

Virtual Learning Object for the Simulated Evaluation of Acute Pain in Nursing Students¹

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This study aimed to evaluate the results of the application of a virtual learning object for the simulated evaluation of acute pain in the learning of undergraduate nursing students and to verify the opinions of the students regarding the quality of the technology. This was a quasi-experimental, non-randomized, before and after study performed with 14 students in the seventh phase of the undergraduate nursing course of the Federal University of Santa Catarina. The pre (8.84) and post-test (9.31) means revealed significant differences in learning after the intervention ($p=0.03$). In the qualitative evaluation the flexibility of access, access independent of time/place, freedom to decide the best learning route and the similarity with reality were highlighted. It constitutes a promising educational tool, an interactive experience, similar to reality, dynamic and constructive learning. The application of the technology has brought positive results for learning about pain evaluation, contributing to fill the gap in the teaching of the thematic.

Descriptors: Nursing; Pain; Nursing Informatics; Educational Technology; Education, Nursing.

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Aplicação de objeto virtual de aprendizagem, para avaliação simulada de dor aguda, em estudantes de enfermagem

O objetivo do estudo foi avaliar os resultados da aplicação de um objeto virtual de aprendizagem para avaliação simulada da dor aguda na aprendizagem de estudantes de graduação em enfermagem e verificar sua opinião sobre a qualidade da tecnologia. Trata-se de estudo quase experimental, não randomizado, do tipo antes e depois, realizado com 14 estudantes da sétima fase da graduação em enfermagem da Universidade Federal de Santa Catarina. As médias de pré (8,84) e pós-teste (9,31) revelaram diferença significativa na aprendizagem, após intervenção ($p=0,03$). Na avaliação qualitativa, destacaram-se a flexibilidade de acesso, o acesso independente de tempo/lugar, liberdade para decidir o melhor percurso de aprendizagem e a semelhança com a realidade. Constitui promissora ferramenta educacional, uma experiência interativa, semelhante à realidade, dinâmica e construtiva de aprendizagem. A aplicação da tecnologia trouxe resultados positivos para a aprendizagem da avaliação da dor, contribuindo para o preenchimento da lacuna no ensino da temática.

Descritores: Enfermagem; Dor; Informática em Enfermagem; Tecnologia Educacional; Educação em Enfermagem.

Objeto virtual de aprendizaje para evaluación simulada de dolor agudo por estudiantes de enfermería

El objetivo del estudio fue evaluar los resultados de la aplicación de un objeto virtual de aprendizaje para evaluación simulada de dolor agudo en el aprendizaje de estudiantes de graduación en enfermería y verificar su opinión sobre la calidad de la tecnología. Se trata de un estudio casi experimental, no aleatorio, del tipo antes y después, realizado con 14 estudiantes de la séptima fase de la graduación en enfermería de la Universidad Federal de Santa Catarina. Los promedios de la prueba, antes (8,84) y después (9,31), revelaron diferencia significativa en el aprendizaje después de la intervención ($p=0.03$). En la evaluación cualitativa se destacaron la flexibilidad de acceso, el acceso independiente de tiempo/lugar, libertad para decidir el mejor curso de aprendizaje y la semejanza con la realidad. Constituye una promissora herramienta educacional, una experiencia interactiva, semejante a la realidad, dinámica y constructiva de aprendizaje. La aplicación de la tecnología presentó resultados positivos para el aprendizaje de la evaluación del dolor, contribuyendo para llenar un vacío en la enseñanza de la temática.

Descriptorios: Enfermería; Dolor; Informática Aplicada a la Enfermería; Tecnología Educativa; Educación en Enfermería.

Introduction

Pain is a universal experience, uniquely experienced by the individual, considered a public health problem. In Brazil, as in other countries, the prevalence of pain affects 45% to 80% of patients during the period of hospitalization⁽¹⁻²⁾. This situation may be related to inadequate training of health professionals in the area of pain, evidenced by the absence of the theme in the pedagogic projects of undergraduate courses, which

contributes significantly to the difficulties encountered in the professional practice⁽³⁾. Considering that the teaching-learning process is based on the practice of nursing care and that nurses play an important role in pain management, it is understood that they need to know how to evaluate it adequately in order to provide the necessary care to patients.

Studies conducted in developed countries, where basic and specialized education regarding pain is advanced, also highlight weaknesses in the learning of issues related to the evaluation and management of pain, with this situation in developing countries possibly being even more pronounced⁽⁴⁻⁵⁾. Concerned with this situation, major organizations such as the International Association for the Study of Pain and the Brazilian Association for the Study of Pain have stimulated the development of new educational strategies in the area of pain, due to the relevance of the theme from the perspective of care. Faced with the need for changes in the current teaching-learning process, it is observed that communication and information technologies impel even more changes in the most diverse areas of knowledge, causing significant impact in the teaching-learning process, and also representing new opportunities and challenges for educators and students⁽⁶⁾. In this context, virtual learning objects (VLO) are highlighted, characterized by flexible learning environments compatible with active learning methodologies, which valorize the autonomy of the students⁽⁷⁾.

From the conceptual point of view a VLO can be defined as a small unit that comprises a determined educational context. It represents an active and constructive teaching-learning strategy which constitutes the center of a new paradigm of instructional design for web-based learning, due to its support for various file types and also due to its characteristic of reuse⁽⁸⁻⁹⁾. Thus, the creation and evaluation of the simulated virtual learning object for the evaluation of acute pain in adults (OVADOR) was developed by the authors from the fundamentals of Problem Based Learning (PBL)⁽¹⁰⁻¹²⁾, one of the most promising methodologies in the area of health education, and also from Evidence Based Learning (EBL). In this context, the application of the educational intervention mediated by the OVADOR seeks to offer undergraduate nursing students an innovative experience, based on an active teaching-learning strategy and also conforms to the ethical issues involved, since, through the simulation, learning that occurs during the real experience of the pain of the patients is avoided.

The study aimed to evaluate the results of the

application of a virtual learning object for the simulated evaluation of acute pain in the learning of undergraduate nursing students and to verify the opinions of the students regarding the quality of the technology.

Materials and Method

This was a quasi-experimental, non-randomized, before and after study, approved by the Research Ethics Committee of the UFSC (No. 171/2008), and conducted from September to October 2009. The intentional non-probabilistic sample of subjects was composed of 14 students from the seventh phase of the undergraduate program in nursing of the Federal University of Santa Catarina (UFSC). The study included the students who signed the Terms of Free Prior Informed Consent (TFPIC), with the availability to participate in study during extra-curricular time, who accessed the proposed content and completed the questionnaires for data collection.

The educational intervention consisted of the following steps: 1 - Recognition of the OVADOR and signature of the TFPIC (in-person meeting), 2 - Access to the video and welcome, syllabus, expectations questionnaire, glossary and completion of the pre-test questionnaire, 3 - Access to the theoretical content for the deepening of knowledge (slides, texts, crosswords, articles for download in PDF, links to websites), 4 - Use of the OVADOR simulated environment and 5 - Completion of post-test questionnaire and qualitative evaluation of the technology. Steps 2 to 5 were carried out entirely online through the Moodle® Virtual Learning Environment.

Regarding the simulated environment (OVADOR), students were presented with two cases of virtual adult patients, one in a medical surgical ward and the other in an intensive care unit. The following tools for the evaluation of pain were available (Figure 1): 1 - Consult the Medical Records; 2 - Evaluate the Patient; 3 - Determine Diagnosis; and 4 - Prescribe Intervention. The tool "To Evaluate the Patient" had the options: 1 - To Talk to the Patient; 2 - To Apply a Pain Scale (Numeric Visual and Critical-Care Pain Observation Tool); 3 - To Evaluate Behavioral Aspects; and 4 - To Evaluate Physiological Aspects.

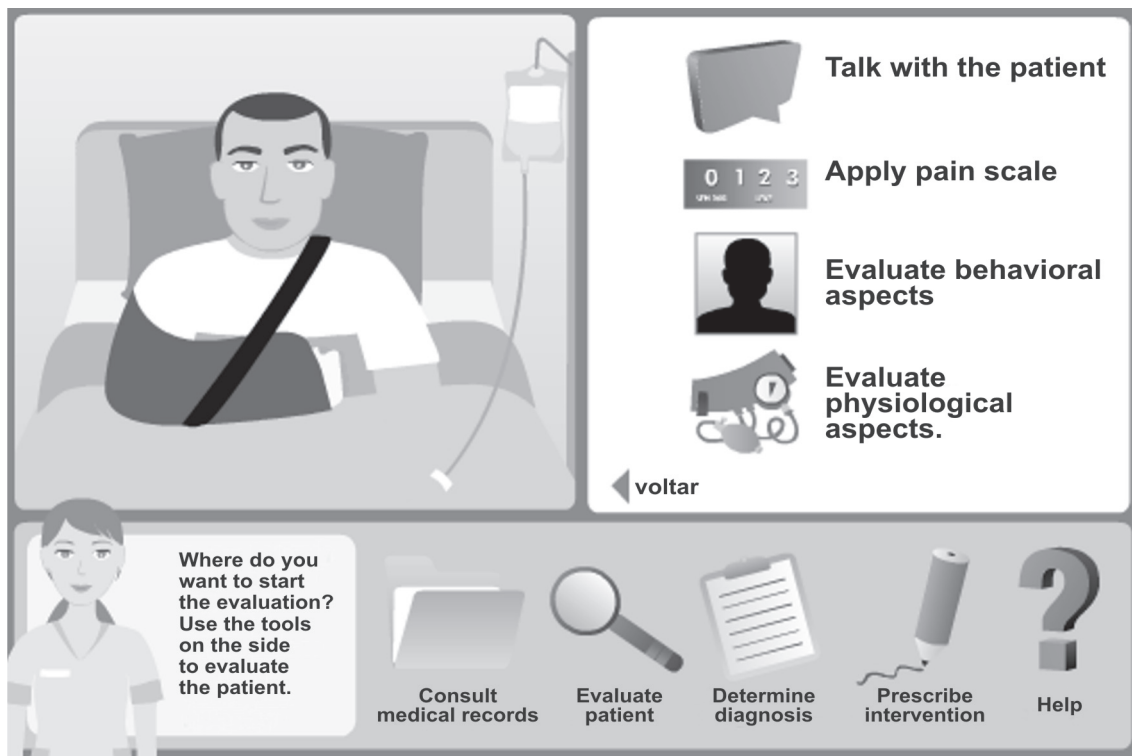


Figure 1 - Tools for the evaluation of virtual patients in the OVADOR. Florianópolis, Brazil, 2009.

Data collection was performed using four instruments: 1 - Socio-demographic data questionnaire, 2 - Questionnaire (pre and post-test) on the evaluation of acute pain (Figure 2), 3 - Qualitative evaluation of

technology questionnaire and 4 - Report of accesses of the students to the OVADOR (database that registers information regarding the navigation of the users in the environment).

1. Explain in your own words why pain is considered the 5th vital sign:
2. Regarding its duration, pain can be classified as:

<input type="checkbox"/> Acute or neuropathic	<input type="checkbox"/> Acute or chronic
<input type="checkbox"/> Chronic or neuropathic	<input type="checkbox"/> Neuropathic or visceral
3. Nociceptive pain results from stimulation of nerve endings by nociceptive (allogenic) substances, such as the substances resulting from the inflammatory process

<input type="checkbox"/> True	<input type="checkbox"/> False
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4. Acute persistent pain can lead to diverse alterations in the human organism. Indicate the answer that does not belong to the group of alterations resulting from acute pain:

<input type="checkbox"/> Tachypnea
<input type="checkbox"/> Tachycardia
<input type="checkbox"/> Decreased intestinal motility
<input type="checkbox"/> Calm facial expression
<input type="checkbox"/> Intense perspiration
5. When evaluating a patient with a wound in his left leg with a numeric visual scale, an intensity = 6 was identified. How can this pain and its severity be classified, considering that the evaluation was conducted with a numerical scale from 0 to 10?

<input type="checkbox"/> No pain	<input type="checkbox"/> Intense Pain
<input type="checkbox"/> Mild Pain	<input type="checkbox"/> Unbearable Pain
<input type="checkbox"/> Moderate Pain	
6. In your opinion, patients always tell the truth when they report feeling pain.

<input type="checkbox"/> Agree	<input type="checkbox"/> Partially disagree
<input type="checkbox"/> Partially agree	<input type="checkbox"/> Disagree totally
<input type="checkbox"/> Neither agree nor disagree	
7. List the characteristics that are related to acute pain:

<input type="checkbox"/> Acute pain is poorly localized and has no biological alert function
<input type="checkbox"/> Acute pain does not cause neurovegetative alterations and does not disappear after healing of the injury
<input type="checkbox"/> Commonly related to tissue injury, well localized and usually associated with neurovegetative changes and anxiety
<input type="checkbox"/> The losses associated with pain are exclusively emotional, with the presence of depression being common

(continue...)

(continuation)

8. Pain affects many patients every day worldwide and is considered a public health problem. Check the options which demonstrate the importance of the identification of the pain:

Favors the guidance and outcome of the treatment and the of patient, promotes humanized care, promotes patient recovery

Only helps to evaluate whether the proposed treatment is effective

Defines that the patient presents infection

Only promotes patient satisfaction and comfort

9. Pain resulting from surgical incisions over prolonged periods can become chronic pain.

True False

10. Relate the responses of the left column with those on the right, indicating the severity of the pain from reading the results of the numeric rating scale:

(A) No pain	<input type="checkbox"/> 1 to 3
(B) Mild pain	<input type="checkbox"/> 4 to 6
(C) Moderate pain	<input type="checkbox"/> 0
(D) Intense pain	<input type="checkbox"/> 10
(E) Unbearable pain	<input type="checkbox"/> 7 to 9

11. The signs and symptoms of acute pain that can be observed in patients are:

Crying, facial contractions, elevated arterial pressure and heart rate

Flushing, tachycardia, fever

Perspiring, pallor, bradycardia

Calm facial expression, tachypnea, bradycardia

12. Indicate the scale that can be used to evaluate pain in sedated and intubated adults in critical care units.

Numeric scale Categorical verbal scale

Behavioral Pain Scale All of the above scales

13. The Numeric Visual Scale is used to evaluate the intensity of pain in conscious adults, since it requires the active participation of the patient who self-assess and reports their pain on a scale of 0 to 10.

True False

14. Indicate how the evaluation of pain in adults should be performed:

Only at the time of admission of the patient

Only after the performance of painful procedures

Only when patients complain of pain

In a systematic way, helping to control the occurrences of pain and the efficacy of the therapy

16. Give two physiological signs of acute pain that can be observed in adult patients:

17. Give two behavioral signs of acute pain that can be observed in adult patients:

18. Adult patient, the 3rd postoperative period of cardiac surgery, complaining of pain in the sternal region. During the evaluation of the patient, heart rate=120bpm, arterial pressure=150/100 mmHg, axillary temperature=36.7°C, respiratory rate=10mpm were identified, as well as the presence of diarrhea, tremors, perspiring, painful facial expression, discreet bleeding in dressing at the site of incision, bodily agitation, moaning and antalgic position. Cite which signs characterize behavioral signs of pain in the described case:

19. Based on information from the case described above, cite the physiological signs of pain presented by the patient:

20. For the patients to evaluate their pain adequately through the numerical scale it needs to be explained to them first. Describe how the numeric pain scale should be applied in conscious adult patients that have received the explanation.

Figure 2 - Questionnaire on acute pain evaluation applied during the educational intervention. Florianópolis, 2009.

The socio-demographic data questionnaire consisted of open questions that included the variables: age, gender, use of information technology, number of hours of internet access per week for educational purposes, and experience of the students with VLEs. The qualitative evaluation included the identification of difficulties during the study, description of positive and less positive aspects related to the use of the technology, perception about the contributions to learning, suggestions for improvements, level of anxiety during the simulation (scale of 0 to 10) and general satisfaction of the students with the OVADOR (scale of 0 to 10). The results obtained were collected and analyzed in spreadsheets using the software Excel® 2007 and the analysis occurred through

descriptive statistics (absolute frequency, means, standard deviation) and inferential statistics (*student's t test*), with a significance level considered of $p < 0.05$ for the confidence interval of 95%.

Results

The analysis of the personal data of the students ($n=14$) revealed a young sample with a mean age of 24 years and predominantly female (84.2%). The mean weekly hours of web access for educational purposes was 11.4. The computer resources more used by the students included: slide editors, email and Moodle® VLE (100%), as well as social networks and text editors (94.7%). From the means and standard deviation obtained from

the pretest evaluation ($M=8.84$, $SD=0.57$) and the post-test evaluation ($M=9.31$, $SD=0.51$) of the students, the two-tailed paired Student's t test was applied between the means which resulted in $p=0.03$

When comparing the variables of time necessary to evaluate each virtual patient in the OVADOR and the post-test evaluation results, it was found that the means of the students were above 8, which did not allow the relationship between the variables to be established (Figures 3, 4).

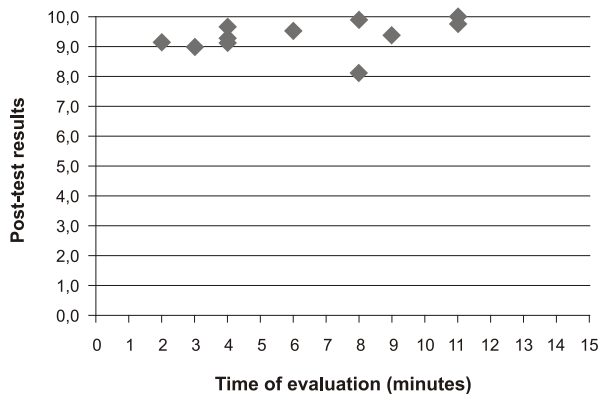


Figure 3 - Results at post-test compared to the time of evaluation of the surgical patient. Florianópolis, Brazil, 2009.

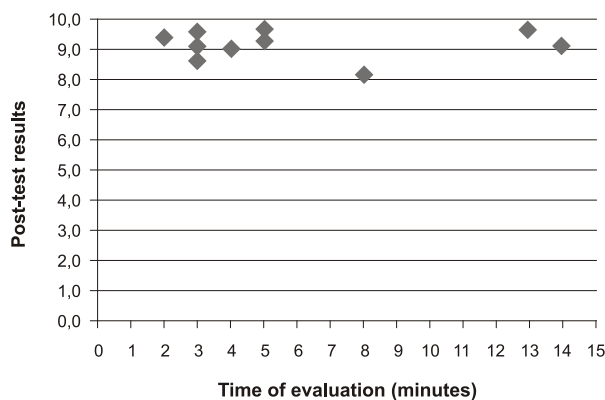


Figure 4 - Results at post-test compared to the time of evaluation of the intensive care patient. Florianópolis, Brazil, 2009.

The results of the qualitative evaluation of the OVADOR highlighted the flexibility of access offered by computer technology, especially the valorization of the aspects of access independent of time and place, according to personal need: (...) *adaptation of our time availability because it could be done according to the availability of each person* (Student 9); (...) *practicality and ease of access, providing the opportunity of learning for all, regardless of workload, domestic commitments* (...) (Student 14).

Regarding the freedom to decide the best route

for the learning process, the premise of active learning methodologies, the following reports are highlighted: (...) *presents different ways of learning, since the mode of evaluation does not remain the same all the time* (Student 9); (...) *encourages the participant to seek related issues* (...) (Student 13).

The perception of the students regarding the proximity of the simulation to the reality experienced in the care practice can also be identified: (...) *in an almost practical way it shows us how the evaluation of the pain of a patient should be carried out* (Student 1); (...) *seeing the situation it becomes clearer to assimilate what has been studied* (Student 4); (...) *when caring for a patient today I think immediately about the pain. I'm more attentive, especially "to see" the pain through the signs and symptoms when it is not visible*, (Student 13); *The simulated environment tries to approach the practice and makes us feel in the same learning place* (Student 14).

In relation to the less positive aspects, the students mainly cited problems related to technical matters, such as: *The biggest difficulty was that several times I tried to start the study and the page did not load, even using Firefox* (Student 4), *I think the biggest difficulty was the delay in opening the page* (...) (Student 14).

Specifically regarding the OVADOR, some difficulties were mentioned related to the signs of pain presented by the virtual patients: *In the case of the boy with the broken arm, I was in some doubt regarding whether his color change was related to the pain or not* (Student 12); (...) *the difficulty I encountered was to evaluate the sedated patient of the simulated environment, as the presented signs were unclear* (...) (Student 13).

Students also suggested improvements in order to facilitate the teaching-learning process mediated by this type of educational technology in undergraduate nursing courses. A total of 13.3% indicated a need for improvements in the signs of pain presented by the virtual intensive care patient and 46.7% suggested the inclusion of new clinical cases related to different contexts (collective health, emergency, fundamentals of nursing). The level of anxiety reported by the students during the evaluation of the virtual patients in the OVADOR reached levels between 6 and 9 in 57.14% of the students and the evaluation of overall student satisfaction in relation to the technology obtained scores between 8 and 10.

Discussion

The average hours per week of students accessing the web for educational purposes and the use of various

resources offered by information and communication technologies indicate the proximity of the students with resources that can provide learning experiences. These findings are similar to other studies which show a growing interest of students in such technologies⁽¹²⁻¹³⁾. Analyzing the means and standard deviation obtained in the pre and post-tests of the students it was observed that the overall mean in the post-test was higher than in the pre-test ($p=0.03$). It can then be considered that the educational intervention provided significant results in the learning of the students. By identifying these results, it can be inferred that education mediated by a VLO in an online environment can result in improvements in the nursing teaching-learning process, with similar results encountered in other studies⁽¹³⁻²¹⁾.

The OVADOR provided the students with a learning opportunity through an active and collaborative association/relationship, allowing access independent of time or place, thus meeting the needs of the individual students. The technology also provided the freedom to decide on the learning route, corresponding to the premise of the methodology of PBL⁽¹¹⁾, the method used in previous studies^(7,10-11,14,17). The recognition is highlighted of a simulated environment with real situations experienced in the health field, approaching

those of the practice, an aspect highly valued by the students which can also further motivate them to study the thematic^(18,20-21).

Some of the suggestions for improvements recommended by the students, such as the elaboration of other simulated environments in different care contexts, were also observed in other studies^(13,17). This finding demonstrates the acceptability of the technology among students, reinforcing the idea that it could be applied more frequently in educational institutions, benefiting the teaching-learning process of future nurses. The high levels of anxiety (6 to 9) reported by 57.14% of the students during the simulation indicates their immersion in the environment, to the point of feeling anxious at the moment of evaluation of the virtual patients, as might occur during a real experience. The general satisfaction of students in relation to the OVADOR, reaching scores of 8 to 10, must be highlighted, demonstrating once again the acceptability of the technology for educational purposes. During the educational intervention mediated by the OVADOR the relationship between the steps of PBL and EBL in the student learning was observed, especially valorizing the freedom to construct their own learning route⁽¹²⁾, as shown in Figure 5:

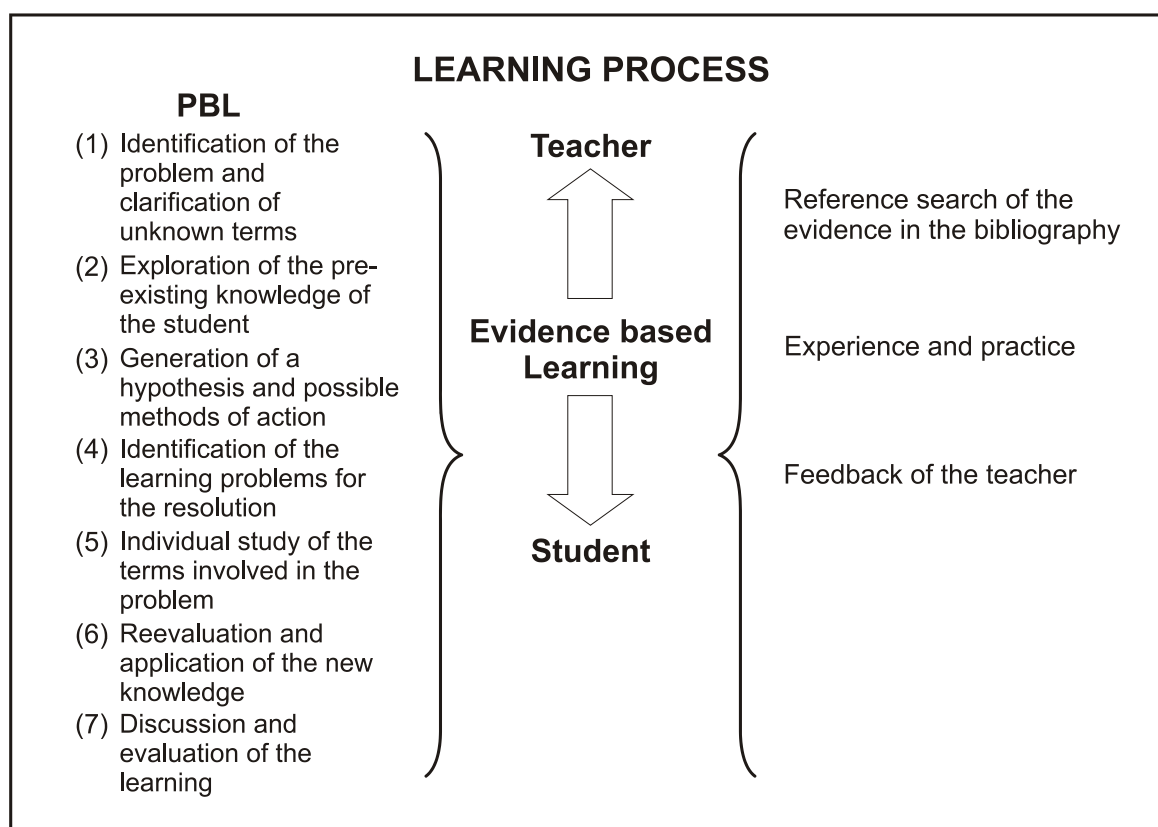


Figure 5 - Model of the PBL and EBL teaching-learning process. Florianópolis, Brazil, 2009.

It can be observed from the findings of this study, that the association of such learning methodologies coupled to computer resources can provide positive experiences for learning in nursing, in that it enables the student to make a critical analysis of situations and to search for resolution strategies for determined problems^(10-12,17).

Conclusion

The results of this study showed that the OVADOR delivered an interactive educational experience to the undergraduate students in nursing, similar to real situations experienced in healthcare. It was concluded that the OVADOR is a dynamic, constructive, innovative method which is appealing for the learning of the students, in the teaching of simulated acute pain evaluation to nursing students.

Analysis of the pre and post-test means allowed the observation of the influence of the OVADOR in the learning of the study participant students after the educational intervention. Concerning the qualitative evaluation, the flexibility of access, valorization of access independent of time/place, freedom to decide on the best learning route, and the similarity of the simulation with the real situations experienced in the care practice were highlighted. Based on these, it was concluded that, despite the limited sample of students, the OVADOR reached the objectives proposed by the study, i.e. identified positive outcomes for the learning of future nurses.

It should also be considered that teaching mediated by the concept of VLO still constitutes a challenge for developers, researchers, educational institutions, teachers and students, due to the increasing insertion in the area of nursing, as well as the need for familiarization with web-based technologies. The development of other studies in different care contexts is recommended, as well as the analysis of the various aspects related to the teaching-learning process mediated by the concept of VLO and its impact on patient care, in order to contribute to scientific knowledge in the area of nursing and the training process of future nurses.

References

- Mendonça SHF, Leão ER. Implantação e monitoramento da dor como 5º sinal vital: o desenvolvimento de um processo assistencial. In: Leão ER, Chaves LD. Dor 5º sinal vital: reflexões e intervenções de enfermagem. 2ª ed. São Paulo: Martinari; 2007.
- Ranger M, Campbell-Yeo M. Temperament and Pain Response: A Review of the Literature. *Pain Management Nurs.* 2008; 9(1): 2-9. Disponível em: http://www.medscape.com/viewarticle/573874_5
- Chaves LD, Leão ER, organizadoras. Dor 5º Sinal Vital: Reflexões e Intervenções de Enfermagem. 2ª ed. São Paulo: Livraria Martinari; 2007. 639 p.
- Teixeira MJ, Yeng LT, Romano MA, Fernandes MM. Abordagem multi e interdisciplinar de pacientes do dor crônica. In: Leão ER, Chaves LD, organizadoras. Dor 5º Sinal Vital – Reflexões e Intervenções de Enfermagem. 2ª ed. São Paulo: Martinari; 2007. p. 53-83.
- Polomano RC, Dunwoody CJ, Krenzischek DA, Rathmell JP. Perspective on pain management in the 21st century. *J PeriAnesthesia Nurs.* [internet]. 2008 [acesso 15 abr 2009]; 23(1). Disponível em: <http://www.ncbi.nlm.nih.gov/pubmed/18226792>
- Marin H, Cunha ICKO. Perspectivas atuais da informática em enfermagem. *Rev Bras Enferm.* [Internet]. 2006 maio-jun [acesso 20 set 2009]; 59(3):354-7. Disponível em: <http://www.scielo.br/pdf/reben/v59n3/a19v59n3.pdf>.
- Cogo ALP, Silveira DT, Catalan VM. Objetos de aprendizagem digitais como ferramenta de apoio na educação em enfermagem. 10. Congresso Brasileiro de Informática em Saúde. [Internet]. 2006. [acesso 15 abr 2009] Florianópolis. p. 368-9. Disponível em: <http://www.sbis.org.br/cbis/arquivos/768.pdf>
- Wiley DA. Connecting learning objects to instructional theory: A definition, a metaphor and a taxonomy. In: Wiley DA, editor. *The Instructional Use of Learning Objects.* [Internet]. 2000. [acesso 30 abr 2009]. Disponível em: <http://www.reusability.org/read/chapters/wiley.doc>
- Schibeci R, Lake D, Phillips R, Lowe K, Cummings R, Miller E. Evaluating the use of learning objects in Australian and New Zealand schools. *Computers Educ.* [Internet]. 2008; 50:271-83. [acesso 20 mai 2009]. Disponível em: http://www.sciencedirect.com/science?_ob=MIImg&_imagekey=B6VCJ-4KFMM6P-1-1&_cdi=5956&_user=687353&_orig=search&_coverDate=01%2F31%2F2008&_sk=999499998&view=c&wchp=dGLzVlb-zSkzV&md5=d2f5a70af86eb5133a0fc6ef904108bc&ie=/sdarticle.pdf
- Soares SMS, Serapioni M, Caprara A. A aprendizagem Baseada em Problemas na Pós-Graduação: a experiência do curso de gestores de sistemas locais de saúde no Ceará. *Rev Bras Educ Méd.* 2001;5(1):54. [acesso 10 mai 2009]. Disponível

- em: http://www.scielo.br/scielo.php?pid=S0034-89102005000200014&script=sci_arttext
11. Sasso GTMD, Souza ML. Simulação Assistida por Computador: a convergência no processo de educar-cuidar da enfermagem. *Texto Contexto Enferm*. [Internet]. 2006 abr-jul; 5(2):231-9. [acesso 10 jul 2009]. Disponível em: <http://www.scielo.br/pdf/tce/v15n2/a05v15n2.pdf>
 12. Walsh A. *The tutor in problem based learning: a novice's guide*. Hamilton: McMaster University; 2005.
 13. Peres HHC, Duarte YAO, Maeda ST, Colvero LA. Estudo exploratório sobre a utilização de recursos da informática por alunos de graduação em enfermagem. *Rev Esc Enferm USP*. [Internet]. 2001 [acesso 10 jun 2009]. 35(1):88-94. Disponível em: <http://www.ee.usp.br/reeusp/upload/pdf/569.pdf>
 14. Peres HHC, Meira KC, Leite MMJ. Ensino de didática em enfermagem mediado pelo computador: avaliação discente. *Rev Esc Enferm USP*. [Internet]. 2007 [acesso 10 ago 2009]. 41(2):271-8. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0080-62342007000200014
 15. Barbosa SFF, Marin HF. Web-based simulation: a tool for teaching critical care nursing. *Rev. Latino-Am. Enfermagem*. [online]. 2009 jan-fev. [acesso 15 jan 2010] 17(1). Disponível em: <http://www.scielo.br/pdf/rlae/v17n1/02.pdf>
 16. Zem-Mascarenhas SH, Cassiani SHB. Development and Evaluation of an Educational Software for Pediatric Nursing Education. *Rev. Latino-Am. Enfermagem*. [online]. 2001 [acesso 10 jul 2009] 6(9):13-8. Disponível em: <http://www.scielo.br/pdf/rlae/v9n6/7820.pdf>
 17. Sardo PMG. *Aprendizagem Baseada em Problemas em Reanimação Cardiopulmonar no ambiente virtual de aprendizagem Moodle®*. [dissertação]. Florianópolis: UFSC/PEN; [Internet] 2007. 226 p. Disponível em: <http://www.tede.ufsc.br/teses/PNFR0589-D.pdf>
 18. Mahoney J. Do you feel like you belong? An on-line versus face-to-face pilot study. *Vision. J Rogerian Nurs Sci*. 2006; 14(1):16-26. Disponível em: http://findarticles.com/p/articles/mi_6877/is_1_14/ai_n28417594/pg_5/
 19. Campbell M, Gibson W, Hall A, Richards D, Callery P. Online vs. face-to-face discussion in a web-based research methods course for postgraduate nursing students: A quasi-experimental study. *Int J Nurs Stud*. 2008; 45(5):750-9.
 20. Tait M, Tait D, Thornton F, Edwards M. Development and evaluation of a critical care e-learning scenario. *Nurse Educ Today*. 2008; 28(8):970-80.
 21. Tse MMY, Lo LWL. A web-based e-learning course: Integration of pathophysiology into pharmacology. *Telemedicine e-Health*. 2008;14(9):919-24.

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