Original Article

Virtual objects to support the teaching-learning process of physical examination in nursing*

Objetos virtuais para apoio ao processo ensino-aprendizagem do exame físico em enfermagem

Objetos virtuales para el apoyo al proceso enseñanza-aprendizaje del examen físico en enfermería

Marisa Inês Corradi[1]; Sandra Honorato Silva[2]; Edson Emilio Scalabrin[3]

ABSTRACT

Objective: To describe the process of constructing virtual learning objects of physical examination in nursing. **Methods:** The study involved developing a product and research included four phases: planning, theoretical model development and evaluation of virtual objects by 19 experts and 38 students. **Results:** We stress the importance of steps to build virtual objects. In this overall assessment, for the average *ranking* of the 31 variables studied, 18 achieved scores between 4-5, 11 had scores between 3 - 3.9, and 2 had scores between 2 - 2.9. **Conclusion:** An innovation for consolidating the use of integrated computer technology into undergraduate nursing education must support the teaching and learning of physical examination in nursing, optimizing intra-and extracurricular activities and maximizing learning outcomes.

Keywords: Nursing education; Informatics in nursing; Physical examination

RESUMO

Objetivo: Descrever o processo de construção dos objetos virtuais de aprendizagem do exame físico em enfermagem. **Métodos:** O estudo envolveu o desenvolvimento de um produto e a pesquisa contemplou quatro etapas: planejamento, elaboração do modelo teórico, desenvolvimento dos objetos virtuais e avaliação por 19 especialistas e 38 discentes. **Resultados**: Ressalta-se a importância das etapas para a construção de objetos virtuais. Na avaliação global, o *Ranking* médio mostrou que das 31 variáveis avaliadas, 18 atingiram escores entre 4-5, 11 entre 3-3,9 e 2 com escores entre 2-2,9. **Conclusão**: A inovação pela consolidação do uso das tecnologias computacionais integradas ao ensino de graduação em Enfermagem deve apoiar o processo de ensino e aprendizagem do exame físico em enfermagem, otimizando as atividades desenvolvidas intra e extraclasse e maximizando os resultados de aprendizagem.

Descritores: Educação em enfermagem; Informática em enfermagem; Exame físico

RESUMEN

Objetivo: Describir el proceso de construcción de los objetos virtuales de aprendizaje del examen físico en enfermería. **Métodos:** El estudio involucró el desarrollo de un producto y la investigación contempló cuatro etapas: planificación, elaboración del modelo teórico, desarrollo de los objetos virtuales y evaluación por 19 especialistas y 38 discentes. **Resultados**: Se resalta la importancia de las etapas para la construcción de objetos virtuales. En la evaluación global, el *Ranking* promedio mostró que de las 31 variables evaluadas, 18 alcanzaron escores entre 4-5, 11 entre 3-3,9 y 2 con escores entre 2-2,9. **Conclusión**: La innovación por la consolidación del uso de las tecnologías computacionales integradas a la enseñanza del pregrado en Enfermería debe apoyar el proceso de enseñanza y aprendizaje del examen físico en enfermería, optimizando las actividades desarrolladas intra y extra clase y maximizando los resultados de aprendizaje.

Descriptores: Educación en enfermería; Informática aplicada a la enfermería; Examen físico

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** Study carried out at Pontifícia Universidade Católica do Paraná - PUCPR, Curitiba, (PR), Brazil.*

[1] Graduate student (Master) at the Graduate Program in Health Technology at Pontifícia Universidade Católica do Paraná-PUCPR, Curitiba, (PR), Brazil.

[2] Professor of the Nursing Course and in the Graduate Program in Health Technology at Pontifícia Universidade Católica do Paraná, Curitiba, (PR), Brazil.

[3] Professor at The Computer Technology Science in the Graduate Program in Health Technology at Pontifícia Universidade Católica do Paraná-PUCPR, Curitiba, (PR), Brazil.

Corresponding Author: **Marisa Inês Corradi**
R. Prof. Fernando São Paulo, 1207 - São João - Feira de Santana - BA - Brazil
Cep: 44051-544 E-mail: m.corradi@pucpr.br

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INTRODUCTION

Technology affects society in a very complex way, leading to significant changes in the activities performed by men[1]. In this context, the change in the Information Technology paradigm due to its increasing popularization, breaks with the idea of information technology as an isolated science, reinforcing its tendency to interdisciplinarity, and making people using it increasingly more in the several areas of knowledge.

In the teaching of Nursing, new proposals to develop systems to support professors during the teaching and learning process, involving different aspects regarding the working process of nursing and nurses, have been explored since 1985[2], and important contributions have occurred especially those geared to the nursing process, which characterizes a method that systematizes the practice, and enables the identification of the patients' problem in a scientific way, with the objective of fostering nursing care in an individualized fashion[3-4].

The physical examination, a tool used in the stage of collecting data of the nursing process is part of the nurses' functions and responsibilities and it is an essential requirement for nursing appointment and prescription, which are legally considered as private activities of this professional[5].

So that nurses can perform the physical examination in their practice, the teaching and learning process should focus on theoretical and procedural capacity building of students during the undergraduate course.

However, some articles highlight the difficulties professors face to teach the physical examination, pointing out the absence of a specific subject to teach the propedeutic base, the insufficient workload to teach physical examination and students' unpreparedness in the knowledge of the propedeutic base to apply it to the field practice[6].

Although professors focus on the teaching of the nursing process, thorough the country, there is lack of resources that respect students' learning pace and that can be used in the absence of a professor.

Information technology can be used as a resource to support learning. Its main idea is to "break" the educational content into several parts that can be reused in several learning environments. Any electronic material that has information that help knowledge construction can be considered a learning object, this information can be an image, a HyperText Markup Language (HTML) page*, an animation, or a simulation[7].

The Ministry of Education recommends that learning objects have the objective of enhancing face-to-face or distance education, encouraging research and the construction of new knowledge to improve quality, equality, and efficiency of the teaching systems, through the didactic incorporation of new information technology and communication[8].

The development of information technologies and the experiences geared to their application in teaching, in health and in nursing have reinforced the intention to associate them with the nursing physical examination. Thus, this article has the purpose of describing the process to build virtual learning objects of the nursing physical examination.

METHODS

This is a study involving the development of a product to build virtual objects that is a digital educational resource and research carried out in the stage of specialists' assessment of the objects proposed.

The construction of a virtual object to support teaching nursing physical examination presented the following stages: planning, preparation of the theoretical model, development, and validation.

The study population for the assessment stage was formed by 19 specialists, 11 were nursing professors, six were education professors, and two were IT professors, following the multidisciplinary characteristic of the study, there were 38 nursing students, 18 were in the 4th period and 20 in the 7th period.

Four instruments were prepared to assess professors in the area of nursing, education, information technology, and nursing students.

All variables selected were assessed in the 13 modules that form the virtual learning objects.

To answer about the variables proposed in the instruments, a Likert-type scale was used with a set of closed answers ranging from: strongly agree, agree, not sure, disagree, strongly disagree, as answer options, to measure the level of agreement and disagreement of specialists and students.

In the five point scale, values below 3 were considered as disagree, values above 3 as agree and 3 as "indifferent" or "no opinion", it was the "neutral point". An open space was left for specialists' suggestions, deviation corrections, and enhancement of the virtual objects.

For result analysis, a quantitative approach was used to establish the mean ranking (MR).

According to Resolution # 196/96, the project was approved by the research Ethics Committee at Pontifícia Universidade Católica do Paraná (PUC/PR), under License # 317/07. The experts and students that took part in this assessment stage gave their written consent.

RESULTS

The planning, initial stage in the construction of the

* Hypertext Markup Language is a language used to produce Web pages.

virtual object, demanded decisions that involved the issues of the theme to be approached, the target-audience, the pedagogical approach used for teaching the physical examination, the structure, and the division of the virtual learning objects.

The decisions are the basis so that design of the virtual object contemplates the conditions that can produce the necessary knowledge. When there is focus on the expected learning outcomes, it is easier to select the adequate instructional material and the activities that will lead students to the proposed pedagogical objectives

To prepare the theoretical model, considering the definitions of the planning, we wanted to explore and select the contents that formed the information, as a model to structure the modules organized and distributed by systems and segments of the human body. The sources of information referred to the construction of learning objects, basic and nursing science related to the physical examination. Thirteen modules were proposed: 1- Introduction with the definition of nursing physical examination and the propedeutic techniques; 2: integumentary system; 3: integumentary system (nails and hair); 4: head and neck; 5: neurologic system; 6 and 7: cardiovascular system; 8: respiratory system; 9: breasts and armpits; 10: gastrointestinal system; 11: genitourinary system; 12: locomotor system and 13: reporting the physical examination. A script with the definition of the items that form each module was designed together with the instructional content.

The 13 modules were structured in objectives to show students what they could learn in the module to be studied, the instructional content referring to the techniques of the physical examination, and the possible abnormalities found in each system or segment of the human body with self-assessment exercises. The self-assessment exercises were proposed so that at each module learners could check their performance with the possibility to go back and use the object when deemed necessary[9].

The development of virtual objects was carried out by a team formed by a General Coordinator, two Instructional Designers, three Graphic Designers and two Programmers of the Center for Technology in Teaching at PUC/PR. The time made available by the team to format the 13 modules of the virtual objects "physical nursing examination" was 50 hours/work. The professional of the area, nurses in this case, should take active part on this stage to develop the virtual objects.

For this development, a schedule of activities and a responsibility matrix were prepared, to potentiate the work of the team involved.

The virtual learning objects "nursing physical examination" were formatted, following a set of standards and specifications Sharable Content Object Reference Model (SCORM)[10], that aims to facilitate the reuse of educational objects, with aspects such as their durability, maintenance, accessibility, and adjustability.

Each module was developed according to the theoretical model proposed and structured into two components: the descriptive chart used to express the characteristics of the module, and the content represented by serial screens of several categories.

The descriptive chart has an introduction text to present the objectives, the pre-requisites of students' previous knowledge necessary to study the module, the level of complexity, the mean time of study, the date of the last update, and the technical pre-requisites, such as: Microsoft Internet navigator and macromedia Flash Player 8** plug-in so that users can watch videos and listen to the sounds.

The elements forming the learning objects refer to electronic texts and animations (videos, sounds, pictures and photos), to make students closer to the possible segment or system abnormalities presented by patients in a real situation, and the development of the skills involved in the propedeutic techniques such as cardiac and pulmonary auscultation.

The screens have been developed to facilitate the acquisition of knowledge on the nursing physical examination.

As for the learning assessment, the self-assessment screens display an interactive structure for retention and reapplication of the skills worked, presented in the several answer possibilities.

When the development stage is finished, the virtual learning object should be made available in a repository. In the present case, the learning objects "nursing physical examination" were made available in the Eureka repository***, to be assessed by specialists.

The objective of the assessment was to correct deviations, enhance, and improve virtual objects; it involved specialists in the areas of nursing, IT, education and students.

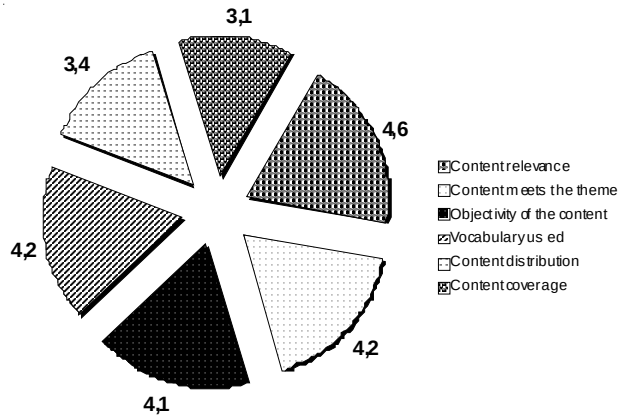
The mean Ranking obtained as a result of agreements and disagreements expressed by specialists in the assessment of the content and of the self-assessment exercises of the 13 modules of the virtual learning object nursing physical examination are presented on the data of Pictures 1 to 5.

In the global analysis, the mean Ranking of the assessment by specialists shows that among the 31

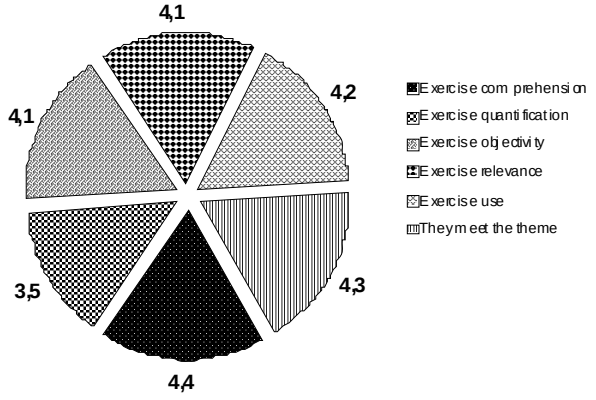
** The Adobe® Flash® Player software is navigation plug-in for several Web platforms.

*** Eureka is the Virtual web-based learning environment of the Pontifícia Universidade Católica do Paraná (PUCPR) for collaborative learning with the purpose to foster distance education and training through the Internet, as a mean to create virtual communities that take part in courses that were traditionally face-to-face.

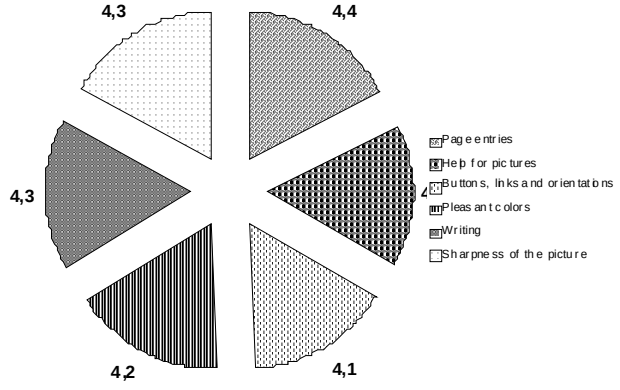
variables assessed, 18 reached scores between 4-5, 11 scores between 3-3.9, and two presented scores between 2-2.9. There was a common relation of disagreement, in the nursing and education specialists' assessment that highlighted the insufficient amount of exercises and the lack of feedback.



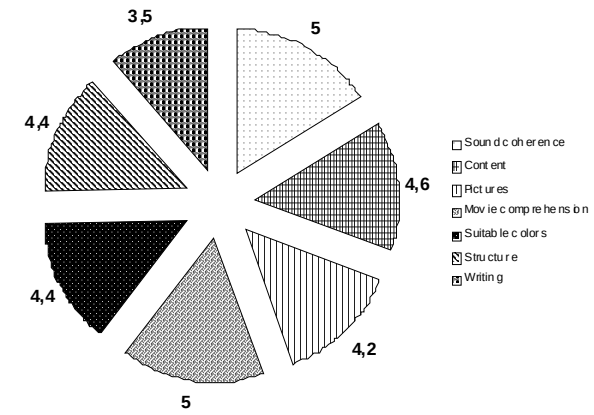
Picture 1 – Assessment of the content carried out by nursing specialists.



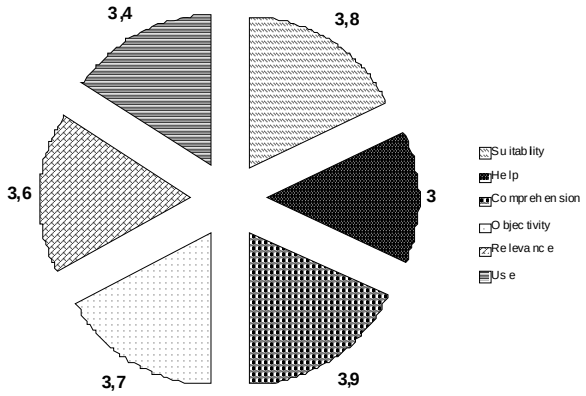
Picture 2 – Evaluation of self-assessment exercises carried out by nursing specialists.



Picture 3 – Assessment of the technical aspects carried out by IT specialists



Picture 4 – Assessment of the pedagogical aspects for content and media suitability by education specialists



Picture 5 – Assessment of the pedagogical aspects of the self-assessment exercise carried out by education specialists.

Although undergraduates of the 4th and 7th period presented different entry knowledge to the nursing physical examination, there were similarities in the assessments, both regarding the RM, and the suggestions presented.

DISCUSSION

The learning objects have been conceived and developed according to a support view, to carry out the teaching and learning process of a clientele from the Nursing undergraduate course, assuming that in the course students have the first theoretical and practical contact with the nursing process and its stages.

The objects approach basic and fundamental aspects of the physical examination that should be more encompassing and deeper as soon as students reach the goals initially proposed, and are ready to learn new skills, both cognitive and motor. The issues related to attitudinal skills, required to perform the physical examination, have not been focused in the construction of the learning

objects, and they should be approached in classes, laboratory practices, field practices, and in training.

The teaching and learning process of the nursing physical examination requires memorization, repetition of the propedeutic techniques and reinforcement. Thus, the design of the online courseware, virtual learning objects "nursing physical examination" is based on the behavioral learning model[11] which observes the presentation of content in small modules, the suitability to the pace of learning and to students' skills, the individual learning according to students' pace, thus, enabling the selection of paths through the instructional material.

The model shows the need for students to present, among others, as entry behavior knowledge in the anatomy and physiology of human organ systems, because when they raise data on patients they should be able to relate them with the physiology and morphology of the region examined, and interpret them considering the normality standards to determine problem situations and to later prepare nursing diagnoses.

The texts are theoretical support tools to users of the learning object that should be simple, clear and objective. These, together with the animations, become valuable teaching tools to help students with difficulty to abstract the concepts, because they provide a playful environment for the development of the class, and encourage cognitive processes, such as perception, memory, language, and thinking and enable modeling actual events that evolve temporally[12].

To ensure that a learning object is suitable as a support tool for learning, its plan should be designed and its pedagogical and ergonomic attributes should be assessed by an interdisciplinary team[13]. In this context, the nursing physical examination modules have been quantitatively and qualitatively assessed by nursing, IT and education specialists and by nursing students.

The design of the virtual objects and the participation of nurses in the development team is a new professional horizon that demands, in addition to specific knowledge in the area, basic IT knowledge, which contributes to the scientific communication of innovative practices[14].

FINAL REMARKS

According to the stages of the present study, the first stage was that which required greater time and dedication. This building process demanded a careful analysis of the literature about learning theories, the process and the nursing physical examination, and the SCORM standards and specifications, used to structure the learning courseware to ensure quality both in planning, designing and developing virtual learning objects.

As for the development, we may state that it is a stage that requires the participation of a technical team expert in developing materials, so that the characteristics and specificities of these tools are met and, thus, the pedagogical goals are reached.

The stage of assessment by specialists enabled to extract the agreement and disagreement regarding the self-assessment exercises of the nursing physical examination module, favoring the correction of deviation, enhancement and improvement of the virtual objects. These corrections and updates are made easier by modularity, which allows for content update without changing the structure.

We believe that these objects can meet their purpose, as a support tool for nursing undergraduates, that start learning about the nursing process and physical examination; however, they should be deepened and extended as soon as students demonstrate they master cognitive and psychomotor skills required in the first stage, with a gradual increase in the complexity of the educational activities proposed.

We hope that innovation through the use of computer technology in the nursing undergraduate course may support the teaching and learning process of the nursing physical examination, using this process in the classroom, in nursing laboratories and in practice fields. Its use could also be extended to permanent education programs in health care services.

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