

## Effectiveness of educational video on peripheral venous puncture for Portuguese-speaking student nurses

*Efetividade de vídeo educativo sobre punção venosa periférica para acadêmicos de enfermagem lusófonos*

*Efectividad del video educativo sobre la punción venosa periférica para académicos de enfermería lusófonos*

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### ABSTRACT

**Objective:** to evaluate the effectiveness of an educational video on Portuguese-speaking student nurses' knowledge of peripheral venipuncture. **Method:** a quasi-experimental study of the before-and-after type was conducted with 85 student nurses by pre- and post-tests using a validated questionnaire of 20 items on vein puncture. **Results:** correct replies increased significantly ( $p < 0.005$ ) on seven questions regarding: the best veins for puncture, need for inspection and palpation, antisepsis in circular movements, positioning of the tourniquet, indication of scalp use, flexible device dwell time and complications of the procedure. In the pre-test, median hits were 15 (interquartile range = 17), while in the post-test median hits were 16 (interquartile range = 17),  $p = 0.000$ . **Conclusion:** the educational video was effective educational technology to assist in teaching nurses about peripheral venipuncture.

**Descriptors:** Nursing; Nursing, Students; Educational Technology; Audiovisual Aids; Health Education.

### RESUMO

**Objetivo:** avaliar efetividade de vídeo educativo no conhecimento de acadêmicos de enfermagem lusófonos acerca da punção venosa periférica. **Método:** estudo quase-experimental, do tipo antes e depois, desenvolvido com 85 acadêmicos de enfermagem, com pré e pós testes realizados a partir de questionário validado composto por 20 questões acerca do conhecimento sobre punção venosa. **Resultados:** houve melhora significativa ( $p < 0,005$ ) nos acertos de sete questões referentes as melhores veias para punção, necessidade de inspeção e palpação, antisepsia em movimentos circulares, posicionamento do torniquete, indicação do *scalp*, tempo de permanência de dispositivo flexível e complicações do procedimento. No pré-teste, a mediana de acertos de 15 (Intervalo interquartil=17), enquanto no pós-teste a mediana de acertos foi de 16 (Intervalo interquartil=17),  $p=0,000$ . **Conclusão:** o vídeo educativo apresenta-se como tecnologia educacional efetiva para auxiliar no ensino da enfermagem sobre a PVP.

**Descritores:** Enfermagem; Alunos de Enfermagem; Tecnologia Educacional; Recursos Audiovisuais; Educação em Saúde.

### RESUMEN

**Objetivo:** evaluar la efectividad del vídeo educativo sobre el conocimiento de académicos de enfermería lusófonos en cuanto a la punción venosa periférica. **Método:** un estudio cuasi-experimental, del tipo antes y después, desarrollado junto a 85 estudiantes de la enfermería, con pruebas previas y posteriores realizadas a partir de un cuestionario validado compuesto de 20 preguntas sobre el conocimiento de la punción venosa. **Resultados:** hubo una mejora significativa ( $p < 0,005$ ) en lo que se refiere a las respuestas correctas a siete preguntas relativas a las mejores venas para la punción, la necesidad de inspección y palpación, la antisepsia en movimientos circulares, la posición del torniquete, la indicación de la aguja mariposa (*scalp*), el tiempo de permanencia del dispositivo flexible y las complicaciones del procedimiento. En la prueba previa, el promedio de respuestas correctas fue de 15 (rango intercuartil = 17), mientras que en la prueba posterior el promedio de respuestas correctas fue de 16 (rango intercuartil = 17),  $p=0.000$ . **Conclusión:** el vídeo educativo se presenta como una tecnología educativa eficaz para ayudar a enseñar enfermería sobre PVP, punción venosa periférica.

**Descriptores:** Enfermería; Estudiantes de Enfermería; Tecnología Educacional; Recursos Audiovisuales; Educación em Salud.

## INTRODUCTION

The Peripheral Venous Puncture (PVP) procedure is habitually performed worldwide in the health services. It is estimated that 200 million punctures are performed in the United States per year, which characterizes PVP as one of the most frequent interventions performed by Nursing in the clinical practice context, especially in the hospital setting to infuse fluids and different medications<sup>1,2</sup>.

Its installation requires extensive scientific-technical knowledge to avoid several attempts and insertion in unfavorable anatomic sites. It is relevant that nurses have clinical expertise to find the necessary caliber, preferred veins, functionality, and possible complications given that direct access to the bloodstream allows for local and systemic infections. Therefore, it is indispensable that Nursing students and professionals have adequate knowledge and skills for a better performance in this PVP procedure<sup>3</sup>.

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The teaching-learning process during Nursing undergraduate courses has incorporated different strategies to facilitate knowledge acquisition, with an emphasis on Information and Communication Technologies (ICTs), which provide subsidies to expand teaching in classrooms by using computer and telecommunication resources<sup>4,5</sup>. A study carried out in the United States with Nursing students showed that the use of videos is one of the most preferred instructional methods<sup>6</sup>.

The use of ICTs, such as educational videos, is considered important for the dynamization of teaching, as well as to develop skills in the students<sup>7</sup>. Moreover, the introduction of technological resources enables quick access to contents and information, promotes responsibilities, knowledge, scientificity and autonomy in the students, not only within the university, but it favors the availability of learning methods at home<sup>7,8</sup>.

The use of technological resources, such as educational videos, is a complementary strategy for the teaching-learning process because it favors the acquisition of knowledge and skills, and is also a social media tool that affects in a positive way the teaching and learning process in Nursing education, which can corroborate with the promotion of autonomy in the students<sup>9</sup>, in addition to being an easy-to-understand and effective pedagogical resource.

An integrative review conducted in Brazil on audiovisual resources used in Nursing teaching reveals that there are still few studies in the scientific literature on this theme, despite its frequent use in Nursing classes to illustrate procedures of the clinical practice<sup>10</sup>. Thus, by considering that the choice and use of technologies for teaching must be guided by research results, there is a need and pertinence of studies that investigate the effectiveness of different existing technological options. Accordingly, this study aims to evaluate the effectiveness of an educational video in the knowledge of Lusophone Nursing students about peripheral venous puncture.

## METHOD

This is a quasi-experimental study of the before-and-after type, which was developed from February to December 2019 with students of an undergraduate Nursing course from a higher education institution in the state of Ceará, focused on teaching the Luso-Brazilian population. Such institution had students from Portuguese-speaking countries such as Brazil, East Timor, Portugal, Cape Verde, Guinea-Bissau, Angola, Mozambique, and São Tomé and Príncipe.

The target population was represented by students enrolled in the 2019.1 and 2019.2 semesters in the "Semiotics Applied to Nursing" subject at the study institution. The inclusion criteria were as follows: being regularly enrolled in the subject and having availability to watch the video. And, as exclusion criteria, students who did not complete the follow-up with the post-test within 15 days. Thus, the sample consisted in 85 Nursing students.

Data collection was conducted in two meetings. In the first one, the participants were explained about the study objective and, the ones who agreed to participate were requested to sign the Free and Informed Consent Form. Subsequently, there was the application of the theoretical pre-test built and validated according to the authors' guidance<sup>11</sup>, composed of 20 questions with true (T) and false (F) options about the anatomy of the venous network, material used for PVP, procedure and complications. Later, the educational video, lasting seven minutes and 58 seconds, was collectively projected through Datashow for all the students. It is important to highlight that, in the classroom, the video was displayed only once, but a link on the YouTube® platform (<https://www.youtube.com/watch?v=tXXHNqhGglU>) was provided to ensure unlimited access to the information and greater fixation of the content provided in this new digital technology.

In the second meeting, held 15 days after the application of the pre-test, the students were gathered in a classroom and arranged in chairs lined up to fill out the post-test.

A database was prepared in Excel and data was exported to the *Statistical Package for the Social Sciences* (SPSS) 25.0 software for statistical analysis. The categorical variables were analyzed from absolute and percentage frequencies. Non-adherence to the normality of the continuous data was confirmed through the *Kolmogorov-Smirnov* test. The McNemar's test was used to verify the existence of differences in the correct answers to the questions between the pre- and the post-test. The median of the total scores of correct answers before and after the educational intervention was analyzed through the Wilcoxon test. The significance level adopted in all tests was 5%, with a 95% confidence interval.

The video was built and validated as an integral component of an educational hypermedia on Peripheral Venous Puncture<sup>11</sup>. A total of 44 specialists participated in the validation process, 22 from the Nursing area and 22 from the IT area, who were granted access to the hypermedia and also to the videos incorporated in such technology. The items evaluated were the objectives, content, relevance, effectiveness, usability, functionality, and efficiency. Specifically regarding the efficiency of the videos, all the specialists considered these audiovisual resources as adequate and comprehensible. After this stage, validation was conducted with 21 Nursing students, who classified the hypermedia

and the videos availed as “very good” and that they could be used as a resource to facilitate the teaching-learning process in venous puncture.

This study respected Resolution 466/2012 of the National Health Council, which deals with research studies on human beings, and was approved by the Research Ethics Committee of the Federal University of Ceará (*Universidade Federal do Ceará*, UFC) under opinion No. 666,368.

## RESULTS

Of the 85 participants, 81.17% (69) were female, with a mean age of 21.82 ( $\pm 3.32$ ). There was prevalence of the Brazilian nationality, with nearly 82.4% (70) Brazilian participants, followed by 5.9% (5) from São Tomé and Príncipe, 4.7% (4) from Guinea-Bissau, 2.4% (2) from Angola, 3.5% (3) from Cape Green, and 1.2% (1) from East Timor. It was identified that 84.7% (72) had never performed any peripheral venous access. In relation to the experience with educational technologies, 58.8% (50) had already undergone educational moments with the use of video. The data related to the correct answers in each item of the questionnaire are presented in Table 1.

**TABLE 1:** Correct answers in each item of the questionnaire to assess the students' theoretical knowledge on peripheral venous puncture. Redenção, CE, Brazil, 2019.

Items	Pre-test n (%)	Post-test n (%)	p-value*
1. Best veins for puncture: basilic and cephalic	44 (51.8)	64 (75.3)	0.000
2. Choice of veins of the antecubital fossa for blood collection	65 (76.5)	67 (78.8)	0.839
3. Metacarpal veins are ideal for medication in <i>bolus</i>	37 (43.5)	38 (44.7)	1
4. Necessary material for PVP	76 (89.4)	79 (92.9)	0.581
5. Need to use procedure gloves during the procedure	72 (84.7)	73 (85.9)	1
6. Antisepsis with 70% alcohol in circular movements before the puncture	55 (64.7)	82 (96.5)	0.000
7. Need to use sterile gloves during the procedure	61 (71.8)	64 (75.3)	0.607
8. Puncture must be performed through inspection and palpation	68 (80.0)	78 (91.8)	0.013
9. The initial punctures must be made in the proximal region	30 (35.3)	32 (37.6)	0.850
10. Information that must be present in the identification of the access	74 (87.1)	78 (91.8)	0.344
11. Need to use a tourniquet during the procedure	55 (64.7)	59 (69.4)	0.481
12. The distance from the insertion site of the tourniquet in the venous puncture is from 10 cm to 15 cm	55 (64.7)	70 (82.4)	0.009
13. The use of a tourniquet in older adults must be done carefully	78 (91.8)	80 (94.1)	0.687
14. Scalp (needle catheter) is ideal for in- <i>bolus</i> intravenous administration of non-irritating medications	42 (49.4)	58 (68.2)	0.012
15. When introducing Abocath (flexible catheter), the bezel must be down with an angle from 15 to 25 degrees	35 (41.2)	38 (44.7)	0.629
16. Permanence time of the flexible catheter	44 (51.8)	55 (64.7)	0.035
17. The numbering of Abocath (flexible catheter), done through <i>Galge</i> , is classified in odd numbers	26 (30.6)	33 (38.8)	0.337
18. Restriction of puncture in members with arteriovenous fistula	71 (83.5)	76 (89.4)	0.227
19. The tourniquet must be removed after verifying the presence of venous return	72 (84.7)	78 (91.8)	0.146
20. The complications of peripheral venous puncture can be local or systemic	65 (76.5)	75 (88.2)	0.021

\* McNemar's test.

In the pre-test, the median of correct answers was 15 (Interquartile Range=17), while in the post-test, the median of correct answers was 16 (Interquartile Range=17),  $p=0.000$ . Table 1 presents the indexes of correct answers for each of the questions of the questionnaire applied.

## DISCUSSION

The use of the video as an educational strategy shows that digital technologies are complementary tools in Nursing undergraduate courses, aiding in the teaching-learning process. In this study, the intervention with an educational video contributed to an increase in the knowledge of the following items: selection of veins ( $p=0.000$ ), puncture site ( $p=0.009$ ), antisepsis ( $p=0.000$ ), inspection/palpation of the puncture site ( $p=0.013$ ), indication for the use of scalp ( $p=0.012$ ), permanence time of the catheter ( $p=0.035$ ), and puncture complications ( $p=0.021$ ).

A study conducted in Portugal with 122 Nursing students reveals that the participants appreciate the use of videos as a technology to favor improvements in the skills inherent to the Nursing procedures<sup>12</sup>. In China, an intervention study, which proposed to assess the benefits of using videos in the feedback on practical skills of 195 Nursing students, identified an improvement in the performance of procedures such as preparation of beds, asepsis, verification of vital signs and oxygen therapy after receiving the video through instant messaging on smartphones<sup>13</sup>.

Therefore, the use of digital materials, such as videos, in teaching practices favors the learning process, given that access to the content is unlimited, which makes it possible to repeat the phases of the procedure until understanding the technique and solving the doubts. Therefore, the use of this educational technology helps students as a method to acquire knowledge, especially within the scope of Nursing<sup>14,15</sup>.

In this sense, the use of technology in teaching is due to the fact that this resource contributes to better understanding the subject matter studied, as well as for allowing the student to make knowledge flexible, respecting each person's learning pace<sup>16</sup>. In addition, it favors the best performance of the students given the possibility of watching the video several times, as well as it helps in skills development through IT tools.

Accordingly, a study with a methodological design carried out in Ribeirão Preto, in the inland of São Paulo, on the use of a virtual reality simulator considered it a valid and promising tool to teach the vacuum blood collection procedure to undergraduate Nursing students<sup>17</sup>. In Australia, a qualitative study conducted with 142 Nursing students shows that the use of videos favored self-assessment and critical reflection on communication skills with patients, as well as it increased the students' self-confidence when interacting with the population<sup>18</sup>.

However, in India, a quasi-experimental study with the objective of comparing the use of an educational video in the demonstration of obstetric palpation with 60 Nursing students evidenced that traditional teaching in laboratories obtained better rates of correct answers in the evaluation of skills when compared to the use of the video<sup>19</sup>. It shows that, despite the fact that the video is an easy-to-apply audiovisual resource, promoting the students' involvement to visualize the Nursing procedures, it does not enable improvements in the clinical practice, and laboratory time is necessary so that the students can develop such skills.

An integrative literature review conducted in Brazil on education strategies applied to Nursing teaching on venous puncture infers that, despite the digital technologies availed, their use does not voids face-to-face meetings from their importance. The best results are reached when the student receives theoretical content and practices associated with the virtual simulator or other digital technologies. Therefore, new learning strategies favoring the acquisition of knowledge and skills to provide safe and efficient care that do not cause iatrogenies related to Nursing care must be implemented in undergraduate courses to encourage the development of skills in the performance of venous puncture<sup>20</sup>.

In this study, it was possible to identify that most of the participants had never performed any PVP, which corroborates a study conducted in Rio Grande do Norte with students of five semesters of a Nursing course in which the results showed that the students do not have practical skills to perform the procedure<sup>21</sup>.

For students that do not have experience in PVP, acquiring knowledge on vascular anatomy becomes fundamental to perform the procedure. In this study, there was significant statistics ( $p=0.000$ ) on the anatomy of veins. These findings confirm results found in a research study in Ceará with the use of hypermedia, in which there was 14.9% of difference in the numbers of correct answers after using the educational technology about venous puncture. Nursing students believe that the improvement in knowledge and enhancement regarding the anatomy of the venous network favor the reduction of incorrect punctures and complications<sup>22,23</sup>.

Another action to avoid adverse events is the performance of antisepsis with 70% alcohol before the puncture in order to reduce skin pathogens, which makes it essential to adopt methods of effective continuous learning and training, such as the use of technologies. Thus, the findings of a systematic review with meta-analysis conducted in the Netherlands on the use of audiovisual technology to teach venous puncture showed that there was a 17.9% reduction of contamination after the application of a technological intervention<sup>24</sup>.

The performance of the puncture with the help of inspection and palpation was another variable in which there was a significant improvement in the number of correct answers. Its relevance is justified because the propaedeutic methods make performance of the procedure safer and with higher chances of success, although there are strategies with greater technological resource, such as puncture guided by ultrasound, which convey more accuracy to the procedure and have contributed to fewer puncture attempts, such as a higher level of patient satisfaction<sup>25</sup>.

Another significant finding was regarding the use of a tourniquet that contributes to the congestion of the local venous circulation, which makes veins more prominent and visible, and must be applied above the puncture site, but not for a prolonged time. It is worth emphasizing the need for correct cleaning and disinfection to promote patient and professionals team safety, as they can be reservoir and transmission vehicles for multi-resistant microorganisms, which promotes cross-contamination.

Other information that showed a significant improvement in the number of correct answers was the administration of medication in *bolus* with the use of scalp. The use of a catheter with steel needles must be avoided for long-term intravenous therapies, as it can cause medication overflow and irritation in the vessel<sup>26</sup>. Therefore, adherence to the precaution of avoiding the use of scalp favors the reduction of complications and improves patient satisfaction regarding the Nursing care provided, which enables a clinical practice free of harms.

It is important to highlight the the risk of developing local and systemic complications associated with PVP failure can result in more prolonged hospital stay and anguish for the patients. The most frequent complications are infiltration, swelling, obstruction, phlebitis and accidental removal, among others. Consequently, a research study conducted in Singapore revealed that 67.6% of the catheters are removed due to some complication<sup>27</sup>.

With that, the use of several strategies is pertinent to teach PVP, so that Nursing students understand the technique, its risks and its benefits. To make the teaching-learning process accessible and dynamic, the incorporation of technologies is a tool that provides an active environment for learning with different methods. This is consonance with a study conducted in Sweden that supports the use of technologies in training as it favors learning about the theme, which results in the reduction of complications during Nursing procedures, as well as it ensures patient safety<sup>28</sup>.

The use of audiovisual technology in the teaching-learning process is considered an effective strategy for Nursing undergraduate courses because it contributes to the process in which the students are protagonists in learning. However, a randomized study in Turkey that used a digital social network platform to publish the method for performing drug administration did not identify any significant difference between the use of Instagram and classroom teaching<sup>29</sup>.

It is then emphasized that technologies provide new learning environments in the Nursing area, so as to contribute to academic training and permanent education by offering interactive subsidies through audiovisual tools that favor learning. However, there are obstacles for their development, such as IT infrastructure and the need to train professors regarding their development and handling<sup>30</sup>.

### Study limitations

This study presents the limitation of having been developed in a public university and that the findings may not reflect the reality of other teaching scenarios.

### CONCLUSION

There was an improvement in knowledge after the educational intervention in which the median of correct answers in the theoretical test rose from 15 to 16 with a statistical significance ( $p=0.000$ ). It was verified that, of the 20 items, seven presented an increase in the number of correct answers, with statistical significance. Thus, the video proved to be effective to assist in Nursing education on PVP.

There should be more encouragement to the employment of educational videos in the practical subjects of the Nursing course to optimize students' learning. It is suggested to conduct future studies aiming to build digital and printed educational technologies on PVP, and that these resources are compared regarding their effectiveness in teaching the theme.

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