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The effect of game-based scenario writing on the clinical reasoning of internship nursing students in cardiovascular emergencies and critical care units

Mahnaz Antikchi[1], Sara Heydari[2] and Fatemeh Bakhshi[1*]

Abstract

Background Nurses' failure to properly apply clinical reasoning (CR) can result in diagnostic errors especially in cardiac emergencies and critical care that compromise patient care and threaten patient safety. Therefore, nursing education must employ appropriate teaching approaches, particularly throughout internships, to enhance students' CR skills.

Aim This study aimed to assess the effect of game-based scenario writing on the CR of internship nursing students in cardiac emergencies and critical care units.

Methods An unblinded, randomized, controlled trial with a parallel control group was conducted with 82 nursing students who were experiencing cardiac emergencies and critical care internships from June to September 2023. The participants were randomly assigned to either the intervention group ($n = 41$), which received game-based scenario writing in the two phases of the pre-internship and internship periods, or the control group ($n = 41$), which received routine internship training. Data were collected at baseline and the end of the internship course, and the instruments included participants' characteristics, a CR test, and a satisfaction questionnaire.

Results At the end of the cardiac emergencies and critical care internship course, compared with the control group, the intervention group presented a significant increase in CR (12.30 ± 3.6, 14.57 ± 3.9, $p < 0.05$). Within-group Comparison of pre-test and post-test CR scores only showed a significant increase in the intervention group ($p = < 0.001$).

Conclusions The current study's findings support the argument that the gamified scenario-writing method can be an effective and dynamic learning method. It appears that employing this approach in nursing education could potentially enhance the CR of nursing students during their internship courses. Therefore, applying this method is recommended to nursing educators, especially for cardiac emergencies and critical care unit internship courses.

Keywords Nursing student, Clinical reasoning, Internship, Gamification, Cardiac critical care

*Correspondence:
Fatemeh Bakhshi
fateme.bakhshii@gmail.com
Full list of author information is available at the end of the article

Introduction

Clinical reasoning (CR) is a skill, process, or outcome that clinical professionals such as doctors, nurses, and dentists rely on to observe, collect, and interpret data for diagnosis, treatment, and care [1]. The concept of CR emerged for the first time in the nursing literature during the 1960 s [2–4]. Nurses utilize CR in the nursing process to identify nursing diagnoses and evaluate the outcomes of interventions to increase patient well-being. The absence of proper application of CR among nurses can result in diagnostic errors that compromise patient care and pose a threat to patient safety [5, 6].

The literature lacks adequate evidence that can effectively determine the development of CR skills, particularly within the field of clinical nursing [4]. A study in Taiwan reported that 80% of undergraduate nursing students did not have a satisfactory level of clinical competence [7]. Improving clinical competence by promoting CR is a top priority for higher education institutions aiming to nurture nursing students [8]. Chang et al. (2024) reported that even nursing students with a satisfactory level of clinical competency could not manage a critically ill patient [9].

The challenging scenarios underscore the complexity and importance of clinical decision-making faced when delivering nursing care, particularly for critically ill patients [10]. Nurses in emergency and critical care units must make quick and vital decisions in response to the fast-changing health conditions of these patients [11]. Patient management in cardiac emergency cases is complicated [12]. CR enables nurses to deliver safe and efficient care in these cases and encourage them to make clinical decisions autonomously [13]. CR helps nurses manage new patients, interpret their information, identify alterations in patients' critical status, and deliver safe nursing interventions [14]. However, insufficient CR among nurses may result in poor clinical decisions and lead to adverse patient outcomes [15, 16].

Inadequate understanding of the disease, memory problems with prior knowledge, incomplete data gathering, and flawed information processing techniques are common issues regarding CR among individuals [17]. The necessary knowledge for diagnosing and caring for a disease often resides within the individual's mind. However, since the required information is stored in their minds as distinct pieces with no relation, it cannot be accessed and brought back simultaneously in clinical decision-making [18]. To promote CR ability, individuals need to learn how to connect its components properly. Components of CR include gathering information, generating hypotheses, formulating a problem, making a differential diagnosis, selecting a primary diagnosis, and developing a plan of care, management, or treatment [19]. By choosing appropriate strategies, educators can help nursing students strengthen their CR and establish connections between its components. These strategies include exposure to a wide range of clinical situations, activation of prior knowledge (such as asking the student to explain why), emphasizing important features (identifying essential differences in a clinical case and trying to find differences between similar cases), and creating classification and illness scripts [20].

Nurses and nursing students must develop their CR and problem-solving skills through hands-on experience in acute patient care to effectively care for critically ill patients with heart disease [21]. CR development facilitates the integration of theory into practice and the advancement of patient management in cardiac emergencies and critical care [22]. The use of teaching–learning approaches such as simulation, case-based learning, problem-based learning, collaborative learning, think-aloud, scenario writing, and presence in various clinical situations during undergraduate training programs can help develop CR and facilitate the integration of theory into practice [23, 24]. In addition to these approaches, multiple measures are available to assess and ensure the advancement of CR in an individual [20]. These assessment methods also help individuals develop CR. These methods have been developed for evaluation in different contexts, such as work-based learning environments (such as direct observation, global assessments, written notes, and think-aloud) and nonwork-based learning environments (such as extended matching questions, modified essay questions, patient management problems, key feature examinations, and objective structured clinical examinations). Nevertheless, the wide range of methods available has posed a challenge for nursing educators in selecting the most suitable approach for the content and learning environment [20].

In undergraduate programs, nursing students typically begin their education in cardiac emergencies and critical care through theoretical coursework before putting their knowledge into practice in a clinical setting [25]. Relying on the learning achieved in the theoretical course, it is possible to help students develop CR in the internship period by choosing appropriate methods [26]. Scenario writing is a method that has been introduced for training and assessing CR in students. In this method, students are divided into small groups. Then, they are presented with several signs and symptoms of the desired disease, and they are asked to write a scenario corresponding to these symptoms. Students examine the signs and symptoms, develop a scenario, diagnose the problem, practice clinical decision-making, and indicate strategies for providing patient care. Implementing this method before the internship allows for a realm of unforeseen opportunities

and circumstances, offering nursing students the chance to make trial decisions before diving into clinical training. The development and presentation of a scenario by students, among other peers, increases self-confidence and improves CR [27]. In addition to the use of this method for CR learning and assessment, the progression of CR must be prioritized throughout the internship period. The use of CR assessment methods in work-based learning environments, such as written notes in the internship period, accompanied by feedback and reflection, facilitates the continuation of the development of CR [20].

The introduction of approaches that help the development of CR is one of the innovations of recent years in medical science education, especially nursing [28]. In addition, the introduction of gamification is another recent educational innovation [29]. Gamified education can help improve knowledge, skills, and clinical competencies cost-effectively [30]. In gamification, game principles are combined with educational content or objectives to motivate student learning [31]. Over the past few years, medical education researchers have utilized game concepts to design various analog and digital educational games [32]. Gamified education can be used in a wide range of situations, from classroom simulation to virtual reality or augmented reality, according to educational content and facilities [33]. Considering that CR involves the use of cognition and metacognition to make professional judgments and inferences and solve problems [34], the use of game principles can help develop CR by creating pleasure in learning activities [29].

As mentioned above, we hypothesized that combining the game principles with the scenario writing test in the classroom and the clinical written notes in the cardiac emergencies and critical care internship course can change the CR ability of nursing internship students. This study aimed to assess the effect of game-based scenario writing on the CR of internship nursing students in cardiac emergencies and critical care units.

Method

Study design

The present study is an unblinded, randomized, controlled trial with a parallel control group.

Study setting, participants and sampling

The study settings were the School of Nursing and Midwifery, Shahid Sadoughi University of Medical Sciences, Yazd, Iran, and Afshar Hospital, a university-affiliated hospital that is the major cardiac center in Yazd Province, Iran. In Iran, a bachelor's degree in nursing is four years, and students complete two semesters each academic year. In the last year of nursing, i.e., the 7th and 8th semesters, nursing students are trained in the clinical environment, which is called the internship period. Several internship courses are held during this period, one of which is the cardiac emergencies and critical care internship course [35]. The nursing education curriculum established by the Ministry of Health in Iran outlines that students achieve theoretical knowledge of cardiac emergencies and critical care management in their fifth and sixth semesters. In the 7th or 8th semester, they acquire the ability to merge theoretical knowledge with practical application in cardiac and emergency care settings.

Owing to the requirement of passing theoretical courses in cardiac emergencies and critical care, nursing students in their first days of the 7th semester were eligible for participation in this study (before entering the internship period). Willingness to participate in the study and being an internship student in the field of cardiac emergencies and critical care were other inclusion criteria in this study. Participants who had previously been involved in both scenario writing workshops and advanced echocardiogram interpretation workshops and did not pass the theoretical academic units of cardiac emergencies and critical care were not included in the study.

Based on the initial values from the study of Hong and Yu [36], and considering $\alpha = 0.05$, $\beta = 0.20$, $d = 2.4$, $S1 = 3.94$, and $S2 = 3.38$, the required sample size was obtained as 38. Considering 15% attrition, this resulted in a final sample size of 45 students in each group.

Sample size formula:

$$n_1 = n_2 = \frac{\left(S_1^2 + S_2^2\right)\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2}{d^2}$$

To be conservative and avoid the negative impact of attrition, 90 students were included in the study. For random assignment via online software (www.random.org/sequences/), each student was given a code between 1 and 90 and randomly assigned to two groups on the basis of the output of the software: a game-based scenario writing program (GSWP) or an intervention group ($n = 45$) and a typical internship program (TIP) or a control group ($n = 45$). Students entered the study after providing informed consent. Eight students were excluded from the study for various reasons. In the intervention group, four students were excluded: two students did not attend the session workshops fully, one student did not complete the questionnaires, and one student withdrew from the study. In the control group, similarly, four students were excluded: one student failed to complete the initial questionnaires and expressed an unwillingness to participate in the

research, two students did not complete the questionnaires in the post-test, and one student withdrew from the study. As a result, we had a total sample size of 82 individuals whose data were examined, with 41 participants assigned to the GSWP (intervention) group and another 41 participants assigned to the TIP (control) group Fig. 1.

Data collection

The period of data gathering spanned from June to September 2023. The intervention period in both groups lasted 10 weeks. At the beginning of the study, students from both groups came to the nursing school, where they completed an informed consent form, provided demographic information, and took a pretest. The demographic questionnaire sought information on age,

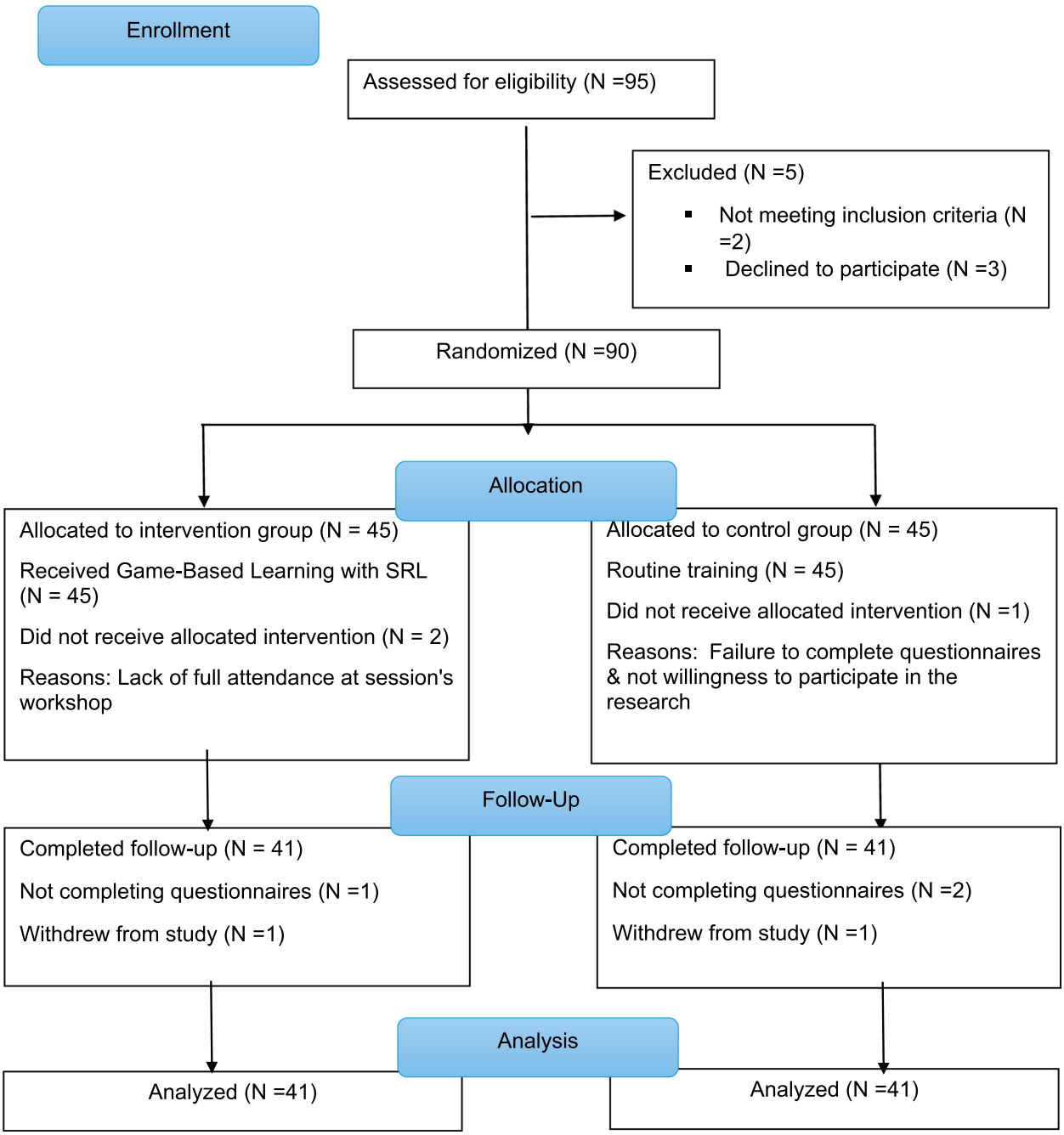

Fig. 1 Participant flow diagram (CONSORT 2010)

gender, GPA, and previous attendance at CR workshops, as well as scenario writing and game-based seminars and courses. To avoid contamination of the intervention and prevent the information from interacting between the two groups, the internship shifts of students in the control and intervention groups were not scheduled simultaneously in the same hospital wards. Additionally, At the outset of the study, students were informed that they must refrain from disclosing any information or training received throughout the cardiac emergency and critical care internship to their peers in the control group until the completion of the study.

Within the University Learning Management System (LMS), the students spent 45 min taking the pretest. Next, participants in the GSWP engaged in two initial sessions of intervention for two days, spending four hours each day. The individuals from both groups subsequently took part in the internship program of cardiac emergencies and intensive care. Students in both groups received routine internship training. The internship program requires participants to complete 11 seven-hour shifts in cardiac emergency and critical care units in the direction of faculty members and cardiac unit head nurses. Throughout the internship course, the students in the intervention group were asked to produce five written notes outlining critical cardiac cases they managed while caring for patients. To limit interaction between the students in the intervention and control groups, internship shifts were carefully scheduled during the study period. Once all the students finished their internship period (two months after the study commenced), they underwent the posttest. The posttest was conducted in the same way as the pretest. The CR tests in the pretest and posttest included key feature (KF) and comprehensive integrative puzzle (CIP) questions.

Both groups had their satisfaction levels assessed via a researcher-made questionnaire after completing cardiac emergencies and critical care internship courses. To ensure a balance of learning opportunities for both groups, the control group attended the game-based scenario writing sessions as the intervention group at the end of the study.

Study intervention

The intervention was implemented by the research team and a teaching team in two phases, including two faculty members (named F1 and F2) from the medical-surgical nursing department who possess several years of experience in working and teaching in the cardiac critical care and emergency departments and one faculty member from the medical education department (named F3). Phase one consists of initial game-based scenario writing sessions in eight steps over two days. In phase two, the continual assessment of CR during the internship was performed via written clinical notes.

Phase one, game-based scenario writing sessions

First day In the *first step*, the medical education faculty outlined the goals and approach to conducting the scenario writing sessions for 40 min for the students. Then, the students were split into 15 groups composed of three individuals, each in the *second step*. F1 elaborated on the game's methodology in 30 min. During the *third step* of the intervention, the students responded to twenty multiple-choice questions regarding cardiovascular emergencies. The cognitive level of the questions varied, with 20–25% falling under Taxonomy One, 60–65% under Taxonomy Two, and 10–15% under Taxonomy Three, following Milman multiple-choice question design principles [37]. Once the answers were verified, the teams' scores were shared, and F2 explained the correct responses and potential questions via the Pendleton feedback method [38, 39]. On the basis of the exam scores, the top three teams were each awarded one of the following prizes, selected by their members: Team members in different groups have the option to switch positions if both parties consent, to receive a tip from the professors in the next step as a bonus card, and to ignore a mistake in the next stage as a life card. In this phase, the primary focus was to summarize the course content, clarify game rules, and establish a collaborative and teamwork-oriented environment for students. In total, an hour and a half were considered for this section.

F3 used examples to teach the students the scenario writing method in the *fourth step*. F3 took measures to ensure that the students had all the necessary details for creating the scenario. This stage lasted for 30 min. Once this segment concluded, the students were allotted a 15-min break for snacks. In the *fifth step*, the students were instructed to create two clinical scenarios drawn from the given explanations and keywords, actively engage in group interactions within a 20-min timeframe for each set of words, and prepare to present these scenarios during the second day. The implementation of this step also took 40 min. In steps four and five, groups could use their awards.

Second day During the *sixth step* of the intervention, the representatives of each group presented the developed scenario for 5 min. After each presentation, the professors exchanged thoughts with other groups regarding both the positive aspects and areas needing improvement or potential errors within the written scenario over a 3-min conference. Using an online checklist as their tool for assessment, the teaching team and group

representatives rated the scenarios on the basis of their size, integration of signs and symptoms, coherence, use of clinical indicators, and proximity to real descriptions. This step took approximately two hours.

In the *seventh step*, after reviewing the checklists, a summary of the key points was compiled, and the three top teams were announced and inspired. Approximately 30 min was considered for this step. In the end, F1 facilitated a 30-min debriefing session aimed at reconsidering important points and frequent mistakes that were spotted.

Phase two, clinical written notes throughout the internship course

In the intervention group, students received their internship training in cardiac emergencies and intensive care. Students in the same groups in phase one started the internship course. The competition between the groups continued in this phase as well. Once more, the top three groups from the first phase were awarded one of the three prizes suggested in the prior phase on the basis of their preference. Groups could use their prize during phase two. In this course, the groups were asked to write five structured written notes about five patients hospitalized in the cardiac emergency and critical care wards. During the internship, the students wrote scenarios on the basis of written notes of their clinical conditions, demographic information, and disease patterns. Next, nursing diagnoses and patient management plans were completed for that case. The students should mention the reasons for the proposed nursing interventions. The written notes from the groups were shared with F1 and F2. At the end of this internship course, all the groups met again in the classroom. The group representatives presented two cases (scenarios) in 15 min on the basis of the choices of the group members. The evaluation was performed on the basis of checklists by the teaching team and representatives. The sum of the scores of the two phases was used to determine the final score of the top groups. The top three groups were announced and awarded awards.

Instruments

Clinical reasoning tests (key features-KF and comprehensive integrative puzzle-CIP)

The test consisted of seven questions (five KF questions and two CIP questions). The KF questions included five cases, each with eight choices. The students had the opportunity to select from a total of eight options, opting for either one correct answer or up to three. The number of correct choices was specified in the description of the question body; if the student chose more than the number of correct options, a negative grade was considered for the student.

Two questions were designed as CIPs. The three main parts of the questionnaire included scenarios, signs, and nursing interventions. Each part contains three options: A, B, and C. The scenario part presented three alternatives stemming from three clinical cases. The sign part included descriptions of signs connected to three distinct clinical cases. Three nursing care options were detailed in the nursing intervention section for the three cases mentioned earlier. Following that, the response section depicted three distinct modes of answers through four choices (e.g., the first choice being CAA, BAC, and AAC). Those students who selected the choice containing three accurate modes were successful in arriving at the right solution.

The development of the questions involved inviting three nursing faculty members with expertise in cardiac emergencies and intensive care from the Department of Medical-Surgical Nursing. They then gathered in one session to discuss and refine the strengths and weaknesses of the questions. To assess face and content validity, the test was given to ten faculty members in the Departments of Medical-Surgical Nursing and Medical Education. During this phase, feedback from the faculties was implemented, resulting in the completion of the test version for use in both the pretest and posttest. The internal consistency of the questionnaire was also acceptable on the basis of Cronbach's alpha coefficient (0.78). The CR score ranged from 0–20 (Supplementary file 1).

Satisfaction questionnaire

A descriptive survey was completed at the end of the internship course to gather information. The results of this step of the survey show the level of satisfaction of the participants in the two groups in different areas. The satisfaction questionnaire was researcher-developed and presented electronically. The participants were asked to rate their level of satisfaction with each category on a Likert scale ranging from strongly agree (5) to strongly disagree (1). This questionnaire consists of 20 items in three parts, which ask about students' satisfaction with the course content domain in nine items with scores ranging from 9–45, instructor domain with seven items with scores ranging from 7–35, and four items in learning environment domain scores ranging 4–25. Two steps were passed to ensure the psychometric reliability of the tool. Initially, face validity was assessed through individual interviews with students, allowing participants to provide valuable feedback on the difficulty level, suitability, and clarity of the items. In the subsequent step, the content validity of the questionnaire was tested by 10 faculty members of the Nursing School. In this step, the

relevance, clarity, and simplicity of the satisfaction questionnaire were assessed using the Content Validity Index (CVI). The CVI scores obtained for relevance, clarity, and simplicity were 0.85, 0.92, and 0.95, respectively. The questionnaire's internal consistency was 0.83 using Cronbach's alpha (Supplementary file 1).

Ethical considerations

Ethics approval was issued by the Research Ethics Committee of Shahid Sadoughi University of Medical Sciences and Health Services of the Institutional Review Board (IRB) (code of ethics IR.SSU.RSI.REC.1402.022). Blinding was not feasible in the study because the intervention was easily recognizable by both the researcher and participants. Throughout this research, the guidelines outlined in the Declaration of Helsinki were followed, such as clarifying the research goals and obtaining informed consent from participants, offering the choice to partake in the study, ensuring the ability to withdraw at any time, emphasizing the safety of the interventions, answering questions and providing the results to participants if desired [40]. Students in both groups could choose not to take the test or attend training sessions, instead requesting regular internship training. The students were guaranteed that their academic evaluation would remain unaffected by any of the test scores collected in this research. Furthermore, if they are unwilling to participate, dealing with faculty members in the study will not pose a problem for them.

Data analysis

The data were analyzed via SPSS version 23 (IBM Corporation, NY). By following the normal distribution of the data of CR and satisfaction scores, parametric analysis was selected as the appropriate analytical method. Quantitative variables are presented as the means and standard deviations, whereas categorical variables are presented as frequencies and percentages. The pretest homogeneity of the general characteristics and dependent variables was assessed through chi-square tests. For bivariate analysis, when the variable was compared with quantitative variables by pre- and post-test periods, Student's t-test (paired and independent) was used.

Results

Baseline characteristics

In this study, of the 90 nursing students who were included, 82 completed the questionnaires entirely (41 individuals in each group). Table 1 shows the results of the main measured demographic variables in both study groups. The participants in both groups reported a lack of experience in attending similar workshops on CR, gamification, and scenario writing. There was no significant relationship (P value >0.05). As a result, the two groups were homogeneous in terms of these variables at the beginning of the study.

Table 1 Characteristics of the study sample ($N=82$) and comparisons between the intervention and control groups

Variables	Study sample Frequency (%)	Intervention group ($N=41$)	Control group ($N=41$)	p-value
Gender				
Male	36 (43.9)	17 (41.46)	19 (46.34)	$\chi^2=0.198$
Female	46 (56.1)	24 (58.54)	22 (53.66)	df = 1
				$p=0.656$
Age				
20–22	72 (87.80)	37 (90.24)	35 (85.36)	$\chi^2=0.123$
23–25	10 (12. 20)	4 (9.76)	6 (14.64)	df = 1
				$p=0.445$
GPA status				
14–16	12 (14.64)	6 (14.64)	6 (14.64)	$\chi^2=0.00$
16.01–18	70 (85.36)	35 (85.36)	35 (85.36)	df = 1
				$p=1.00$

Abbreviations: Chi-square (χ2), *N* sample size, *M* mean, *SD* standard deviation

$p<.05$

Between-group comparison of the clinical reasoning score

According to Table 2, the results of the independent t-test revealed that the average CR scores in the GSWP (intervention) group increased significantly compared with those in the TIP (control) group (P value $=0.008$).

Within-group comparison of the clinical reasoning score

According to Table 3, in the TIP group, the average CR score was 13.43 ± 4.27 in the pretest and 12.30 ± 3.60 in the posttest, which was a statistically significant difference (p value <0.001). Compared with that of the pretest, the average score of the posttest decreased. In the GSWP group, the average pretest CR score was 12.06 ± 3.95, and the posttest CR score was increased to 14.57 ± 3.90, which was a statistically significant difference (p value <0.001).

Satisfaction scores of the two groups

According to Table 4, the intervention's average satisfaction scores in all domains were higher than those of the control group. This difference was significant only in the instructor domain (p-value $=0.035$).

Discussion

This study investigated the effect of the game-based scenario writing program on the CR of nursing students during the internship period in cardiac emergencies and

Table 2 Between-group comparison of the total CR score at two data collection times

Variables	Control group		Intervention group		Independent t-test statistics	
	M	SD	M	SD	t*	*p*-value
Pre	13.43	4.27	12.06	3.95	− 1.515	0.134
Post	12.30	3.60	14.57	3.90	2.732	0.008

Abbreviations: Mean, SD standard deviation

$p < .05$

* Independent t-test

Table 3 Within-group comparison of the total CR score at two data collection times

Variables	Pre		Post		t*	*p*-value
	M	SD	M	SD		
Control group ($N = 41$)	**13.43**	4.27	**12.30**	3.60	4.58	< 0.001
Intervention group ($N = 41$)	**12.06**	3.95	**14.57**	3.90	12.75	< 0.001

Abbreviations: Mean, SD standard deviation

$p < .05$

* Paired t-test

Table 4 Comparison of the satisfaction scores between the intervention and control groups

Satisfaction items	Intervention group		Control group		t*	*p*-value
	M	SD	M	SD		
Content Domain	41.29	6.21	38.87	5.7	1.8	0.073
Instructor Domain	30.0	4.37	29.17	3.68	0.928	0.035
Learning environment Domain	20.39	3.27	20.04	3.42	0.462	0.64

Abbreviations: Mean, *SD* standard deviation

$p < .05$

* Independent t-test

critical care. To the best of our knowledge, the current study is the first to assess the effectiveness of combining scenario writing and gamification in nursing students' CR. The findings indicated that the gamified scenario writing educational intervention may enhance nursing students' CR skills for providing nursing care in cardiac emergencies and critical care. A review of the literature has shown that the use of game-based learning [41, 42] approaches positively improve students' clinical decision-making skills. A systematic review revealed that students' experience, involvement, and motivation were enhanced through gamification training approaches, leading to improved teamwork and student relationships [43]. The findings of a quasi-experimental study, which investigated the impact of escape rooms as a gamification-based educational tool on nursing students' CR and teamwork skills, revealed that students engaged in escape room activities showed significant improvements in CR, decision-making, collaboration, and leadership skills. This educational approach not only enhanced student engagement but also facilitated the application of theoretical knowledge in practical settings [44]. A scoping review showed that educational strategies, including the use of case studies, problem-based learning, and serious games, provide the opportunity to practice and make decisions in different clinical practice situations and develop CR skills in nursing students [45]. However, a multimethod study showed that applying serious games in the context of teaching acute heart failure to nursing students could improve students' engagement and intrinsic motivation. Still, it did not significantly improve their CR scores [46].

Few studies have also examined the effectiveness of scenario writing on CR. In line with the current study's results, Akbari et al. (2022) reported that short-term scenario writing training can effectively improve the CR of

medical student internships during the internal department's rotation period [27]. Aliyari et al. (2019) reported that the teaching of CR in emergency nursing during crises has significantly improved and promoted critical thinking in nursing students [5].

The results of the comparison within the groups before and after indicated that the average CR scores in both groups showed a significant difference. Based on the results, the average score in the control group decreased in the post-test compared to the pre-test, but in the intervention group, the average post-test score improved compared to the pre-test. To explain this finding, it could be noted that the current study was designed using gamification techniques based on real-life cardiac patient management scenarios and using gamification elements based on several key learning theories for the intervention group. David Kolb's Experiential Learning Theory is one of the main theories supporting this study. According to this theory, learning occurs through direct and active experience [47]. In this study, students actively applied their knowledge and strengthened their CR and decision-making skills by participating in simulated cardiac patient management scenarios. This approach allowed them to gain meaningful experiences by encountering realistic clinical situations. Constructivism theory also plays an essential role in this method. According to this theory, learners construct new knowledge based on their previous knowledge and experiences [48]. In the gamification scenarios, students actively structured their knowledge by analyzing information, solving problems, and making decisions in simulated situations. This process helped them apply theoretical concepts to practical situations and gain a deeper understanding of the management of cardiac patients. Social learning theory was also used in this method. Students learned teamwork, communication, and leadership skills through interacting and collaborating with their teammates to solve scenarios [49]. These social interactions could help to enhance learning and improve group performance. Overall, the study intervention tried to create a dynamic and interactive environment for teaching CR and teamwork to nursing students by combining experiential learning, constructivism, and social learning theories. These methods might have made learning more engaging and prepared students to face real clinical challenges.

After the internship course in cardiac emergencies and critical care concluded, a survey was conducted to assess student satisfaction with the teaching methods implemented in both groups. The results of the study indicated a significant difference in student satisfaction in the instructor domain (p value $=0.035$). However, no significant difference was observed between the students in the two groups in the content and learning environment domains (p value >0.05). A study that applied gamification and augmented reality in mechanical ventilation training for nursing students reported a high level of satisfaction among students with the educational methods used [50]. A systematic review revealed that gamification increases satisfaction with the learning experience and meaningful improvement in learning outcomes [51]. Awada et al. (2024) applied the effectiveness of virtual patient platforms designed for learning CR in cardiovascular diseases. This platform included simple to complex scenarios to investigate heart diseases. The results of the study indicated a high level of satisfaction among students and educators due to the flexibility in generating the platform scenario and providing feedback on the student's performance [52].

Limitations

This study has several limitations. First, the complexity of CR makes it challenging to assess. However, we utilized validated assessment methods, specifically the KF and CIP, as the educational literature has confirmed their reliability [53]. Additionally, students received clear instructions on how to complete the assessments before they commenced. Second, the analysis did not account for confounding variables, which represents a significant limitation. We did consider demographic variables, including age, gender, and GPA, ensuring they were balanced between both groups. Third, the motivation regarding learning and the course was not assessed, which presents another limitation of this study. Understanding the impact of motivation on student engagement and performance could provide valuable insights for future research. However, we tried to assess students' satisfaction with the course. This approach allows us to gather feedback on the strengths and weaknesses of the educational program and can guide future improvements [54]. Fourth, the evaluation of students' CR was limited to a single field, cardiac emergencies, and critical care, and conducting the study in just one center may affect the generalizability of the findings. Future research that incorporates an expanded scenario-writing approach with more gaming features in various nursing clinical learning environments will aid in enhancing CR and clinical competence among nursing students in managing diverse critical situations.

Conclusions

This study effectively integrates game-based learning with scenario-based learning in nursing education, providing an innovative and practical approach to the field. It appears that employing this approach in nursing education could potentially enhance the CR of nursing students during their internship courses in cardiac

emergencies and critical care units. This method may serve as a valuable addition to nursing educators' strategies, potentially fostering a more engaging and motivating learning environment that supports students in developing CR, which is required for their future roles in cardiac emergencies and critical care settings.

Furthermore, it is important to acknowledge the lack of existing research on scenario writing methods in the nursing educational field. This suggests a need for future studies to explore the impact of this teaching method, especially when combined with gamification, compared with other educational approaches currently used to improve CR in nursing education.

Abbreviations

CR	Clinical reasoning
GSWP	Game-based Scenario Writing Program
TIP	Typical internship program
LMS	University Learning Management System
KF	Key features
CIP	Comprehensive integrative puzzle

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-07079-w.

Supplementary Material 1

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Trial registration
Not applicable.

Authors' contributions
MA and SH designed the project. MA, FB, and SH managed the project and collected all data. MA and FB analyzed the data. MA, FB, and SH were responsible for manuscript preparation. All authors contributed to reviewing the paper before submission.

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Data availability
The datasets for the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
Throughout this research, the guidelines outlined in the 1964 Declaration of Helsinki were followed, such as clarifying the research goals and obtaining informed consent from participants, offering the choice to partake in the study, ensuring the ability to withdraw at any time, emphasizing the safety of the interventions, answering questions and providing the results to participants if desired. Students in both groups could choose not to partake in the study. Ethics approval was issued by the Research Ethics Committee of Shahid Sadoughi University of Medical Sciences and Health Services of the Institutional Review Board (IRB) (code of ethics IR.SSU.RSI.REC.1402.022).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Research Center for Nursing and Midwifery Care, Department of Nursing, School of Nursing and Midwifery, Non-Communicable Diseases Research Institute, Shahid Sadoughi University of Medical Sciences, Bouali Ave., Safaeyeh, Yazd, Iran. [2]Department of Medical Education, Medical Education and Development Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

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