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Evaluation of Teaching Strategies on Peripheral Venipuncture Used with University Students

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Abstract

Objective: To evaluate two teaching strategies on peripheral venipuncture used with university students.

Methods: Quasi-experimental study conducted from October to November 2015 with 82 nursing students of a private university in Ceará. In order to check the previous knowledge of students, a pre-test was held and, after implementation of the educational strategy, a post-test on Peripheral Venipuncture was applied. A binomial test was used to analyze data and p values <0.05 were considered statistically significant.

Results: The students showed good acceptance of the strategies used. However, the use of hypermedia reached statistically significant differences (p<0.000) between the number of correct answers in the pre-test and the post-test when compared to the results of the positive control group.

Conclusion: The experimental group showed better performance in the post-test compared to the positive control group with the dialogic lecture.

Keywords: Nursing; Educational technology; Educational measurement; Catheterization; Peripheral

Introduction

The changes observed in university education pervade the ways of learning and teaching, so that teaching strategies adopted in undergraduate courses dispose of a wide 3 variety of possibilities that favor the process of teaching and learning [1,2].

Thus, it is noted that, in undergraduate and graduate environments, teaching must go hand in hand with computerization in order to allow extracurricular study and to prepare the student for the reality he will find in the practical field. There, knowledge and skills are needed to deal with situations similar to reality in order to facilitate the acquisition and development of abilities and clinical procedural skills and, consequently, learning [3].

There are several learning methods that can be used for teaching. These include simulation, modeling, lecture and virtual learning environments. Dialogic expository lectures have been the most widely used teaching tool in undergraduate courses and can be described as a display of concepts, with active participation of students, in which prior knowledge is extremely important, being considered as a starting point [4].

Other strategies used are technological tools or learning objects that employ teaching materials developed through the use of multimedia and interactivity with resources of Information and Communication Technology (ICT). Mediation of ICT in learning has led to the formation of educational environments supported by social-constructive theories, resulting in changes in the professional training process. In addition, the association between ICT and the flexibility of Distance Learning (DL) point out to an important space for the learning process [5].

One content covered in the curriculum of the nursing course is the intravenous therapy which involves performing the technique of Peripheral Venipuncture (PV) [6].

Peripheral venous catheters are primarily inserted by the nursing staff and it is estimated that a significant proportion of the working time of these professionals is directed to the care of peripheral vascular devices [7].

Given the above, it is the responsibility of health professors to provide different modalities of teaching so that the student

may know and choose different educational tools, as well as may identify the various ways to improve the teaching and learning process [6,7].

Based on these considerations, the present study aimed to evaluate teaching strategies on peripheral venipuncture with university students.

Methods

Quasi-experimental study conducted with the students of the seventh semester of the Bachelor Course of Nursing course of a private university in the state of Ceará, Brazil.

The course chosen was Adult Health, which has theoretical and practical modules and includes the subject of peripheral venipuncture.

The target population consisted of 82 students divided into two groups: positive control (41 students) and experimental (41 students). The invitation to participate in the study was made at the beginning of the semester during the presentation of the course and data were collected between October and November 2015. The same questionnaire for assessing the learning was applied (pre and post-test) both in the positive control group and in the intervention group, for comparison of the performance of students.

The criteria for inclusion in the positive control group were being regularly enrolled in the Adult Health course and having the availability to attend the dialogic expository lecture on PV. The criteria for inclusion intervention group were: being regularly enrolled in the Adult Health course, having some basic knowledge on informatics and accessing all classes on PV.

Disobedience to any inclusion criteria involved in the discontinuation of the participation. However, there were no losses due to withdrawal or mischaracterization of the criteria.

For verification of previous knowledge (pre-test) and of the knowledge acquired after application of the educational strategy (post-test), a structured questionnaire was built containing 26 questions, with true (T) and false (F) options, addressing the anatomy of the venous system, the material used for PV, and the procedure and complications of PV, and this questionnaire was validated by three experts.

The positive control group had access to the dialogic expository lecture, with a workload of four hours, presented by the researcher with aid of multimedia resources with slide show on Microsoft PowerPoint®. The lecture plan followed the same content of the hypermedia. The application of questionnaire for content assessment happened at the beginning of the class (pre-test) and 15 days after it (post-test).

The intervention group had access to hypermedia on PV in the computer lab of the university in which face to face meetings were held. In the first meeting was held the presentation of the teaching strategy, the implementation of the pre-test, then the setting of hypermedia in the virtual environment. After 15 days, the second meeting was held, and the post-test was applied. It is worth noting that the hypermedia on PV was previously validated by nursing and computer specialists, and it was proper for use [8].

The students had free access to hypermedia during the 15 days after the first face to face meeting. During this period, the student was able to connect to the learning platform from any computer with access to Internet in his own home or at the university.

Means and standard deviations of the numeric variables were calculated, and a binomial test was applied to verify the percentage of correct answers of items related to knowledge on PV in which the p-values that were greater than 0.05 indicate that there was a number of right answers among students, statistically not less than 85%, rejecting the null hypothesis.

Results

Female predominance in both groups was observed, as the frequency of women was 84.1% (69). With regard to age, there was also a similarity in the age range of participants as the majority had between 20 to 26 years of age, with a mean age 26.06 years and the median of 24.

Among the four questions on the anatomy of the venous network, it was observed that students performed better in the post-test in both groups after the class and the hypermedia. However, it is noteworthy that three items showed higher scores in the evaluation performed after the use of hypermedia. One is related to the first item of **Table 1** refers to the choice of the best vein to be used to perform the PV. This fact represents a success because the choice of the appropriate site is one of the first decisive steps to continue the procedure of peripheral venipuncture.

The second point concerns the choice of the vein for blood collection, and the adjustment level in both groups was 90.2% (p=0.882). With regard to the vein for medication in bolus and the best vein for the elderly and children, post-test of the hypermedia showed higher values, of 61% (p=0.000) and 56.1% (p≤0.000), when compared to the post-of the expository lecture, but there was no statistical significance in any of the groups **(Table 1)**.

Table 1 Comparison of learning before and after the application of the traditional teaching method and the educational hypermedia.

Variables	Expository Lecture		Hypermedia	
	Pre-test	Post-test	Pre-test	Post-test

	Right answers *		p†	Right answers *		p†	Right answers *		p†	Right answers *		p†
	f	%		f	%	%	f	%		f	%	
Venous network anatomy												
1. The most suitable vein to perform the PV is the basilic and cephalic vein (T).	15	36.6	<0.000	26	63.4	0	14	34.1	<0.000	35	85.4	0.592
2. Veins of the antecubital fossa are ideal for blood collection for laboratory tests (T).	34	82.9	0.419	37	90.2	0.882	30	73.2	0.882	37	90.2	0.882
3. The metacarpal are ideal for medication in bolus (F).	18	43.9	<0.000	20	48.8	<0.000	23	56.1	<0.000	25	61	0
4. In elderly and children, the digital and cephalic veins are the most recommended (T).	15	36.6	<0.000	19	43.6	<0.000	22	53.7	<0.000	23	56.1	<0.00 0
* Frequency and percentage of right answers among the total number of students evaluated before and after the intervention; † Binomial test												

In **Table 2** are the questions relating to the equipment required to perform the PV procedure.

Regarding the material, the dialogic expository lecture group obtained a mean score of 65.9% (p=0.001) in the pretest and the hypermedia group, 82.9% (p=0.419), and in the post-test both groups had the same number of right answers, which was 97.6% (p=0.998). The increase in the value of p between the pre and post-test suggests that more than 85% of students answered correctly, and this was statistically significant. As regards the use of gloves and personal protective equipment, this showed no statistical differences. However, when students were asked about the collective protection equipment, there was a small difference in the number of right answers in the post-test of the lecture group, with 97.6% (p=0.998), and of the hypermedia group, with 92.7% (p=0.956) **(Table 2)**.

Table 2 Comparison of learning before and after the application of the traditional teaching method and the educational hypermedia.

Variables	Expository Lecture						Hypermedia					
	Pre-test			Post-test			Pre-test			Post-test		
	Right answers *		p†	Right answers *		p†	Right answers *		p†	Right answers *		p†
	f	%		f	%	%	f	%		f	%	
Material used in the PV												
5. Material used in PV (T).	27	65.9	0.001	40	97.6	0.998	34	82.9	0.419	40	97.6	0.998
6. The use of gloves is dispensable for experienced professionals (F).	39	95.1	0.989	39	95.1	0.989	36	87.8	0.756	41	100	1
7. The PPE used in PV are lab coat, mask, goggles, gloves (T).	28	68.3	0.005	35	85.4	0.592	28	68.3	0.005	38	92.7	0.956
8. The CPE used in PV are the biosafety rules and devices (T).	37	90.2	0.882	40	97.6	0.998	31	75.6	0.077	38	92.7	0.956
* Frequency and percentage of right answers among the total number of students evaluated before and after the intervention; † Binomial test												

In the third group of questions, the technique of PV and actions during the procedure are discussed **(Table 3)**.

Table 3 Comparison of learning before and after the application of the traditional teaching method and the educational hypermedia.

Variables	Expository Lecture						Hypermedia					
	Pre-test			Post-test			Pre-test			Post-test		
	Right answers *		p†	Right answers *		p†	Right answers *		p†	Right answers *		p†
	f	%		f	%		f	%		f	%	
PV procedure												
9. It is considered a sterile procedure (F).	37	90.2	0.882	37	90.2	0.882	29	70.7	0.014	35	85.4	0.592
10. The puncture should be performed by inspection and palpation (T).	35	85.4	0.592	35	85.4	0.592	31	75.6	0.077	37	90.2	0.882
11. Punctures must begin proximally and then distally (F).	18	43.9	<0.000	22	57.3	<0.000	14	34.1	<0.000	22	53.7	<0.000
12. After fixing the device, the identification is made (T).	37	90.2	0.882	41	100	1	35	85.4	0.592	41	100	1
13. The tourniquet is dispensable item in the procedure (F).	31	75.6	0.077	32	78	0.151	25	61	0	31	75.6	0.077
14. The distance between the insertion site and the tourniquet is 10 to 15 cm (T).	32	78	0.151	38	92.7	0.956	28	68.3	0.005	36	87.8	0.756
15. The tourniquet should be used with caution in the elderly (T).	39	95.1	0.989	40	97.6	0.998	34	82.9	0.419	41	100	1
16. The needled catheter is ideal for medication in bolus (T).	26	63.4	0	38	92.7	0.956	29	70.7	0.014	36	87.8	0.756
17. The needled catheter is ideal for tortuous veins (F).	30	73.2	0.882	31	75.6	0.077	18	43.9	<0.000	30	73.2	0.882
18. The flexible catheter is used within 72 hours (T).	34	82.9	0.419	39	95.1	0.989	34	82.9	0.419	41	100	1
19. The flexible catheter is classified with uneven numbers (F).	25	61	0	26	63.4	0	18	43.9	<0.000	29	70.7	0.014
20. PS 0.9% is recommended when doing the procedure instead of distilled water (T).	28	68.3	0.005	31	75.6	0.077	21	51.2	<0.000	23	56.1	<0.000
21. Puncture on limb with fistula is avoided (T).	35	84.2	0.592	38	92.7	0.956	31	75.6	0.077	38	92.7	0.956
22. Gauze is used to aid the PV with flexible catheter (T).	20	48.8	<0.000	31	75.6	0.077	23	56.1	<0.000	34	82.9	0.419
23. "Ballerina vein" is a myth and there is no evidence in the literature (F).	21	51.2	<0.000	30	73.2	0.882	28	68.3	0.005	38	92.7	0.956

*Frequency and percentage of right answers among the total number of students evaluated before and after the intervention; †Binomial test

It is observed in **Table 3** that, when investigating whether the puncture should be performed by inspection and palpation, the expository lecture group showed no difference between the pre and post-test, with 85.4% (p=0.592). In the same item, the intervention group showed an increase in the result, in which the frequency of correct answers went from

more than 75.6% to 90.2%, before and after the intervention, respectively. The use of needled catheter in tortuous veins was at the theme that got minimal increase in the lecture group, from 73.2% to 75.6%, while in the intervention group, an increase of 29.3% was observed.

The fourth and last group of questions is related to complications of PV and this has three questions **(Table 4)**.

Table 4 Comparison of learning before and after the application of the traditional teaching method and the educational hypermedia.

Variáveis	Expository Lecture						Hypermedia					
	Pre-test			Post-test			Pre-test			Pre-test		
	Right answers *		p†	Right answers *		p†	Right answers *		p†	Right answers *		p†
	f	%		f	%	%	f	%		f	%	
Complications related to the PV												
24. After identifying venous return, the tourniquet is removed (V)	21	51.2	<0.000	31	92.7	0.956	36	87.8	0.756	41	100	1
25. Complications of PV may be local and systemic (V)	36	87.8	0.756	38	75.6	0.077	31	75.6	0.077	40	97.6	0.998
26. Complications are related to chemical and physical factors (V)	32	78	0.151	37	90.2	0.882	32	78	0.151	41	100	1

* Frequency and percentage of right answers among the total number of students evaluated before and after the intervention; † Binomial test

Regarding the removal of the tourniquet after identifying venous return, the number of correct answers in the post-test was 87.8% (p=0.756) for the lecture group, and 100% (p=1) for the hypermedia group. As regards local and systemic complications and related factors, the post-test showed 75.6% (p=0.077) and 90.2% (p=0.882) right answers for the lecture group, respectively. In turn, the post-test for the hypermedia group showed 97.6 (p=0.998) and 100% (p=1) right answers, respectively **(Table 4)**.

It was observed that in the ninth and tenth items, in the pretest of the positive control group, students remained with the same number of right answers after the dialogic lecture. In other items, a good use of the content delivered was observed, with notable improvement in the results of the post-test, and the number of right answers was high for both, the lecture and the hypermedia group.

Discussion

In this study, it was possible to analyze the benefit of using ICT as hypermedia during theoretical teaching on PV and it was also possible to compare the performance of students with both, the hypermedia and the lecture. The analyses of means of scores after the application of the two teaching methods showed that students had increased their knowledge with the two methods used. However, it is worth noting that the use of hypermedia for teaching PV achieved statistically significant different values between the pre and the posttest when compared to the results of the positive control group.

The incorporation of ICT in education of health professionals has been increasingly advocated due to the benefits such as acquisition of qualified content, lifelong learning support, access flexibility, enrichment and personalization of the experience of the student and improved communication and support networks [7,8].

Dialogic lectures, besides promoting the exchange of information between educators and students, represent the first step to facilitate the assimilation of knowledge and to convey the reality of the student towards meaningful content [9-11].

Students generally demonstrate higher learning outcomes with educational technologies when it comes to comprehension of the content, understanding of learning goals and relevance of information [12].

It is worth noting that there has been a considerable increase after the presentation of the lecture in which only three items related to the handling of needled, flexible catheter had no significant increase of right answers. This showed the same number of right answers in the pretest.

Corroborating these findings, a study conducted in the United States with 136 students from various courses in the health area of pharmacotherapy making a comparison of teaching through classroom lessons with interactive cases and an online course. The results showed that after each proposal, the group using the online mode obtained better performance in an evaluation containing 20 items in the theme of pharmacotherapy [10].

Another study using a video simulating a puncture and central venous access heparinization showed that this is a strategy that increased both the technical and the cognitive

knowledge of students by means of an experimental study. This strategy is feasible in the teaching-learning process and is useful as a support tool for teachers and for the development of undergraduate nursing students [13,14].

However, a quasi-experimental study using expository lecture and hypermedia on Sexually Transmitted Diseases (STDs), the results showed a good acceptance by nursing students with positive evaluation in all variables studied, showing that this is a facilitator for learning. There was evidence of learning of the content with statistical difference in the mean of right answers between the pre and the post-test [15].

Combining these data with the findings of the present study, it was observed that in the group of students who used the hypermedia, few items showed no increase in knowledge on PV, which was expected in the post-test. Thus, it can be inferred that the environment is useful to promote learning.

Thus, it is emphasized that the results on learning presented here corroborate those of other studies using digital media in higher education. A research that aimed to compare the gain of knowledge about bladder catheterization technique before and after the application of an educational software revealed increased knowledge of the participants after using digital tools, and thus these are considered useful in the teaching-learning process with undergraduate nursing students [13,15].

In order to obtain good results in the use of learning with students, the motivation to learn must be taken into account. This motivation involves interest to face challenges, the desire to gain knowledge, being something that mobilizes students to work through the relations of exchange between the teacher and other students. Thus, the motivation is related to personal interests, to the learning environment and to the student-teacher interaction.

Thus, it is clear that the use of the two methods by the nursing students in the study favored the learning because there was an increase in the number of correct answers in the post-test, what was possible by the teaching intervention with the help of expository dialogic lectures and educational hypermedia. Consequently, this will reflect on the critical-reflexive argument in various situations in the academic and professional field.

Conclusion

Teaching strategies such as dialogic lectures and educational hypermedia are useful tools for teaching. However, the findings of the present study showed that the experimental group had a better performance in the post-test compared to the positive control group with dialogic lecture. Differences were minimal in some items, but it was revealed that students showed ease and interacted with the virtual learning environment as an important supporting tool in the classroom.

This study has the limitation that it was applied only in a private university of Ceará, which makes it pertinent to carry out further studies in the context of other realities, so that the findings of the present study can be contrasted to others. It is noteworthy that important issues remain unresolved, especially regarding the training of teachers for the development of digital competence and improvement of the access to educational technologies of nursing courses in public and private universities.

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