



Instructional design to develop an online course on urinary catheterization

Design instrucional no desenvolvimento de curso online sobre cateterismo urinário

Diseño de instrucción en el desarrollo de curso en línea sobre cateterización urinarios

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ABSTRACT

Keywords: Urinary catheterization;
Education distance;
Education continuing

Objective: Describe the development and evaluation of the online course on urinary catheterization for nursing professionals and undergraduate students. **Methods:** The contextualized instructional design method was used during the process of conception, development, implementation and evaluation. **Results:** The course was developed by researches and evaluated by the experts, obtaining 93% approval; 67% of the items were evaluated as excellent, 26% of the items were satisfactory, 4% of the items were reasonable and only 1% of the items were evaluated as unsatisfactory. **Conclusion:** The planning of the development phase of online courses is fundamental to their quality and the efficacy of the project. The course developed will enable new perspectives in graduate courses, in training programs and in personal development, based on the construction of individualized, flexible and collaborative knowledge utilizing new educational technologies.

RESUMO

Descritores: Cateterismo urinário; Educação a Distância; Educação Continuada

Objetivo: Descrever o desenvolvimento e a avaliação do curso on-line sobre cateterismo urinário para os profissionais de enfermagem e estudantes de graduação. **Métodos:** Foi utilizado o método design instrucional contextualizado durante o processo de concepção, desenvolvimento, implementação e avaliação. **Resultados:** O curso foi desenvolvido por pesquisadores e avaliados por juízes, obtendo aprovação de 93%; 67% dos itens foram avaliados como excelentes, 26% dos itens foram satisfatórios, 4% dos itens eram razoáveis e apenas 1% dos itens foram avaliados como insatisfatórios. **Conclusão:** O planejamento da fase de desenvolvimento de cursos on-line é fundamental para a sua qualidade e eficácia. O curso desenvolvido permitirá novas perspectivas em cursos de pós-graduação, em programas de treinamento e desenvolvimento pessoal, com base na construção do conhecimento individualizado, flexível e colaborativo, utilizando as tecnologias educacionais.

RESUMEN

Descriptores: Cateterización Urinaria; Educación a Distancia; Educación Continua

Objetivo: Describir el desarrollo y evaluación de curso en línea sobre el cateterismo urinario para los profesionales de enfermería y estudiantes de posgrado. **Métodos:** Se utilizó el diseño de instrucción contextualizada en el diseño, desarrollo, implementación y evaluación. **Resultados:** El curso fue desarrollado por investigadores y evaluados por jueces, obtener la aprobación del 93%; 67% de los artículos fueron evaluados como excelentes, el 26% de los artículos fueron satisfactorios, el 4% de los artículos eran razonables y sólo el 1% de los artículos fueron calificados como insatisfactorios. **Conclusión:** La fase de planificación del desarrollo de los cursos en línea es fundamental para su calidad y eficacia. El curso permitirá a los nuevos puntos de vista desarrollados en los cursos de postgrado en programas de formación y desarrollo personal, basado en la construcción del conocimiento individualizado, flexible y colaborativa utilizando tecnologías educativas.

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INTRODUCTION

There is little to no doubt regarding the importance and the impact of the new Communication and Information Technologies (CITs), especially the Internet, on our lives, especially in terms of handling information and building knowledge. The arrival of CITs has radically changed our relationship with information and the world. If the key issue was once having access to information, nowadays the concern is what to do with so much information and how to select which information is relevant and reliable.

Distance education (DE) is a teaching-learning process mediated by technologies in which professors and students are spatially and/or temporally separated. This type of education has a long history and dates from the experiences of education by mail initiated in the 18th century, and has been expanding since the mid-19th century. Several media are used nowadays, from printed material to online simulators with interaction between the student and the educational center, using asynchronous (at different times) or synchronous (simultaneous) communication between students and professors⁽¹⁾.

DE draws on a broad variety of media. Media is the term used to refer to a vast and complex system of expression and communication. Literally, “media” is the plural form of the word “medium”, whose corresponding words in Latin are also “media” and “medium”, respectively⁽²⁾.

Videos, games, animations and illustrations, for example support the interactivity within a virtual environment and provide a more active and engaging learning experience for the DE learner⁽³⁾. Media produced for didactic/pedagogical purposes have been termed “Digital Educational Material” (DEM); that is, a type of material created to meet educational objectives which incorporate digital resources. The use of learning objects contributes to the educational development⁽⁴⁾. Some examples of DEM include videos, hypertexts, animations, LO, web pages, learning games and simulation, among others. This type of material is characterized by its pedagogical design and attributes. Therefore, media once developed mainly for illustrative purposes have been transformed by the theories of pedagogical design of online resources, and DEM play an important role in the support of online teaching-learning processes⁽⁵⁾.

The development of strategies for DE have been molded by the various theories proffered over the last few decades. The understanding of transactional distance Moore⁽⁶⁾ and online interaction⁽⁷⁾ equivalence⁽⁸⁾ and connectivism⁽⁹⁾ have shaped DE pedagogy. The idea that DE pedagogy cannot be based on one single theory while excluding all others, as it should be based on the use of empirical, scientific or philosophical points of view and theories. This attitude is consistent with the current pluralist and postmodern society, and it values the internal coherence of each theory and the points of intersection among them so as to provide better practices, experiences and improvement within the teaching-learning process⁽¹⁰⁾.

Virtual learning environments (VLEs) are computer systems available on the Internet that aim to support

activities mediated by CIT. These tools allow the integration of multiple media, languages and resources to present information in an organized manner and to develop interactions between people and DEM, making it possible for students to build individual and collective knowledge. VLEs also allow students to manage their learning in terms of study place and time, encouraging the development of independent, self-regulated students who take responsibility for building their own knowledge⁽¹¹⁾.

A growing interest in the use of DEM in the education of health professionals has been observed, as seen in literature. For health professionals and students, the use of distance education strategies and CITs have made positive contributions as they facilitate the acquisition and understanding of technical and scientific information and are available in just in time, which improves and/or modifies professional practice in the workplace, enabling continuous updating and improvement of skills and processes, as well as directing changes in the way patients are cared for⁽¹²⁻¹⁸⁾.

Although the number of studies regarding the use of online strategies in the technical qualification and education of healthcare professionals has been growing every year, few publications describe the way these courses and objects were conceived and developed, leaving an important gap in the literature. This study describes the methodological steps taken in the development of an online course on urinary catheterization for nursing undergraduate students, using the contextualized instructional design model. This model uses applied research and technological production to develop new processes or products oriented by market needs⁽¹⁹⁾.

METHODS

The development of an online course must be based on a method that ensures student learning, so as to meet the educational objectives proposed. In this context, methodology is a set of guidelines, procedures, analysis tools and techniques that define the standard expected for the development of systems or educational applications, which must comply with requirements of standardization, flexibility, documentation, modulation and planning⁽²⁰⁾.



Figure 1 - Phases of the contextualized instructional design

The contextualized instructional design (CID) method was used to comply with these demands during the process of conception, development, implementation and evaluation of the online course. The CID method is comprised of five interconnected and dynamic phases: analysis, design, development, implementation and evaluation (Figure 1)⁽²¹⁾.

This project involved nurses from the teaching hospital of the University of São Paulo, as well as undergraduate, master's and doctoral students from GEPETE (GEPETE, as per its acronym in Portuguese).

RESULTS AND DISCUSSION

The phases of the contextualized instructional design for the development of the online course are presented below:

Analysis

This is the initial phase of development of an online course, in which it is fundamental to carefully analyze educational needs, identify the characteristics of the student groups and verify restrictions⁽²²⁾. The aim of this phase is therefore to understand the educational problem and to design a solution, with the participation of students, experts and professors, following the steps (1) Selection of the theme, (2) Target users, (3) Educational objectives, (4) Available resources described in figure 2:

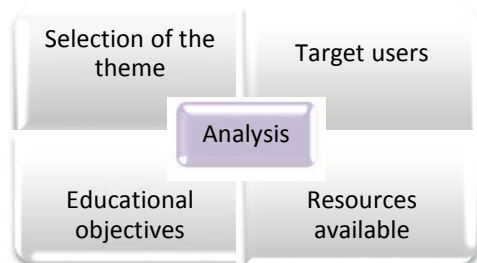


Figure 2 - Contextualized instructional design (Analysis phase)

(1) Selection of the theme

Urinary catheterization is an invasive procedure which

is very common in intensive care units and is directly correlated with cases of urinary tract infection, dramatically prolonging hospital stays. It has been shown that the technical qualification of professionals responsible for performing the procedure and maintenance of the catheter can reduce infection to rates varying between 17 and 69%. In light of its relevance in the general context of nursing care, nurses from the professional improvement service of the teaching hospital of USP (HU-USP), also members of GEPETE, chose this theme to be developed in the online course. The course was to be delivered to students via the School's virtual learning environment – Moodle.

(2) Target users

The definition of the target users is an important step in planning, as it guides aspects related to the selection of the theme, the content and educational objectives expected to be established and achieved⁽²³⁾. Considering the profile of the institution where the course will be offered – a teaching hospital – the target users of this course include nursing undergraduate students and nursing professionals;

(3) Educational objectives

Educational objectives are the results expected from the educational activity, or the goals which the educator aims to achieve utilizing pedagogical activities. These objectives may be grouped into three domains: (a) cognitive, related to the appropriation of information and concepts by the student linked to memory and intellectual skills; (b) emotional, related to the emotional reactions the student experiences during the learning process; and (c) psychomotor, which emphasizes the operative and motor skills the student develops during the learning process⁽²⁴⁾.

The contextualized instructional design proposes five standard levels of use, associated with new technologies such as the Internet for the development of distance educational programs, namely: informative, supplementary, essential, collaborative and immersive⁽²¹⁾. All standards were included in this project, with an emphasis on content, activities and communication.

The informative and supplementary standards

Table 1 – Educational objectives of the online course on wounds, encompassing the three learning domains

Educational objectives		
Cognitive domain	Emotional domain	Psychomotor domain
<ul style="list-style-type: none"> - Learning the anatomy and physiology of the urinary system and the mechanism of urine formation; - Learning the concepts, purposes and classifications of urinary catheterization; - Identifying the importance of the urinary catheterization technique; - Analyzing the main complications of the procedure. 	<ul style="list-style-type: none"> - Perceiving the importance of studying the theme for their professional practice; - Demonstrating ethical attitudes in wound photography practice; - Demonstrating a favorable attitude towards the search for, and acquisition of, knowledge; - Elaborating a study plan to promote effective participation in the course, identifying their own knowledge needs; - Acting in a participative and ethical manner in the study group, contributing to the development of the group; - Demonstrating respect in interpersonal relationships, always responding to the participants and receiving the contributions of the other members. 	<ul style="list-style-type: none"> - Demonstrating, moving, selecting, activating, building, typing, clicking, accessing, sending, printing, handling the virtual learning environment – Moodle; - Using the virtual learning environment Moodle with self-assurance; - Applying knowledge regarding the urinary catheterization procedure by means of virtual simulation.

comprise the information and content of the course, explaining to the students how the content will be approached, the educational objectives expected to be reached by the end of the course, instructions regarding the structure and how to navigate the Moodle platform, activities to be performed, instructions regarding the use of the tools available in the environment, bibliographical references used in the development of the content and a welcome message.

The essential standard includes the activities developed within the course, including interactive graphic presentations and evaluative exercises at the end of the modules.

The collaborative and the immersive standards depend on student-student and student-tutor interaction and communication. Towards this purpose, socialization and discussion activities were developed with the use of tools from the Moodle platform, such as forums and chats, with a forum for questions at the end of each module (Table 2).

(4) Available Resources

The available resources were selected in this step. A survey was performed regarding the human, material and financial resources to be used in the development of the educational proposal. The material resources used were those available from the Center of Nursing Laboratories for Teaching, Skills, Simulation and Research (CELAB, as per its acronym in Portuguese) and from the Center of Studies in Telenursing (CETEnf, as per its acronym in Portuguese) at the University of São Paulo School of Nursing, which offers computers and programs such as Articulate®, (<https://www.articulate.com>) allowing the creation and publishing of interactive graphic elements.

The learning environment chosen was the Moodle - Modular Object-Oriented Dynamic Learning Environment - which is an open source program based on the socio-constructivist pedagogy of learning support (<https://moodle.org>). It consists of a system to manage educational activities, aimed at the creation of online communities in virtual environments to stimulate

collaborative learning.

The Telemedicine discipline at the medical school of the University of São Paulo has developed an educational tool called the Virtual Man, which consists of a three-dimensional graphic representation of macro- and microscopic, internal and external structures of the human body. It is an effective resource to transmit knowledge regarding anatomy, physiology, pathophysiology and molecular mechanisms in the form of learning objects. The dynamic images of these learning objects allow for a better understanding of the educational objectives established in the course. The Virtual Man was developed to complement diverse themes in health education. Videos regarding the Virtual Man may be viewed online at: <http://www.projetohomemvirtual.com.br>.

Design and development

The design and development phases included the planning of instruction and the creation of the instructional materials and products, specifying the setting in which learning will take place and including elements, pedagogic approach, contents, media and tools, and other specific requirements. In this phase, the activities, interactions and rules of adaptation to be applied during the phase of execution are scheduled (Figure 3). As a result, a package is generated with all the information necessary for the execution of the units described.



Figure 3 - Contextualized instructional design – Phases of design and development

Table 2 – Relationship between the tools and the immersive educational standard of the online course on urinary catheterization

Tools	Immersive educational standard
Course program and instructions	Emphasis on orientation regarding: navigability of the learning platform, objectives and duration of the course, deadlines for completion of activities, exercises and evaluations
Learning objectives	Emphasis on the content with interactive materials and mandatory and complementary reading of texts and handbooks provided by the professor
Texts for mandatory and complementary reading	
Internal and external links	
E-mail, social forum, questions, news and content forums and evaluation	Emphasis on group communication and interaction. Sharing of knowledge, ideas, opinions and information. This tool allows interaction within the group and the identification of the degree of knowledge, motivation, rhythm and nature of individual and group learning
Content fixation exercises	Emphasis on the activity. The main function is formative evaluation, assisting the student to apply the knowledge acquired through exercises with practical and objective questions related to the theme
Glossary	Emphasis on the activity. The main function is the fixation of content and terms used. This tool enables the collective construction of the main terms used in the course
Group work - Wiki	Emphasis on group communication and interaction, offering an opportunity to apply the knowledge acquired and to promote group socialization

Classes were planned and developed based on an analysis of the theoretical contents necessary to support each educational objective established, with the definition of five modules presenting different characteristics and demanding that the learner possess the skills and ability to use the Internet and its tools, namely: Module I – Review of the anatomy and physiology of the urinary system; Module II – Basic theme concepts; Module III – Procedure of urinary catheterization; Module IV – Preventing complications; and Module V – Case study.

Videos from the Virtual Man were developed together with a team of graphic designers. These videos demonstrate the anatomic structures of the female and male urinary systems in 3D and the procedure of urinary catheterization in both sexes step by step (Figure 4).

In order to record the procedure of urinary catheterization a storyboard was created to represent the development of the frames of the procedure animation, which allows visualization of the sequence of contents and scenes, resulting in a draft of how the application will be organized⁽²³⁾.

In the development phase, the hypertexts were digitized and images, links and pictures were selected that would promote student learning and understanding.

This phase also involved the development of a video by members of the subgroup which detailed the procedure of both male and female urinary

catheterization. After digitalization of the hypertext, images and films, the entire content was uploaded onto the Moodle platform and was made available on the USP server for all departments.

The modules contained assessment with closed questions, games or forums for discussion/questions, as well as a glossary. Should a student fail to provide a correct answer in an evaluative exercise, he/she can find help within the system, obtain feedback, review the theoretical information and/or clarify information/ask questions in the forum.

The modules are organized so that students can advance to the next module only after completion of all of the assessments for that particular module; however, they can return to the modules they have already completed at any time during the course. At the end of each module, the bibliographical references used and web links were presented, enabling students to navigate to other materials to extend their knowledge.

At the beginning of the course, there is an area in which the student is instructed regarding the importance of the theme, purpose of the course, educational objectives and structure of the course. Students also receive information regarding the group that developed the course and a welcome message.

The formative assessments of the online course on urinary catheterization involve exercises in the form of

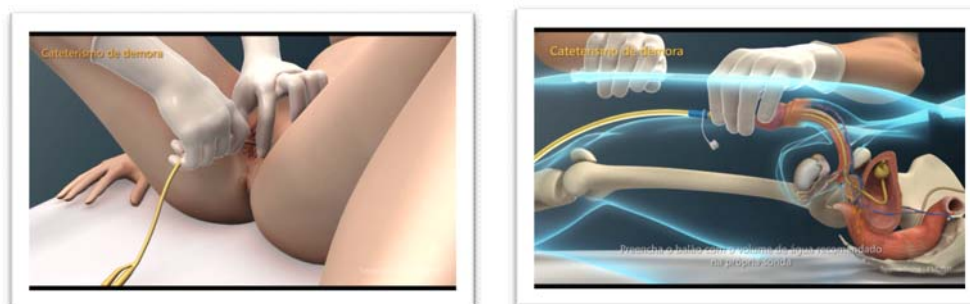


Figure 4 - Videos from the Virtual Man (urinary catheterization)

Table 3 - Evaluation tool

Evaluation: educational aspects	
Relevance of the theme	The theme is important for the nursing student/professional
Objectives	The objectives proposed for the course were achieved
Texts/hypertexts	Adjustment, clarity and coherence of the concepts and vocabulary in relation to the theme, depth or superficiality, quantity of information provided, size (very long, short or adequate), instructions regarding the course/activities, bibliographic references and range of the objectives proposed were adequate to meet the learner's needs
Activities (Forum, glossary, exercises)	Activities correlated with the information and contents provided and contributed to the student's learning; the degree of exigency, the type, the number and the range of the objectives proposed were adequate
Evaluation	The instruments and the forms of evaluation contributed to individual and collective learning
Deadline for study	The deadline established for completing the activities and the study was adequate
Environment interface	
Navigability	Ease of moving from one page to another within the environment, operation of the buttons, menus and icons
Accessibility	Ease of access to the pages of the virtual environment
Design of the screens	Organization of the contents and resources on the screen, colors, font and informational density (quantity of information present on each screen)
Didactic resources	
Interactivity	Students were able to interact with each other, with the group and with the professor through the virtual environment using e-mail, the forum, the glossary and through the development of group activities
Relevance	Relevance, coherence and types of resources used to achieve the objectives (e-mail, forum, glossary and developing group activities).
Presentation of the resources	Functionality and technical quality of the environment resources (figures, pictures, animation and links)

true or false or multiple choice questions, as well as by participating in the forums. Objective evaluations have a medium level of difficulty and offer students an immediate response regarding their performance, showing the correct answer and the score obtained.

Implementation and evaluation

The implementation phase involves the configuration of the educational technological resources and tools in the Moodle platform, allowing access to the course. This course was evaluated by a board comprised of 12 experts, including nurses with masters degrees, PhDs in nursing and graduate students.

The instrument to evaluate the online course covered educational aspects, the environment interface and didactic resources, it was adopted from “*Instrumento de Avaliação da Qualidade de Objetos de Aprendizagem*” developed by “*Coordenação Central de Educação a Distância*” (CCEAD PUC-RIO) (Table 3)⁽²⁵⁾. According to a review research, Learning Objects are evaluated using non validated questionnaires⁽²⁶⁾.

As evaluation criteria, each subitem was evaluated according to a numerical scale between 1 and 4 (unsatisfactory, reasonable, satisfactory and excellent, respectively). The evaluator was instructed to mark the criterion chosen for each subitem with an “X”. When a reasonable or unsatisfactory evaluation was received, a suggestion for improvement or reason for the lower score was requested of the evaluator, so as to adjust and improve the environment.

In general terms, the course was well evaluated by the experts, obtaining 93% approval; 67% of the items were evaluated as excellent, 26% of the items were satisfactory, 4% of the items were reasonable and only 1% of the items were evaluated as unsatisfactory (Figure 5).

The research proposal was submitted to, and accepted by, the Research Ethics Committee of the University of

São Paulo School of Nursing (Process no. 1062/2011/CEP-EEUSP SISNEP CAAE: 0068.0.196.000-11)

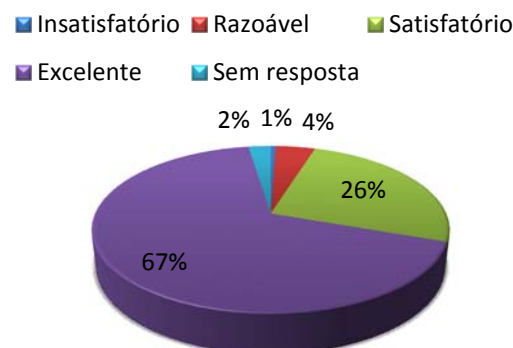


Figure 5 - General evaluation of the online course on urinary catheterization

The evaluation of the online course on urinary catheterization will be discussed in another article that will be published.

CONCLUSION

The planning of the development phase of online courses is fundamental to their quality and the efficacy of the project. The creation of an online course using a developmental methodology guides the choice of different technological resources, defines the educational objectives and the target audience and schedule of activities, in addition to evaluating the course in order to make improvements.

The course developed will enable new perspectives in graduate courses, in training programs and in personal development, based on the construction of individualized, flexible and collaborative knowledge utilizing new educational technologies.

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