THEORETICAL-METHODOLOGICAL MODEL TO DEVELOP AND VALIDATE EDUCATIONAL TECHNOLOGY FOR THE NURSING AREA

MODELO TEÓRICO-METODOLÓGICO DE ELABORAÇÃO E VALIDAÇÃO DE TECNOLOGIA EDUCACIONAL PARA A ÁREA DA ENFERMAGEM

MODELO TEÓRICO-METODOLÓGICO CON EL OBJETIVO DE CREAR Y VALIDAR TECNOLOGÍA EDUCATIVA PARA EL ÁREA DE ENFERMERÍA

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Objective: to present a theoretical-methodological framework guiding the development and validation of educational technology, specifically didactic booklets for the Nursing area. Method: this is a theoretical-reflexive study grounded on Bloom's Taxonomy. Results: the study presented a theoretical-methodological model outlining the educational material script and content development in accordance with Bloom's Taxonomy recommendations, in the Cognitive Process dimension. Additionally, it outlined the steps for creating and validating educational booklets: situational analysis, literature and documentary review, content selection and summarization, script development, creation and layout of the illustrations, validation with experts, and validation with the target audience. Final considerations: the theoretical-methodological model proposal consolidates the knowledge existing in the literature and assists nurses and researchers in creating educational booklets with greater scientific rigor, increasing their effectiveness potential.

Descriptors: Educational Technology. Nursing. Health Education. Methodology as a Subject. Educational and Promotional Materials.

Objetivo: apresentar um modelo teórico-metodológico para nortear a elaboração e validação de tecnologia educacional do tipo cartilhas educativas para a área da Enfermagem. Método: trata-se de um estudo teórico-reflexivo, baseado na Taxonomia de Bloom. Resultados: o estudo apresentou um modelo teórico-metodológico que descreve a elaboração do roteiro e conteúdo do material educativo seguindo as recomendações da Taxonomia de Bloom, na dimensão do processo cognitivo. Ainda, apresentou os passos para elaboração e validação de cartilhas educativas: diagnóstico

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situacional, revisão de literatura e documental, seleção e sumarização de conteúdo, elaboração do roteiro, criação e diagramação de imagens, validação com especialistas e com o público-alvo. Considerações finais: a proposição do modelo teórico-metodológico solidifica o conhecimento da literatura e auxilia enfermeiros e pesquisadores na elaboração de cartilhas educativas com maior rigor científico e passíveis de efetividade.

Descritores: Tecnologia Educacional. Enfermagem. Educação em Saúde. Metodologia como Assunto. Materiais Educativos e de Divulgação.

Objetivo: presentar un modelo teórico-metodológico para orientar la creación y validación de tecnología educativa del tipo folletos didácticos para el área de Enfermería. Método: estudio teórico-reflexivo basado en la Taxonomía de Bloom. Resultados: el estudio presentó un modelo teórico-metodológico que describe la elaboración del guión y contenido del material educativo siguiendo las recomendaciones de la Taxonomía de Bloom, en la dimensión del Proceso cognitivo. También presentó los pasos para crear y validar folletos educativos: Diagnóstico situacional, Revisión de documental y de la literatura, Selección e sumario del contenido, Elaboración del guión, Creación y diagramación de imágenes, y Validación con especialistas y con la población objetivo. Consideraciones finales: la propuesta del modelo teórico-metodológico consolida el conocimiento existente en la literatura y auxilia enfermeros e investigadores en la creación de folletos educativos con mayor rigor científico y buenas perspectivas de efectividad.

Descriptores: Tecnología Educativa. Enfermería. Educación en Salud. Metodología como Tema. Materiales Educativos y de Divulgación.

Introduction

Educational Technologies in Health (ETHs) are resources used in the teaching process as instruments that ease and promote knowledge dissemination. ETHs should be employed with the objective of enhancing people's involvement in the educational process, thus contributing to their autonomy and skills development[1].

Technologies can be divided into three groups: hard technologies, soft-hard technologies, and soft technologies. Soft-hard technologies, the focus of this study, refer to those related to structured knowledge that can be represented, for example, by care models, protocols and standards[2]. By using soft-hard technology in Nursing care, nurses can go beyond bonding with and welcoming the patients, delivering assistance that is structured and developed focused on each person's needs. Thus, it is possible to develop an intervention that can clarify doubts, provide guidance to cope with difficulties, promote knowledge, and change attitudes related to the patients' and their family's health[1].

In this sense, educational materials such as booklets, infographics and flipcharts[3]; audiovisual materials such as films, short videos and TV programs; demonstration materials such as simulators or models[4]; and interactive technologies such as games, animations and websites, are examples of soft-hard technology resources; in other words, they encompass structured knowledge in their development, which will address both knowledge and health care aspects. Development of these ETHs should incorporate resources such as health communication, following the social, behavioral and communication sciences principles, in order to inform and shape people's knowledge, attitudes and behaviors[5]. In particular, educational booklets have been extensively developed in the health area with a significant emphasis on Nursing.

They have the potential to yield better results for health education programs and interventions, as they can streamline and ease the health team's work in relation to the guidelines for patients and caregivers, in addition to assisting people in better understanding the processes they are undergoing[1]. This is a particularly important issue in the pediatric population, who, due to their condition as developing human beings, has limited resources to deal with the challenging situations involving the health-disease process

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and understand the changes imposed by the situations they are experiencing.

For creating booklets aimed at promoting individual learning, their development needs to be systematic and structured. This means that it is necessary to decide and define objectives and to choose content, procedures and activities, as well as to determine which resources and strategies will be employed based on theoretical and methodological frameworks with a view to ensuring effectiveness of the intended outcome[6]. In addition to that, it is necessary to thoughtfully select the assessment instruments for the product under development, which will be applied both with experts and with the target population[7-8].

However, there are no studies that provide a systematic approach to be followed for developing this technology, and few studies indicate the use of theoretical and/or methodological frameworks as a guide to develop materials such as educational booklets.

One of the theoretical frameworks that can guide the production of these materials in the health area is Bloom's Taxonomy[9]. In the Nursing scope, it has been most commonly used to structure and assess pedagogical strategies employed in professional training, both in face-to-face and in distance learning contexts[10]. Nurses have also employed it as a support tool to guide the health education process for patients and families[11]. However, this taxonomy is hardly used to develop educational materials for patients. Therefore, Bloom's Taxonomy is still rarely cited in the literature as a framework for the development of materials targeted at Public Health education, especially in the Nursing area, as no reports of documented experiences have been found in the scientific literature.

Thus, the objective of this theoretical-reflexive study is to present a theoretical-methodological model to guide the development and validation of educational technology, specifically didactic booklets in the Nursing area.

Theoretical-methodological model to develop and validate educational booklets for the Nursing area

To identify the necessary steps for producing educational booklets, a narrative literature review was conducted, searching for studies on the development of this type of material to discuss the *state-of-the-art* in this theme, focusing on the booklet creation stages, language and presentation style of the material, development team members required, and the theoretical frameworks and validation instruments used.

Based on the literature, the following stages for developing and validating educational booklets were listed: Situational diagnosis; Literature and documentary review; Content selection and summarization; Script development based on theoretical frameworks and situational diagnosis; Creation and layout of the illustrations; and Validation with experts and with the target audience (Figure 1).

Figure 1 – Stages for developing and validating educational booklets. Florianópolis, Santa Catarina, Brazil – 2023
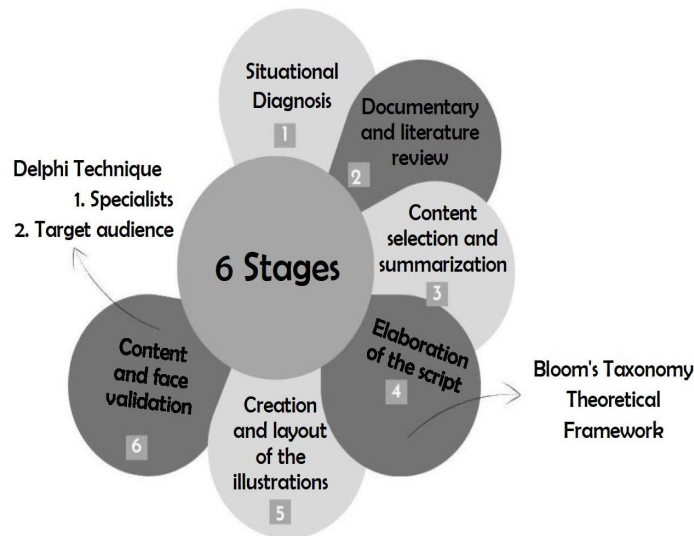
Source: The authors.

Stage 1: Situational diagnosis

This stage refers to the grounds/reasons for developing the educational booklet, where data are collected from/about the target audience, who are the prospective users of the technology proposed. In this sense, the situational diagnosis identifies the future users' knowledge and learning needs so that, combined with the scientific literature in the area, they may devise the framework for the content to be addressed and presented[12].

Stage 2: Literature and documentary review

During this stage, a search is conducted in the scientific literature, including databases and/or Gray Literature such as theses, dissertations, manuals, guidelines and recommendations from professional associations in the area regarding the content that can assist in developing the educational booklet. This stage ensures reliability of all the information presented in the material to be developed[5].

Stage 3: Selection and summarization of the topics that will be included in the educational booklet

After gathering the data from the target audience and conducting the literature review, the next step involves selecting and summarizing the topics to be included in the educational booklet. The important points are selected and analyzed to define the best way to present them, considering the target audience's age group, the previous situational diagnosis, and the bibliographic survey conducted.

Stage 4: Educational material script and content development

Subsequently, each booklet section will be planned by nurses and the health care team in collaboration with professionals from the design, communication and/or illustration areas. This collaborative effort will result in the educational booklet first version (pilot). The principles for creating educational materials, such as contrast, visual thinking, aesthetic dimension, use of metaphors and analogies, alignment, careful

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consideration about font style, language and selection of images and colors should be observed in accordance with the recommendation proposed in the literature[5]. The professionals from the design, communication and illustration areas can participate through formal partnerships and acquired funding.

In this stage, it is essential to use a theoretical and methodological framework for the booklet to clearly align with its objectives, present content in an increasing complexity order, and employ resources and strategies that ease knowledge acquisition. In this sense, the theoretical and methodological framework proposed in this article for developing the educational booklet is Bloom's Taxonomy. This taxonomy[9] was created in 1948 by Benjamin Bloom and collaborators at the American Psychological Association's request, which led the effort to organize the creation of a taxonomy for the educational context.

This framework is divided into specific development domains: Cognitive, Affective, and Psychomotor. Among these domains, the Cognitive one is the most used by educators to define objectives, strategies and educational plans, as well as to assess the intended audience's learning, that is, the target population[9]. In the model proposed in this article, learners are

referred to as the target audience. The Cognitive domain is related to learning and mastering knowledge, which involves the prospective users' new knowledge acquisition, continuous intellectual, skill and attitude development or, in this case, the learners'[9].

The structure proposed in Bloom's Taxonomy consists of a two-dimension table, composed of the Knowledge and the Cognitive Process dimensions. The Knowledge dimension has four subcategories: Effective knowledge (basic knowledge), Conceptual knowledge (interrelation of the basic elements), Procedural knowledge (practical skills), and Meta-cognitive knowledge (awareness of the knowledge acquired).

The Cognitive Process dimension has its objectives organized into six categories – Remembering, Understanding, Applying, Analyzing, Synthesizing and Creating – which gradually increase in terms of complexity and are interdependent[9] and interconnected (Figure 2). For each category, action verbs in the gerund are included to describe how the objectives will be achieved and to ease selection of the educational strategies and technologies. The Cognitive domain categories were revised and updated by a group of researchers in 2001.

Figure 2 – Bloom's Taxonomy dimensions. Florianópolis, Santa Catarina, Brazil – 2023
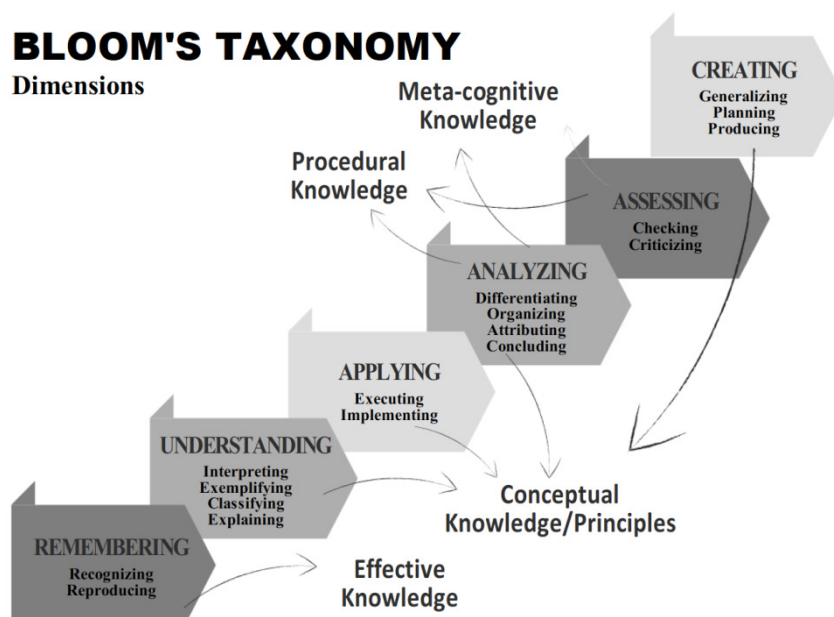
Source: The authors.

According to the development stages of the educational booklet proposed in this article, when initiating Stage 4 (*Script development*), the topics and content to be addressed in the material have already been listed. In this sense, it is at the script development moment that Bloom's Taxonomy will be implemented.

Following this taxonomy, the first stage in the Cognitive Process dimension is to engage the target audience in recognizing and reproducing ideas and content, hence the name *Remembering*. Initially, the booklet theme should be introduced to its target audience and encourage them to recall/recognize their existing knowledge about the topic, previously acquired in situations such as consultations or health education sessions. The *Effective knowledge* applied in this stage relates to presenting basic content about the topic proposed.

Subsequently, the *Understanding* category addresses new knowledge and principles about what is intended to be taught, proposing the target audience to interrelate the basic concepts with new ones, explaining them in a more elaborate manner. In this stage, the educational booklet also encourages future users to express the information learned in their own words. Creativity should be employed to propose interactive activities, such as drawings and reflections that stimulate prospective users to externalize what they have learned.

In the *Applying* category, the booklet content is directed towards applying and implementing the new knowledge in a specific situation. Nurses conduct the booklet plot in a way that guides future users to this learning experience. *Conceptual knowledge* continues to guide development of this content.

Next, in the *Analyzing* stage, all the information in the booklet should be distributed into more important and less relevant parts. The plot should help prospective users understand the relationship between these parts. *Conceptual knowledge* continues to support the proposal along with *Procedural knowledge*, linked to specific contents and techniques, as well as to the perception about when and how they

should be used. *Meta-cognitive knowledge*, also applied in this stage, involves the future users' ability for self-knowledge and self-perception about learning and the strategies proposed. The booklet content can also explore the prospective users' limits and potentialities, which should be known beforehand.

The *Assessing* category is guided by Procedural knowledge and by Meta-cognitive knowledge.. The booklet proposes future users to assess/check what they have learned and their attitudes through tasks such as games, drawings and word searches, among other activities, which will be developed with the creativity of the development team. The objective is to propose activities that, when solved by the prospective users, generate a critical analysis of the knowledge acquired.

Finally, in the *Creating* category, the educational booklet suggests that future users put into practice the knowledge and skills acquired. A task will be proposed, asking the prospective users to share real-life experiences related to the topic discussed and how they will solve them based on the knowledge acquired. It is recommended to include some blank pages or elements guiding future users in completing this task[9].

Stage 5: Creation and layout of the illustrations

It takes place simultaneously with Stage 4 because the illustrations should be planned while the development team describes the booklet content guided by Bloom's Taxonomy. The image communicative function (decorative, representational, organizational, transformational or interpretative) and its cognitive function (drawing the attention, activating or building knowledge, minimizing cognitive load, easing learning transfer, supporting motivation) should be considered. Image resolution and licensing, as well as the relationship between images and text, should also be studied[13]. When dealing with children's books, illustrations should be tailored to this audience, considering issues such as readability, handling, format and typography[13].

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Stage 6: Educational booklet content validation by expert professionals and by the target audience

After creating the first educational booklet version, content validation will be carried out by specialists in the relevant area of interest. Content and face validation can be conducted simultaneously, provided that the illustrations for the product have already been developed. The developers may choose to validate the content before preparing the images, which can lead to cost savings and greater confidence in subsequent illustrations. It is necessary that experts in the design area take part in face validation of the technology proposed. The inclusion criteria for specialists should involve professionals with expertise in the area and/or topic of the material to be developed, with experience regarding theoretical knowledge combined with clinical or market practice.

For this stage, the Delphi technique is one of the methods used to perform the validation process. Its objective is to ease and improve the decision-making process of a group of specialists and/or target audience about a product, without these individuals interacting with each other[14]. Therefore, the educational booklet is presented, and its evaluation will take place through questionnaires/instruments. More than one evaluation round can be conducted until consensus is reached in the specialists' answers. Anonymity, individual feedback and overall opinion analysis are some of the features of this technique. Implementing the Delphi technique involves the following stages: 1. Selection of the experts; 2. Creation of the Data Collection Platform, with inclusion of the experts' characterization questionnaire and of the questionnaires for validating the educational booklet face and content; 3. Initial contact with the experts to invite their participation; 4. Sending the material (script and illustrations) and validation instrument with space for suggestions (Round 1); 5. Receiving the answers; 6. Qualitative and quantitative analysis of the answers; 7. Necessary adjustments based on the analysis. In case the evaluation does not achieve the desired agreement level, new rounds can be conducted. 8. Illustration and layout finalization, and sending the material to the experts; 9. Possibility of sending the material to the target audience, alternating with analyses and adjustments; and 10. Process conclusion[14].

The Educational Content Validation Instrument in Health (*Instrumento de Validação de Conteúdo Educativo em Saúde*, IVCES)[7] has been used for content validation and was developed for health professionals to validate educational materials in the area, ensuring that the target audience receives technologies with more reliable and appropriate content. The instrument comprises 18 items: Objectives (5 items); Structure/Presentation (10 items); and Relevance (3 items). It offers three answer options: I disagree = 0; I partially agree = 1; and I totally agree = 2. This instrument should be sent only to the health specialists and to the target audience.

The Educational Content Validation Instrument in Health (*Instrumento para Validação de Aparência de Tecnologias Educacionais em Saúde*, IVATES)[8], developed and validated in Brazil, consists in aesthetically validating educational materials in health, encompassing all artistic aspects of the material, such as colors, lines, drawings, images and harmonization of all the information with the constructed scenario. It is one of the most recent instruments in the national literature and has been used for the validation of educational materials. This instrument should be applied both to specialists in the area and in design. The instrument comprises 12 items with 5 answer options on a 5-point adjective scale: I totally disagree = 1; I disagree = 2; I partially disagree = 3; I agree = 4; and I totally agree = 5. Validating educational materials using instruments designed to assess their aesthetic aspect is of major importance because it is essential for the target audience that the message conveyed through this material is clearly understood, and that the images provide a facilitating means for learning.

To evaluate the specialists' answers, it is recommended to use the Content Validity Ratio (CVR), where the critical CVR refers to its lowest level, so that the agreement level among the specialists exceeds that of chance for a given item. The objective of using the CVR is to reduce the risk of bias related to the experts' panel, as the critical cutoff value depends on the number of specialists included[15]. The CVR is calculated for each instrument item (CVR-I) and for the total: CVR-S = Sum of totals/Number of items. For CVR-I calculation, the following formula is used: CVR-I = (Ne-N/2)/(Ne-N/2), where Ne refers to the number of experts that answered *I totally agree* and N is the total number of specialists. The items that do not reach the critical value should be revised, and the booklet content adjusted. In addition to the CVR, it is recommended that the domains evaluated include a space for suggestions from the experts, with a subsequent qualitative analysis of the results.

Final Considerations

Using a theoretical-methodological framework for developing educational technologies in health (didactic booklets in this case), is essential to ensure the creation of effective soft-hard technologies. Therefore, proposing methodological steps based on literature and on Bloom's Taxonomy provides a possibility to consolidate knowledge and assist nurses in creating such products with quality and scientific rigor. In addition to providing health professionals and researchers with theoretical-methodological grounds for the development and validation of educational booklets, this proposal can foster the conduction of comparative studies across various contexts and populations, by proposing a systematic approach for developing these materials.

It is noted that proposing the situational diagnosis as the initial stage in the method suggested will greatly contribute to developing an educational material customized to the intended audience's particularities, allowing the entire creative process to be directed to the target audience (prospective users) developmental phase characteristics, allowing their understanding and highest possible autonomy level in self-care.

Collaborations:

1 – Conception and planning of the project: Valéria de Cássia Sparapani;

2 – Data analysis and interpretation: Valéria de Cássia Sparapani, Ana Izabel Jatobá de Souza, Jane Cristina Anders, Juliana Coelho Pina and Patrícia Kuerten Rocha;

3 – Writing and/or critical review: Valéria de Cássia Sparapani, Ana Izabel Jatobá de Souza, Jane Cristina Anders, Juliana Coelho Pina and Patrícia Kuerten Rocha;

4 – Approval of the final version: Valéria de Cássia Sparapani, Ana Izabel Jatobá de Souza, Jane Cristina Anders, Juliana Coelho Pina and Patrícia Kuerten Rocha.

Conflicts of interests

There are no conflicts of interest.

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