"Chronic Wounds" Educational Game: Guidelines for Professionals Regarding Wound Assessment, Prevention, and Treatment

Jogo educativo "Feridas Crônicas": Orientação para profissionais na avaliação, prevenção e tratamento de feridas

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Abstract

Introduction Effective chronic wound treatment requires early diagnosis, an interdisciplinary approach, and innovative tools, such as clinical protocols, educational games, and mobile applications. Implementing these tools, especially educational games, facilitates teamwork and contributes to safe care, minimizing risks and adverse events.

Objective The present study aimed to develop and validate an educational game to guide healthcare professionals in the assessment, prevention, and treatment of chronic wounds.

Materials and Methods Forty-four nurses validated the application content using the Delphi technique. Data analysis adopted the Content Validity Index (CVI).

Results The integrative literature review identified 5,952 articles, but we excluded 1,532 due to duplication. In total, we selected 4,420 articles for title reading, 2,188 for abstract reading, 36 for full-text reading, and 15 as the basis for the current study. The nurses classified the game's content from "inadequate" to "totally adequate" in the first evaluation; after corrections, they re-evaluated the content from "adequate" to "totally adequate." The CVI ranged from 81.82 to 100.00 in the first evaluation and from 97.73 to 100.00 in the second evaluation.

Conclusion The literature review allowed specialists to design and validate the "Chronic Wounds" game. Nurses considered the game functional, reliable, adequate, and efficient to assess, prevent, and treat patients with acute and chronic wounds.

Keywords
- healing and recreational games
- nursing
- wounds and injuries

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Resumo

Introdução O tratamento eficaz de feridas crônicas exige um diagnóstico precoce, uma abordagem interdisciplinar e a utilização de ferramentas inovadoras, como protocolos clínicos, jogos educativos e aplicativos móveis. A implementação dessas ferramentas, especialmente dos jogos educativos, facilita o trabalho em equipe e contribui para uma assistência segura, minimizando riscos e eventos adversos.

Objetivo Construir e validar um jogo educativo para orientar profissionais de saúde na avaliação, prevenção e tratamento de feridas crônicas.

Materiais e Métodos A validação do conteúdo do aplicativo foi realizada por 44 juízes enfermeiros, utilizando a técnica Delphi. Para a análise de dados, foi adotado o Índice de Validade de Conteúdo (IVC).

Resultados Durante a revisão integrativa da literatura, foram identificados 5.952 artigos, sendo que 1.532 foram excluídos por duplicidade. Foram selecionados 4.420 artigos para leitura do título, 2.188 para leitura do resumo, 36 após leitura integral e 15 para a base do trabalho. Os juízes consideraram o conteúdo do jogo entre “inadequado” e “totalmente adequado” na primeira avaliação; após correções, foi reavaliado entre “adequado” e “totalmente adequado”. O IVC variou de 81,82 a 100,00 na primeira avaliação e de 97,73 a 100,00 na segunda.

Conclusão A revisão da literatura permitiu a construção e validação do jogo “Feridas Crônicas” por especialistas, sendo considerado funcional, confiável, adequado e eficiente para que enfermeiros possam avaliar, prevenir e tratar pacientes com feridas agudas.

Palavras-chave

- cicatrização e jogos recreativos
- enfermagem
- ferimentos e lesões

Introduction

Wounds are a public health problem in Brazil and worldwide, with high morbidity and mortality rates. Their impact on patients is significant, causing pain, immobility, disability, psycho-emotional changes related to self-esteem and self-image, and social changes resulting from hospitalizations and time away from social life and work.[1,2]

Nurses are often responsible for the treatment and prevention of chronic wounds, assessing and prescribing the best dressings for each injury. In addition, nurses guide and supervise the nursing team in applying dressings.[3,4]

Wound care requires early diagnosis, interdisciplinary action, and the implementation of tools, such as protocols, educational games, and applications. Healthcare professionals must have specific knowledge and technical skills and participate in continuing education, whether through online or in-person courses. Wound assessment should be comprehensive, individualized, and systematized, facilitating teamwork and adding up-to-date scientific knowledge, resulting in safe care, free from harm and adverse events.[5–7]

Adopting measurement instruments, educational games, and applications is crucial to assist professionals in assessing risks, formulating diagnoses, determining care plans, and planning preventive measures. These methods place the professional or student at the center of the teaching-learning process, developing new skills and increasing the motivation to perform procedures.[8]

Educational games are technologies guiding decision-making in clinical care issues, adding scientific rationality and serving as guides to assess, prevent, and treat wounds. They provide information on the best prophylactic-therapeutic approach for each clinical assessment performed by the nursing and multidisciplinary team, confirming their effectiveness as a guiding instrument for care.[9–11]

Developing an educational game for nursing professionals is a proven valid strategy for training, diagnosis, and therapeutic approaches, especially in the relationship between theory and practice and the interrelation of knowledge and learning contextualization. As digital technology becomes indispensable in the daily tasks of many professionals and students in the healthcare area, computer engineering develops tools assisting the performance of technical skills through educational games.

Objective

The present study aimed to develop and validate an educational game to guide healthcare professionals in wound assessment, prevention, and treatment.

Materials and Methods

This methodological research used Vygotsky’s socio-constructivist theory and the Child-Centered Game Development as theoretical frameworks.[12]

The central point from Lev Semionóvich Vygotsky’s social interactionist theory is social relationships, which shape the subject through their relation and interaction with the environment.[11] The framework considers the player-game

interaction, in which the player can use actions, such as decision-making, choice, prioritization, and reasoning of problem-solving strategies, through mediating tools.[13]

The child-centered game development (CCGD) framework considers that game development requires subject participation in the entire creation and validation process to incorporate their needs, beliefs, and perceptions. This encourages subjects to take on the role of informants, users, testers, and even partners in the design. The CCGD has five phases: analysis, concept, design, implementation, and evaluation,[12] as described below.

The game was designed from May to July 2022.

Phase 1–Analysis: In this phase, during their clinical practice providing care to wounded patients, the authors found that many nurses had difficulty in cleaning, assessing, prescribing preventive measures, and treating skin lesions correctly, leading to risk, harm, and lack of safety for patients.

Phase 2–Concept: We performed a literature review and defined the following steps for research development: topic identification and research question selection; establishment of inclusion and exclusion criteria for studies; definition of the information to gather from the selected studies and study categorizations; evaluation of the studies included in the integrative review; result interpretation; review presentation; and knowledge synthesis.

The objective was to answer the following guiding question: "What evidence is available in the literature regarding wound cleaning, assessment, prevention, and treatment?".

To construct the appropriate question to answer this clinical question, we used the PICO strategy, in which P corresponds to the population (wound assessment, cleaning, prevention, and treatment), I stands for intervention (a technique for wound cleaning, assessment, prevention, and treatment), C corresponds to comparison (not applicable), and O stands for outcome (the game).[14]

We performed a literature review in the PubMed, Cochrane, and LILACS databases and the SciELO virtual library. We searched for articles published from 2018 to 2022, using the following controlled descriptors in health sciences: *Wounds and Injuries*, *Healing and Recreational Games,* and their corresponding terms in Portuguese and Spanish. We determined the search strategy by combining the selected descriptors and the Boolean operator "AND".

The inclusion criterion for selecting publications was their availability as full texts. We excluded theses, dissertations, monographs, and technical and case reports.

The two authors independently selected the studies retrieved in the process of literature review by reading their titles, abstracts, and full texts to ensure they covered the research theme and met the inclusion criterion.

Phase 3–Design: This stage involved planning and producing the game's educational content, defining the topics, writing the subjects, selecting the media, and designing the interface (layout). We decided to use texts, drawings, and photos structured as topics.

Phase 4–Implementation: We designed the prototype onto the chosen target platform using the Adobe Illustrator software.

Phase 5–Evaluation: An expert committee evaluated the first version of the game's content for its validation using a methodological approach based on the criteria established by Pasquali.[15]

A judging panel consisting of specialist nurses (stomatherapists and dermatology nurses) performed the content validation of the "Chronic Wounds" game.

The validation study of the "Chronic Wounds" game occurred at Hospital Clínico Samuel Libânio from Universidade do Vale do Sapucaí, by stomatherapy nurses registered with the Brazilian Association of Stomatherapy or specializing in Dermatological Nursing registered with the Brazilian Association of Dermatological Nursing.

The judges' selection occurred by convenience sampling using the snowball method, that is, after identifying a subject who met the study inclusion criteria, we asked them to indicate other potential participants.

The inclusion criteria for the judges were to have a nursing undergraduate certificate and to be a specialist in the area. We excluded professionals who agreed to participate in the research but did not respond to or submit the evaluation questionnaire within 15 days of receiving it.

The definition of the number of participants in the judging panel relied on the Brazilian Association of Technical Standards ISO/IEC 25062:2011, which recommends a minimum sample of 10 subjects for each type of professional participating in the study. The total number of study participants was 44.

Data collection occurred from August to November 2022 using the Delphi technique.[16] This technique uses questionnaires for instrument content evaluation by the judges, seeking an agreement level of 50 to 100% among them. Delphi usually requires 2 to 3 rounds or evaluation cycles, potentially more. The current study required a 100% agreement among the judges to validate the application.[16,17]

Each study participant received an invitation letter by e-mail consisting of an initial presentation by the researcher, clarifications on the research topic, a copy of the opinion of the Research Ethics Committee, an informed consent form, explanations on the significance of the evaluator for the study, the evaluation cycles, and instructions to complete the evaluation and send the completed questionnaire within 15 days starting from the delivery day.

The questionnaire had two parts. The first part identified the evaluator (5 questions), including the type of postgraduate degree, time since graduation, time working in the field, and academic background. The second part was the evaluation of the game content (19 questions), involving the graphic presentation, topic sequence, clarity and comprehension of the information, the scientific basis of the information, the appropriateness of the material for the level of the proposed target audience, the writing style, the proper number of illustrations, wound definition, wound cleaning according to the presence of exudate and tissue present in the injury, risk factors, preventive measures, and treatments for the following types of wounds: pressure injury, venous ulcer, friction injury, and incontinence-associated dermatitis.

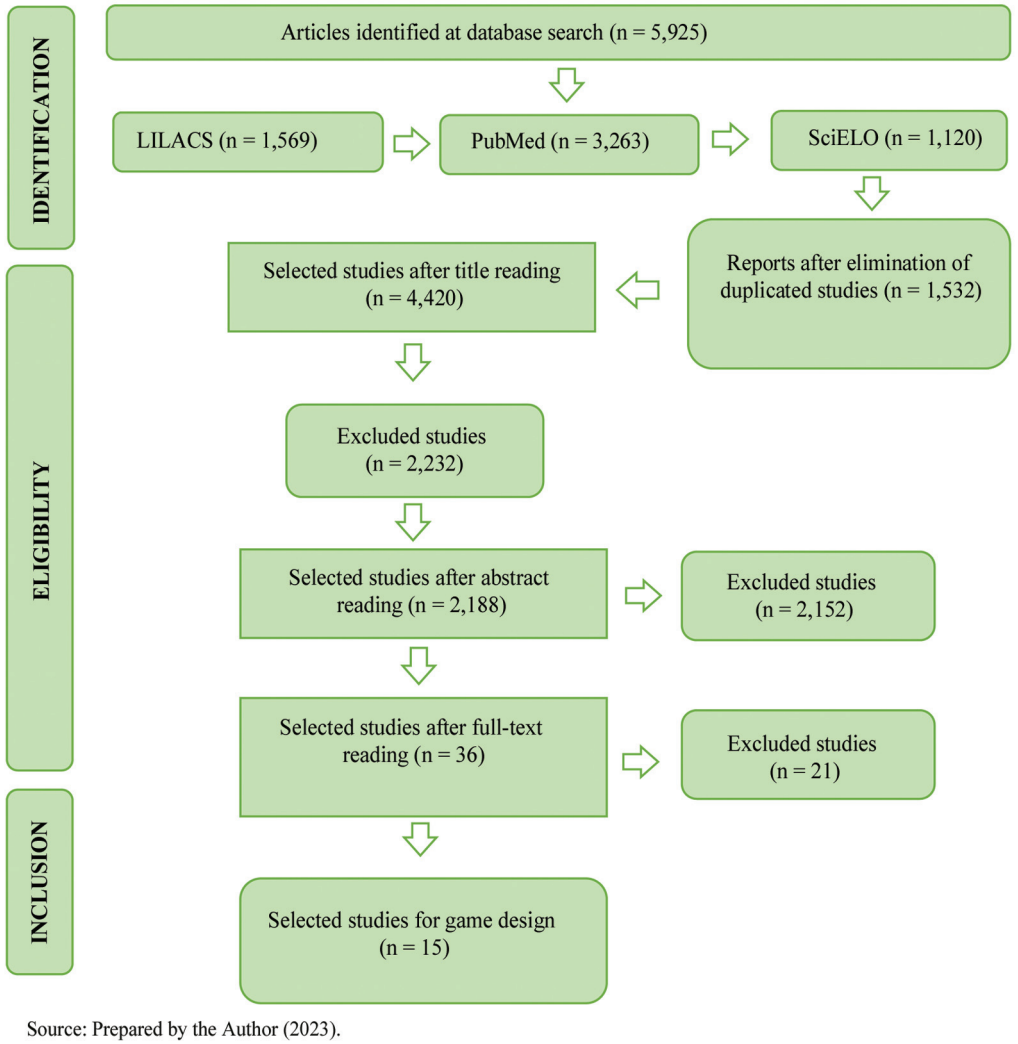


Fig. 1 Flowchart of the identification, selection, and inclusion of studies following the PRISMA guidelines.

Answers were arranged on a four-point Likert scale, with the options “adequate,” “partially adequate,” “completely adequate,” and “inadequate,” with instructions for optional descriptive answers. We counted the answers marked as “adequate” or “completely adequate.” We reviewed items classified as “inadequate” or “partially adequate” based on the judges’ suggestions and presented them in a new evaluation round following the Delphi technique. We used the Content Validity Index (CVI) for aesthetic analysis.[18]

The CVI value for validating a questionnaire is the sum of the number of “adequate” and “completely adequate” answers divided by the total number of responses. This value must be greater than or equal to 0.80.

The Ethics Committee of Faculdade de Ciências Médicas Dr. José Antônio Garcia Coutinho approved this study (opinion no. 2,520,803).

Results

We initially identified 5,952 articles and excluded 1,532 since they were duplicated in the database. Thus, we selected 4,420 articles for title reading, 2,188 studies for abstract reading, and 36 studies for full-text reading. We selected 15 studies as the basis for building the game (►**Fig. 1**).

►**Table 1** lists the questions presented to the judges and the values of the CVI, with the 1st evaluation score ranging from 81.82 to 100.00 and the 2nd evaluation score ranging from 97.73 to 100.00. These scores indicate that the content of the “Chronic Wounds” game was excellent.

►**Table 2** presents the main topics of each question and the judges’ evaluation of the content of the “Chronic Wounds” game using the Delphi technique. Answers from the first evaluation ranged from inadequate to fully adequate, and we achieved a consensus after the second evaluation of the game by the judges.

►**Fig. 2** shows some screens of the “Chronic Wounds” game. The game has 48 screens, including 5 for risk factors, 4 for definitions, 4 for categories or stages, 20 for prevention, and 15 for treatment of pressure injuries, venous ulcers, and friction injuries, plus definitions and categories or stages. At the end of the game, the user must get 90% correct answers to receive the certificate. We registered the game “Chronic

Table 1 Content Validity Index values per judges' assessment

Evaluated questions	Content Validity Index	
	First evaluation (%)	Second evaluation (%)
Is the content appropriate for the target audience?	81.82	100.00
Does the content present relevant information for the target audience?	84.09	100.00
Are the subtitles pertinent?	93.18	100.00
Is the text sequence logical and coherent?	94.15	100.00
Does the content facilitate the teaching and learning process on the topic?	93.18	100.00
Is the vocabulary accessible to the target audience?	86.36	100.00
Is the text of the "Chronic Wounds" game clear and objective?	81.82	100.00
Is the verbal language easy to assimilate?	88.64	100.00
Is the visual composition attractive and organized?	82.76	100.00
Is the content motivating?	81.82	100.00
Does the content clarify doubts about the subject?	84.09	100.00
Regarding the definition of wound types (pressure injury, venous ulcer, diabetic foot, friction injury, and incontinence-associated dermatitis)	88.64	100.00
Regarding the description of signs and symptoms (pressure injury, venous ulcer, friction injury, and incontinence-associated dermatitis)	91.89	100.00
Regarding the description of preventive measures (pressure injury, venous ulcer, friction injury, and incontinence-associated dermatitis)	90.91	97.73
Regarding the description of the treatment type of lesions (pressure injury, venous ulcer, friction injury, incontinence-associated dermatitis)	95.45	100.00
Regarding the description of the type and definition of personal protective equipment	93.18	100.00
Regarding the friction injury category description	100.00	100.00
Regarding the description of pressure injury stage types	95.45	100.00
Regarding the description of the incontinence-associated dermatitis classification	97.73	100.00
Regarding the definition of the wound cleaning technique according to the tissue type and exudates	95.54	100.00
Regarding the description of wound cleaning solutions	95.61	100.00
Regarding the description of the tissue type present in the wound	97.66	100.00

Wounds" with the Brazilian National Institute of Industrial Property under Process number BR512022003397-6. The game is available on the Play Store.

Discussion

Nurses are using educational materials to improve their knowledge of a given technique, resulting in effortless procedure performance with the least potential risk, without damage or adverse events, increased productivity, and contributing to the optimization and provision of quality care.[19,20]

Online stores offer several educational materials, which are increasingly available and range from physical examinations to skin lesion assessment, prevention, and treatment. Well-designed and used educational tools can benefit the population and professionals, leading to faster access to healthcare services, laboratory and imaging tests, and disease diagnosis and treatment.[21,22]

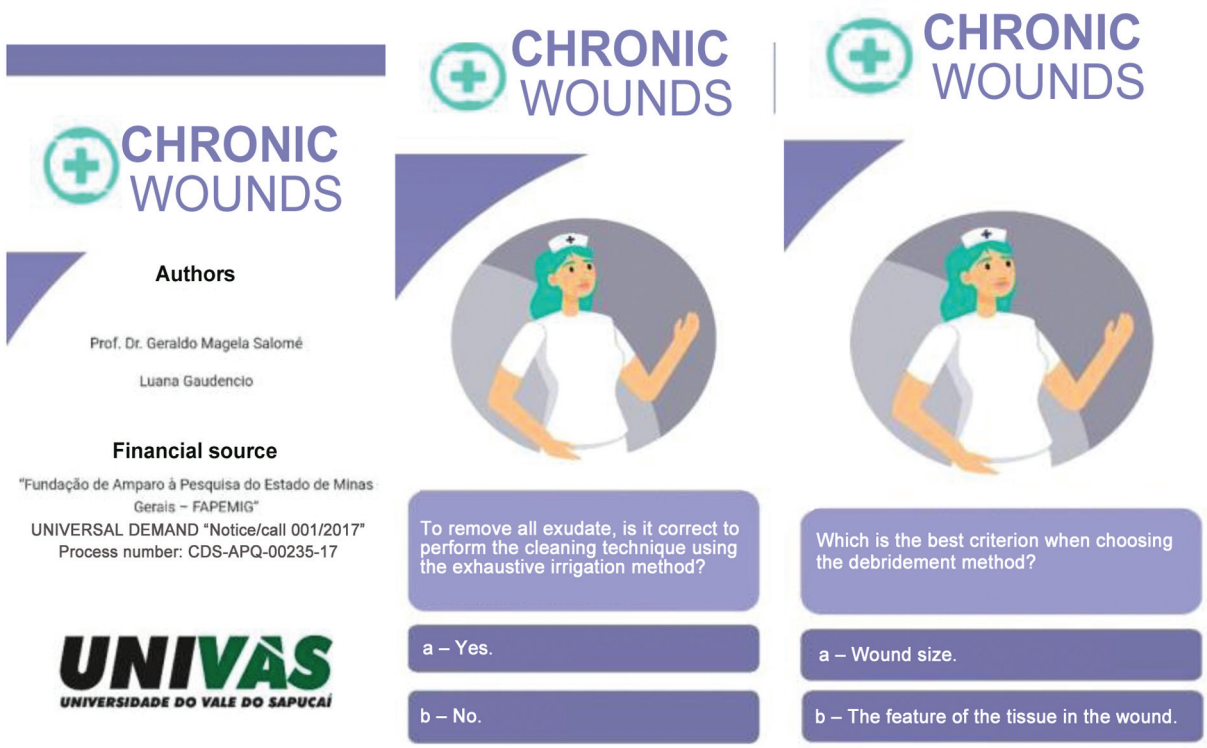
The "Chronic Wounds" game aimed to facilitate access to significant information for nurses during wound dressing, helping them to review the cleaning technique, assessment and prescription of preventive measures, and treatment of acute or chronic wounds. The professional will learn and resolve any doubts potentially arising during the procedure.

Educational games allow professionals to improve the teaching-learning process while having fun, improving patient care and satisfaction, and promoting safe procedure performance, ensuring the continuity of the healing phase.[21,22]

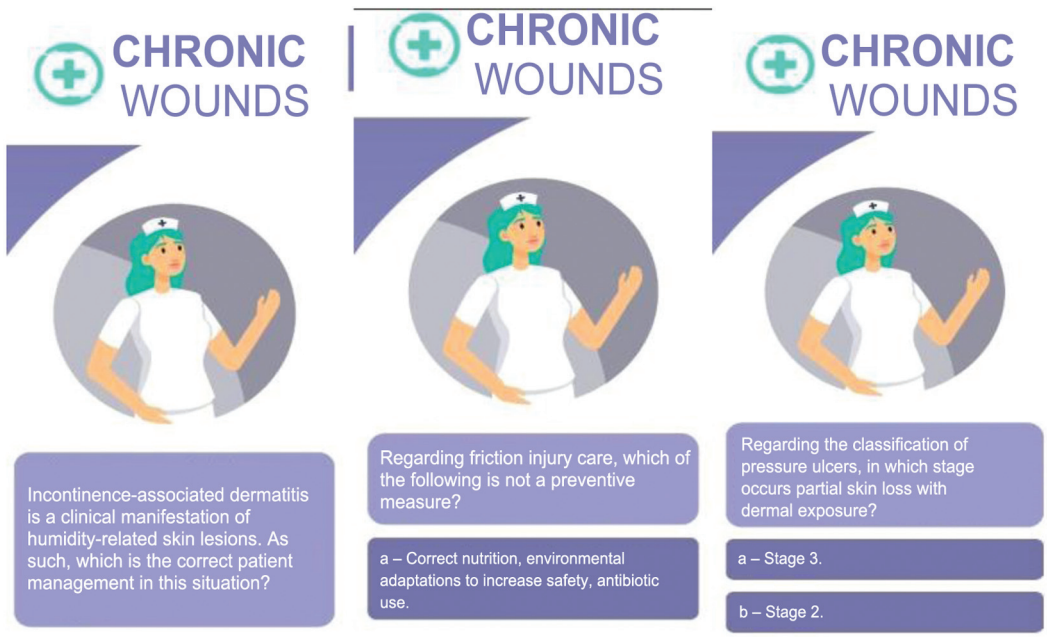
Table 2 Evaluation of the “Chronic Wounds” game content by judges using the Delphi technique

Evaluated topics	First evaluation				Second evaluation			
	IND	PAD	ADQ	TAD	IND	PAD	ADQ	TAD
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Is the content appropriate for the target audience?	02 (05)	06 (14)	20 (45)	16 (36)	0 (0)	0 (0)	24 (55)	20 (45)
Does the content present relevant information for the target audience?	03 (07)	04 (09)	19 (43)	18 (41)	0 (0)	0 (0)	23 (52)	21 (48)
Are the subtitles pertinent?	01 (02)	02 (05)	24 (55)	17 (39)	0 (0)	0 (0)	27 (61)	17 (39)
Is the text sequence logical and coherent?	02 (05)	01 (02)	30 (68)	11 (25)	0 (0)	0 (0)	33 (75)	11 (25)
Does the content facilitate the teaching and learning process on the topic?	02 (05)	04 (09)	27 (61)	11 (25)	0 (0)	0 (0)	31 (70)	13 (30)
Is the vocabulary accessible to the target audience?	02 (05)	01 (02)	31 (70)	10 (23)	0 (0)	0 (0)	33 (75)	11 (25)
Is the text of the “Chronic Wounds” game clear and objective?	02 (05)	04 (09)	31 (70)	07 (16)	0 (0)	0 (0)	36 (82)	08 (18)
Is the verbal language easy to assimilate?	0 (0)	08 (18)	23 (52)	13 (30)	0 (0)	0 (0)	27 (61)	17 (39)
Is the visual composition attractive and organized?	01 (02)	04 (09)	26 (59)	13 (30)	0 (0)	0 (0)	29 (66)	15 (34)
Is the content motivating?	0 (0)	08 (18)	25 (57)	11 (25)	0 (0)	01 (02)	30 (68)	13 (30)
Does the content clarify doubts about the subject?	0 (0)	07 (16)	26 (59)	11 (25)	0 (0)	0 (0)	31 (70)	13 (30)
Regarding the definition of wound types (pressure injury, venous ulcer, diabetic foot, friction injury, and incontinence-associated dermatitis)	0 (0)	05 (11)	27 (61)	12 (27)	0 (0)	0 (0)	30 (68)	14 (32)
Regarding the description of signs and symptoms (pressure injury, venous ulcer, friction injury, and incontinence-associated dermatitis)	0 (0)	04 (09)	28 (64)	12 (27)	0 (0)	0 (0)	31 (70)	13 (30)
Regarding the description of preventive measures (pressure injury, venous ulcer, friction injury, and incontinence-associated dermatitis)	0 (0)	02 (05)	29 (66)	13 (30)	0 (0)	0 (0)	30 (68)	14 (32)
Regarding the description of the treatment type of lesions (pressure injury, venous ulcer, friction injury, incontinence-associated dermatitis)	0 (0)	03 (03)	30 (68)	11 (25)	0 (0)	0 (0)	31 (70)	13 (30)
Regarding the description of the type and definition of personal protective equipment	0 (0)	0 (0)	22 (50)	33 (50)	0 (0)	0 (0)	22 (50)	22 (50)
Regarding the friction injury category description	0 (0)	02 (05)	25 (57)	17 (39)	0 (0)	0 (0)	26 (59)	18 (41)
Regarding the description of pressure injury stage types	0 (0)	1 (02)	29 (66)	14 (32)	0 (0)	0 (0)	29 (60)	15 (34)
Regarding the description of the incontinence-associated dermatitis classification	0 (0)	2 (5)	28 (64)	14 (32)	0 (0)	0 (0)	30 (68)	14 (32)
Regarding the definition of the wound cleaning technique according to the tissue type and exudates	0 (0)	02 (05)	29 (66)	13 (30)	10 (23)	0 (0)	0 (0)	33 (75)
Regarding the description of wound cleaning solutions	0 (0)	02 (05)	29 (66)	13 (30)	07 (16)	0 (0)	0 (0)	36 (82)
Regarding the description of the tissue type present in the wound	0 (0)	03 (03)	30 (68)	11 (25)	0 (0)	0 (0)	24 (55)	20 (45)

Abbreviations: ADQ, adequate; IND, inadequate; PAD, partially adequate; TAD, totally adequate.



Source: Prepared by the authors (2022).



Source: Prepared by the authors (2022).

Fig. 2 Example of a screen from the "Chronic Wounds" game.

To develop this game, we initially identified in a literature review the most significant information to guide nurses in wound dressing. Next, experts validated the game's contents. It is worth noting that the development of software coherently and appropriately presupposes the identification of the real needs of users and, subsequently, their validation.[23]

Regarding content validation, the expert evaluation revealed that the game offers clear, understandable, and appropriate language, relevant content, and importance in clinical practice. The content validation of the "Chronic Wounds" game was consensual among the judges and excellent per the CVI in the second round from the Delphi technique.

The CVI demonstrated that the content addressed in the game is reliable and valid. This reliability allows its indication for nurses to evaluate and prescribe preventive measures and treatments for skin lesions as a way of contributing to their knowledge and improving care since professionals will see their knowledge through the game, also facilitating communication between professionals and users, increasing treatment compliance.

The results of the validation of this instrument are consistent with those from a study performed in southeast Brazil to validate software to assess, prevent, and treat pressure injuries. This study evaluated items related to language and content, which presented an excellent CVI. A tool with good usability must have an intelligible and understandable language to the target audience and practical relevance.[3]

Several studies report that in the organization and interface of software screens and system content, the device must present clear content, quickly accessible and easy to use.[3,24]

Validation of educational technologies by professionals with experience in evaluating software content is crucial since they have a keener eye for aspects that can influence the learning, empowerment, and self-care process.[3,25,26]

In the present study, we wanted to provide questions and answers clearly and objectively, using simple vocabulary and sufficient information through short texts to avoid ambiguity and allow the transmission and capture of messages and learning. This data corroborates the findings of several studies on software validation, which obtained satisfactory evaluations regarding the clarity, objectivity, and attractiveness of the language.[26]

The validation of the game’s content indicates the reliability of the information, and the significance of the topics addressed for the learning process of nurses during the dressing procedure. However, a limitation of our study is the lack of validation of the tool regarding functionality and usability by information technology professionals, which could restrict its use due to difficulties in handling the menus and not understanding the information provided, which is the perspective of the future study we will develop.

Conclusion

The literature review allowed the design of the “Chronic Wounds” game, which underwent validation by experts in the area. The game content was considered functional, reliable, appropriate, and efficient, providing nurses with an effective tool to assess, prevent, and treat patients with acute and chronic wounds. The educational game developed in this study offers practical and accessible training, allowing nurses, physical therapists, and physicians to acquire technical knowledge and skills in the safe and efficient use of laser therapy. This will result in a significant improvement in the quality of care provided to patients.

Authors’ Contributions

GMS: data analysis and/or interpretation, statistical analysis, final manuscript approval, conceptualization, study conception and design, resource management, methodology, and software; LG: data analysis and/or interpretation, funding acquisition, data collection, project management, and and software.

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Clinical Trials

None.

Conflict of interests

The authors have no conflict of interests to declare.

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