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Active methodologies in peripheral venous catheterization: Skills development with a low-cost simulator

Metodologias ativas no cateterismo periférico venoso: desenvolvimento de habilidades com simulador de baixo custo

Metodologías activas en cateterismo venoso periférico: desarrollo de habilidades con simulador de bajo costo

Bruna Pedroso Canever[1]
Marina Silva Sanes[2]
Saionara Nunes de Oliveira[3]
Aline Lima Pestana Magalhães[1]
Marta Lenise do Prado[2,4]
Diovane Ghignatti da Costa[1]

1. Universidade Federal de Santa Catarina, Departamento de Enfermagem. Florianópolis, SC, Brasil.

2. Universidade Federal de Santa Catarina, Programa de Pós-graduação em Enfermagem. Florianópolis, SC, Brasil.

3. Hospital Universitário Polydoro Ernani de São Thiago. Florianópolis, SC. Brazil

4. Universidade Federal do Amazonas, Programa de Pós-Graduação em Enfermagem. Manaus, AM. Brasil.

ABSTRACT

Objective: To investigate nursing students' perception on the contribution of using a low-cost simulator in the development of technical skills for peripheral venous catheterization. **Method:** A qualitative and descriptive study carried out in a public university of southern Brazil. Data was collected from 25 nursing students in 2019 by means of a questionnaire about peripheral venous catheterization, developed with the support of a low-cost simulator. Data was analyzed using Minayo's operative proposal. **Results**: Two categories emerged from the data. 1) Skills development for peripheral venous catheterization: the students pointed out that the use of the simulator makes it possible to understand each stage of the procedure and to identify where they need to improve the technique, preparing them for contact with the patient. 2) Difficulties encountered in using the low-cost simulator. The students highlighted the low fidelity of the simulator and the limitation of the training by simulation without communication. **Conclusions and implications for practice**: The students perceive the low-cost simulator as a relevant tool for the development of venipuncture skills and they suggest its improvement to increase fidelity, as well as the incorporation of communication at the moment of puncture for greater realism of the simulated experience.

Keywords: Nursing; Teaching; Simulation Training; Peripheral Catheterization; Nursing Students.

RESUMO

Objetivo: Conhecer a percepção de estudantes de enfermagem sobre a contribuição do uso do simulador de baixo custo no desenvolvimento de habilidades técnicas para o cateterismo periférico venoso. **Método:** Estudo descritivo de abordagem qualitativa, realizado em universidade pública do sul do Brasil com 25 estudantes de enfermagem. Os dados foram coletados em 2019, por meio de questionário acerca do cateterismo periférico venoso, desenvolvido com apoio de simulador de baixo custo. Para análise, seguiu-se a proposta operativa de Minayo. **Resultados:** A partir dos dados, surgiram duas categorias. 1) Desenvolvimento de habilidades para cateterismo periférico venoso: os estudantes apontaram que o uso do simulador possibilita compreender cada etapa do procedimento e identificar onde precisam aperfeiçoar a técnica, preparando-os para o contato com o paciente. 2) Dificuldades encontradas na utilização do simulador de baixo custo. Os estudantes destacaram a baixa fidelidade do simulador e a limitação do treinamento por simulação sem comunicação. **Conclusões e implicações para a prática:** Os estudantes percebem o simulador de baixo custo como uma relevante ferramenta para o desenvolvimento de habilidades do cateterismo periférico venoso, sugerem seu aperfeiçoamento para aumentar a fidelidade e a incorporação da comunicação no momento da punção para o maior realismo da experiência simulada.

Palavras-chave: Enfermagem; Ensino; Treinamento por Simulação; Cateterismo periférico; Estudantes de enfermagem.

RESUMEN

Objetivo: Conocer la percepción de los estudiantes de enfermería sobre el aporte de usar un simulador de bajo costo en el desarrollo de habilidades técnicas para cateterismo venoso periférico. **Método**: Estudio descriptivo con enfoque cualitativo, realizado con 25 estudiantes de enfermería en una universidad pública del sur de Brasil. La recopilación de datos se llevó a cabo en el año 2019, a través de un cuestionario sobre venopunción periférica, desarrollado con el apoyo de un simulador de bajo costo. Los datos se analizaron a través de la propuesta operativa de Minayo. **Resultados:** A partir de los datos surgieron dos categorías: 1) Desarrollo de habilidades para cateterismo venoso periférico: los estudiantes señalaron que utilizar el simulador permite comprender cada etapa del procedimiento e identificar dónde deben mejorar la técnica, lo que los prepara para el contacto con el paciente. 2) Dificultades encontradas al usar el simulador de bajo costo. Los estudiantes destacaron la baja fidelidad del simulador y la limitación para entrenar la técnica sin comunicación. **Conclusiones e implicaciones para la práctica:** los estudiantes perciben al simulador de bajo costo como una herramienta relevante para desarrollar habilidades en cateterismo venoso periférico, sugieren su perfeccionamiento para aumentar su fidelidad e incorporar la comunicación al momento de la punción para lograr mayor aproximación a la realidad en la experiencia simulada.

Palabras clave: Enfermería; Enseñanza; Entrenamiento Simulado; Cateterismo Periférico; Estudiantes de Enfermería.

Corresponding author:
Bruna Pedroso Canever.
E-mail: brunacanever@gmail.com.

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INTRODUCTION

Nursing training requires the development of specific competences and, among these, technical competence, which includes developing skills to perform activities that will support health care in the services. Some of these techniques are invasive in nature and, for this reason, the students need to learn them in safe environments for those involved in the teaching-learning process.

This condition goes beyond the teacher-student relationship, considering that health care is provided in the health services, including the users of the services as main actors in this process.[1] Among the invasive techniques that demand innovative learning strategies, in order to promote skills development in a safe manner, there is peripheral venous catheterization or peripheral venipuncture, whose learning requires attention and care.

Thus, the adoption of innovative pedagogical strategies, congruent with complex teaching-learning scenarios, is urgent as identified in the nursing knowledge field. Active methodologies help teachers to work in these scenarios, as they bring together pedagogical concepts that stimulate learning in a critical and reflective way, activated by the individual in training, who learns to learn.[2] Associating such conceptions to the teaching-learning process that involves invasive techniques enables skills development in a safe manner, by using teaching strategies, such as simulation.

Simulation is an evidence-based teaching and learning method that has been used in nursing education in developed countries for several years,[3,4] and is a growing practice worldwide. In addition, simulation-based learning has been appreciated by the nursing students, as it presents positive experiences such as increased involvement in learning, decreased levels of anxiety, and satisfaction and self-confidence in learning.[5]

Nowadays, there is an increasing use of simulators in nursing education,[6] which are available on the market by specialized companies to meet the demand for the development of specific technical skills of health professionals and students. There are numerous types of simulators for health training available on the market, from parts for training unique procedures to high-tech simulators.[7] However, the high cost of acquiring and maintaining laboratories equipped with high-fidelity simulators has been pointed out as a limiting factor for their use.[8]

The continued use of this resource and the frequency required to meet the students' learning requirements impose a high financial cost on the schools, considering that the equipment with greater fidelity is very expensive and is not accessible to all the educators.[9,10] This situation generates limitations in the use of simulation equipment during the training process of nursing students.

In order for learning to be streamlined, the simulation environment and equipment are designed to reflect the reality of a real patient care environment. This degree of realism or fidelity varies between low, medium, and high, depending on the complexity of the task and on the level of knowledge of the student.[11]

Low-fidelity simulation has less realism and resemblance to the environment and/or equipment than those usually found in the real clinical environment. This type of simulation involves the use of static mannequins or task trainers, known as Low-Cost Simulators (LCSs), designed to help the student practice a specific psychomotor skill, such as venipuncture, nasogastric tubing, and urinary catheterization, among others.[8,12] In addition, because they use little technology, LCSs involve simple maintenance and reduced costs when compared to high-fidelity devices.[13]

For this reason, LCSs have been adopted in different realities in the world and contributed to the teaching-learning process of students in the health area.[8,14] They are an economically feasible alternative, which expands the training opportunity not only for students, but also contributing to the technical improvement of workers in a safe and controlled environment, promoting safe learning, especially in the development of psychomotor skills.

A number of studies indicate that simulation-based educational nursing interventions are effective, with particularly large effects in the psychomotor domain.[15,16] However, there is evidence that the effect of simulation-based nursing education does not indicate that it is proportional to the level of fidelity.[8] It is also highlighted that most of the research studies in simulation in nursing education involves high-fidelity simulation, with a limitation in research studies with low-fidelity simulation.[17]

With regard to peripheral venous catheterization, a low-cost simulator can be built by the teachers and students themselves, using simple and often disposable materials. There is in the literature a model of LCS developed in Brazil for this purpose, which was evaluated as efficient by teachers.[18] For being an innovative technology, the guiding question of this study was the following: What is the contribution of using a low-cost simulator for the development of the students' technical skills for peripheral venous catheterization?

The aim of this study was to know the nursing students' perception on the contribution of using the low-cost simulator in the development of technical skills for peripheral venous catheterization.

METHOD

A descriptive study with a qualitative approach, developed in a public university in the South of Brazil. The research scenario was the laboratory of nursing practices, whose theoretical-practical activities include the first curricular subject in which the students come into contact with techniques that support nursing care. Among other topics, the course syllabus includes the development of technical skills in peripheral venous catheterization. In its schedule, three meetings are planned, one theoretical and two practical, to address the content of nursing care in peripheral venous catheterization and fluid therapy before the students go to the real scenario: the hospital.

In the practical activities, the students used an LCS for peripheral venous catheterization. It is a prototype that reproduces part of an upper limb in which it is possible to visualize and feel a vein, place the tourniquet, puncture, visualize blood reflux, start fluid therapy or administer *bolus* medications, or even collect blood, as shown in Figure 1. The prototype was based on a

Figure 1. Low-Cost Simulator. Florianópolis-SC, 2019.
Source: Personal archive.

model presented at the Latin American Simulation Congress held in Chile and validated by professors from a Federal Higher Education Institution.[18]

Before starting the practical class, the teachers presented the low-cost simulator to the students, explaining how it worked and demonstrating the step-by-step of peripheral venous catheterization and the installation of the fluid therapy. The time used for this dialog was 50 minutes.

Immediately after that moment, the students were divided into three groups to carry out the practice with the simulator. Each group was accompanied by a teacher in different rooms of the laboratory, and the duration of the practice was 2 hours 50 minutes. In addition to the low-cost simulator, the following materials were used for the practice: tourniquet, over-the-needle catheter, needle, syringe, butterfly catheter, vacutainer collection tubes, equipment, physiological serum, cotton, alcohol, and examination gloves. Each student had the opportunity to perform three procedures (blood collection, puncture with a butterfly catheter and with an over-the-needle catheter, and fluid therapy). The teacher followed the development of the simulated practice by observing, guiding, and giving feedback, whenever necessary. In the end, the students were also able to ask questions about the procedures performed.

The study had 25 participants enrolled in the course surveyed in the collection semester, constituting a convenience sample. Data saturation guided the decision that enough information had been gathered to answer the research objective.[19]

It was considered as an inclusion criterion to be an undergraduate nursing student enrolled in the curricular subject responsible for developing the competences related to peripheral venous catheterization and fluid therapy. The exclusion criterion adopted consisted of being absent from at least one of the three meetings to develop the activities on the theme. Ten students were excluded from the study.

Data was collected by the main researcher in the first semester of 2019, in April and May, after the third meeting, which concluded the theoretical-practical activities in the laboratory.

Data was collected by means of a questionnaire composed of open questions regarding the use of the low-cost simulator, which were about the following: perception on the use of the low-cost simulator for the development of the peripheral venous catheterization technique; stages of the peripheral venous catheterization procedure and the use of the simulator; advantages and disadvantages in using a low-cost simulator; and improvement suggestions.

After verbatim transcription, the information was analyzed according to Minayo's operative proposal,[20] composed of two operational moments. The first moment maps the fundamental determinations of the study, and the other, known as interpretative, consists of the representation of the encounter with the empirical facts. The second operational moment has two stages: ordering and classification of data, which comprises the horizontal and exhaustive reading of the texts, cross-reading, final analysis, and writing the report with the presentation of the results. Information processing resulted in two categories.

As for the ethical aspects, the research was approved under CAAE-82218418.0.0000.0121, with the consent of the participants through individual signature of the free and informed consent form. To preserve the anonymity of the study participants, an alphanumeric identification was used: E ("*estudante*" in Portuguese) for student, followed by ordinals from 1 to 25, corresponding to the number of participants, who were sequentially ordered according to the questionnaire delivery order.

RESULTS

The participants' perceptions on the use of the low-cost simulator for the training of peripheral venous catheterization pointed out two categories: skills development for peripheral venous catheterization, and difficulties encountered in using the low-cost simulator.

Skills development for peripheral venous catheterization

Skills development for peripheral venous catheterization in nursing education requires the integration of theoretical, practical, and attitudinal knowledge, which is presented concurrently during its execution. It is one of the first invasive procedures that the

students learn to perform, which mobilizes expectations and feelings for such learning.

The use of the low-cost simulator for the development of technical skills for peripheral venous catheterization proved to be a relevant resource for the students' learning, as it allowed for the identification of the stages of the simulation training that most contributed to the learning process, according to the perceptions of each participant. The following records show the different stages of the technique that were highlighted by the students:

> *The insertion of the equipment to the catheter, because it showed the agility I need* (E7).
>
> *I had a very hard time placing the tourniquet and it was in this simulator that I learned* (E22).
>
> *Palpation to find the vessel, because it was the most similar stage* (E12).
>
> *The puncture, for the resistance of the needle; it simulates very well the pressure to the vessel* (E15).

Another point highlighted by the students was that the simulator enables learning from the teacher's explanation and from the identification of their own errors, allowing them to reflect on the stage of the technique that still needs improvement:

> *Practice, because there we make mistakes and think about it* (E10).
>
> *The practice itself, and the teacher's demonstration helped a lot, explaining the step-by-step* (E11).
>
> *Before I had no idea how it should be done, with the equipment I could see what the biggest challenge was and improve it* (E13).

The students highlighted as advantages in the use of the simulator the possibility of executing the procedure in a controlled situation before performing it on the patient, allowing for previous experience, as well as understanding the stages to be performed:

> *We have a good experience before training in the practice field (E18)*
>
> *The advantages are based on the principle that the simulator helps in the real view of the facts to be performed (E15).*

When relating the educational experience to the practice in the real scenario, the students identified the simulation training and the space as safe environments for learning, in addition to demonstrating an ethical commitment to human beings by reflecting about the impossibility of performing this simulation training on a person who does not need such intervention, herein identified as a classmate.

> *It does not allow for major errors and consequences [the practice in the real scenario]. Freedom that would be impossible with a classmate. It allows us to acquire the skills without causing consequences (E9).*
>
> *Learning with the simulator is of great value, because it is simple, practical and helps us to simulate the puncture with blood reflux (E2).*

Difficulties encountered when using the low-cost simulator

The students signaled as difficulties the presence of holes and marks that remain in the simulator after several puncture attempts, as they visually indicate the puncture site. Another aspect refers to the distance from the technique, when compared to a real situation of peripheral venous catheterization, since it does not resemble an upper limb. In addition, the device has only one vein, a condition that directs its location and that may not represent the real conditions for performing the technique, such as the variation of the patients' clinical conditions. The following records illustrate those perceptions:

> *[...] there are holes after we insert the needle; it could be a little better in that sense (E2).*
>
> *[...] just one vessel, it makes the location more obvious, mainly with the marks left by the needles at each attempt (E10).*
>
> *The simulator could be more like a limb and not attached to a body, distancing itself from reality (E5).*

To improve the simulator, the students suggested some modifications to make it more similar to the anatomy of a limb, such as the convenience of the surface covering the simulator being similar to the skin and having a greater number of veins with different diameters.

> *[...] improving the surface, becoming more like the skin (E9).*
>
> *Increasing the weight and stiffness of the arm and increasing the number of veins with different diameters would be very interesting (E4).*
>
> *[...] it should be a little heavier and more faithful to the anatomy (E13).*

Still on the weaknesses found in the use of the simulator, the students highlighted the difficulty in having an exact notion of reality, as well as the impossibility of training relational competences, such as communication, as it was a limb.

> *[...] that it did not give us full/greater sense of the reality of the procedure. Like tissue tension, etc. (E24).*
>
> *It is not very faithful to reality; we did not have the possibility to train communication (E18).*

DISCUSSION

One of the fundamental elements in undergraduate nursing is the development of competences based on knowledge, skills, and attitudes, which are improved by the students during the course. It is known that there is an expectation on the part of the nursing students regarding more specific techniques such as catheterization, blood pressure measurement, dressing, and peripheral venous catheterization, the latter being the focus of this study.

In this context, competent teaching represents knowledge and know-hows linked to the scientific, technical, ethical, political, relational, and aesthetic dimensions of training. For the student to reach technical competence, it is necessary to use a set of elements that allow organizing the logical reasoning in each stage of the procedure, requiring the articulation of knowledge, skills, and attitudes during its execution.[21]

In the case of the curricular subject in which the LCS was used, an approximation to the technical-scientific knowledge was promoted, supporting the students in the development of dexterity, by exercising the step-by-step of the procedure, in controlled and safe conditions. In other words, this skill was developed prior to the scenario of internship field practices, understanding that the LCS minimizes the anxiety and expectation of the students, as well as the risks of unnecessary harms associated with patient care, because it is a moment without the patient's actual presence.[22]

The use of the LCS also allows, within the full/total development of the skill, that the student is able to divide the technique into other minor skills such as antisepsis, tourniquet, puncture, blood collection or fluid therapy. In other words, it is the gathering of less complex skills, dynamically orchestrated in an appropriate order that allows apprentices to know their strengths in performing the technique, as well as to identify their weakness.[23] And this, in the construction of knowledge about peripheral venous catheterization, happens gradually, since it is something procedural and systematized.

In this sense, the importance of the teaching-learning relationship between teacher and student lies in identifying the well-developed stages and those that need improvement. With the LCS, there is the possibility of developing each stage of the technique, allowing students to be aware, with the teachers' mediation, of the aspects that they need to improve. In addition, it is possible to stop at any time, review the procedure, and return to the process without causing harms and/or risks.[24,25]

The possibility of detailing the materialization of the technique with the use of the simulator has pedagogical relevance in the perspective of a procedural construction of knowledge. This construction occurs through the initial integration of technical and scientific knowledge, which will be associated at a later time with the attitudes necessary for nursing care to be configured in a competent and safe action.

The act of raising awareness allows students to reflect, increasing the understanding of their needs in the educational process. The awareness process enables the encounter with a subjective world, which students learn as they get to know themselves. In this encounter, there is a movement of transcendence from the naive view to the apprehension of reality, a condition in which the individuals take a critical attitude about their own knowledge.[26]

The development of technical skills through the use of LCS allows for an experiential learning of the student in a safe and controlled space, closer to the real environment. Thus, it is reiterated that simulation as a teaching strategy allows the students to actively experience a specific context, ensuring its practice with autonomy and avoiding possible adverse events for the patients.[27] Building knowledge with the use of active methodologies allows the nursing student to play a leading role, especially since situations that generate anxiety and stress can emerge and be discussed in the pedagogical context.[28]

The LCS allows the students to identify errors during skills development and to refer to the importance of this moment for the learning process. Thus, simulation activities enable the students to think about their educational process as apprentices, becoming aware of and reflecting on their practice, reframing their way of thinking and acting, improving practices and techniques to be used more effectively with the patient in the health environment.[29] Thus, the articulation of competences that the students use during active teaching strategies, such as simulation, go beyond the technical level of the procedure, generating reflection and a consequent transformation of learning.[30]

A recent study on the relevance of active methodologies in nursing courses signals that value-based training is capable of transcending the competences of future nursing professionals.[31] Regarding this research, it is considered that such values are expressed in the responsibility to develop skills in safe environments. Especially when comparing the conditions of the simulation training in the LCS and directly in humans, both among classmates and in patients during practices in internship fields. The learning process with an LCS in a favorable environment, guided by the teacher, generates the possibility of making mistakes and learning from them, both about the technique itself and about the implications that result from it if it were performed in non-simulated environments, directly in humans. This condition weaves a network of reflections, which involves factors far beyond the development of the technical skill itself, given the complexity of human valuation and the network of relationships present in the provision of health services.

By using the LCS, with attention to the experience of the nursing students, it is possible to problematize how training can raise relevant issues to professional training in nursing. The use of the LCS in the context of active methodologies allows for notions of safety and responsibility to be addressed, demonstrating that the use of these resources is guided by ethics.[32]

In different areas, a number of research studies show that using simulation as a teaching strategy is efficient to improve the acquisition of knowledge, the performance and safety of the students and also of health professionals in different care procedures.[28,33-35] However, the choice of complex scenarios may not meet the needs of what it is intended to develop. Teacher preparation and planning bring together two essential activities for

the pedagogical intentionality to be expressed in the provision of educational activities that really meet the learning objectives. For technical skills, the focus is on repetitive training of a particular action and/or sequence, followed by feedback. In this sense, a number of advantages are verified for the nursing courses with the use of the LCS, as it allows for the development of technical skills through the repetitive performance of procedures, whenever necessary, to ensure mastery by the student without causing a significant increase in costs.

The possibility of exhaustively training invasive procedures in simulators allows experiencing the sensation of reality. Procedures like probes, catheters, punctures, auscultation, CPR maneuvers, communication, and teamwork are some of the possibilities that simulation and simulators offer.[36] A study carried out in Sweden with nursing students in venipuncture training identified a correlation between better performances and self-training, which corroborates the potentiality of the use of the LCS in the training of nurses, as they allow numerous attempts.[23]

However, the use of the LCS also presents weaknesses. The low fidelity of the equipment limits the perception of the real environment, in particular the execution of the procedure in real patients. However, the safety resulting from its use, both of the students and of the patients, in learning invasive techniques relativizes the limitations identified in the study. A controlled and realistic environment allows the students to experience spaces and train techniques and/or procedures, giving them the opportunity to make mistakes and learn from them, without these mistakes causing harms to the health of individuals.[36]

Despite the need for improvements, such as the appearance and reliability of the device signaled in the category on the difficulties encountered in using the LCS, in general, its use in this research contributed to the students' learning, enabling advances in the teaching process. Similar results in nursing teaching were found in other studies, in different scenarios, and with different types of devices, such as: in child and family care;[24] in mental health;[37] and in care for aged individuals.[38]

Another point described by the students, categorized as difficulties, refers to the training of relational competences, such as communication, which was insufficient for being a simulation with only one limb, especially because its appearance differs greatly from a real situation. The results of a number of research studies highlight communication as a possible skill to be developed and improved by means of simulations, when the simulator interacts with the student, including reactions and non-verbal communication, conditions that the LCS does not offer.[37,39]

In view of the results, it is considered that it is convenient to provide professional training based on participatory and problematizing processes, with the use of active methodologies in a simulation environment, both from the pedagogical point of view and from the financial feasibility perspective. On the other hand, it is highlighted that they promote reflection on the teaching-learning process, as verified in this research with the use of the LCS to develop peripheral venous catheterization skills. Such a dynamic process reaches both the individual (self-knowledge) and the collective level, by means of observations of oneself and of the other in performing the technique, through interactions between teachers and students, as well as of the students with each other.

CONCLUSIONS AND IMPLICATIONS FOR THE PRACTICE

The peripheral venous catheterization technique is a procedure that offers risks and generates anxiety both in those who perform it and in the patient. During training, the nursing students need to have skill and confidence before performing it in real settings, in direct care to the patients. Thus, reasserting the objective of this study, it is evident that the use of low-cost simulators was considered by the students as a positive experience that, in addition to contributing to the development of the technical skill of peripheral venous catheterization, provided learning without risk of causing unnecessary harms.

As a limitation of this study the fidelity of the LCS is signaled, which, despite presenting advances in the involvement of the students in carrying out the technique, in exhaustive training, this characteristic was presented as a central element of disadvantage. However, the students signaled suggestions for improving the LCS, with which it will be possible to refine it so that it becomes closer to reality, in the sense of thinking approximations in relation to the skin, the appearance of the vessels, and the sensitivity in the puncture of the vein, among other aspects. Experimental studies are still needed in order to compare the effects of using or not using the LCS in skills development for peripheral venous catheterization.

The study contributes to the teaching and learning process as it demonstrates that the development of technical skills in nursing training can incorporate low-complexity resources, techniques, and simulators. It is highlighted that this measure must be accompanied by pedagogical intentionality in all the stages of the process. Undergraduate nursing courses can use this experience to create possibilities consistent with their reality and with the students' reality.

In another perspective, even though peripheral venous catheterization is substantially related to the development of technical skill, it is necessary to highlight the notions of ethics, responsibility, and problematization as parts of equal relevance to the educational process. Such breadth of reflection is necessary, given the complexity that involves improving the health of a person who needs nursing care, such as peripheral venous catheterization, which should be supported by ethics, respecting human beings and patient safety. In this way, the teaching-learning of competences in peripheral venous catheterization should also address these assumptions.

AUTHOR'S CONTRIBUTIONS

Study design. Bruna Pedroso Canever, Marina Silva Sanes, Saionara Nunes de Oliveira

Data collection or production. Bruna Pedroso Canever, Marina Silva Sanes, Saionara Nunes de Oliveira, Aline Lima Pestana Magalhães

Data analysis and interpretation of the results. Bruna Pedroso Canever, Marina Silva Sanes, Saionara Nunes de Oliveira, Aline Lima Pestana Magalhães

Writing and critical review of the manuscript. Approval of the final version of the article. Responsibility for all aspects of the content and the integrity of the published article. Bruna Pedroso Canever, Marina Silva Sanes, Saionara Nunes de Oliveira, Aline Lima Pestana Magalhães, Marta Lenise do Prado, Diovane Ghignatti da Costa

ASSOCIATE EDITOR

Cândida Caniçali Primo.

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