

Perioperative patient safety: active methodologies as teaching-learning-assessment strategies

Segurança perioperatória do paciente: metodologias ativas como estratégias de ensino-aprendizagem-avaliação

Seguridad del paciente perioperatorio: metodologías activas como estrategias de enseñanza-aprendizaje-evaluación

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ABSTRACT: Objective: To develop educational resources on perioperative patient safety and educational interventions for undergraduate nursing students. **Method:** Methodological study aimed at the development of educational resources on patient safety in the perioperative period, according to an instructional design model, with 22 nursing students at a federal university in Porto Alegre, in 2019. **Results:** Resources and interventions were developed on the basis of the goals for perioperative patient safety through games, simulation and structured objective clinical examination. Four simulation scenarios, validated by teachers, based on the Simulation Design Scale, were created on prevention of health care-related infection, safety in prescribing, use and administration of medications, and effective communication in the transition of care. **Conclusion:** Instructional design guided the development of educational resources on perioperative patient safety, enabling interventions with active methodologies. The resources developed allowed the involvement of students in different perspectives, making them reflect on their practice and reformulate it, consolidating learning about patient safety.

Keywords: Learning. Nursing. Teaching. Patient safety. Patient simulation.

RESUMO: Objetivo: Desenvolver recursos educacionais sobre segurança perioperatória do paciente e intervenções educativas na graduação de enfermagem. **Método:** Estudo metodológico direcionado para a elaboração de recursos educacionais sobre segurança do paciente no perioperatório, segundo o modelo de *design* instrucional, com 22 graduandos de enfermagem de uma universidade federal de Porto Alegre, em 2019. **Resultados:** Desenvolvidos recursos e intervenções baseados nas metas de segurança perioperatória do paciente, por meio de jogo, simulação e exame clínico objetivo estruturado. Quatro cenários de simulação, validados por professoras, a partir da Escala do *Design* da Simulação, foram criados sobre prevenção de infecção relacionada à assistência de saúde, segurança na prescrição, uso e administração de medicamentos e comunicação efetiva na transição do cuidado. **Conclusão:** O *design* instrucional guiou o desenvolvimento de recursos educacionais sobre segurança perioperatória do paciente, viabilizando intervenções com metodologias ativas. Os recursos desenvolvidos permitiram o envolvimento dos alunos em diferentes perspectivas, fazendo-os refletir sobre sua prática e reformulá-la, consolidando a aprendizagem acerca da segurança do paciente. **Palavras-chave:** Aprendizagem. Enfermagem. Ensino. Segurança do paciente. Simulação de paciente.

RESUMEN: Objetivo: desarrollar recursos educativos sobre seguridad del paciente perioperatorio e intervenciones educativas en el pregrado de enfermería. **Método:** estudio metodológico dirigido a la elaboración de recursos educativos sobre seguridad del paciente en el perioperatorio, según modelo de diseño instruccional, con 22 estudiantes de graduación en Enfermería de una universidad federal de Porto Alegre, en 2019. **Resultados:** se desarrollaron recursos e intervenciones a partir de objetivos de seguridad del paciente perioperatorio, mediante juego, simulación y examen clínico objetivo estructurado. Se crearon cuatro escenarios de simulación, validados por docentes, basados en la Escala de Diseño de Simulación, sobre prevención de infecciones relacionadas con el cuidado de la salud, seguridad de la prescripción, uso y administración de medicamentos y comunicación efectiva en la transición del cuidado. **Conclusión:** el diseño instruccional orientó el desarrollo de recursos educativos sobre seguridad del paciente perioperatorio, posibilitando la realización de intervenciones con metodologías activas. Los recursos desarrollados permitieron involucrar a los estudiantes en diferentes perspectivas, haciéndolos reflexionar y reformular su práctica, consolidando el aprendizaje sobre la seguridad del paciente.

Palabras clave: Aprendizaje. Enfermería. Enseñanza. Seguridad del paciente. Simulación de paciente.

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INTRODUCTION

The learning process is unique, and each person understands what generates more cognitive and emotional connections, valuing and expanding prior knowledge by associating it with their experiences and preexisting knowledge¹. The student must give meaning to the new information received, assuming responsibility for their knowledge^{1,2}. By stimulating the appropriation of learning and facilitating the development of knowledge, skills and attitudes, active teaching methodologies empower the student and prove to be effective².

The digital age demands interactive educational interventions for the student; some of the tools applied are educational games and digital teaching resources, which are complementary in the teaching-learning process³. Considering teaching-learning-assessment, simulation and the method called Objective Structured Clinical Examination (OSCE), demonstrate satisfactory results in the development and clinical evaluation of health students^{4,5}.

Nurses must learn safe patient care through innovative ways of teaching and learning, with constructive and contextualized practices. In teaching-learning in nursing, it is expected to encourage students to develop critical thinking based on the best evidence for safe and quality care⁴.

Patient safety is defined as the reduction, to an acceptable minimum, of the risk of avoidable harm associated with health care resulting from adverse events⁶. The perioperative period is the period that encompasses the pre-, intra- and postoperative periods.

This research is justified by the training of human resources in nursing with competence building in patient safety focused on the perioperative period, using active teaching strategies. We sought to elucidate the following question: how can active methodologies support the teaching-learning-assessment of nursing students about patient safety in the perioperative period?

OBJECTIVE

To develop educational resources on perioperative patient safety and educational interventions in undergraduate nursing.

METHOD

Methodological study with the development of educational resources on patient safety and educational interventions

focused on the perioperative period, based on the instructional design model⁷, which is linked to the production of educational resources and structures the teaching-learning planning in five stages: analysis, design, development, implementation and evaluation (Figure 1)⁷.

The intervention was in a federal university located in Porto Alegre, Brazil with a degree in nursing, in a discipline that addresses clinical-surgical content. It took place in a classroom and simulation laboratory, with a mirrored room for observation of patient simulation with high-fidelity mannequins.

The study population consisted of 24 students from the fifth semester, considering the following inclusion criteria: students enrolled in the discipline who attended classes of educational interventions and who agreed to participate in them, ranging from 19 to 22 students. Thus, the sample was different at each stage of the activities: all students present on the simulation and structured objective clinical examination (OSCE) days and 19 participants who completed the first and last class questionnaires.

From April to July 2019, six classes were conducted with educational interventions aimed at the perioperative care of adults and elderly, addressing the six patient safety goals. Contents were explored through group work, use of videos, games and digital educational resources (online apps Kahoot![®], a game-based learning platform and Mentimeter[®], a platform for creating and sharing interactive slideshows) and simulation. OSCE was used to assess clinical skills.

In the simulations, the Guide for the Simulation Scenario⁸ was adapted for perioperative nursing care with an emphasis on patient safety. Four scenarios were created, evaluated and validated in their applicability by two specialist professors of the discipline itself, using the Simulation Design Scale (SDS)⁹. The evaluation of educational quality using a system of indicators can be obtained by teachers in their subjects, using the grouping or composition of factors, giving meaning to the indicator in a systemic view¹⁰.

Created by the National League for Nursing (NLN), the SDS aims to assess the structuring of scenarios; its response pattern is Likert-type, with the option of “not applicable”, when the statement does not refer to the simulated activity performed.^{9,11}

The students participating in the simulation evaluated the scenarios through the Questionnaire on Educational Practices (QEP), with 16 statements answered on the Likert scale, divided into four factors about active learning, collaboration, different ways of learning and high expectations¹².

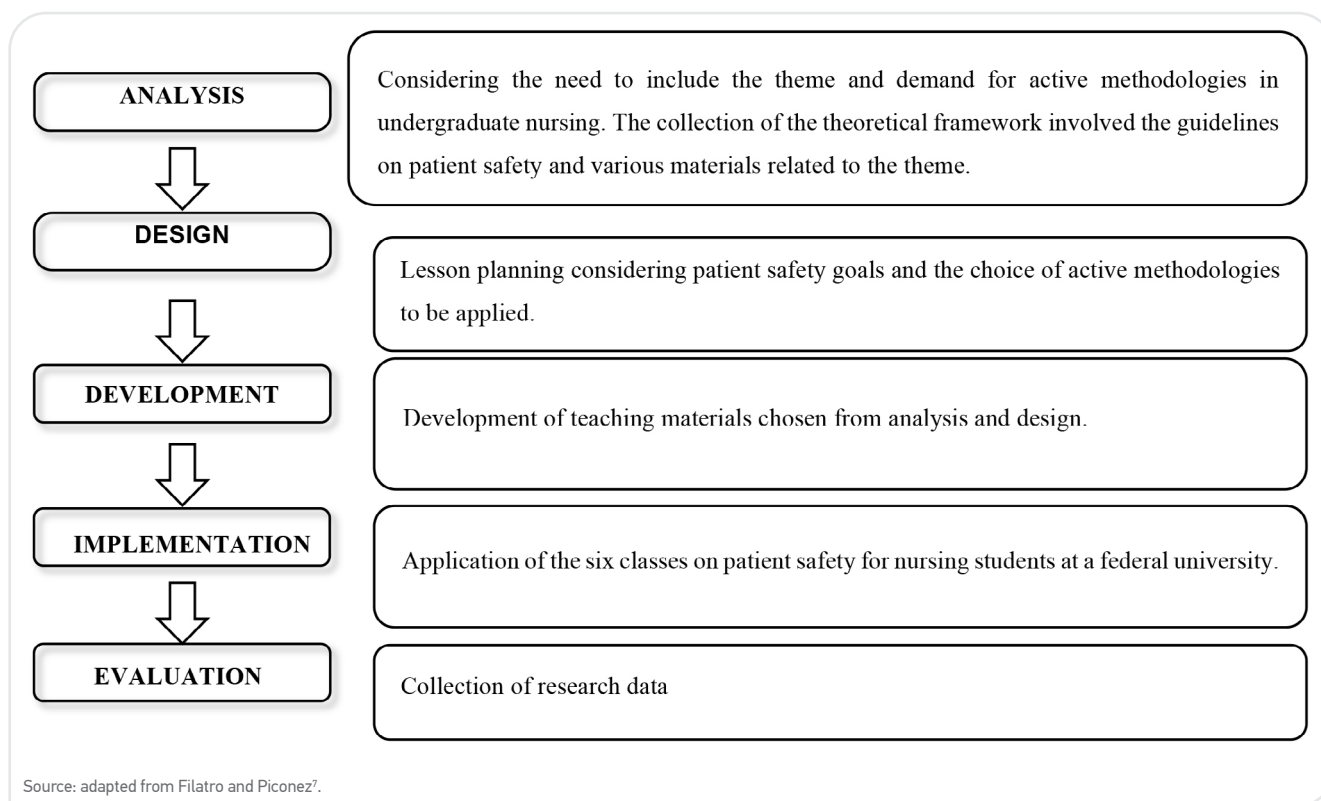


Figure 1. Steps of instructional design. Porto Alegre (RS), Brazil, 2019.

Both instruments used in the simulation (SDS and QEP) were analyzed on the basis of the Content Validation Index (CVI=number of valid responses/total number of responses). The results were dichotomized, using the Likert scale values 4 and 5 as valid responses, and values equal to or greater than 0.8 were considered acceptable agreement rates¹³.

For the students, two questionnaires were applied, one before the first class and the other after the educational interventions, to assess perceptions and attitudes about patient safety, knowledge about the perioperative theme and experiences with active methodologies. The instruments were adapted by the researchers through studies conducted by the World Health Organization (WHO), which evaluated the Multi-professional Curriculum Guide for Patient Safety^{14,15}. The two questionnaires addressed knowledge, perceptions and attitudes towards patient safety; 16 adapted questions¹⁴, were added to the last one, with Likert-type answers, about classes, content and active methodologies (Chart 1).

The McNemar test was used to assess the knowledge, perceptions and attitudes of students about patient safety, considering $p < 0.05$ as statistically significant. The description

of the students' experiences with the classes, content and active methodologies was expressed using frequency and percentages.

Quantitative data were entered into an Excel spreadsheet and then into the Statistical Package for Social Science 26.0 for statistical analysis.

The procedures respected the provisions of Resolution No. 466, of December 12, 2012, of the National Health Council. The project was approved by the Research Ethics Committee of the proposing institution under Opinion No. 3,222,320, with CAAE No. 09004419.9.0000.5345.

RESULTS

Four guides were prepared for simulation scenarios, organization and development of activities, covering perioperative nursing care:

1. Surgical site infection, hand hygiene and safe surgery;
2. Correct patient identification and effective communication and care transition;

Chart 1. Questions about classes, content and active methodologies. Porto Alegre (RS), Brazil, 2019.

Q1	The goals of what is patient safety were clear
Q2	It was important to incorporate these patient safety classes into my curriculum
Q3	I improved my knowledge, skills and attitudes as a result of these classes
Q4	I acquired new knowledge and skills that will be useful in my career
Q5	I will apply the knowledge taught to the actions of my professional life
Q6	My understanding of the principles and importance of patient safety has increased as a result of these classes
Q7	These classes increased my motivation about patient safety in my professional activity
Q8	The teaching-learning strategies used in the classes facilitated my learning
Q9	The instructor made my understanding easier
Q10	The presentation was culturally appropriate
Q11	Educational resources added to my learning
Q12	Having completed the classes facilitated my understanding
Q13	The simulation provided an opportunity to build my knowledge on the topic
Q14	The method used to assess my clinical ability (OSCE) was effective
Q15	The duration of the classes was sufficient
Q16	This curriculum subject is at the most appropriate time to address the topic

Source: adapted from Farley et al.¹⁴.

3. Safety in the prescription, use and administration of medications;
4. Pressure injuries and falls.

The contextualization included classes for theory introduction, video presentation, game and digital educational resources on safe surgery, surgical site infection, perioperative recommendations, patient identification and communication and care transition. Simulations took place in the laboratory with a high-fidelity mannequin and students for role play, right after the briefing. A maximum of four students were submitted to the scenario, and the whole class participated in the debriefing.

Two OSCE activities were developed in the simulation laboratory, according to established learning objectives, where the first was considered a pilot. Its application was planned with four simultaneous stations and three themes: prevention of health care-associated infection (HAI), safety in the prescription, use and administration of medications and effective communication in the transition of care. The essentials for the execution of the examination were recorded: script, preparation, necessary resources, guidance for the evaluator, clinical cases and the assessment checklist of each station with feedback of formative evaluation of the student's performance.

Validation of simulation scenarios

In the evaluation of the teachers with the SDS⁹, scenarios 1 and 2 obtained agreement of 0.92 and scenarios 3 and 4, 0.87.

In the evaluation of the undergraduates with the QEP¹², the agreements of scenarios 1 and 2 were: active learning (0.88); collaboration (0.67); and different ways of learning and high expectations (1.0 each), while in scenarios 3 and 4: active learning (0.85); collaboration (0.68), different ways of learning (0.88) and high expectations (0.90).

Assessment of nursing students before and after interventions

Students evaluated their perceptions, attitudes and knowledge regarding the topic, marking the option that best described their level of agreement in a questionnaire provided in the first and sixth classes. Nineteen valid questionnaires were obtained for comparison.

There was a greater increase in questions 5 and 10, a decrease ($p=0.50$) in 7, with no change in 1, 4 and 9, and questions 13 to 16 remained at 100%, but without statistical significance (Table 1).

To analyze the students' experience, 16 questions were added to the post-test, with statements about the perception of the content and effectiveness of active methodologies. All questions related to class content (Q1–Q7) obtained a percentage above 94.4% of maximum score. As for the effectiveness of the active methodologies applied, the questions obtained with the highest percentage of "agree" and "totally agree" were: Q8, with 94.4%; Q9 and Q10, with 100%; Q11, with 94.4%; and Q12, with 100% (Figure 2).

Table 1. Proportion of answers agreeing with the sample statements. Porto Alegre (RS), Brazil, 2019 (n=19).

Questions	Pre-test (%)	Post-test (%)	p-value
Health care system safety			
1. Most health care workers make mistakes.	57.9	57.9	1.000
2. In my country, there is a safe health care system for patients.	21.1	42.1	0.219
3. Medical error is very common	57.9	68.4	0.687
4. It is unusual for a patient to receive the wrong medication.	5.3	5.3	1.000
5. Health care workers receive training on patient safety.	42.1	73.7	0.070
Personal influence on safety			
6. Telling someone else about a mistake I made would be easy.	10.5	15.8	1.000
7. It is easier to find someone to blame than to focus on the causes of the mistake.	57.9	47.4	0.500
8. I feel confident talking to someone who shows a lack of concern for patient safety.	36.8	57.9	0.289
9. I know how to talk to a person who has made a mistake.	21.1	21.1	1.000
10. I am always able to ensure that patient safety has not been compromised.	5.3	31.6	0.063
11. I believe that reporting errors will help improve patient safety.	94.7	100.0	1.000
12. I am able to talk about my own mistakes.	63.2	68.4	1.000
Personal attitudes about patient safety			
13. By focusing on the causes of incidents, I can contribute to patient safety.	100.0	100.0	-
14. If I keep learning from my mistakes, I can prevent incidents.	100.0	100.0	-
15. Admitting my mistakes and dealing with them will be an important part of my job.	100.0	100.0	-
16. It's important that I learn how to best admit my mistakes and deal with them by the end of graduation.	100.0	100.0	-

DISCUSSION

The implemented classes sought to contribute to the training, autonomy and safety of nurses. Resources on perioperative patient safety were developed, applying active methodologies in all educational interventions, providing the introduction of content and contributing to critical and meaningful thinking and doing¹⁶.

Educational games and digital teaching resources

The use of the Mentimeter[®] digital resource was an effective alternative for an interactive audience, ensuring student engagement, stimulating the co-production of ideas, reducing unnecessary exposure (anonymous feedback), sharing decision-making responsibility and providing new experiences. Anonymity and immediate feedback helped to broaden involvement and minimize disinterest. New teaching methods must

be in accordance with a more interactive teaching-learning perspective for the student³.

In the game Kahoot![®], the interaction built an active participation and led to the questioning and testing of their knowledge. In an anonymous environment for responses, the student could choose a fictitious nickname to access the game, making it more fun and increasing participation. Educational games and digital resources place the student at the center of the process, helping to build their autonomy and cooperation^{3,17}. Gamification influences the attractiveness and motivation of learning and, as an integrative social strategy, develops leadership skills¹⁷.

Positive points were: scheduling the time, possibility of using images provided by the platform or attaching images from the internet, attractive layout and musical theme, and a relaxed and dynamic after-class environment. All participated, showed satisfaction with the proposal and each answer was quickly provided with the number of correct answers. Negative points were: necessary computer, speakers and

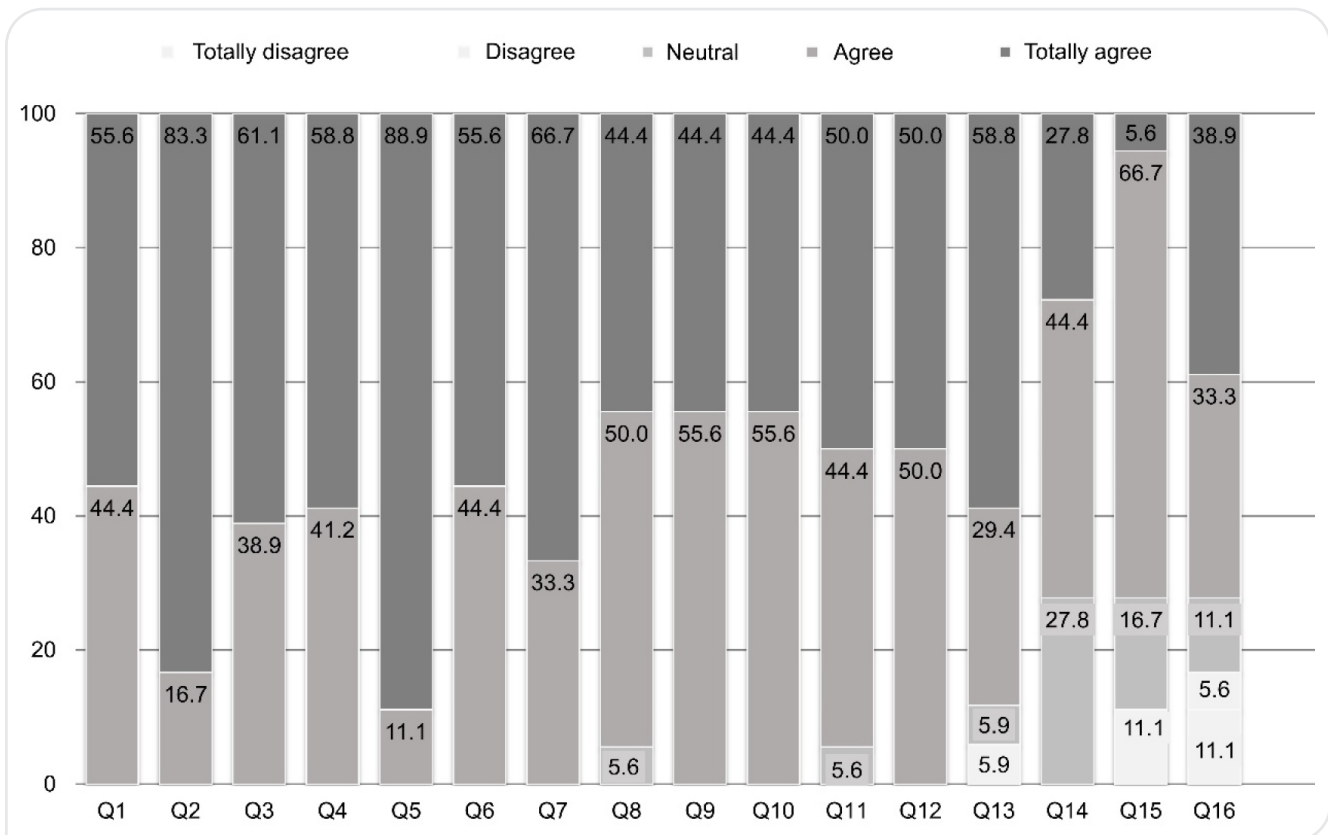


Figure 2. Student feedback on the survey post-test. Porto Alegre (RS), Brazil, 2019 (n=19).

projector for the game, internet available and limited characters for questions and answers.

Simulation as a teaching-learning strategy

The simulation scenarios required a guide adapted to the proposed theme and structured components, guaranteeing the instructional design. Most of the available tools do not have features that cover all aspects of the design to work with patient safety, and for this reason, the adapted Simulation Scenario Guide⁸ was used.

All steps for simulation scenarios were ensured, but there must be caution in decision-making in the simulated environment, taking advantage of the debriefing to point out the positive and vulnerable aspects of the activity for the purpose of self-assessment⁴. The scenarios were reproduced in the laboratory, with materials provided by the Materials and Sterilization Center, and by the Surgical Center of the teaching hospital, providing a real environment and safety for the student in learning, with theoretical-practical focus¹⁸.

Regarding the definition and use of simulation to approach patient safety, a meta-analysis, including 22 studies, evaluated the effectiveness of simulation comparing learning and performance between students and graduate nurses, showing a significant improvement in both post-simulation parameters¹⁹. A systematic review²⁰ on simulation of acute patients showed that simulation achieved better results in patient safety outcomes, and that this type of training benefited patient-oriented care²⁰.

A scoping review evaluated the clinical impact of simulation-based education for nurses. In 26 publications covering 20 educational topics, simulation programs were positively evaluated, demonstrating improvements in the knowledge and skills of trained nurses²¹.

Application of OSCE

One of the main components of learning is summative and/or formative assessment. The teacher offers students subsidies to improve their learning, allowing them to acquire skills

for professional practice. Some traditional evaluation methods value knowledge, failing due to the lack of stimulus to critical thinking, while others favor criticality, but have low reliability and reproducibility, either due to the instrument or subjectivity of the evaluation⁵.

We planned two applications with OSCE, a tool dependent on the adequacy of resources for its execution, such as construction and number of stations, namely scoring methods and available time⁵. The construction matrices were important to preconceive and apply the technique. The OSCE proposal must be well planned and supported, considering the skills to be developed and evaluated⁵. After the pilot test, it was possible to establish clear objectives and adequate planning for the methodological purposes. The student became aware of his mistakes and successes, and the teacher perfected his teaching-learning-assessment process. There was feedback immediately after the stations, enabling the student to review their decisions and behaviors.

Validation of simulation scenarios

Validation and documentation of the design of simulation scenarios standardize its implementation, reducing errors and increasing teacher and student satisfaction. The student experiences a simulation scenario closer to reality to develop skills, such as psychomotor, cognitive and interpersonal skills⁹.

Simulation scenarios have characteristics that guide the construction and assurance of learning objectives. They can be evaluated through the SDS, on the basis of the points to be considered and contemplated during the creation of the process, contributing to the development of specific items of the methodology^{9,22}. The four scenarios constructed were validated by teachers using the SDS and its analysis, through the CVI¹³. The results allowed us to consider the CVI as adequate.

In the validation by the undergraduates, the four simulation scenarios were evaluated by the QEP¹². The factors “active learning”, “different ways of learning” and “high expectations” showed CVI equal to or greater than 0.8 in all scenarios. The “collaboration” factor had a CVI of 0.67 in scenarios 1 and 2, and 0.68 in scenarios 3 and 4.

There were three factors with adequate agreement in the assessment of students, and one of the factors did not demonstrate an acceptable level¹³. Due to the characteristics of the “collaboration” factor, one of the explanations for the low agreement could be in relation to the questions that make up the item: “I had the opportunity to work with my colleagues during the simulation” and “During the simulation,

my colleagues and I had to work on the clinical case together”. It is inferred that the students’ interpretation was that there was physical separation during the execution of the method, as only some students were submitted to the scenario, while the others watched, waiting for the debriefing.

The number of participants submitted to each scenario varied between two and four students²³. In this study, aiming not to compromise the quality of the simulation, up to four students were used. The need for reform in nursing education encourages a formative transformation of students. However, the shortage of teachers and the increase in the student population require educators to use simulation strategies for large groups: a small portion is submitted to the development of the scenario, while most act as observers²³.

Assessment of students before and after interventions

For knowledge, perceptions and attitudes regarding patient safety in the perioperative period, students marked the one that best described their level of agreement. There was no statistically significant difference between the pre- and post-test response patterns. Even if there were technical elements within the issues addressed, there were also psychobehavioral elements (for example, dealing with conflict situations), which may have contributed to the absence of difference. Behavioral changes can be a challenge in environments where information is widely disseminated, but changes in attitudes can be scarce^{4,24,25}.

Feedback from students regarding the perception of content showed that 94.4% agreed with the statements. As for the effectiveness of the active methodologies applied, there was a greater variation of responses. Over 90% of students agreed that the strategies facilitated learning, that the role of the instructor/facilitator was important, that the presentation was culturally appropriate, and that the study’s educational resources contributed to teaching-learning. Just over 70% of undergraduates agreed that the OSCE was effective and of sufficient duration, and that the timing in the curriculum to address this topic was adequate. The first day of OSCE activity (pilot) was marked by the challenges of implementing a new method for those involved, both teachers and students^{24,25}. Inexperience with the clinical evaluation methodology required a pilot test, with several necessary and corrected adjustments, where the second application of the OSCE proceeded in a clearer, concise and objective way.

The study had as limitations the sample size, which may have impaired the statistical power in the evaluation of students, before and after the interventions, the inexperience of the discipline teachers with the clinical evaluation methodology (OSCE), and the need for the researchers to provide for materials laboratory activities through their own resources, thereby spending more time to organize the scenarios.

This study contributes to nursing education by addressing the issue of patient safety in the perioperative period through active methodologies, including the application of the OSCE, still little used as an assessment of the clinical skills of students in undergraduate nursing courses.

CONCLUSION

The instructional design model guided the development of educational resources on perioperative patient safety, enabling interventions to be carried out with the application of active methodologies aimed at nursing students, providing an exchange of ideas in a dynamic environment, with student satisfaction and participation. The simulation scenarios constructed included perioperative nursing care with an emphasis on safety aspects and were validated by specialist teachers; also, they can be made available for use. Regarding teaching-learning-assessment, the OSCE construction and application matrix included four simultaneous stations with themes on HAI prevention: safe surgery, safety in prescription, use and administration of medications and effective communication applied in care transition.

The activities triggered feelings of satisfaction among students and researchers, indicating the implementation of

these educational interventions in nursing education with a focus on the perioperative period. The methodologies applied in the study with the developed resources allowed the involvement of students in different perspectives, making them reflect and reformulate the practice, consolidating learning about patient safety.

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CONFLICT OF INTERESTS

There is no conflict of interests.

AUTHORS' CONTRIBUTIONS

MVOSN: project management, formal analysis, conceptualization, data curation, research, methods, resources, writing — original draft, writing — review and editing, supervision, validation and visualization. RKS: formal analysis, conceptualization, research, methods, resources, writing — original draft and writing — review and editing. BRA: formal analysis, conceptualization, research, methods, resources, writing — original draft and writing — review and editing. KV: formal analysis, conceptualization, data curation, methods, supervision and validation. RCAC: formal analysis, conceptualization, data curation, research, methods, supervision, validation and visualization.

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