(3), (4), (5)
Xu Li ^[13]	2022	51	51	Nursing intern	Situational teaching + Escape room	Situational teaching	1. CTDI-CV 2. Learning engagement questionnaire 3. Self-satisfaction survey	(2), (3), (4), (5)
Lorena ^[14]	2020	117	120	Nursing intern	Escape room	Traditional teaching	1. GAMEX 2. Self-satisfaction survey	(2), (3), (6)
Jose M ^[15]	2022	197	109	Nursing student	Escape room	Logical escape room	1. AQ 2. Cooperative play-based learning 3. Strategic motivation questionnaire	(7), (8)
Guadalupe ^[16]	2022	128	120	Nursing student	Escape room	Traditional teaching	Nursing service satisfaction questionnaire 1. ECODI	(2), (3)
Arantxa ^[17]	2022	162	140	Nursing student	Escape room	Lecture teaching	2. Satisfaction questionnaire	(2), (3)

Note: C is the control group, T is the intervention group; (1) Self-directed ability; (2) Satisfaction; (3) Achievements; (4) Critical thinking; (5) Level of learning engagement; (6) Game experience; (7) Stigmatizing attitudes; (8) Learning process. Abbreviations: Critical Thinking Ability Scale (CTDI_CV); Game Experience Scale (GAMEX); Attribution questionnaire (AQ); Diabetes Knowledge Scale (ECODI).

3.3. Results of the meta-analysis

3.3.1. Influence of escape room teaching method on nursing students' professional achievement

A total of 5 pieces of literature reported the professional scores of nursing students, and 4 articles were included in the meta-analysis [11-13,15,16]. Heterogeneity existed among the studies ($I^2 = 96\%$, $P < 0.01$). Sensitivity analysis showed that Lorena's study was the main source of heterogeneity. After the exclusion of this study, the heterogeneity decreased, which may be related to the use of an objective structured clinical examination (OSCE) model for score recording. However, there was still heterogeneity among the remaining studies ($I^2 = 78\%$, $P < 0.01$), so the random effects model was used for analysis. The results show that the escape room teaching method can improve the professional achievement of nursing students [standardized mean difference (SMD) = 0.98, 95% confidence interval (CI; 0.38, 1.59), $P < 0.0001$], as shown in **Figure 3**. Subgroup analysis was conducted according to the different total scores of the grades and divided into a total score of 100 points [SMD = 0.59, 95% CI (0.31, 0.88), $P < 0.0001$], with a total score of 10 points [SMD = 1.11, 95% CI (0.85, 1.38), $P < 0.0001$], and a total score of 50 points [SMD = 0.49, 95% CI (0.26, 0.72), $P < 0.0001$], the results showed that the escape room teaching method improved the performance of all three groups, as shown in **Figure 4**.

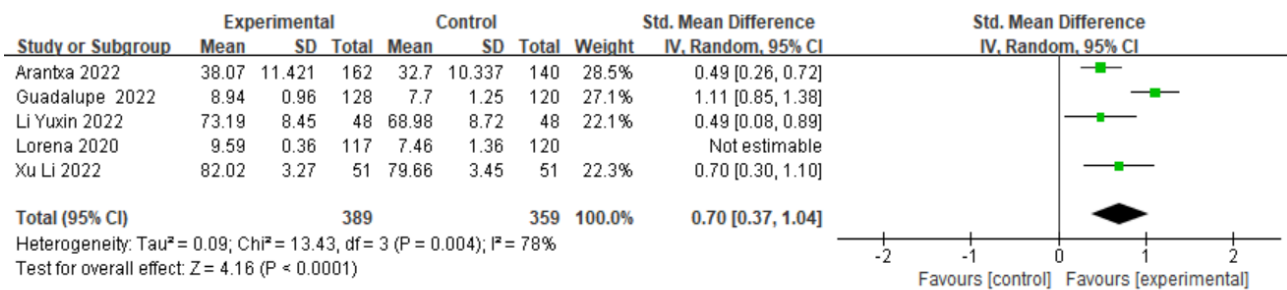


Figure 3. The effect of the escape room teaching method on nursing students' achievement

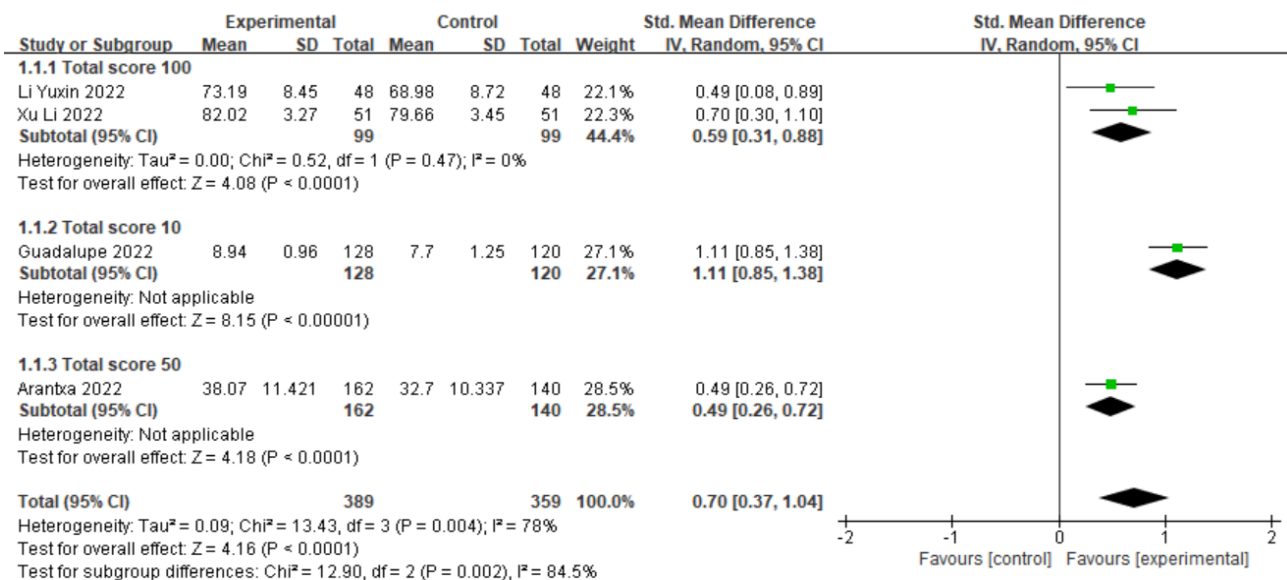


Figure 4. A subgroup analysis of the effect of the escape room teaching mode on nursing students' achievement

3.3.2. Influence of escape room teaching method on nursing teaching satisfaction

There are 5 pieces of literature in total consisting of a satisfaction survey on the escape room teaching

method [11-13,15,16]. In Xu Li's study, the satisfaction survey was conducted in the form of a rating, while Lorena and Guadalupe's studies only surveyed the satisfaction of the escape education group and lacked data from the control group. Two pieces of literature were entered into the meta-analysis, and there was heterogeneity among the studies, so the random effects model was used for analysis [11]. The results showed that the escape room teaching method had no significant effect on the satisfaction of nursing education content [SMD = 0.63, 95% CI (-0.31, 1.57), $P = 0.19$], as shown in **Figure 5**. The source of heterogeneity may be related to the different questionnaires used to collect satisfaction.

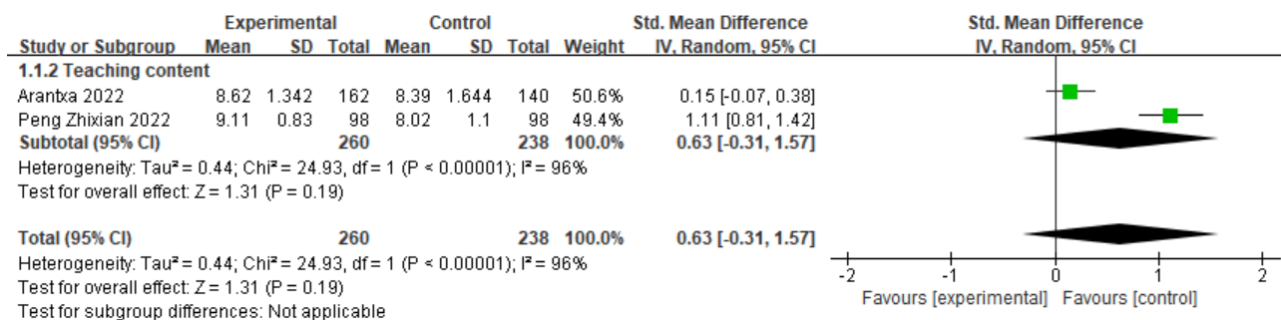


Figure 5. The effect of the escape room teaching method on content satisfaction in nursing education

3.3.3. The effect of the escape room teaching method on nursing students' critical thinking

The influence of the escape room teaching method on nursing students' critical thinking is reported [10,12]. There is no significant heterogeneity among the studies ($I^2 = 0$, $P < 0.0001$), so the fixed-effect model is used for analysis. The results showed that the escape room teaching method can improve the critical thinking of nursing students [MD = 12.64, 95% CI (7.91, 17.37), $P < 0.0001$], as shown in **Figure 6**.

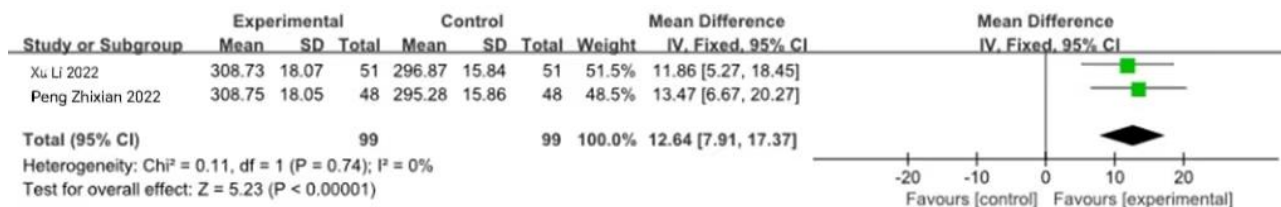


Figure 6. Influence of the escape room teaching method on the critical thinking of nursing students

3.3.4. The effect of the escape room teaching method on the learning engagement level of nursing students

This paper reported the influence of the escape room teaching method on the learning engagement level of nursing students [10,12]. There was no significant heterogeneity among the studies ($I^2 = 0$, $P < 0.001$), so the fixed-effect model was used for analysis. The results showed that the escape room teaching method can improve the learning engagement level of nursing students [MD = 4.18, 95% CI (1.74, 6.62), $P < 0.0001$], as shown in **Figure 7**.

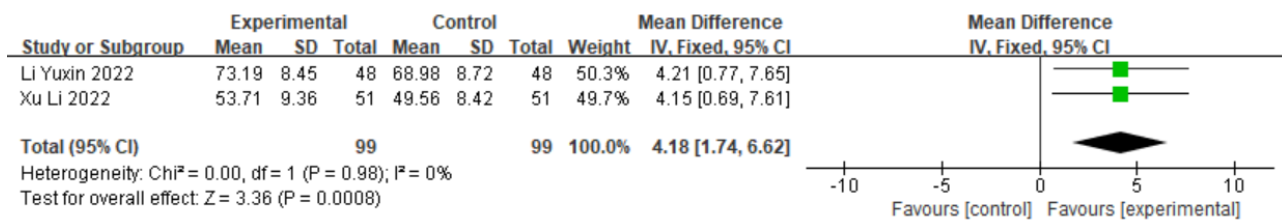


Figure 7. The effect of the escape room teaching method on the learning engagement level of nursing students

3.4. Publication bias and sensitivity analysis

Less than 10 pieces of literature were included in this study, so a funnel plot was not made. The sensitivity analysis of the studies whose outcome index was achievement was removed one by one, and it was found that Lorena’s studies had great heterogeneity. After removing their studies, the remaining studies were dynamically observed, and their heterogeneity results changed little, indicating that the data results were relatively stable.

4. Discussion

4.1. The escape room teaching method can improve the professional achievement of nursing students

The results of this study showed that the professional achievement of nursing students in the experimental group was improved and the difference was statistically significant [SMD = 0.98, 95% CI (0.38, 1.59), $P < 0.0001$] as compared to the traditional teaching method (control group). Research shows that not all students have the same study habits and learning skills, and it is beneficial to assess students with different strategies [5], while the escape room teaching method creates a dynamic educational environment that enhances knowledge retention, encourages contact, improves communication, and enhances learning [17,18]. Nursing students are provided with different assessment and learning strategies that can help them achieve better academic performance.

4.2. The influence of the escape room teaching method on nursing teaching satisfaction

The results showed that the escape room teaching method had no significant effect on the satisfaction of nursing education content [SMD = 0.63, 95% CI (-0.31, 1.57), $P = 0.19$]. However, many studies have shown that the escape room teaching method has a high degree of satisfaction in terms of educational content, which is contrary to the results of this study [12,13,15]. The reason may be that the escape room teaching method lacks the data of the control group in terms of satisfaction, some satisfaction is expressed by “rate”, and most satisfaction questionnaires are self-made questionnaires, with certain heterogeneity among them. The number of satisfaction literature included in this study is too small and there is significant heterogeneity, hence the results may be biased to some extent. More randomized controlled trials are needed on the effect of the escape method on nursing teaching content.

4.3. The escape room teaching method can improve the critical thinking and learning engagement of nursing students

The results of the meta-analysis in this study showed that it can significantly improve nursing students’ critical thinking [MD = 12.64, 95% CI (7.91, 17.37), $P < 0.0001$] and learning engagement [MD = 4.18, 95% CI (1.74, 6.62), $P < 0.0001$] as compared to the control group. During the process of the escape room teaching method, nursing students need to carefully evaluate and judge the situation of cases, make a comprehensive nursing plan by recalling knowledge, thinking and reasoning, analyze various factors in the secret room, constantly reflect on themselves, and cooperate with other personnel. Through the escape room teaching method, nursing students’ critical thinking ability and learning commitment level are developed and improved. It is an essential method to cultivate nursing students’ critical thinking ability to make correct

decisions after analysis, synthesis, and evaluation ^[19]. Knowledge can be presented in various forms such as text, pictures, video, audio, etc. during the escape room teaching method. Students take this as the basis to recall the corresponding knowledge and carry out subsequent operations, effectively stimulating students' interest in learning, and improving the level of learning investment ^[4].

5. Limitations and prospects of this study

There are some shortcomings in this study, as only the relevant Chinese and English databases were retrieved, which may have language bias. In addition, the escape room teaching method has significant heterogeneity in the professional achievement and nursing teaching satisfaction of nursing students. There are some differences in the application scenarios of the escape room teaching method and the measurement tools of outcome indicators. The results of this study show that the escape room teaching method can improve the professional achievement, critical thinking ability, and learning involvement of nursing students, but has no significant effect on the satisfaction of nursing teaching. Therefore, further relevant research is needed to clarify the effect of the secret room escape teaching method and explore the localized feasible escape room teaching method.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] The CPC Central Committee and The State Council issue China's Modernization of Education 2035. People's Education Press, 2019(5): 6–10.
- [2] Bigdeli S, Kaufman D, 2017, Digital Games in Health Professions Education: Advantages, Disadvantages, and Game Engagement Factors. *Med J Islam Repub Iran*, 31: 117.
- [3] Khanna A, Ravindran A, Ewing B, et al, 2021, Escape MD: Using an Escape Room as a Gamified Educational and Skill-Building Teaching Tool for Internal Medicine Residents. *Cureus*, 13(9): e18314.
- [4] Li J, Gao W, Ling Y. 2020, A Review of the Foreign Chemistry Escape Room Game Teaching Model. *Journal of Chemical Education*, 2020(2): 88–92.
- [5] Gómez-Urquiza JL, Hueso-Montoro C, Correa-Rodríguez M, et al, 2022, Nursing Students' Experience Using an Escape Room for Training Clinical Skills and Competencies on Emergency Care: a Qualitative Observational Study. *Medicine (Baltimore)*, 101(30): e30004.
- [6] Dimeo SP, Astemborski C, Smart J, et al, 2022, a Virtual Escape Room versus Lecture on Infectious Disease Content: Effect on Resident Knowledge and Motivation. *West J Emerg Med*. 23(1): 9–14.
- [7] Anguas-Gracia A, Subirón-Valera AB, Antón-Solanas I, et al, 2021, an Evaluation of Undergraduate Student Nurses' Gameful Experience While Playing an Escape Room Game as Part of a Community Health Nursing Course. *Nurse Educ Today*, 103: 104948.
- [8] Wang L, Wu W, Guan Y, et al, 2021, Research Progress of Escape Room Teaching in Nursing Education. *Chinese Nursing Research*, 35(14): 2517–2522.
- [9] Liu X, Yuan R, Liang R, 2022, Key Points and Application Progress of Escape Room Teaching Method in Nursing Teaching. *Journal of Nurses Training*, 37(14): 1296–1300.
- [10] Higgins JP, Altman DG, Gøtzsche PC, et al, 2011, The Cochrane Collaboration's Tool for Assessing Risk of Bias in Randomised Trials. *BMJ*, 343: d5928.
- [11] Peng Z, Wang L, Huang Y, et al, 2022, Application of Wisdom Tree Doodle Guide Joint Escape Room

Assessment in Nursing Teaching of Higher Vocational Nursing Students. *Chinese General Practice Nursing*, 20(22): 3154–3156.

- [12] Li Y, Gong C, Tan L, et al, 2022, Application of Escape Room Teaching Model in Clinical Practice Teaching in Department of Cardiovascular Medicine for Baccalaureate Nursing Students. *Journal of Nursing Science*, 37(2): 56–59.
- [13] Xu L, Yang L, Li E, et al, 2022, Application of “Escape Room” Game Teaching Combined with Situational Case in Nursing Training Teaching of Neurology Department. *Chinese Journal of Medical Education Research*, 21(7): 948–952.
- [14] Gutiérrez-Puertas L, Márquez-Hernández VV, Román-López P, et al., 2020, Escape Rooms as a Clinical Evaluation Method for Nursing Students, *Clinical Simulation in Nursing*, 49: 73–80. <https://doi.org/10.1016/j.ecns.2020.05.010>
- [15] Rodríguez-Ferrer JM, Manzano-León A, Cangas AJ, et al, 2022, a Web-Based Escape Room to Raise Awareness About Severe Mental Illness Among University Students: Randomized Controlled Trial. *JMIR Serious Games*, 10(2): e34222.
- [16] Molina-Torres G, Cardona D, Requena M, et al, 2022, The Impact of Using an “Anatomy Escape Room” on Nursing Students: a Comparative Study. *Nurse Educ Today*, 109: 105205.
- [17] Bujanda A, Bujanda E. DIABESCAPE: an Innovative Educational Project on Diabetes. *Endocrinol Diabetes Nutr (Engl Ed)*, 69(6): 392–400.
- [18] Cates AL, Krueger J, Simpson SE, et al, 2020, Comparing the Effectiveness of a Virtual Toxicology Escape Room at Two Emergency Medicine Residencies. *Cureus*, 12(10): e11262.
- [19] Gentry SV, Gauthier A, L’Estrade Ehrstrom B, et al, 2019, Serious Gaming and Gamification Education in Health Professions: Systematic Review. *J Med Internet Res*, 21(3): e12994.

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