BMC Medical Education

RESEARCH

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Peer-led versus instructor-led structured debriefing in high-fidelity simulation: a mixed-methods study on teaching effectiveness

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Abstract

Background Debriefing is the essential element of simulation teaching. Peer-led structured debriefing simulations could be a suitable approach because of the peers' similarity in age and experience to the students. The purpose of this study was to compare the teaching effectiveness of peer-led debriefing versus instructor-led debriefing in high-fidelity simulation scenarios.

Methods The study used a mixed-method approach, integrating quasi-experimental and qualitative components. A total of 88 third-year nursing students were randomly distributed into the instructor-led or peer-led group, with equal sample sizes in both cohorts. The study compared knowledge acquisition, simulation performance, student satisfaction and self-confidence in learning, and debriefing experience between the two groups. In addition, interviews were conducted with students in the peer-led group after the course.

Results The scores of students' simulation performance scale were higher in the peer-led group than in the instructor-led group, and both groups made significant gains in knowledge. The peer-led group and instructor-led group demonstrated similar performance in terms of knowledge, simulated performance, reporting experience, student satisfaction, and learning confidence. The semi-structured interview results indicated that students in the peer-led group expressed approval of peer facilitators.

Conclusions Our study demonstrated that students in the peer-led group showed better performance in the simulation, and both groups demonstrated improved knowledge. Thus, with the premise of peers receiving training, the peer-led simulation teaching method can be regarded as a supplementary strategy for simulation teaching to enrich the form of simulation teaching and improve the effectiveness of simulation teaching.

Keywords Simulation, Peer teaching, Debriefing, Teaching and learning

Introduction

With increasing international attention to patient safety and patients' increasing awareness of self-rights protection, opportunities for medical interns to improve their clinical skills have gradually diminished. Consequently, a gap has emerged between theoretical teaching and clinical practice, presenting one of the most challenging issues in medical education [33, 51]. High-fidelity scenario simulation has been proposed as an appropriate teaching

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method to tackle this challenge. By replicating authentic clinical environments, it offers students the opportunity to enhance nursing skills in a safe setting, alleviating concerns about patient harm [9, 50, 51]. Debriefing is an essential component of simulation-based education, and its quality significantly impacts the outcome of simulation teaching [18, 31, 34]. Effective debriefing offers the advantage of maximizing student learning outcomes and ensuring the attainment of instructional goals [11].

The most effective debriefing method remains a topic of debate. Traditionally, teachers serve as facilitators in debriefing [53]; however, research indicates that instructor-led debriefing does not consistently yield positive effects on student learning [21]. It can induce stress and anxiety among students, potentially affecting their simulation performance [28], and may even result in negative simulation experiences for nursing students [40]. Due to the unequal power dynamics between teachers and students, teachers may adopt a dominant role during debriefing, which can diminish students' motivation, willingness, and opportunity to express their ideas [10]. Psychological safety is crucial for successful debriefing [3]. Exploring debriefing methods to bridge the status gap between facilitators and students, create an emotionally safe learning environment, and encourage expression and self-reflection warrants further exploration [30]. Peer-led debriefing, derived from peer-assisted learning, could be seen as an effective alternative to teacher-led debriefing. Social learning theory, proposed by American psychologist Albert Bandura [47], emphasizes the interaction between individuals, behavior, and the environment. By integrating the observation of real-life models with individual autonomy and subjective abilities, individuals can engage in self-directed learning and enhance learning effectiveness [4]. Peers serve as the most readily accessible source of observation and learning for students. Due to similarities in age, background, and learning experiences, it's easier to establish emotional and cognitive congruence [52]. Therefore, compared to the traditional teacher-student relationship, students find it easier to express themselves openly and accept knowledge from their peers [2, 54]. In peer teaching situations, students not only feel less nervous and more confident but also demonstrate improved performance[20, 29, 37]. Furthermore, peer tutors, possessing a dual perspective as both teachers and students, can use language that resonates with their learners, explain concepts at an appropriate level, and identify issues that teachers might overlook, thus enhancing student learning [6, 49]. At the same time, peer tutors, allowed serving as educators, can enhance their confidence and problem solving skills [54, 57]. Through this process, they develop teaching skills, enabling them to evolve into competent medical educators [48]. Peer-assisted teaching, as a reciprocal and mutually beneficial strategy, has the potential to supplement traditional teacher-led instruction effectively, potentially alleviating the teaching burden on instructors while being more cost-effective and efficient [20, 58].

However, there is limited research on peer-led debriefing in nursing education, and the findings are inconsistent [13, 29, 45]. Roh et al. [45] indicated that nursing students in instructor-led debriefing groups demonstrated better simulated performance and satisfaction compared to those in peer-led groups. Similarly, Kim et al. [29] revealed that instructor-led debriefing led to improved nursing skills and higher-quality debriefing. However, [13] found that peer and teacher-facilitated debriefing are equally effective, with upper-level students capable of fulfilling the role of debriefing facilitator. Additionally, a study revealed that peer feedback effectively enhances students' nursing skills and abilities, while also fostering their reflective abilities and enhancing peer tutors' sense of empowerment in comparison to teacher feedback [56]. The research also pointed out that the implementation of structured peer feedback enhances peer tutors' feedback practices, which are comparable in quality to faculty feedback. The inconsistency may arise from varying definitions of "peers" in these studies; some chose students participating in the simulation simultaneously, while others included peers from higher grades. Additionally, there is often a lack of comprehensive preassessment and training for peers in peer-led simulation teaching research, which may contribute to the differences in findings. This highlights the need for further validation through additional studies.

Therefore, this study adopts the Near Peer Teaching (peer tutors from different academic levels) approach [57], recruiting peer facilitators from senior students, to explore the effectiveness and satisfaction of simulation teaching between teachers and peer tutors who have received standardized training. This approach aims to enhance peer-led debriefing programs and provide supplementary solutions for teachers.

Methods

Study design and participants

This study used a mixed methods approach, integrating a quasi-experimental design and a qualitative study using semi-structured interviews. The number of participants was determined using G*Power 3 calculations [15]. Using simulated performance as the primary outcome measure, the effect size was calculated to be 0.50 [44]. With a significance level of 0.05, a power of 0.80, and an effect size of 0.50, the estimated sample size was 26 per group. The participants consisted of 88 third-year nursing students who were enrolled in the high-fidelity scenario

simulation of the Emergency and Critical Care Nursing curriculum and agreed to take part in the study. Before this, they had no experience with high-fidelity simulation. The students were randomly assigned by the administrative staff to an instructor-led group or a peer-led group. In total, 44 students were assigned to the peer-led group, and 44 students were assigned to the instructor-led group. Students voluntarily formed groups of five to six, with each facilitator leading two groups in simulation and debriefing. To prevent contamination, students in the instructor-led group attended the class on June 16th, 2021, while students in the peer-led group attended the class on June 17th and June 18th, 2021. Figure 1 illustrates the study design.

Procedures

Preparation before the class

Peer Facilitator Preparation **Selection**

Peer facilitators were recruited from senior students based on criteria developed by reviewing the literature and consulting nursing education experts. The final selection criteria for peer facilitators included: (1) Completion of the Emergency and Critical Care Nursing curriculum and passing the exam, (2) Achievement of theoretical and practical test scores within the top 15% of the class, or (3) Participation in the National Nursing Skills Competition. Ultimately, 2 students meeting these criteria were selected as peer facilitators.

Training

(1) Collective lesson preparation: Peer facilitators and teachers participate in joint lesson preparation meetings to establish teaching objectives, outline simulation teaching process, and define the debriefing content. (2) Workshop training: The training follows the best practice standards set by the International Nursing Association for Clinical Simulation and Learning (INACSL), and is conducted by an instructor certified by the National League for Nursing in simulation teaching. During the workshop training, the instructor guided peer facilitators on the key points and precautions of debriefing teaching. (3) Watching simulation teaching videos: Gain experience by observing real simulation teaching videos of the teaching team on the Massive Open Online Course (MOOC) website. (4) Observing the formal simulation teaching process: Peer facilitators are required to observe the formal simulation teaching process conducted by the teacher.

Competency evaluation

After completing the training tasks, peer facilitators conducted simulation teaching to assess their

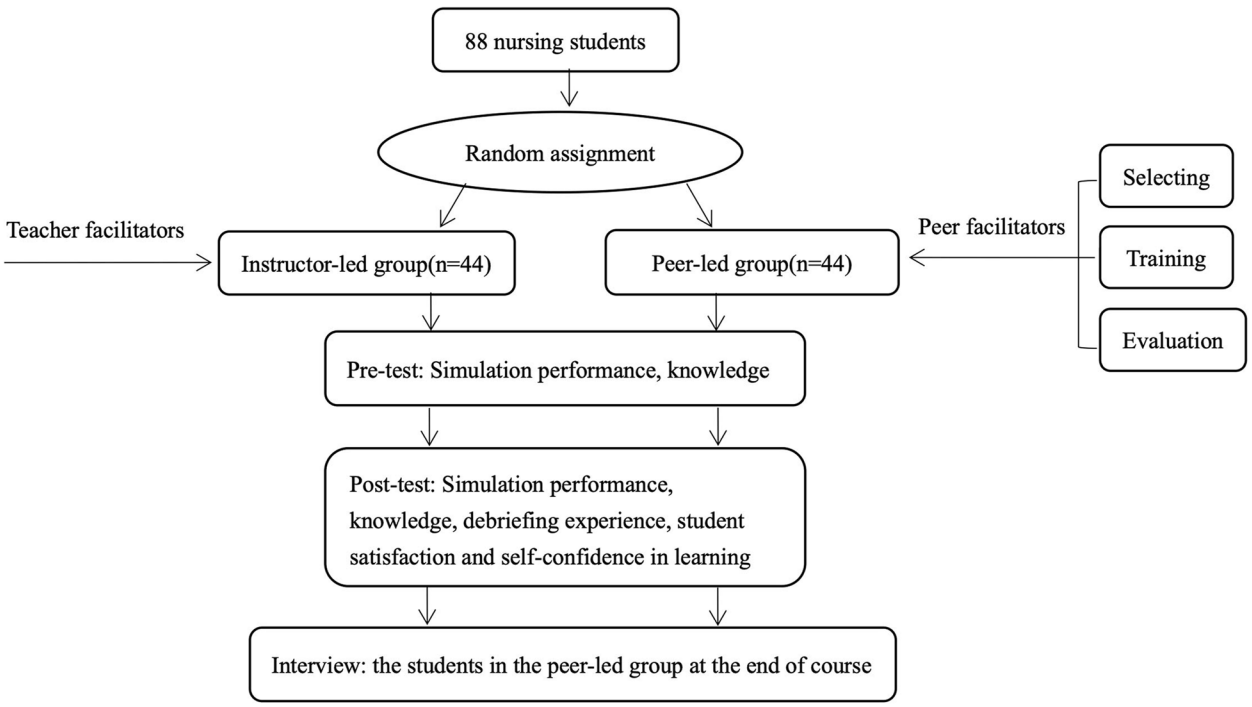

Fig. 1 Research design

competency. Their performance was evaluated by the instructor certified in the National League for Nursing simulation teaching using the Debriefing Assessment for Simulation in Healthcare (DASH) scale. Peer facilitators who scored more than 5 points (indicating a medium level) on this scale were considered competent.

Teacher Facilitator Preparation The teachers in the control group have all completed the simulation teaching training and obtained the simulation teaching qualification. They participate in collective lesson preparation meetings with peer facilitators to identify teaching objectives, simulation teaching process and debriefing content.

Student Preparation Teachers need to provide students with simulation teaching cases one week in advance. Students voluntarily form groups of five to six to complete tasks such as case analysis, role assignment, and proposing emergency plans before the course. The roles consist of three to four nurses, one patient family member, and one observer. In the simulation scenario, the nurses evaluate the condition of the simulator and collect data based on its performance, collaborating to treat the patient. The family member assumes the role of the patient's son or daughter, simulating nurse-patient communication. The observer is responsible for monitoring interactions between team members and patients, as well as overseeing all aspects of the simulation process. Using the Plus (+)/Delta (Δ) method, the observer records the strengths, weaknesses, and areas for improvement of the team members. After the simulation, the observer collaborates with the team to provide feedback and report the observation results.

Teaching Scene Preparation (1) Teaching case preparation: The teaching team consisted of theoretical instructors, practical instructors from the experiment center, and clinical experts in emergency critical care, totaling ten individuals. The final teaching case was determined by the teaching team according to best simulation practice standards, application guidelines for clinical simulation teaching, and a collection of classic cases.

(2) Simulation environment: Two high-fidelity simulation classrooms with identical settings and equipment were utilized as simulation environments. The equipment includes an Annie QCPR whole-body resuscitation simulator, a sim-pad report instrument, an automatic defibrillator, a multifunctional ECG monitor, a basic respirator, an oxygen cylinder, infusion supplies, rescue supplies, and a rescue vehicle.

Pilot

We conducted a pilot simulation teaching process with 15 students, administering pre- and post-test questionnaires before formal implementation to ensure the feasibility of the simulation plan as well as the clarity and readability of the survey instruments.

Implementation

The cases and simulation environments of both groups were fully aligned. The formal simulation teaching process proceeded as follows:

(1) Introduction: The facilitator introduced the course format, simulation environment, laboratory products, and teaching objectives to the students based on the content discussed during the collective lesson preparation before class. After this, the students were given 10 min to complete simulation preparation.
(2) Formal simulation: Students conducted simulations in groups within the high-fidelity simulation classroom. The facilitator, observer, and other students in the group observed the performance of students in the feedback room. They utilized the debriefing tablet to record students' strengths, weaknesses, and encountered problems. The formal simulation session lasted for 10 min.
(3) Debriefing: After completing the simulation, students entered the feedback room, which provided a quiet and private environment for structured debriefing. The debriefing session lasted 20 min. Following the 3C model (context, content, course), the facilitator led the debriefing session, guiding students to introduce their performance during the simulation [19]. This model is widely used in China and consists of the following three stages:

①Context phase: Allow students time to discuss the simulation they just completed to release their emotions and feelings.
②Content phase: Under the facilitator's guidance, students reflected on the issues encountered during the simulation and analyzed the reasons. The facilitator employed the advocacy-inquiry method for questioning strategies. a. "I see"-Facilitators and observers objectively report their observations on students' performance during the simulation, avoiding subjective judgments. b. "I believe"-Facilitators provide their perspective on the actions discussed, considering their impact on patient care.

c. "I wonder"-Exploring the underlying reasons for students' errors during simulated scenarios.
③Course phase: The facilitator and students reviewed the teaching objectives and key points of the simulation teaching together to obtain experience and discussed the application of their learning in real clinical settings.

Interview

After the course, we conducted semi-structured interviews to gain deeper insights into the feelings and experiences of both peer tutors and students in the peer-led group. Participants include 12 students from the peer-led group and 2 peer tutors. Both the student and peer tutor versions of the interview outline consisted of 4 questions (Appendix A). Each interview lasts 15–20 min. The audio-recorded interviews were transcribed into text by two researchers who were not involved in the interview process.

Instruments

Debriefing assessment for simulation healthcare

The competency of the peer facilitator was measured using the rater version scale of debriefing assessment for simulation healthcare developed by the panel of simulation experts [5]. The scale consisted of 6 elements: establishing an engaging learning environment, maintaining an engaging learning environment, structuring the debriefing in an organized way, provoking engaging discussions, identifying and exploring performance gaps, and helping trainees achieve or sustain good future performance. Ratings were made on a 7-point Likert scale ranging from 1 (extremely ineffective/abysmal) to 7 (extremely effective/outstanding). The Cronbach's alpha coefficient of the scale was 0.89.

Knowledge test

To assess students' knowledge improvement following the simulation teaching, we employed a questionnaire prepared by teachers based on the teaching objectives of knowledge and skills. The questionnaire consisted of 10 multiple-choice questions covering basic patient nursing, defibrillation, and CPR (cardiopulmonary resuscitation) knowledge (Appendix B). Experts in the field reviewed the test items to ensure their reliability.

Simulation performance

The study used the Chinese version of the Sweeney-Clark Simulation Performance Rubric, developed by Chu et al. [44]. This version employs a self-evaluation method and consists of 8 items, evaluating students' simulation performance in various domains, including medical history collection, patient health education, laboratory examination data interpretation, nursing intervention, nursing assessment, clinical judgment, communication, and safety. Ratings were conducted on a 5-point Likert scale ranging from 1 to 5 for each item. Cronbach's alpha of the scale was 0.827, test-retest reliability of the scale was 0.77, split-half reliability of the scale was 0.829, Cronbach's alpha of the scale in the present pretest study was 0.929 and the posttest study was 0.915.

Debriefing experience scale (DES)

We utilized the debriefing experience scale developed by [42], comprising 20 items across 4 dimensions. These dimensions included Analyzing Thoughts and Feelings (4 items), Learning and Making Connections (8 items), Facilitator Skill in Conducting the Debriefing (5 items), and Appropriate Facilitator Guidance (3 items). Responses were recorded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's alpha of the scale in previous studies was 0.930, whereas our study calculated it to be 0.933.

Student satisfaction and self-confidence in learning (SSSCL)

The scale developed by [26] was utilized to assess participants' satisfaction and confidence in simulation teaching. It comprises 13 items rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating greater satisfaction and self-confidence in simulation teaching. The Cronbach's alpha of the scale was 0.814, while in our study it was calculated to be 0.910.

Data collection

To commence the study, the teachers invited participants verbally, explaining the aims, content, and significance of the study. Before the class session, we used the Debriefing Assessment for Simulation Healthcare scale to assess the competence of peer facilitators in the simulation room. Students who volunteered to participate completed the knowledge test questionnaire and the Sweeney-Clark Simulation Performance scale. Although the students had no prior experience with high-fidelity simulation or debriefing, they had participated in role-playing activities in previous courses (e.g., Basic Nursing, Surgical Nursing). To control for potential confounding factors, students were asked to complete the Sweeney-Clark Simulation Performance Scale based on their prior brief simulation experiences. Following the class, we administered the knowledge test questionnaire, the Sweeney-Clark Simulation Performance scale, the SSSCL scale, and the DES to compare the results between the two groups. Additionally, we conducted interviews with students in the peer-led group after the course in the simulation

Table 1 Demographic characteristics ($n=88$)

Variables	IL group ($n=44$) n(%)/[M(p25,p75)]/Mean ± SD	PL group ($n=44$)	X^2 /Z/t	*P*
Age (years)	21(21.00,22.00)	21(21.00,21.75)	-0.763	0.445
Gender			0.306	0.580
Male	9(20.5)	7(15.9)		
Female	35(79.5)	37(84.1)		
Grade of college entrance examination	551(504.75,593.25)	567(538.00,597.50)	-0.709	0.478
GPA (Grade Point Average)	2.85 ± 0.43	2.81 ± 0.48	-0.372	0.711
Knowledge	6.32 ± 1.54	6.02 ± 1.53	0.903	0.369
Simulation performance	23.50(19.00,28.00)	23.50(19.25,31.75)	-1.253	0.210

IL Instructor-led, *PL* Peer-led

room. The Southern Medical University Biomedical Ethics Committee approved the ethics application of the study (Approval No. 2021-033).

Data analysis

The data were analyzed using SPSS statistical software version 24.0. Descriptive statistics, *t*-tests, and nonparametric tests were employed to calculate quantitative data. Normality was assessed using the Shapiro-Wilk test. Group differences were evaluated using independent sample *t* tests or Mann-Whitney *U* tests, depending on the normality of the data. Changes from pretest to post-test within groups were analyzed using paired-sample *t* tests or Wilcoxon signed rank tests, also based on normality. Statistical significance was set at $P<0.05$. Qualitative data analysis followed inductive content analysis methods, with researchers manually encoding interview text after multiple readings.

Results

Homogeneity of demographic characteristics of participants

The homogeneity of demographic characteristics of participants is illustrated in Table 1. Among the 88 students, 16 were men and 72 were women, and their mean age was 21.20 years (standard deviation [SD] = 0.864). There are no significant statistical differences in age (Z=-0.763, $P=0.445$), sex (Z=-0.306, $P=0.580$), college entrance examination scores (Z=-0.709, $P=0.478$), and GPA (Grade Point Average) (t=-0.372, $P=0.711$).

Comparison of the results between the groups from pre-test to post-test

Table 2 presents the knowledge test results of the two groups from pre-test to post-test. Significant statistical differences were observed in the knowledge scores for both the peer-led group (t=-4.158, $P<0.001$) and the instructor-led group (t=-3.189, $P=0.003$).

Table 2 Knowledge scores between peer-led ($n=44$) and instructor-led group ($n=44$) from pre-test to post-test

Group	Pre-test Mean ± SD	Post-test	t	*P*
IL group	6.32 ± 1.54	7.14 ± 1.47	-3.189	0.003
PL group	6.02 ± 1.53	7.05 ± 1.48	-4.158	< 0.001

IL Instructor-led, *PL* Peer-led

Comparison of the results between the groups following the simulation

Table 3 presents the results of knowledge, simulation performance, debriefing experience, student satisfaction, and self-confidence in learning between the groups. There was a significant statistical difference in simulation performance (Z=-1.253, $P=0.041$). There are no significant statistical differences in any other items.

Interview results

Tables 4 and 5 respectively present interview results from the perspectives of students and peer tutors. Both of them had positive experiences with the peer-led simulated teaching.

Discussion

The purpose of this research was to compare the effectiveness of peer-led versus instructor-led simulation teaching in high-fidelity scenario simulation. The results showed that, in terms of the simulated performance of nursing students, peer-led simulation teaching was more effective than instructor-led. Both groups of students demonstrated improved knowledge levels compared to before the simulation. However, there were no significant statistical differences in knowledge, debriefing experience, and student satisfaction and self-confidence in learning between the two groups.

In this study, we found that peer-led and instructor-led debriefing can effectively improve students' knowledge

Table 3 Differences of results between peer-led ($n=44$) and instructor-led group ($n=44$) following the simulation

Variables	Category	IL group [M(p25,p75)]/Mean ± SD	PL group	t/Z	*P*
Knowledge		7.14 ± 1.47	7.05 ± 1.48	0.289	0.773
Simulation performance		24.00(19.50,27.00)	27.00(21.25,31.75)	-1.253	0.041
Debriefing experience	Overall	72.23 ± 5.09	74.14 ± 8.83	-1.242	0.218
	Analyzing thoughts and feelings	16.11 ± 1.65	16.64 ± 2.05	-1.320	0.190
	Learning and making connections	34.45 ± 3.04	35.50 ± 4.07	-1.356	0.176
	Facilitator skill in conducting the debriefing	20.93 ± 1.78	21.30 ± 2.95	-0.699	0.487
	Appropriate facilitator guidance	12.86 ± 1.47	13.32 ± 1.79	-1.041	0.301
Student satisfaction and self-confidence in learning		54(52.00,59.75)	55(50.50,62.00)	-0.598	0.550

IL Instructor-led, *PL* Peer-led

Table 4 Students' perspectives on peer-led simulated teaching

Themes	Subthemes	Sample quote
Teaching effect	Recognized peer tutors with high teaching satisfaction	*"The senior student who taught us has quite extensive experience, as she participated in national nursing skills competitions before."*
		"I feel that the peer tutor was well-prepared in advance and delivered the content quite effectively."
		"I find this experiential style of teaching quite effective."
Strengths and weaknesses	A better atmosphere	*"Having the teacher take the lead might create a sense of oppression, and then it becomes unclear how to proceed."*
		"It allows for more room for us to express ourselves, especially in free discussions."
		"It's not as tense, and the senior student is more approachable."
	Understanding students' needs	*"The senior student is just one year ahead of us and has gone through the same transition from our current state."*
		"She understands us better, knows where we might go wrong, and is aware of the details and nuances. "
		"She is more acquainted with our preferences in terms of teaching styles, making the knowledge more easily acceptable to us."
	Lack of professional authority	*"She (the senior student) may have some shortcomings in clinical experience, particularly in terms of authoritative expertise."*
		"Feel that the senior student lacks authority, she isn't as composed as the teacher, and there is a lack of seamless integration between the two, resulting in less natural interaction."

Table 5 Peer tutors' perspectives on peer-led simulated teaching

Themes	Subthemes	Sample quote
Teaching effect	High student engagement	*"The classroom atmosphere feels more relaxed; there's less pressure compared to when the teacher is leading the class."*
		"My questions are not too serious, and I feel their pressure is reduced a bit."
	Role transition	*"It's not just about learning from a student's perspective but also adopting a teacher's viewpoint in the learning process."*
		"One's thinking and perspective need to be elevated to a higher level when approaching the content of this class."
		"Consciously establishing a cognitive awareness of the (teacher) role."
Strengths and weaknesses	Enhancement of comprehensive abilities	*"It enhances communication skills, time management, and psychological resilience, serving as a comprehensive improvement."*
		"Teaching skills are improved, and divergent thinking becomes a bit stronger. "
		"There is also a lot to learn from students because their thinking is quite divergent."
	More pressure	*"The pressure on the facilitator is a bit higher; it requires a broader knowledge base."*
		"There is a bit of pressure in guiding students, especially with a larger number of students, and some of them being lively and active."
	Training is required.	*"It is advisable to conduct a simulation or assessment for the peer tutor if possible."*
		"Their qualifications are crucial, and training is essential."

levels, similar to previous research [13, 29, 56]. Scenario simulation pre-establishes a realistic environment and incorporates vivid clinical cases, enabling students to apply theoretical knowledge to complete hands-on practice and deepen their understanding throughout the simulation process [38, 51]. As the core and essence of simulation teaching, debriefing facilitates critical interaction between facilitators and students, as well as among students themselves, allowing students to comprehend, analyze, and synthesize their thoughts, feelings, and actions [14, 31, 34].

Both teachers and peer tutors have adopted a structured 3C framework for debriefing, effectively guiding students to explore the causes of simulated problems, identify appropriate handling methods, and learn how to avoid them next time [14, 19]. Through the process of discussion and analysis, students' knowledge is enhanced through acceptance, integration and absorption [16, 22]

Following their respective simulations, students in the peer-led group showed better simulation performance than those in the instructor-led group, aligning with the findings of peer-led learning studies [55, 56]. This may be attributed to students' performance during the simulation process being hindered by the fear of judgment from instructor facilitators [7, 14]. A meta-analysis revealed that Near Peer Teaching is significantly more effective in enhancing learners' procedural skills than teacher-led teaching [57]. The phenomenon can be supported by the status emotion theory and cognitive consistency theory.

According to the power-status theory [41], individuals' emotional experiences can be influenced by their perceived status. Traditionally, teachers play a central role due to their expertise and authority, creating an unequal status dynamic between teachers and students. Thus, under instructor-led simulation teaching, students are more likely to experience significant pressure and nervousness due to the authority of the teacher, which may result in more mistakes being made during the simulation. Cognitive consistency refers to the similarity in knowledge foundation, problem-solving methods, and language systems between peer tutors and students [23, 52]. In this context, peer tutors can facilitate students' comprehension of complex concepts or provide critical evaluations in a more easily digestible manner [20, 43, 48].

In our study, the peer tutors were senior students who shared similar age and experience with the students, thereby possessing equal status and the ability to establish a more relaxed and supportive learning environment [39, 58]. Consequently, during the scenario simulation process, students experienced reduced anxiety, enhanced communication skills, and improved performance [37, 57].

Another reason may be that peer tutors underwent standardized training and passed competency evaluation, thus gaining preliminary proficiency in providing structured debriefing and feedback, and acquiring a certain level of simulation teaching skills. According to the best practical standard of simulation teaching published by INACSL, prior training is also required for peer tutors [1, 12]. Many studies have recommended that peer-assisted learning activities should be structured, well-organized, and monitored [8, 17, 24, 48].

For inexperienced beginners, guiding the team to engage in in-depth discussions and reflections can be challenging, making it difficult to ensure the quality of guiding feedback and achieve the goal of deep thinking [10, 14, 36]. This also explains why the results of our study differ from the findings of Roh et al. [45]. Roh's findings indicated that nursing students in the IL group were more satisfied with their simulation experience than those in the PL group. However, in our study, there was no statistically significant difference in debriefing experience between the IL and PL groups, and both groups had positive simulation experiences. Therefore, having senior peers who are more experienced and have undergone prior training and evaluation as facilitators may be a better choice, but this requires further comparative verification.

We found that there were no significant differences between the two groups in terms of learning satisfaction and self-confidence. Based on the interview results, students in the PL group actively engaged in debriefing, participated in discussions, and expressed high satisfaction with the peer tutors, supporting the research findings of Kim and De Gagne [29]. Compared to self-debriefing or within-team debriefing, structured debriefing, and trained tutors serve as guarantees for the quality of simulated debriefing [27, 46]. It must be acknowledged that teachers possess extensive debriefing experience and a deeper understanding of the advantages and challenges students face during simulations [25]. However, peer teaching is a mutually beneficial process, providing senior peers with an opportunity to practice their teaching skills [6, 57]. Peer tutors constantly reflect on their teaching preparation process, prompting them to integrate teaching, simulation, and clinical experiences to exercise their necessary teaching skills. During the debriefing process, effective communication and knowledge sharing with students can enhance their understanding of key concepts, critical thinking, clinical judgment, and leadership skills [13, 32]. Exceptional, exceptional peer tutors can serve as role models, inspiring students to learn from them and gain valuable insights [35, 48].

Unlike previous studies, our study explored the impact of peer-led versus teacher-led simulation teaching, with both peers and teachers undergoing rigorous training and preparation. This represents a beneficial

attempt to enhance scenario simulation teaching strategies. Peer-led debriefing enhances the effectiveness of simulations while ensuring the achievement of learning objectives, and can serve as a supplementary form of instruction to high-fidelity situational simulation. As Rueda-Medina [46] pointed out, combining peer debriefing and instructor-led debriefing after a simulation session can improve debrief satisfaction and perceived debriefing assessment among nursing students. By incorporating peer debriefing into traditional debriefing sessions, nursing students are encouraged to analyze their strengths and weaknesses, providing them with opportunities for self-reflection with peers and enhancing satisfaction [27]. Based on the findings of our study and other supporting evidence in the literature, peer-led debriefing should be considered as an effective reporting strategy, offering teachers an additional choice to select the most suitable, feasible, and cost-effective method based on the characteristics of the student population.

Limitations and Future Research

The study is limited by the small sample size and the implementation of peer-led simulation teaching in a single course. Future research should evaluate the effectiveness of larger random samples and include other courses. Another limitation is that we conducted the simulation only for one case. Future research can conduct long-term studies by incorporating multiple cases to compare the effectiveness of peer-led versus instructor-led simulation teaching. Furthermore, in our study, we only compared the effects of simulation teaching led by peers and teachers separately. Future research can explore the possibility of combining the two methods in simulation teaching.

Conclusion

Despite these limitations, this study fills a gap in research on peer-led simulation teaching in China. In this study, we used rigorously trained senior students as peer facilitators for simulation teaching. Peer facilitators, due to their similar age and experience, are more adept at communicating and better equipped to comprehend the students' needs. Our findings indicate that students in the peer-led group showed better performance in the simulation, and knowledge improvement was observed in both groups. In conclusion, with the premise of peers receiving training, the peer-led simulation teaching method can be considered as an auxiliary strategy for simulation teaching to enrich the form of simulation teaching, optimize students' simulation performance, and improve the effectiveness of simulation teaching.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-024-06262-9.

Supplementary Material 1.

Supplementary Material 2.

Acknowledgements
The author would like to express their gratitude to the students for participating in this research.

Authors' contributions
X.F., Q.F., Y.F., and P.Z. designed the study and secured ethical approval. T.W. and Q.L. collected and analyzed the quantitative data. W.L. analyzed and interpreted the qualitative data. X.R. was the primary contributor to manuscript writing. L.S. supervised all aspects of the study and obtained funding.All authors read and approved the final manuscript.

Funding
This work was supported by the Department of Education of Guangdong Province under Grant [2022GXJK153] and the 2022 Guangdong Province Undergraduate Teaching Quality and Teaching Reform Engineering Construction Project [No.469].

Data availability
The datasets generated and/or analyzed during the current study are not publicly available due to keeping participants' information confidential but are available from the corresponding author at reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the Southern Medical University Biomedical Ethics Committee (No. 2021-033). Participants were informed about the study's objectives, the confidentiality of their information, and the voluntary nature of their participation. All students provided written informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 18 May 2024 Accepted: 28 October 2024
Published online: 12 November 2024

References

1. Anon. INACSL standards of best practice: simulationSM debriefing. Clin Simul Nurs. 2016;12:S21-S25. https://doi.org/10.1016/j.ecns.2016.09.008.
2. Aljahany M, Malaekah H, Alzahrani H, et al. Simulation-based peer-assisted learning: Perceptions of health science students. Adv Med Educ Pract. 2021;12:731–7. https://doi.org/10.2147/AMEP.S308521.
3. Allen JA, Reiter-Palmon R, Crowe J, et al. Debriefs: teams learning from doing in context. Am Psychol. 2018;73(4):504–16. https://doi.org/10.1037/amp0000246.
4. Bandura A. Self-efficacy mechanism in human agency. Am Psychol. 1982;37(2): 122.
5. Brett-Fleegler M, Rudolph J, Eppich W, et al. Debriefing assessment for simulation in healthcare: development and psychometric properties. Simul Healthc. 2012;7(5):288–94. https://doi.org/10.1097/SIH.0b013e3182620228.
6. Brown J, Collins G, Gratton O. Exploring the use of student-led simulated practice learning in pre-registration nursing programmes. Nurs Standard (Royal Coll Nurs (Great Britain): 1987). 2017;32(4):50–8. https://doi.org/10.7748/ns.2017.e10505.

7. Cantrell MA. The importance of debriefing in clinical Simulations. Clin Simul Nurs. 2008;4(2):e19-23. https://doi.org/10.1016/j.ecns.2008.06.006.
8. Carr SE, Brand G, Wei L, et al. Helping someone with a skill sharpens it in your own mind: a mixed method study exploring health professions students experiences of peer assisted Learning (PAL)[J]. BMC Med Educ. 2016;16(1):48. https://doi.org/10.1186/s12909-016-0566-8.
9. Chow KM, Ahmat R, Leung AW, Y, et al. Is high-fidelity simulation-based training in emergency nursing effective in enhancing clinical decision-making skills? A mixed methods study. Nurse Educ Pract. 2023;69: 103610. https://doi.org/10.1016/j.nepr.2023.103610.
10. Christiansen CR, Andersen JV, Dieckmann P. Comparing reflection levels between facilitator-led and student-led debriefing in simulation training for paramedic students. Adv Simul. 2023;8(1):30. https://doi.org/10.1186/s41077-023-00273-0.
11. Chronister C, Brown D. Comparison of simulation debriefing methods. Clin Simul Nurs. 2012;8(7):e281-288.
12. Decker S, Fey M, Sideras S, et al. Standards of best practice: Simulation Standard VI: the debriefing Process[J]. Clin Simul Nurs. 2013;9(6):S26-9. https://doi.org/10.1016/j.ecns.2013.04.008.
13. Doherty-Restrepo J, Odai M, Harris M, et al. Students' perception of peer and Faculty Debriefing facilitators following Simulation-based Education. J Allied Health. 2018;47(2):107–12.
14. Fanning RM, Gaba DM. The role of debriefing in Simulation-based Learning. Simul Healthcare: J Soc Simul Healthc. 2007;2(2):115–25. https://doi.org/10.1097/SIH.0b013e3180315539.
15. Faul F, Erdfelder E, Lang AG, et al. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39(2):175–91. https://doi.org/10.3758/BF03193146.
16. Fey MK, Jenkins LS. Debriefing practices in nursing education programs: Results from a national study: Nurs Educ Perspect. 2015;36(6):361–6. https://doi.org/10.5480/14-1520.
17. Furmedge DS, Iwata K, Gill D. Peer-assisted learning – beyond teaching: how can medical students contribute to the undergraduate curriculum? Med Teach. 2014;36(9):812–7. https://doi.org/10.3109/0142159X.2014.917158.
18. Groom JA, Henderson D, Sittner BJ. NLN/Jeffries simulation framework state of the science project: Simulation design characteristics. Clin Simul Nurs. 2014;10(7):337–44. https://doi.org/10.1016/j.ecns.2013.02.004.
19. Gross Forneris S, Fey MK. Critical conversations: the NLN Guide for Teaching Thinking. Nurs Educ Perspect. 2016;37(5):248–9. https://doi.org/10.1097/01.NEP.0000000000000069.
20. Guraya SY, Abdalla ME. Determining the effectiveness of peer-assisted learning in medical education: a systematic review and meta-analysis. J Taibah Univ Med Sci. 2020;15(3):177–84. https://doi.org/10.1016/j.jtumed.2020.05.002.
21. Ha EH. Attitudes toward video-assisted debriefing after simulation in undergraduate nursing students: an application of Q methodology. Nurse Educ Today. 2014;34(6):978–84. https://doi.org/10.1016/j.nedt.2014.01.003.
22. Hall K, Tori K. Best practice recommendations for debriefing in simulation-based education for Australian undergraduate nursing students: An integrative review. Clin Simul Nurs. 2017;13(1):39–50. https://doi.org/10.1016/j.ecns.2016.10.006.
23. Henderson S, Needham J, van de Mortel T. Clinical facilitators' experience of near peer learning in Australian undergraduate nursing students: a qualitative study. Nurse Educ Today. 2020;95: 104602. https://doi.org/10.1016/j.nedt.2020.104602.
24. Herrmann-Werner A, Gramer R, Erschens R, et al. Peer-assisted learning (PAL) in undergraduate medical education: an overview. Z Evid Fortbild Qual Gesundheitswese. 2017;121:74–81. https://doi.org/10.1016/j.zefq.2017.01.001.
25. Husebø SE, Dieckmann P, Rystedt H, et al. The Relationship between facilitators' questions and the level of reflection in Postsimulation Debriefing. Simul Healthc. 2013;8(3):135–42. https://doi.org/10.1097/SIH.0b013e31827cbb5c.
26. Jeffries PR, Rizzolo MA. National League for Nursing/Leardal project summary report: Designing and implementing models for the innovative use of simulation to teach nursing care of ill adults and children: a national, multi-site, multi-method study[J]. New York: National League for Nursing; 2006.
27. Kang K, Yu M. Comparison of student self-debriefing versus instructor debriefing in nursing simulation: a quasi-experimental study. Nurse Educ Today. 2018;65:67–73. https://doi.org/10.1016/j.nedt.2018.02.030.
28. Kim M, Kim S. Debriefing practices in Simulation-based nursing education in South Korea. Clin Simul Nurs. 2017;13(5):201–9. https://doi.org/10.1016/j.ecns.2017.01.008.
29. Kim SS, De Gagne JC. Instructor-led vs. peer-led debriefing in preoperative care simulation using standardized patients. Nurse Educ Today. 2018;71:34–9. https://doi.org/10.1016/j.nedt.2018.09.001.
30. Krogh K, Bearman M, Nestel D. Thinking on your feet—a qualitative study of debriefing practice. Adv Simul. 2016;1:12. https://doi.org/10.1186/s41077-016-0011-4.
31. Kuszajewski ML. Nursing simulation debriefing. Nurs Clin North Am. 2021;56(3):441–8. https://doi.org/10.1016/j.cnur.2021.05.003.
32. Lawrence K, Messias DKH, Estrada RD, et al. Peer teaching in high-fidelity simulation: participant experiences and reflections. Nurse Educ. 2018;43(6):312–6. https://doi.org/10.1097/NNE.0000000000000540.
33. Lee JE, Sim IO. Gap between college education and clinical practice: experience of newly graduated nurses. Nurs Open. 2020;7(1):449–56. https://doi.org/10.1002/nop2.409.
34. Levett-Jones T, Lapkin S. A systematic review of the effectiveness of simulation debriefing in health professional education. Nurse Educ Today. 2014;34(6):e58-63. https://doi.org/10.1016/j.nedt.2013.09.020.
35. Liu W, Li YL, Han QH, et al. Construction of peer support education program for nursing students based on social learning theory. J Nursing (China). 2023;30(03):16–9. https://doi.org/10.16460/j.issn1008-9969.2023.03.016.
36. MacKenna V, Díaz DA, Chase SK, et al. Self-debriefing in healthcare simulation: an integrative literature review. Nurse Educ Today. 2021;102: 104907. https://doi.org/10.1016/j.nedt.2021.104907.
37. Mirjalili N, Bonabi TN, Sharifabad MB, et al. Improving nursing students perceived self-efficacy in CPR, through peer-led Educational Method. Adv Educ Sci Volume. 2017;13:86.
38. Mulyadi M, Tonapa SI, Rompas SSJ, et al. Effects of simulation technology-based learning on nursing students' learning outcomes: a systematic review and meta-analysis of experimental studies. Nurse Educ Today. 2021;107: 105127. https://doi.org/10.1016/j.nedt.2021.105127.
39. Nomura O, Onishi H, Kato H. Medical students can teach communication skills – a mixed methods study of cross-year peer tutoring. BMC Med Educ. 2017;17(1):103. https://doi.org/10.1186/s12909-017-0939-7.
40. Pai HC. An integrated model for the effects of self-reflection and clinical experiential learning on clinical nursing performance in nursing students: a longitudinal study. Nurse Educ Today. 2016;45:156–62. https://doi.org/10.1016/j.nedt.2016.07.011.
41. Kemper TD. Power and Status and the Power-Status Theory of Emotions. In: Stets JE, Turner JH, editors. Handbook of the Sociology of Emotions. Handbooks of Sociology and Social Research. Boston: Springer; 2006. https://doi.org/10.1007/978-0-387-30715-2_5.
42. Reed SJ. Debriefing experience scale: development of a tool to evaluate the student learning experience in debriefing. Clin Simul Nurs. 2012;8(6):e211-7.
43. Rees EL, Quinn PJ, Davies B, et al. How does peer teaching compare to faculty teaching? A systematic review and meta-analysis. Med Teach. 2016;38(8):829–37. https://doi.org/10.3109/0142159X.2015.1112888.
44. Chu H-H, Chen Q, Huang L-M, Zhong T. Reliability and Validity of Sweeney-Clark's Simulation Performance Rubric (Chinese version)[J]. J Nurs. 2017;24(8):1–4.
45. Roh YS, Kelly M, Ha EH. Comparison of instructor-led versus peer-led debriefing in nursing students: instructor-led versus peer-led debriefing. Nurs Health Sci. 2016;18(2):238–45. https://doi.org/10.1111/nhs.12259.
46. Rueda-Medina B, Schmidt-RíoValle J, González-Jiménez E, et al. Peer debriefing Versus instructor-led debriefing for nursing Simulation. J Nurs Educ. 2021;60(2):90–5. https://doi.org/10.3928/01484834-20210120-06.
47. Bandura A. Social learning theory. Englewood Cliffs; 1977.
48. Sukrajh V, Adefolalu AO. Peer teaching in medical education: Highlighting the benefits and challenges of its implementation. Eur J Educ Pedagogy. 2021;2(1):64–8. https://doi.org/10.24018/ejedu.2021.2.1.52.

49. Tai JH, Haines TP, Canny BJ, et al. A study of medical students' peer learning on clinical placements: what they have taught themselves to do. J Peer Learn. 2014;7(1):57–80.
50. Tang F, Zhou X, Qian Y, et al. A combination of virtual cases and scenario simulation in comprehensive nursing skill training. J Nurs Sci. 2018;33(18):65–8. https://doi.org/10.3870/j.issn.1001-4152.2018.18.065.
51. Tonapa SI, Mulyadi M, Ho KHM, et al. Effectiveness of using high-fidelity simulation on learning outcomes in undergraduate nursing education: systematic review and meta-analysis. Eur Rev Med Pharmacol Sci. 2023;27(444–58):2.
52. van de Mortel TF, Needham J, Henderson S. Facilitating learning on clinical placement using near-peer supervision: a mixed methods study. Nurse Educ Today. 2021;102: 104921. https://doi.org/10.1016/j.nedt.2021.104921.
53. Wei B, Hu C. Application status quo of guided feedback in nursing simulation teaching. Chin Nurs Res. 2021;35(2):289–91. https://doi.org/10.12102/j.issn.1009-6493.2021.02.018.
54. Widyahening IS, Findyartini A, Ranakusuma RW, et al. Evaluation of the role of near-peer teaching in critical appraisal skills learning: A randomized crossover trial. Int J Med Educ. 2019;10:9–15. https://doi.org/10.5116/ijme.5c39.b55b.
55. Yoo MR, Kang M, Kim H, et al. The effects of self-directed practice using peer-tutoring on confidence, performance and learning satisfaction of nursing students in practicing core nursing skills. J Korean Acad Soc Nurs Educ. 2017;23(1):27–36.
56. Yoong SQ, Wang W, Chao FF, T, et al. Using peer feedback to enhance nursing students' reflective abilities, clinical competencies, and sense of empowerment: a mixed-methods study. Nurse Educ Pract. 2023;69:103623. https://doi.org/10.1016/j.nepr.2023.103623.
57. Zhang H, Liao AWX, Goh SH, et al. Effectiveness of peer teaching in health professions education: a systematic review and meta-analysis. Nurse Educ Today. 2022;118:105499. https://doi.org/10.1016/j.nedt.2022.105499.
58. Zhang Y, Maconochie M. A meta-analysis of peer-assisted learning on examination performance in clinical knowledge and skills education. BMC Med Educ. 2022;22(1):147. https://doi.org/10.1186/s12909-022-03183-3.

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