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# Clinical simulation as a Nursing Fundamentals teaching method: a quasi-experimental study

*A simulação clínica como método de ensino na Enfermagem Fundamental: um estudo quase-experimental*

*La simulación clínica como método de enseñanza en la Enfermería Fundamental: un estudio casi-experimental*

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## ABSTRACT

**Objectives:** to evaluate students' knowledge gain after the implementation of clinical simulation in Nursing Fundamentals disciplines. **Methods:** a quasi-experimental intervention was carried out with 60 students, distributed in comparison and intervention groups, who underwent traditional teaching and traditional teaching associated with simulated teaching, respectively. Pre-test and post-test instruments were applied to both groups. **Results:** after analyzing the students' performance through the applied instruments, both groups had a cognitive evolution along with the taught content, however, when compared, the intervention group obtained a higher knowledge gain than the comparison group (p = 0.016), demonstrating progressive and increasing improvement with the use of the methodology. **Conclusions:** simulated teaching significantly helps students in gaining technical-cognitive knowledge. Therefore, it is recommended to adhere to the use of this methodology for teaching Nursing Fundamentals.
**Descriptors:** Nursing; Teaching; Education, Nursing; Simulation Training; Patient Simulation.

## RESUMO

**Objetivos:** avaliar a implementação da simulação clínica nas disciplinas pautadas na Enfermagem Fundamental quanto ao ganho de conhecimento pelo discente. **Métodos:** realizou-se uma intervenção quase-experimental com 60 estudantes, distribuídos em grupos de comparação e de intervenção, os quais fizeram uso do ensino tradicional e do ensino tradicional associado ao ensino simulado, respectivamente. Foram aplicados instrumentos de pré-teste e pós-teste a ambos grupos. **Resultados:** analisado o desempenho dos estudantes por meio dos instrumentos aplicados, ambos os grupos tiveram uma evolução cognitiva ao longo do conteúdo ministrado, porém, quando comparados, o grupo de intervenção obteve um ganho de conhecimento superior ao grupo de comparação (p = 0,016), demonstrando melhora progressiva e crescente com o uso da metodologia utilizada. **Conclusões:** o ensino simulado auxilia de maneira significativa no ganho de conhecimento técnico-cognitivo dos estudantes. Sendo assim, recomenda-se aderir ao uso dessa metodologia no ensino da Enfermagem Fundamental.
**Descritores:** Enfermagem; Ensino; Educação em Enfermagem; Simulação; Simulação de Paciente.

## RESUMEN

**Objetivos:** evaluar implementación de simulación clínica en asignaturas pautadas en la Enfermería Fundamental cuanto a la adquisición de conocimiento por discente. **Métodos:** realizó una intervención casi-experimental con 60 estudiantes, distribuidos en grupos de comparación e intervención, los cuales hicieron uso de la enseñanza tradicional y enseñanza tradicional relacionada a enseñanza simulada, respectivamente. Fueron aplicados instrumentos de pretest y postest a ambos grupos. **Resultados:** analizado el desempeño de los estudiantes mediante los instrumentos aplicados, ambos los grupos tuvieron una evolución cognitiva al largo del contenido ministrado, pero, cuando comparados, el grupo de intervención obtuvo una adquisición de conocimiento superior al grupo de comparación (p = 0,016), demostrando mejora progresiva y creciente con el uso de la metodología utilizada. **Conclusiones:** la enseñanza simulada auxilia de manera significativa en la adquisición de conocimiento técnico-cognitivo de los estudiantes. Así, se recomienda adherir al uso de esa metodología en la enseñanza de la Enfermería Fundamental.
**Descriptores:** Enfermería; Enseñanza; Educación en Enfermería; Simulación; Simulación de Paciente.

## INTRODUCTION

In recent years, teaching has undergone numerous conceptual, methodological, and training proposals changes, aimed at improving teaching and learning techniques[1-2].

Advances and changes in political, social, and cultural factors have demonstrated the need to use new active training strategies in medical and nursing education. With this, the evolution of teaching methods starts to produce a learning process more centered on the student, moving away from processes oriented only to the institution[3-4].

Simulation is an example of the active teaching methodology that allows training in real conditions, with simulators and actors, in an interactive way, in a controlled environment where the teacher assumes the role of a conductor and not an active supplier of all information. In other words, it is redirected to assume a dialogic posture in the classroom, allowing students to be co-authors of their learning. From this perspective, the intention is not to take the responsibility of the educational process away from the teacher, but to encourage students to also have autonomy in this new process, of which simulation is included[3,5-6].

The importance of training for the future clinical nurse is highlighted. Among the numerous care activities that are incumbent upon it, there is the enteral probe, with which the nursing team is directly involved, actively participating in the procedure of probe passage, fixation, and maintenance, as well as the infusion of diet and medication through this means[7].

Enteral nutrition therapy aims to maintain or recover the nutritional status of the patient since adequate nutritional support is essential in the treatment and recovery of the individual, as well as in improving their quality of life[8].

However, it is necessary to know that, although beneficial, this therapy carries risks of probable incidents and adverse events (AEs) [9]. According to the Ministry of Health, an incident is described as an "event or circumstance that could have resulted, or resulted, in unnecessary harm to the patient", while AEs are defined as any "incident that results in harm to the patient"[10].

An integrative review in the area was able to demonstrate the lack of preparation of nursing professionals regarding the examination and identification of risk factors and adverse effects arising from its use. Therefore, it is essential to train these professionals, to improve their techniques and base them on scientific evidence, to reduce failures[11]. In this sense, it is necessary for professional training to be more coherent with the practical needs of the profession and that the student can train and develop their knowledge and skills, as well as being able to understand their skills to provide safe care and quality to their customers.

In training, it is possible to use simulation as a means of promoting patient safety and managing nursing care techniques. This will facilitate risk-free learning and aid in the acquisition of clinical, communication, and information technology competencies. Therefore, the simulation will play an expressive role in the evaluation of results, improving the capacity for reflection and critical thinking, as well as students' self-efficacy and self-confidence in their clinical abilities in the training process[12-13]. The issue of safety has been discussed globally and has generated, in addition to changes, a growing search for continuous improvement in the quality of health services[14].

Active learning through simulation encourages the training of critical and reflective professionals, making use of a constructivist approach, in which knowledge, better performance in technical and non-technical skills and abilities, in the leadership and communication of the professionals involved, as well as in decision-making[15].

Considering what was listed above, the lack of studies addressing the issue in Brazil, as shown in integrative reviews[16-18], and that the disciplines based on Nursing Fundamentals are essential in the Nursing curriculum, as they provide students with their first contact with the practice for the development of required skills and abilities[19], and at this moment, it is expected that the students develop certain expectations, which can end up generating stressful factors and negative feelings since they are facing the unknown[20], it is necessary to adopt, as early as possible, within the bases of student education, methods that bring them closer to the reality they will find in practice scenarios, thus providing repetitive training and achieving the necessary skills, without compromising the safety of those involved in this process.

## OBJECTIVES

To evaluate students' knowledge gain after the implementation of clinical simulation in Nursing Fundamentals disciplines.

## METHODS

### Ethical aspects

This study was submitted and approved by the Research Ethics Committee of the *Universidade de Brasília – Faculdade de Ceilândia* [University of Brasilia]. It followed the guidelines and regulatory standards of Resolution No. 466/2012 of the National Health Council, which deals with research and tests on human beings[21].

### Study design, period, and location

Quasi-experimental intervention study with a quantitative approach, guided by the STROBE tool and developed from August 2018 to July 2019, at a public university of Distrito Federal, Brazil [Brazil's Federal District].

### Population and sample: inclusion and exclusion criteria

Study participants were students of the undergraduate nursing course. To calculate the sample, the Raosoft® software was used; a margin of error of 8% and a confidence interval of 95% were considered, thus obtaining a total of 52 participants to satisfy the goal of the study.

Students who were regularly enrolled in the two disciplines that make up the area of Nursing Fundamentals, called "Semiology and Semiotechnique 2" (Semio 2) and "Integration to the Practice Scenarios 3" (ICP 3) and who participated in all research stages, were eligible. Students who were on medical leave, currently not attending the discipline, or those who already had training as a nursing technician were excluded.

The study population was initially composed of 78 students, however 16 were excluded during the research due to absence in one of the study stages; and two, because they already had

training as a nursing technician. So, the sample consisted of 60 students, of which, through random distribution, 30 composed the intervention group (IG); and 30, the comparison group (CG).

### Study protocol

The disciplines Semio 2 and ICP 3 are taught in the same period of the Nursing undergraduate course at the university chosen as the research site, as they are disciplines that complement each other. While Semio 2 addresses the theoretical-practical part of Nursing Fundamentals, to equip students to provide care, ICP 3 addresses clinical practice, in which students undergo practice scenarios in the health network to provide patient care, according to the knowledge learned in the classroom and to develop and improve their care skills.

Semio 2 has the following planning: the responsible teachers teach the content through expository-dialogue classes and then take the students to the laboratory to illustrate through practical execution, using anatomical pieces. In ICP 3, whose character is care, students are offered, before heading to the Health Units, intensive and condensed practical classes, demonstrating the techniques that will be addressed in clinical practice throughout the semester.

In this way, in the course of the disciplines, the students are exposed to dialogued and practical expository classes on themes related to Nursing Fundamentals.

Considering the syllabus that is addressed in Nursing Fundamentals, the following themes were chosen to be the object of this study: enteral probe; patient safety; and biosafety.

Given the content and the fact that the subjects are part of the same school period, we selected, in both, moments that addressed the themes chosen for this study, to assess the growth in the performance of the students: Moment 1 - Expositive-Dialogued Class on patient safety and biosafety followed by a practical class in the laboratory (Semio 2); Moment 2 – Enteral probing practical class (ICP 3); Moment 3 – Expositive-Dialogued class of enteral probe followed by a practical class in the laboratory (Semio 2); Moment 4 – Simulated intervention addressing the three themes (Semio 2 and ICP 3).

In each of the moments mentioned above, pre-test and post-test were applied, using the same instrument (technical-scientific performance instrument), which was developed by the responsible researchers and validated by experts. It contained ten questions about the chosen themes, whose answer options consisted of right or wrong.

At first, all students went through Moments 1, 2, and 3. Only after Moment 3 was completed - when those who had been absent in any of the stages were excluded - was the random distribution of participants between the comparison group (CG) and intervention group (IG) performed. Thus, the CG participated only until Moment 3, while the IG also participated in Moment 4, as this was intended for intervention.

Therefore, the CG participated in expository-dialogued classes and conventional practical classes in the laboratory, while the IG participated in expository-dialogued classes, conventional practical classes in the laboratory, plus the simulated intervention. It is worth remembering that the subjects in question had not previously worked with simulated activities, so that, at first, their implementation did not have an evaluative nature, but the purpose of contemplating the objective of this study.

The random distribution of participants between the CG and IG was carried out by drawing lots using the Flip software, in which the main researcher along with the professors of the disciplines used the corresponding number from the frequency list for this purpose. Then, from that, the students were blindly allocated to their groups.

The simulated activity had a scenario also developed by the researchers based on the methodological framework proposed by the National League Nursing/Jeffries Simulations Framework[22], which describes the phases or steps for the construction and development of the simulation. The clinical case (Chart 1) was a chagasic patient with dysphagia; there, we sought to identify the role of the nurse concerning patient safety, biosafety, and care with the nasoenteric tube (NET), under the following learning objectives: to evaluate performance in identifying contact precaution and use of specific protective equipment; pay attention to patient safety, as well as the identification of the risk of falls; evaluate performance in the application of nursing history establishing relationships with the principles of semiology and semiotechnique; pass the nasoenteric tube within the clean technique, ensuring its proper positioning and maintenance.

Furthermore, it was ensured that the scenario had undergone validation by experts.

**Chart 1 –** Clinical practice description, Brasília, Distrito Federal, Brazil, 2019

| | |
|---|---|
| Clinical case: | Patient JPC, 66 years old, male, 50 kg, 1.68 m, sedentary, alcoholic for 20 years, former smoker, retired, lives in Pará with his wife, suffering from chagasic megaesophagus. He was admitted to the emergency room of this hospital with moderate dysphagia. After five days of hospitalization, due to nutritional status, he presented extensive ulcers that were infected (KPC-*Klebsiella pneumoniae carbapenemase*), requiring him to remain in isolation. The patient is still awaiting assistance. |

IG students were randomly assigned to act in the simulated scenario. Each group had 50 minutes for clinical simulation, with the first 5 minutes for scenario recognition (*briefing*), 20 minutes for real simulation, 5 minutes for resolution of the specific post-test instrument for the Moment in question, and 20 minutes for *debriefing*. It is important to point out that the students underwent the simulation *debriefing* with the responsible researchers only after the post-test was resolved, because, in this way, the issues discussed there would not interfere with the answers.

The *debriefing* was of the structured type based on Gibbs' cycle[23]. It was conducted in six stages/phases to encourage students to organize and structure their thinking: description, feelings, evaluation, analysis, conclusion, and action plan.

When the activity ended, the groups of students had no contact with each other, to ensure non-communication between the participants and the secrecy of the simulated scenario. The CG students also performed the clinical simulation at a later time, so that they would not be hindered by the use of simulation in the teaching process.

Figure 1 demonstrates the data collection process.

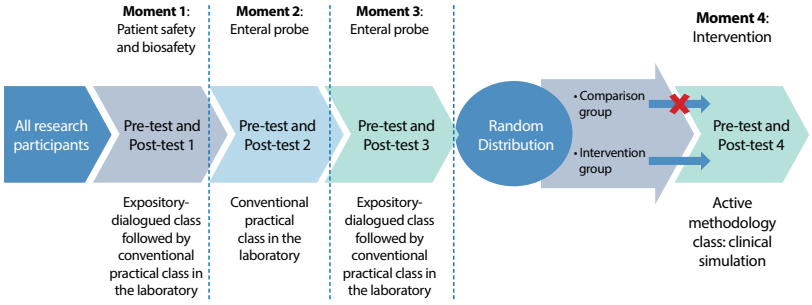


**Figure 1 –** Data collection steps flowchart, Brasília, Distrito Federal, Brazil, 2019

### Analysis of results and statistics

The collected data were initially structured in an Excel spreadsheet and exported to the Statistical Package for Social Sciences - SPSS software (version 20.0) to perform the analysis. Descriptive statistical analyses were performed to obtain the mean, median, standard deviation, and 25th and 75th percentiles. Data normality was verified by the Shapiro-Wilk test. Data did not follow a normal distribution. To verify whether there was a difference between the scores obtained using the technical-scientific performance instrument among participants in the same groups, the results were submitted to the Wilcoxon test. To compare the results between the different groups, the Mann-Whitney U test was used.

## RESULTS

Of the 60 study participants, 48 (80%) were female, while 12 (20%) were male. The average age was 21.2 years, with a minimum of 19 and a maximum of 29 years.

When analyzing the average of correct answers of students regarding the cognitive assessment instrument, it can be seen that the CG spans from an average of 5.3 in the pre-test to an average of correct answers of 7.3 in the post-test. And the IG starts with an average of 4.7 and moves to a final average of 7.7 at the last post-test moment. The delta of knowledge between the groups, based on the average obtained, was 2.1 in the CG and 3.0 in the IG.

While the CG initially had a median of 5.0 and ended up with a median of 7.0, the IG also started with a median of 5.0 but ended up with a median of 8.0.

The knowledge delta between the groups, based on the median obtained from the number of correct answers that the participants obtained when they were submitted to the pre-test and post-test instruments, was 2.0 in the CG, and 3.5 in the IG, with a statistical significance of p = 0.016, as shown in Figure 2.

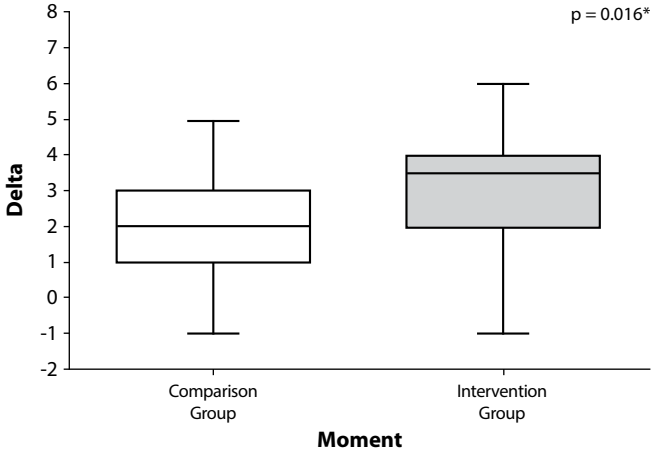


**Figure 2 –** Knowledge gain *Boxplot* presented by students in the comparison group and in the intervention group, Brasília, Distrito Federal, Brazil, 2019

The following figure (Figure 3) demonstrates the performance of students, showing that conventional education provided a gain in knowledge but ended up in a constant, while teaching based on active methodologies — specifically, in this case, using simulation — did not only promote a knowledge gain but also helped in a progressive and growing improvement.

**Table 1** - Analysis of the knowledge of the participants in the comparison group and the intervention group at different times of pre-test and post-test, according to the number of correct answers, Brasília, Distrito Federal, Brazil, 2019

| | Group | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Comparison Group | | | | | | Intervention Group | | | | | |
| | Mean | SD | P 25 | Median | P 75 | *p* | Mean | SD | P 25 | Median | P 75 | *p* |
| Moment 1 | | | | | | | | | | | | |
| Sum of the first pre-test | 5.3 | 1.2 | 4.0 | 5.0 | 6.0 | 0.001* | 4.7 | 1.4 | 4.0 | 5.0 | 6.0 | **< 0.001*** |
| Sum of the first post-test | 6.3 | 1.2 | 6.0 | 7.0 | 7.0 | | 6.3 | 1.1 | 6.0 | 6.0 | 7.0 | |
| Moment 2 | | | | | | | | | | | | |
| Sum of the first pre-test | 6.3 | 1.2 | 6.0 | 7.0 | 7.0 | **< 0.001*** | 6.3 | 1.1 | 6.0 | 6.0 | 7.0 | 0.169 |
| Sum of the first post-test | 7.3 | 1.0 | 7.0 | 7.0 | 8.0 | | 6.6 | 1.0 | 6.0 | 7.0 | 7.0 | |
| Moment 3 | | | | | | | | | | | | |
| Sum of the first pre-test | 7.3 | 1.0 | 7.0 | 7.0 | 8.0 | 0.969 | 6.6 | 1.0 | 6.0 | 7.0 | 7.0 | 0.018* |
| Sum of the first post-test | 7.3 | 1.3 | 7.0 | 7.0 | 8.0 | | 7.3 | 0.7 | 7.0 | 7.0 | 8.0 | |
| Moment 4 | | | | | | | | | | | | |
| Sum of the first pre-test | | | | | | | 7.3 | 0.7 | 7.0 | 7.0 | 8.0 | 0.040* |
| Sum of the first post-test | | | | | | | 7.7 | 0.8 | 7.0 | 8.0 | 8.0 | |
| Knowledge Delta | 2.1 | 1.4 | 1.0 | 2.0 | 3.0 | | 3.0 | 1.6 | 2.0 | 3.5 | 4.0 | 0.016* |

*Wilcoxon (paired samples) and Mann-Whitney U (independent samples) tests were used; SD – standard deviation; P25 – 25th percentile; p75 – 75th percentile; p – p value.*

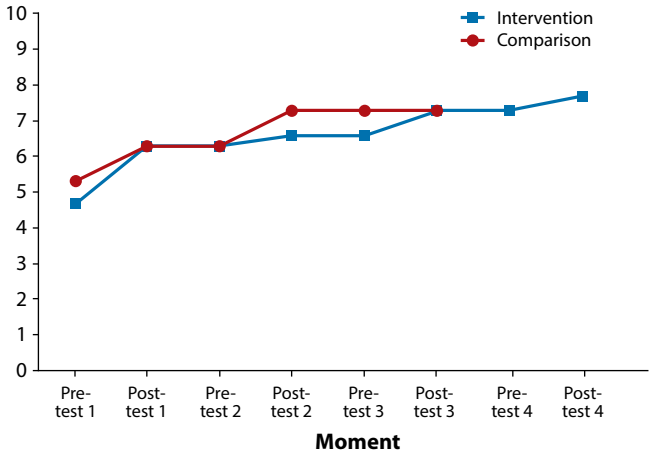


**Figure 3 –** Comparison of knowledge gain between both groups based on averages, Brasília, Distrito Federal, Brazil, 2019

## DISCUSSION

When analyzing the knowledge gain between the comparison and intervention groups separately, we observed that both had a cognitive evolution regarding the taught content. However, after comparing the CG, which had contact only with traditional education, with the IG, which, in addition to traditional education, had the opportunity to learn about the active methodology as a simulation, the result was that the IG obtained knowledge gain superior to the CG.

In a quasi-experimental study, developed with undergraduate students in Nursing (n=28) and Medicine (n=23), Ferreira, Guedes, Oliveira, and Miranda (24) realized that the association of traditional education with realistic simulation demonstrated to be effective in obtaining and, therefore, improving knowledge ($p < 0.001$), and it can be said that the association of methods favored the achievement of better cognitive development in students. This was also corroborated by other studies[25-27].

Faculty members need to become aware of new progressive pedagogical methodologies that assist in the development of teaching capable of transforming nursing care practices. In light of this, changes in the paradigm and in the teaching constructs are needed, leaving the merely traditional scope and seeking new alternatives/means of learning, since a critical view and conscientious decision-making are essential in terms of care[28].

In meaningful learning theory, to learn is to lead the student to relate their previous knowledge to new information. Learning can be considered significant when knowledge starts to provide meaning to the learner's knowledge and practice, as learning unrelated to pre-existing knowledge is purely mechanical[29].

Enteral nutritional therapy patient care is considered of high complexity, so the prevention of adverse events is a commitment of the entire health team, and training is necessary to achieve effectiveness in this process[9].

In a literature review, the most frequent reports of adverse incidents and events were related to the insertion of the enteral tube into the bronchial tree, lung, and brain; esophageal, gastric, and intestinal perforation; administration of diet in the respiratory site as many sectors only use clinical confirmations of device positioning, such as auscultation and pH assessment, not using radiological confirmation, considered the gold standard; among other occurrences associated with the removal of the device[16].

In addition, it is worth emphasizing that patients in these situations ranged from favorable evolution, despite requiring additional treatments, to clinical conditions that progressed to death. These findings are a way of alerting care teams, students, and caregivers about the risks of complications from this procedure[16].

Motta, Rigobello, Silveira, and Gimenes[17], in their integrative review, analyzed the evidence on adverse events related to nasogastric/nasoenteric tube in adult patients and confirmed the above findings plus an injury related to pressure resulting from incorrect tube fixation and connection in venous catheters or other devices. Thus, they demonstrated the need to develop evidence-based guidelines to avoid these events, in addition to the incorporation of technological advances in both patient care and health education, in order to provide qualified care based on patient safety.

Gimenes and Reis state that professionals should expand their studies in other scenarios of action, in order to minimize the risks and adverse events associated with enteral nutrition, and that it is necessary to use innovative methodologies to gain this competence[18].

Evidence from a literature review adds that case-based learning, clinical simulations, practice, and feedback are identified as effective educational techniques, whereas teaching techniques involving passive instructions such as reading or lectures have little or no impact on the outcomes of learning[30].

It is known that much of the knowledge acquired during graduation is not retained for an extended period of time, especially when it is not used in daily practice. Therefore, a strategy capable of helping to increase knowledge retention is to increase the number of moments devoted to clinical practice. In light of this, active learning methods can be a good tool to complement the student's clinical practice, leading to greater retention of the knowledge obtained[30]. In another study, knowledge retention was statistically significant when the post-test was applied two to four weeks after the simulation ($p < 0.001$)[27].

The field of nursing values care that is centered on ethics, collective principles, and safety. The latter ended up gaining prominence, considering that, in the mid-2000s, it was already estimated that 44,000 to 98,000 patients died each year in the United States due to errors made by the healthcare team. Given this scenario, the concern with the training of health professionals began to increase; and, consequently, the use of simulation ended up gaining prominence because it helps students to develop previous skills and abilities, before starting the proper care in real patients[31].

In their randomized clinical trial, Dogru and Aydin[32] compared the effectiveness of high-fidelity simulation and the traditional teaching method on the knowledge and skill development of 72 nursing students. It was found that the realistic simulation was more effective than the traditional teaching method in increasing the knowledge ($p = 0.001$) and skill ($p < 0.001$) levels of students. Another pre-test and a post-test study conducted in Iran with 49 nursing students compared simulation-based education with traditional teaching and found that knowledge

was significantly higher even after three months in the simulation group ($p < 0.05$)[33].

In an integrative review carried out with the general objective of analyzing the theoretical framework of simulation as a teaching strategy for the Nursing course, it was also demonstrated that simulation, in students' view, is considered a more pleasant and pleasurable teaching-learning strategy when compared to traditional education, in addition to providing technical training without subjecting patients, students, and teachers to the risks of this stage of learning[34]. However, the need for the engagement of professors is highlighted, since they must have specialized skills in order to have maximum proficiency, thus ensuring the effectiveness and solidity of this new teaching-learning process[35].

By using this teaching methodology, we can highlight, among the gains obtained, satisfaction, self-confidence, knowledge, empathy, realism, decreased level of anxiety, communication, motivation, capacity for reflection and critical thinking, as well as teamwork. Therefore, we can state that simulation stands out as a tool in the teaching-learning process[36].

Given the above, the need to disseminate this methodology and apply it continuously, and not uniquely, is highlighted, so that its results can last[37].

Finally, we can infer that knowing the incidents, adverse effects, as well as having knowledge and skills with regard to enteral therapy guarantees safe, qualified nursing care based on the best scientific evidence. In addition, we also found that the realistic clinical simulation was an adequate methodological strategy for teaching this theme, as it had positive and significant effects on students' knowledge gain when compared to traditional teaching.

### Study limitations

One limitation was the performance with undergraduate nursing students from a single university and with the approach to a single main theme, which can make it difficult to generalize the findings to other contexts. We also emphasize that the students who are part of the sample of this research had not had previous experiences with clinical simulation, which may be an intermediary factor.

### Contributions to the field of Nursing

As a contribution to professional practice in patient care and in the training process, the study demonstrates that the active methodology through simulation, especially in Nursing Fundamentals, provides greater knowledge gain than traditional teaching. Both teaching methods bring knowledge to the student in the acquisition of adequate professional competence, but the gains in simulation are superior.

## CONCLUSIONS

Our findings were able to show that clinical simulation as a methodological strategy is more efficient for teaching Nursing Fundamentals when compared to traditional teaching since it significantly helped to gain cognitive technical knowledge for students.

Based on the contributions to disciplines that were based on Nursing Fundamentals at this institution, we highlight a possible indication for the use of this teaching modality in other institutions, since the students submitted to the simulation presented a greater range of benefits in consolidating learning.

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