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Effect of a video on developing skills in undergraduate nursing students for the management of totally implantable central venous access ports ☆

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SUMMARY

Background: Handling Totally Implantable Access Ports (TIAP) is a nursing procedure that requires skill and knowledge to avoid adverse events. No studies addressing this procedure with undergraduate students were identified prior to this study. Communication technologies, such as videos, have been increasingly adopted in the teaching of nursing and have contributed to the acquisition of competencies for clinical performance.
Objective: To evaluate the effect of a video on the puncture and heparinization of TIAP in the development of cognitive and technical competencies of undergraduate nursing students.
Method: Quasi-experimental study with a pretest–posttest design.
Results: 24 individuals participated in the study. Anxiety scores were kept at levels 1 and 2 in the pretest and posttest. In relation to cognitive knowledge concerning the procedure, the proportion of correct answers in the pretest was 0.14 (SD = 0.12) and 0.90 in the posttest (SD = 0.05). After watching the video, the average score obtained by the participants in the mock session was 27.20.
Conclusion: The use of an educational video with a simulation of puncture and heparinization of TIAP proved to be a strategy that increased both cognitive and technical knowledge. This strategy is viable in the teaching–learning process and is useful as a support tool for professors and for the development of undergraduate nursing students.

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Introduction

Nursing practice requires diverse competencies from nurses, among which is clinical competence (Werinch et al., 2010) involving skills and abilities that may be acquired through learning.

The learning environment may benefit if, in addition to establishing a relationship with students, their deficiencies and needs are identified and teaching strategies that engage students and enable them to experience situations similar to those they will face in a real clinical situation are devised (Beckman and Lee, 2009).

Communication technologies can be applied in the process of teaching since they allow the interactive construction of knowledge and enable a broader view of a subject for those involved in the educational process, as well as alternatives to control one's own learning. The adoption of these strategies in teaching nursing has increased, given that educational scenarios are not always capable of motivating students, of arousing their curiosity or eliciting from them a more active participation in this process (Haidar, 2009). Given that the acquisition of clinical competencies in a given situation is a gradual process, the use of technologies in teaching nursing has contributed to the development of these skills (Williams et al., 2009). From this perspective, a video-recorded simulation is a teaching technology that allows one to represent reality under controlled conditions, both of the environment and the individuals involved, which in turn favors learning (López and Carvalho, 2006).

This study evaluates the use of a video capable of developing the skills in undergraduates necessary to perform a given procedure. The development of an educational video was chosen because it is a strategy that approximates the daily routine of health care in the classroom, facilitates learning and introduces new issues in the educational process. Even though this is a strategy that facilitates learning, no studies evaluating

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its contribution in the TIAP teaching process were found up to the point this study was conducted.

In Brazil, the puncture and heparinization of Totally Implantable Access Ports (TIAP) is usually taught to advanced undergraduate nursing students, especially those who provide care to cancer patients. It is believed that students entering the third year of the undergraduate program already own maturity and ability to develop the procedure under study, in the face of this aspect, we decided to include them as subjects in this study. Given the relevance of this procedure and the objective to complement learning concerning this subject to a greater number of students, this study was directed to third year students and was characterized as an extracurricular activity.

The puncture and heparinization of TIAP is performed by nurses all over the world. No studies were found to date addressing a teaching strategy of this procedure for undergraduate nursing students. Thus, the identification of strategies that facilitate teaching this procedure in educational institutions is needed to enhance acquisition of both theoretical and practical knowledge since such a procedure requires specific attention from professionals to ensure appropriate catheter management, avoid complications and consequently favor a longer duration in situ.

Literature Review

The acquisition of clinical competencies requires students to have the opportunity to practice procedures several times, enabling them to apply their theoretical knowledge in order to provide safe and competent nursing care in the health care environment. For that, teaching strategies that go beyond the traditional teaching methods are needed (Baxter et al., 2009).

One of the strategies that can facilitate this process is the use of a video in which a given procedure is simulated on a dummy. The video is presented to undergraduates and they can access and watch it as many times as they deem necessary. The students then have the opportunity to practice the procedure on a dummy in a clinical practice laboratory. This is an audiovisual strategy with a higher impact on learning as compared to written language because it presents a series of images, graphic movements, texts and sounds that allow students to better understand the subject presented (Fleming et al., 2009). A literature review, intended to evaluate the use of audio visual resources in the teaching field, indicated some beneficial elements in their application, such as: being a practical method; having a low cost of investment in the acquisition of equipment; having a low cost in video production — tape versus the large population reached; ensured high standards in information understanding; scenes can be replayed; the possibility of being used by an individual or a group; stronger individual impact in program acceptance due to its visual presentation, as opposed to traditional methods such as reading or reading-based methods, as a means to educate individuals (Gagliano, 1988).

The development of an educational video should follow three steps: pre-production, production and post-production. The script is developed in the pre-production phase considering the target population and filming strategies should also be defined at this point. In the next phase, scenes are video recorded according to the script and a professional from the field of production should provide appropriate light and indicate the best angle for positioning cameras and microphones. In the post-production phase, the video is edited and animation and audio is included (Fleming et al., 2009).

The content of the educational video consisted of the management of TIAP, a central venous catheter of long duration designed to ensure safe long-term vascular access to the central venous system to infuse medication and chemotherapy, blood products, parenteral nutrition, and also to facilitate the collection of blood samples for laboratory exams, avoiding multiple peripheral punctures (Rihn, 2001; Mayo, 2001). The presence of the catheter also improves the patients' quality of life, supports better adherence to prolonged treatments, especially in pediatric patients, and reduces stress associated with risks related to chemotherapy infusion performed through the peripheral venous system (Gonçalves et al., 2005; Martins and Carvalho, 2008).

This study seeks alternatives to contribute to the acquisition of knowledge, skills and attitudes required by such a procedure and also evaluates a recorded mock session as a potential teaching strategy.

Objectives

To evaluate the effect of a video addressing the puncture and heparinization of TIAP on the development of cognitive and technical competencies of undergraduate nursing students.

Method

This is a quasi-experimental study with a pretest–posttest design, that is, each subject was his/her own control in each of the studied variables and the sample was characterized as a convenience sample (Polit and Beck, 2011). The study was carried out between January 2009 and January 2010.

Sampling

The study's population comprised students regularly enrolled in the third year of the undergraduate nursing program of a Brazilian public university. Students who did not comply with any of the study's phases, who wished to withdraw from the study or presented performance $\geq$70% in the pretest were excluded from the study. This measure was considered necessary to ensure that students had no previous knowledge concerning the video content, which could influence the results. These students were informed that they were excluded from the study but were allowed to participate in the remaining phases if they wished.

Sample

Forty students (30%) of those who were invited consented to participate in the study. Individual meetings were scheduled at the participants' convenience: eight did not answer the scheduling requests and six scheduled a date but did not attend the meeting. Hence, 26 individuals composed the study's convenience sample. One of the students was excluded for attaining a performance above 70% in the pretest and another asked to withdraw after having taken the pretest and watched the video.

Study Setting

The study was carried out in a laboratory with closed-circuit footage, an area for observation (antechamber with unidirectional viewfinder) and an area for testing and written evaluations (office). The technical procedures were video recorded and after analysis of the tapes, a copy with the respective evaluation was made available to each student.

Study Procedures

The participants were individually received in the laboratory, given clarification about the study and signed free and informed consent forms. After consenting to participate, they filled out self-reporting instruments concerning anxiety and cognitive knowledge of the subject and then watched the video three times before simulating the procedure themselves. Each student was allowed 15 min to perform the procedure on a dummy containing an implanted catheter. A kit containing two pairs of sterile gloves, a packet of sterile gauze, a surgical mask, two 10 ml containers with saline solution at 0.9%, a container with sodium heparin at a concentration of 100 U/ml, two 30×8 needles, two 10 ml

syringes, one 20 ml syringe, a Huber type needle, 30 cm of fenestrated field, adhesive tape and chlorhexidine at 0.5% was provided. This step was video recorded.

Afterwards, the cognitive and anxiety evaluation instruments were applied again in addition to an instrument evaluating their learning experience. Two previously trained researchers collected data. A pilot test was carried out with seven individuals and obtained an inter-raters reliability of 100%.

Variable Intervention: Instructional Video

We developed a video with a duration of 13 min and 47 s containing the following topics: purpose of the TIAP; brief historical account; procedure to implant the catheter; catheter characteristics; use-related complications; advantages and disadvantages; and video-recorded mock session of the puncture and heparinization procedure. The following phases were followed to produce the video: script development based on pertinent literature and respective expert content validation, which considered the consistency of the content, inclusion of topics related to the subject, and verbal language (López and Carvalho, 2006).

Afterwards, the video was developed: a professional from the advertising field performed the video recording, voice recording and final production. The video was recorded in mini DV tapes (digital) and edited using Avid Liquid Pro version 7; the video was validated by five experts, who considered the audiovisual technique, environment, character and procedure simulation. There was an agreement on the relevance of the video for the pertinence criteria (100%); the suggested change by an expert (voice alteration of the locator in a sentence) was accepted and the pilot test showed the relevance and effectiveness of the final product.

Response Variables

Performance of Students Concerning Cognitive Knowledge of the TIAP Procedure

Performance of students concerning cognitive knowledge of the TIAP procedure was evaluated through an instrument with 17 statements concerning the TIAP procedure, scored from 0 to 17.

Practical Performance of Students

The technical performance of each student was analyzed according to a list of 35 steps of the catheter puncture and heparinization procedure, including the preparation of environment and material, antisepsis, puncture and heparinization and recording (score: 0 to 35).

Level of Anxiety

Level of anxiety was obtained through the Zung (1971) self-rating anxiety scale before and after the procedure. It is a four-item Likert scale containing 20 questions characterizing the level of anxiety presented by an individual in a given period of time. The possible score for each item varies from 1 to 4. The minimum possible total score is 20 and the maximum is 80 (cut off point = 50). The higher the score the stronger the symptoms associated with anxiety. The possible weighted levels of anxiety are: I — no anxiety (0 to 0.25); II — mild anxiety (0.25 to 0.50); III — moderate anxiety (0.50 to 0.75); and IV — severe anxiety (0.75 to 1). Therefore, scores were standardized between 0 and 1 for data analysis.

Evaluation of the Learning Experience

Students evaluated their learning experience using a scale measuring the level of acceptance of a given experience that was adapted to the situation.

The knowledge and cognitive instruments and the list of items used to analyze the steps of the catheter puncture and heparinization procedure were face and content validated by five experts working in the oncology field. All the amendments suggested were followed.

Ethical Aspects

The project was submitted to the Research Ethics Committee at the university where the study was developed (protocol no. 0774/2007), accompanied by free and informed consent forms that were later provided to the participants. Free and informed consent forms are intended for subjects to manifest their voluntary consent to participate after receiving proper clarification about the study.

Data Analysis Procedures

The data obtained were entered into an Excel spreadsheet, version 2007, and double entry was used to validate data. Afterwards, the database was structured and analyzed using the Statistical Package for Social Sciences (SPSS), version 17.0 for Windows. The demographic variables *gender* and *age*, the performance of students in the video recorded simulation and evaluation of learning experience were analyzed through the use of descriptive statistics. The normality of the sample average distribution for answers in the pretest and posttest concerning the cognitive and anxiety variables was evaluated by the Kolmogorov–Smirnov test. Afterwards, the paired Student's t test was used to compare the pretest and posttest averages in the variable anxiety. Each sentence concerning the cognitive variable was analyzed by the McNemar test seeking statistical significance of differences before and after the video was presented; the paired Student's t test was used to compare the differences of proportions before and after the intervention. The level of significance was set at $\alpha = 0.05$.

Results

The study included 24 female students with an average age of 22 years. The results obtained in the self-rating anxiety scale in the pretest showed that the level of the students' anxiety was low, with standardized (0–1) scores varying from 0.016 to 0.41, which placed them in levels 1 and 2 of anxiety, that is, below the established cut off point. The standardized scores in the posttest varied from 0 to 0.43; placing them in levels 1 and 2 of anxiety. The results of the paired Student's t test indicated there were no statistically significant differences ($t = 0.671$, $p = 0.509$) between the pretest and posttest for this variable (Table 1).

In relation to the evaluation of cognitive knowledge concerning TIAP puncture and heparinization in the pretest, the results indicated that the participants presented little knowledge of the subject, correctly answering only 14.2% of questions, while the percentage of correct answers in the posttest was 90.7%. The normal distribution of the sample results was confirmed by the Kolmogorov–Smirnov test, which obtained $p = 0.556$ in the pretest and 0.082 in the posttest. The result of the paired Student's t test was $t = -25.631$ and $p < .000$ (Table 1). The proportion of correct answers in the pretest was 0.14 (SD = 0.12) and in the posttest 0.90 (SD = 0.05). The difference of averages was −0.76 ($p < .000$, 95% CI 0.82 to −0.70).

The global average score obtained by students in the procedure simulation, considering the 35 required steps after the video was presented, was 27.20. The steps that presented performance levels lower than 75% were: steps 4 (explained the procedure to the patient), 5

Table 1
Distribution of scores of anxiety and cognitive knowledge before and after watching the educational video.

Variables	Pretest	Posttest	t	p
Self-rating anxiety scale				
Minimum value	0.016	0	0.671	0.509
Maximum value	0.41	0.43		
Cognitive knowledge				
Percentage of correct answers (%)	14.2	90.7	−25.631	<.000

(inspected and palpated the site), 7 (opened the sterilized material in the field), 17 (put the fenestrated field surgery drape on), 18 (located the reservoir with the non-dominant hand and immobilized it), 31 (asked the patient to inflate his/her chest with air and took the needle off while holding the reservoir), 33 (discarded the used material in appropriate container) and 35 (documented the procedure). Steps 1 (gathered the necessary material), 19 (inserted the needle at a 90 degree angle), 26 (clamped the extension) and 27 (decoupled the syringe from the catheter) were 100% correct.

In relation to the evaluation of the learning experience, 23 (95.8%) judged it a very useful strategy, 24 (100%) participants would recommend the simulation preceded by the video and 87% would like to have another course with the same strategy.

Discussion

In relation to socio-demographic data, all participants were female, aged 22 years old on average. The four male students among those invited to participate in the study were not interested in participating. Nursing has been a predominantly female profession worldwide. A longitudinal study evaluating the role of gender in nursing revealed that 318 (91%) individuals were women and that the 296 (84%) were between 18 and 22 years of age (McLaughlin et al., 2010), which corroborates the data found in this study.

Through concrete and sophisticated language, the video allows the simulation of clinical situations that undergraduate students have yet to experience. Thus, the use of a video in this study proved to be a suitable teaching strategy in the case of TIAP puncture and heparinization, since it evidenced increased cognitive knowledge when the results obtained in the pretest and posttest were compared, as well as displaying statistically significant differences ($p<.000$, 95% CI 0.82 to −0.70). The video teaching strategy was also successfully employed in two other studies. A randomized clinical trial was carried out with medical students, physicians and nurses ($n=36$) to evaluate the efficiency of an instructional video to teach the insertion of intra-osseous needles in children. When the results were compared between the intervention group, which attended lectures associated with a video, and the control group, which attended lectures only, the use of a video in improving skills concerning intra-osseous puncture was more efficient with statistically significant results ($p<0.01$, 95% CI 2.74 to −0.37) (Lee et al., 2007). Another study (Williams et al., 2009) that evaluated the impact of simulation using a video in teaching second year undergraduate nursing students ($n=191$) developed and evaluated 11 videos. Most of the students had a positive perception of the video ($m=4.93$, $SD=1.02$, CI 4.25 to 2.54), identified its relevance in clinical practice ($m=5.32$, $SD=0.62$, CI 4.36 to 4.55), indicated that information was presented with quality ($m=5.62$, $SD=1.02$, CI 5.47 to 5.76), and concluded that this strategy encourages learning and has repercussions on clinical practice.

In relation to anxiety related to the use of a video as a teaching strategy, the literature (Lee et al., 2007) did not identify increased levels of anxiety with the use of a video when compared to the traditional method. This study's results, both in the pretest and posttest, indicated that the use of the video strategy did not increase the students' levels of anxiety. The students either presented no anxiety or low levels of anxiety before and after the intervention. Differences were not statistically significant ($p=0.509$). The result was satisfactory because students initiated the intervention with no anxiety or low levels of anxiety and remained in these conditions up to the end of the intervention. Anxiety is caused by situations or even reactions that are unpleasant to individuals. High levels of anxiety and preoccupation can cause clinical suffering and may harm social, occupational and psychological functioning, among other important spheres in an individual's life (Oliveira and Sisto, 2004).

In relation to the competencies necessary to perform the puncture and heparinization of TIAP, only two steps of the technique were not performed by students: step 4 — explained the procedure to the patient and step 31 — decoupled the needle while holding the reservoir. The remaining steps were performed, though the need to review asepsis principles was observed. Therefore, students need to have opportunities to develop and practice clinical competencies safely in a controlled environment in order to ensure safety for patients (Woolley and Jarvis, 2007; Williams et al., 2009).

A study designed to facilitate the acquisition of communication skills during nursing care through the use of a video recorded simulation showed that the use of a video favors nursing care because it allows visual representation of any situation in an organized and controlled manner, an aspect that is hardly achieved in a real situation. This same study also indicates that there are few studies using video recorded simulations in the nursing field and also stresses the influence observers can have on the control of variables to be addressed (López and Carvalho, 2006).

Data obtained in the evaluation of the learning experience revealed that the strategy was well accepted by the individuals ($n=23$, 95.8%) and that all participants considered the experience to be beneficial to their future professional practice. These data corroborate results found in the literature (Lee et al., 2007).

Another relevant aspect identified in the literature in relation to the video teaching strategy was in relation to its cost–benefit ratio (Williams et al., 2009); students can watch the video as many times as necessary and whenever necessary.

A limitation identified in this study is related to the fact that students are from a single institution and only a small number consented to participate in the study, which restricts generalizations. It is, however, worth clarifying that only students enrolled in the beginning of hospital practical activities were selected, so as to ensure they had not previously learned the subject in their academic activities. This fact might have interfered in their interest to learn the procedure in addition to the schedule, which did not coincide with their academic activities and therefore required them to stay longer in the unit.

Conclusions

An educational video allows bringing undergraduate students into proximity with routine clinical situations that they have not yet experienced. It allows teaching procedures not included in the curriculum and certainly alleviates anxiety students might feel when facing such procedures in future supervised training situations and/or professional practice, contributing to the correct performance of their technique and consequently favoring the delivery of quality nursing care.

The educational video with a simulation of TIAP puncture and heparinization proved to be a strategy that improved both cognitive and technical knowledge related to the procedure. It was well accepted by the study participants because it is an attractive didactic tool, which did not trigger anxiety among them. This is a strategy essential for technological development in nursing and is suitable for the teaching–learning process of procedures that require technical competencies in health.

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