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Wise Infant Development®: creation of a software for teaching in pediatric nursing education

Wise Infant Development®: criação de um software para ensino em enfermagem pediátrica

Wise Infant Development®: creación de un software para la enseñanza de la educación en enfermería pediátrica

Wesley Soares de Melo[I]
ORCID: 0000-0002-2979-8517

Isabelle e Silva Sousa[I]
ORCID: 0000-0003-3387-6722

Samara Pereira Souza Mariano[I]
ORCID: 0000-0001-8615-3099

Aglauvanir Soares Barbosa[II]
ORCID: 0000-0003-4909-563X

Dayllanna Stefanny Lopes Lima Feitosa[III]
ORCID: 0000-0002-1358-7328

Vanessa Emille Carvalho de Sousa Freire[I]
ORCID: 0000-0003-3571-0267

Emanuella Silva Joventino Melo[I]
ORCID: 0000-0001-9786-5059

Flávia Paula Magalhães Monteiro[I]
ORCID: 0000-0001-9401-2376

[I] *Universidade da Integração Internacional da Lusofonia Afro-Brasileira. Redenção, Ceará, Brazil.*
[II] *Universidade Estadual do Ceará. Fortaleza, Ceará, Brazil.*
[III] *Universidade Federal do Ceará. Fortaleza, Ceará, Brazil.*

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Corresponding author:
Wesley Soares de Melo
E-mail: wesley_161@hotmail.com

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ABSTRACT

Objectives: to create a software application for nursing education on child development assessment. **Methods:** this is a methodological applied research developed in three stages: analysis, design, and development. Product quality characteristics from the ISO/IEC 25010 standards were adopted. The programming language used was JavaScript. The educational software was developed based on a constructivist cognitive theory. **Results:** it was possible to create the software from the following quality metrics: functional suitability, reliability, usability, performance efficiency, compatibility, security, maintainability, and portability. The technology addresses child development in physical, cognitive, and psychosocial domains and how this assessment should be carried out in Brazil. The software has pre and posttests, 5 learning modules, certificate issuance, support for doubts, and an administrative panel. **Final Considerations**: it is concluded that the software adds to the existing tools for child development monitoring, facilitating students' knowledge acquisition in promoting child health. **Descriptors**: Pediatric Nursing; Child Development; Educational Technology; Software; Nursing Education.

RESUMO

Objetivos: criar um aplicativo de *software* para ensino de enfermagem na avaliação do desenvolvimento infantil. **Métodos:** pesquisa metodológica aplicada, desenvolvida em três etapas: análise, desenho e desenvolvimento. As características de qualidade do produto das normas ISO/IEC 25010 foram adotadas. A linguagem de programação usada foi JavaScript. O *software* educacional foi desenvolvido com base em uma teoria cognitiva construtivista. **Resultados:** foi possível criar o *software* a partir das seguintes métricas de qualidade: adequação funcional, confiabilidade, usabilidade, eficiência de desempenho, compatibilidade, segurança, manutenibilidade e portabilidade. A tecnologia aborda o desenvolvimento infantil nos domínios físico, cognitivo e psicossocial e como essa avaliação deve ser realizada no Brasil. O *software* possui pré e pós-testes, 5 módulos de aprendizagem, emissão de certificados, suporte para dúvidas e painel administrativo. **Considerações Finais:** o *software* agrega às ferramentas existentes para o acompanhamento do desenvolvimento infantil, facilitando a aquisição de conhecimentos dos alunos na promoção da saúde infantil.
Descritores: Enfermagem Pediátrica; Desenvolvimento Infantil; Tecnologia Educacional; *Software*; Ensino de Enfermagem.

RESUMEN

Objetivos: crear una aplicación informática para la enseñanza de la enfermería en la evaluación del desarrollo infantil. **Métodos:** investigación metodológica aplicada, desarrollada en tres etapas: análisis, diseño y desarrollo. Se han adoptado las características de calidad del producto de las normas ISO/IEC 25010. El lenguaje de programación utilizado fue JavaScript. El *software* educativo se desarrolló en base a una teoría cognitiva constructivista. **Resultados:** fue posible crear el *software* a partir de las siguientes métricas de calidad: idoneidad funcional, confiabilidad, usabilidad, eficiencia de desempeño, compatibilidad, seguridad, mantenibilidad y portabilidad. La tecnología aborda el desarrollo infantil en los dominios físico, cognitivo y psicosocial y cómo esta evaluación debe llevarse a cabo en Brasil. El *software* cuenta con pruebas previas y posteriores, 5 módulos de aprendizaje, emisión de certificados, soporte para dudas y panel administrativo. **Consideraciones Finales:** el *software* se suma a las herramientas existentes para monitorear el desarrollo infantil, facilitando la adquisición de conocimientos por parte de los estudiantes en la promoción de la salud infantil.
Descriptores: Enfermería Pediátrica; Desarrollo Infantil; Tecnología Educacional; Programas Informáticos; Educación en Enfermería.

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INTRODUCTION

Children between 1 and 23 months of age are defined as infants[1]. Child development during this stage of life comprises three domains, namely: physical, cognitive, and psychosocial[2].

Child development monitoring or surveillance is an important role of nurses, especially during the infant stage. In this stage, children experience a great biological vulnerability and changes in the affective, psychological, and social aspects. The first two years of life are considered as significant and ideal for interventions that prevent problems in the child development[3].

A international research of systematic review evidenced a lack of interest of health professionals and educational institutions on this subject, resulting in scarcity of stimuli, resources, and knowledge about child development[4].

Researchers from Philadelphia carried out a randomized controlled trial and found that the rates of detection of delays in child development are lower than the prevalence of deficits, due to the lack of skills by professionals providing child care. The authors emphasized the importance of monitoring child development to identify and refer children with delays in a timely manner[5].

Studies carried out in Brazil reveal that the practice of monitoring child development is below expectations, as primary care nurses have focused mainly on anthropometric measures, leaving gaps in child development assessment. Neuro-psychomotor assessment is understood as a difficulty identified by the literature in assessing child development by nurses. There are deficiencies in the ways to assess fine and gross motor development, reflexes, and the association of acquired, expected, or absent skills and milestones for each age group, establishing clinical reasoning towards practice. There is a marked scarcity of information on the assessment of other domains of child development, which limits the full child development surveillance[6-7].

In view of this, it is imperative that nursing students have available tools to increase knowledge about the child development topic and to transport this knowledge into a competent practice, with a sense of promoting child health. In this context, universities offer the best research environment to develop values and build knowledge that are the basis for future nurses.

Professional training must provide students with experiences of reality that encourage them to reflect and act on the context of health care[8]. The literature shows that computer-mediated learning is more interactive and engaging than traditional approaches in the nursing education field[9-12]. The use of computer technology in teaching and learning can foster knowledge acquisition and fill the existing gaps within the traditional approaches regarding child development assessment.

Research is found in the literature aiming at the development of educational software for teaching nursing students in several areas, including pediatrics[13-14]. However, most of these applications focuses on the use of assessment forms and tools, diagnostic support, and rehabilitation[15-17].

Considering the above, it observed that there is a need for teaching and learning tools emphasizing nurses' role of promoting child health. Moreover, the teaching-learning process on child development should be conducted in a dynamic manner to encourgae the consolidation of a body of knowledge that have an impact on future nurses' identity. Undergraduate students must be instigated to develop their professional competencies, which includes the ability to fully assess child development. College is an opportune time to enhance nursing students' knowledge about the child development topic, which is involved in complexity.

In the epidemiological situation of a coronavirus pandemic in which measures of social isolation and withdrawal from work and educational activities take place, technologies of this type become even more important, and can potentially fill the imposed gaps resulting from the discontinuation of one-to-one educational activities.

OBJECTIVES

To create a software application for nursing education on child development assessment.

METHODS

Ethical aspects

As this research did not involve human beings, approval from the Research Ethics Committee was not required.

Theoretical-methodological framework

In this study, the Galvis-Panqueva and Mendoza methodological approach was chosen, due to its clarity and cohesion with the purposes of educational software engineering research. This methodological approach consists of five phases: analysis, design, development, evaluation, and administration[18]. This study describes the three initial phases. The Incremental Model was also used for software development, which provides that the software can have new features added to it, refining and expanding its functionality in later versions[19].

Study design

This is a methodological applied research that involved the construction of an educational software called Wise Infant Development (WID).

Methodological procedures

Study setting

The software was developed, from January 2019 to February 2020, at a public university located in northeastern Brazil. Freelance professionals from software engineering, digital design, and computer networks were hired to develop the software together with the researchers.

Data collection and organization

This study was carried out in three stages, namely:

Stage 1: Analysis

The first stage consisted in carrying out an accurate analysis of the real needs for the software, resulting in the definition of

software theme, purposes, use, contents, and target audience[18]. The existing gaps in child development assessment by nurses lead to the definition of the software's main purpose, which is facilitating the teaching-learning process about this theme[6-7].

Undergraduate nursing students were defined as the target audience, since college is an opportune time to enhance students' abilities for future professional practice. Thus, the software was developed to be implemented within the nursing program, during child health courses, as a teaching-learning support tool. However, it is worth mentioning that the software can also be used for professional training of nurses.

The development of an educational software, as of any other educational tool, must consider how individuals acquire information and the mental processes involved in knowledge acquisition. It is distinguished from the others for its educational character and for being based on a theory of learning that students can build knowledge autonomosly[20]. Thus, through software development, Piaget's genetic epistemology theory was adopted under a constructive cognitive perspective[21].

Piaget's cognitive perspective considers different structural levels of development from birth to adulthood through cognitive constructions. The constructed knowledge is incorporated into mental schemes that work in challenging and problematizing situations[21].

Pedagogical practices carried out under the constructivist approach consider that teachers are mediators of the teaching-learning process. At the same time, students actively participate in their own learning, being exposed to experiments, encouragement, and situations that generate doubt, causing imbalances (cognitive conflicts). Improvements through rebalancing allows developing reasoning skills and the consequent acquisition of new knowledge that is more complex and adapted than the previous one[21].

WID was created based on a constructivist theory that fostered the development of the software as a tool to enhance students' critical-reflective capacity through tests, structured questions (clinical cases), logical schemes, images, and videos. Students are considered protagonists of the learning process.

Stage 2: Design

In this phase, the software name was defined, as well as its logo, icons, and typography. All content that would be covered by the software was also defined in this phase, including the information that should be contained in the software's environment, the design of the system-student interaction, the design of activities covered by the environment, the navigational structure, and the path to be followed by students within the system.

Software content was created based on a literature review conducted by two reviewers in the following databases: Latin American and Caribbean Literature in Health Sciences (LILACS), Medical Literature Analysis and Retrievel System Online (MEDLINE), Scientific Electronic Library Online (SciELO) and the Portal for the Coordination for the Improvement of Higher Education Personnel in Brazil (CAPES Portal – a platform that brings together national and international scientific productions). The controlled MeSH/DeCS terms "infant" and "infant development" and the non-controlled terms "physical development", "psychosocial development", and "cognitive development" were used combined by the Boolean operator "AND".

Titles and abstracts were read and selected for full-text review. Scientific articles available electronically in full text, in the databases chosen, published in Portuguese or English, in the last 5 years, were included. Manuals, books, and official publications of the Brazilian Ministry of Health were also considered. Duplicates and studies not addressing child development were excluded.

A total of 22 articles, 3 manuals, 7 books and 1 official publication of the Ministry of Health of Brazil were included in the review. After reading all the material, authors extracted the most relevant information to a file that was used throughout software development.

Stage 3: Development

This stage consisted of the materialization of the design and content defined in the previous phase. It included the choice of computational tools, multimedia resources, implementation of interactive effects, interface development, and the selection of the programming language[18].

The development process followed ISO/IEC 25010 (Systems and software engineering – Systems and software Quality Requirements and Evaluation (SQuaRE) – System and software quality models) quality requirements[22]. This international standard establishes a set of criteria consisting of eight characteristics that are divided into sub-characteristics related to the quality properties of a software, as shown in Chart 1.

Chart 1 – Requirements for software quality

System/software quality requirements		
Characteristic	**Sub-characteristic**	**Definition**
Functional suitability	Functional integrity; functional correction; functional fitness.	Need for software functionality to meet what was requested in its requirements.
Reliability	Maturity; fault tolerance; recoverability; availability.	Software's ability to maintain its performance level under established conditions over a period of time. This characteristic is perceived when the software, under certain conditions (e.g., scarcity of resources), manages to execute its functionalities in a reliable way.
Usability	Adequacy recognition; apprehensiveness; protection against errors; operability; user interface aesthetics; accessibility.	Effort required to use the software as well as the individual judgment of its use by a set of users. It indicates that the software can be used by specific users with certain levels of effectiveness, efficiency and satisfaction.
Performance efficiency	Time; resources; capacity.	Characteristic related between software performance level and the amount of resources used, under established conditions.

To be continued

Chart 1 (concluded)

System/software quality requirements		
Characteristic	**Sub-characteristic**	**Definition**
Compatibility	Coexistence; interoperability.	Ability of a product, system or component to exchange information with other products, systems or components, and/or performing its necessary functions while sharing the same hardware or software environment. It is hoped that the software can exchange information with other systems in the same operating environment.
Security	Confidentiality; integrity; no repudiation; accountability; authentication.	Protection of information and data and the control of the level of access of people, products or systems according to the types and levels of authorization. Software's ability to protect its information and data according to established authorization levels.
Maintainability	Analyzability; modifiability; modularity; reusability; testability.	Effort required to make specified software modifications.
Portability	Adaptability; navigation capability; ability to replace.	Ability of the software to be transferred from one environment to another efficiently and effectively.

Source: Systems and Software Quality Requirements and Evaluation 25010/2011.

The database was developed with the help of mongoDB (version 4.2.3). Then low fidelity prototypes were built using Axure RP®. Subsequently, the contents, design, interface, and interactions were added, creating high-fidelity prototypes, with similarity and functionality faithful to the final version of the product.

The photographs for composing the software were extracted from three websites (Freepik, Pexels, and Unsplash) with free licenses for use and disclosure. Videos and photos from the website of the Brazilian Ministry of Health were also used.

The next stage of development covered programming and testing. Visual Studio Code, a source code editor developed by Microsoft (version 1.36.1), was used for programming the software. The programming language used was JavaScript.

To facilitate access to the software (so that there was no need to download it for use), we opted for the system software type of program, which is hosted on a cloud server. The Amazon Web Services (AWS) was used for hosting.

To enhance software visibility, identity representation, and ease of memorizing the link by users, a domain purchase was made at GoDaddy.

RESULTS

WID was created using the ISO/IEC 25010 quality requirements. We sought to meet the functional adequacy requirement through software features, content, and requirements defined, considering the target audience. Reliability was achieved by reliably running software functionalities, as described above. Usability was obtained by implementing textual content, graphics, and images aiming at effectiveness, efficiency, and user satisfaction. Performance efficiency was achieved by using specific resources and features in software development. Compatibility was achieved by using the system in an operating environment and running other systems simultaneously. Protection measures in software development and use, and information and data access protection, were implemented. Maintainability was achieved through the ability to make modifications to the software, such as deploying new features and updating content. Portability was achieved through the possibility of transferring the software from one environment to another while maintaining its requirements efficiently and effectively. Finally, the software platform could be accessed through an access link.

WID can be a tool to enhance the teaching on child development while maintaining scientific and pedagogical rigor. The teaching provided through the software described in this study may be a privileged moment of knowledge construction that fosters the consolidation of a body of knowledge on the child development topic. The software provides a flexible, dynamic, and conducive environment for studies. It instigates critical-reflective reasoning by exposing contents in different formats and layouts and the resolution of questions and clinical cases that facilitate new knowledge acquisition. Thus, the software meets the theory used for its development, comprising the goals mentioned above.

Software basic functions

The initial screen allows user identification and registration using e-mail and password. The options "Reset password" and "Register" are available.

The registration screen allows students' registration, requiring the mandatory filling of the following information: full name, birth date, gender, marital status, education level, bachelor's degree course level, e-mail, and password. Registration requires the use of a "Verification code" sent to users by e-mail. It also shows the options "Resend code" (when user has not received the e-mail), support (which conducts user to an e-mail that can be used to send questions regarding the software), and "Login" (if the user is already registered).

In the password reset screen, users can create a new password, confirm password, and log in. After filling in these data, the "Verification code" field and the "Send" button are available to complete the process. There are also the options "Resend code", support by e-mail, "Register" and "Login".

Pretest function

After logging in, users are automatically directed to a welcome screen with their identification, followed by a text informing about the pretest, aiming at measuring students' prior knowledge on child development.

The pretest consists of 16 multiple choice questions containing only one correct answer. Such strategy is a way to mediate knowledge assessment, providing a reflection on the efficacy of the software as an educational tool[23].

The questions were distributed in the following degrees of difficulty: 25% easy, 50% medium, and 25% difficult. This characteristic allows statistical analyses of the items regarding their levels of difficulty, discriminative power, and correlation with

external criteria[24]. It is noteworthy that the software mixes these issues without establishing an increasing order of the mentioned complexitys degrees.

After the pretest, another screen is shown, informing the completion of this stage and the total number of correct answers. We decided not to make available to students which questions were answered correctly and incorrectly, to avoid memory bias in the posttest.

The questionnaire was created by the two researchers who carried out the literature review, to extract content to compose the software. On that occasion, the questions for the pre and posttests were elaborated.

After the questionnaire was developed, and in order to make it possible to implement it within the software, a validation step was carried out by nursing experts. The panel of experts consisted of three PhD nurses and two nursing professionals with a master's degree, all working in research on health care technology and participating in a research group on child and adolescent health at a university located in the Maciço do Baturité region, Ceará, Brazil. A minimum agreement of 80% was required for the questionnaire to be considered valid in the validation process. Suggestions were accepted to improve the questionnaire items.

Main software screen

After completing the pretest, students are directed to the main screen as shown in Figure 1. This contains students' identification and the following navigation options: about, teaching modules, tests, certificate, frequent questions, edit profile, and logout. At the bottom of this screen, it is possible for users to follow their progress (represented in a linear style).

Figure 1 - Wise Infant Development main screen

About Wise Infant Development

This item provides a description of what the software is, its purpose, and contribution to nursing practice.

Teaching modules

The teaching modules were organized as follows: Module I - Introduction (4 lessons; 4 screens); Module II - Physical development (15 lessons; 42 screens); Module III - Cognitive development (6 lessons; 14 screens); Module IV - Psychosocial development (5 lessons; 5 screens); Module V - Child development in Brazil (6 lessons; 12 screens).

Each module is represented by an image. A brief description of the content of each module is shown when users hover the mouse on the symbol that is next to the module's name. Below each module, it is possible to follow students' progress. It is noteworthy that there is no assessment available at the end of each module. However, it is possible to have access control and monitor users' progress in the WID administration panel, discussed later, which was designed for this purpose.

It is worth mentioning that there is no obligation to end a module so that the next one is released, considering that the child development theme is formed by dynamic contents that complement each other, and that this whole process happens simultaneously. Bearing that in mind, it was decided to release navigation in more than one module without concluding the previous one. However, for the sake of organizing the teaching-learning process, students are advised to preferentially complete a module, in order to navigate through the others.

The modules' contents are arranged in texts and flowcharts that can be enlarged for better viewing (complemented with photos and videos extracted from the Brazilian Ministry of Health's website that can be watched on the WID platform to further facilitate learning), didactically organized in "Lessons" with the respective numbering, which adds a sense of content localization and better distribution. This also facilitates memorization and taking notes during the software use, as shown in Figure 2.

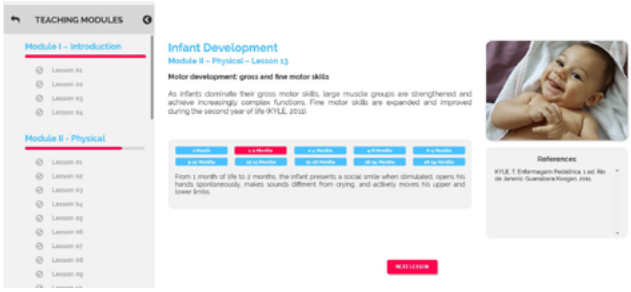

Figure 2 - Format and structure of the Wise Infant Development teaching modules

It is worth noting that the videos shown in the WID platform are viewed using streaming technology, a form of instant audio and video broadcasting. Through streaming, it is possible to watch videos without downloading them, which makes accessing content faster.

The screens inform where users are located (e.g., Module II - Physical - lesson 13: Gross and fine motor skills), a strategy adopted for students to be guided in the content exploration. Photographs, text boxes, and video presentations can be accessed by clicking on the content presented in the upper right corner of the screen. Below this content, bibliographic sources are available as well as text boxes with important information.

The left side menu contains the modules, giving the opportunity for users to return to any lesson of any module or to return to main screen. It is also possible to monitor users' progress in this module. At the bottom of the screen is the "Next lesson" button.

Upon completion of each module, a screen is generated with a motivational "Congratulations" message, followed by user's name stating that the module has been completed successfully, as shown in Figure 3.

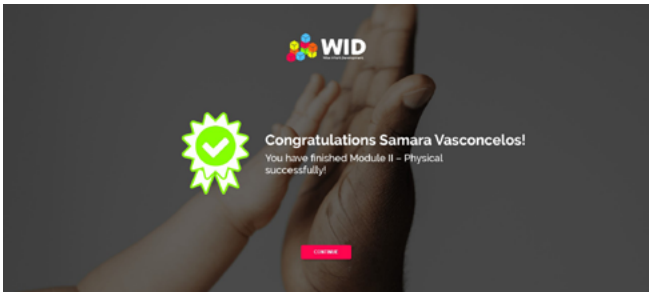

Figure 3 - Screen displayed by Wise Infant Development when users finish teaching modules

Posttest function

After finishing all modules, students are guided by the software to a posttest screen, with textual information reporting the need for a posttest to release access to the certificate. By clicking on "Continue", users are directed to the posttest questions.

It is worth mentioning that the questions applied in the posttest are the same as in the pretest, allowing a comparative analysis and contributing for the assessment of what students have absorbed while using the software[25].

The posttest questions are displayed for users in a different order from the pretest to minimize memorization. After completing the posttest, the number of correct answers is shown and the "Continue" button appears so that students can have a certificate.

Tests

In the "Tests" area, students can access the number of questions correctly answered in the pretest and the posttest, after their completion, when all teaching modules are completed. Otherwise, the software informs users that it is mandatory to complete the modules so that the posttest can be released.

Certificate

By clicking on the certificate button, a certificate of completion of the computer-mediated course will be generated. If a student has not completed all teaching modules and the posttest, he or she will be informed that such requirements are necessary for obtaining the certificate.

The certificate informs that students participated in the computer-mediated course, the period of its completion, equivalent workload, students' full name, and the college/university where it was carried out. On the back of the certificate, there is information about the modules taken by students, the number of hours, the software logo and the college/university in which the course was conducted.

Frequent questions

Frequently asked questions with the appropriate answers and support are shown, in case a user has any questions about the software.

Edit profile

The user profile contains information provided during registration. This information can be edited at any time using the "Edit profile" function.

Software administration panel

There is also an administration panel for monitoring purposes, as shown in Figure 4. The panel allows supervising all registered students' progress and the management of the activities performed within the software. Using this panel, the tutor/teacher can have access to students' registration data, number of correct and incorrect answers during the pre and posttest, students' progress in the teaching modules and promote a pedagogical mediation.

Figure 4 - Wise Infant Development administrator's panel

DISCUSSION

The software development aimed at the teaching-learning process about child development, requiring different types of knowledge. The complexity of the software development process was expected as the development of any educational technology requires rigor and scientific support, in addition to establishing a dialogue with software engineering, pedagogical foundations, and digital design.

The WID is a dynamic tool, covering textual content plus digital media. Moreover, it is believed that it can foster students' autonomy and proactivity, contributing to training nursing professionals' skills related to the topic of child development assessment.

In this context, educational approaches deal with constant changes to adapt to new digital realities that emerge from the unstoppable technological development. Such changes promote profound social transformations, making educational software important tools for education[26].

The use of computer applications in formal nursing education has been positively assessed, since it provides simulation and realistic demonstration, promotes significant changes in the traditional teaching activities, improves the social representations, and contributes to knowledge acquisition and retainment, combining virtual and real environments[27].

The introduction of new technologies in the educational context can improve the teaching of complex contents[28]. In this way, computational applications can be used to improve teaching and learning about child development.

The use of educational software can help both nursing professionals and students developing clinical judgment and critical-reflexive reasoning, contributing to improve quality of care[29].

The literature reveals a gap when it comes to tools that facilitate decision-making in nursing care for children and adolescents[30]. Most available programs are directed to the organization of services and to facilitate diagnosis of diseases, as shown in a literature review that found a lack of technologies in health care to intermediate health promotion and disease prevention[31].

Authors of a study carried out in the field of the child development state that the accumulation of scientific evidence must support intelligent, creative, participatory, and equitable strategies to promote child health[32]. However, the absence of computational applications for health promotion result from an old problem, which is the fact that studies discussing health promotion are scarce compared to the extensive studies carried out on diseases and medical diagnoses[31].

In a search carried out in the literature on educational software aimed at the child health theme, we have found technologies created to assist in detecting pathologies, clinical procedures, diagnoses and nursing interventions such as: a mobile application for detection of early pediatric cancer[33]; a software to support decision-making in the selection of nursing diagnoses and interventions for children and adolescents[30]; a software for the nursing process in a Neonatal Intensive Care Unit organized by the Basic Human Needs and the International Classification for Nursing Practice taxonomy[34]; and the Serious game E-baby, for teaching neonatal nursing on skin integrity based on evidence[35].

An integrative review research on the development and use of new technologies in health and education, from 2011 to 2017, points out that technologies for teaching child care are geared towards clinical situations and/or nursing records. The results of this research show the existence of computer programs for the clinical assessment of premature newborns and for the nursing records in a Neonatal Intensive Care Unit[36]. Given the above, the importance of the technology developed in the present study stands out, as it is a software with educational content for promoting child health.

The software developed in this study contributes to valuing health promotion due to its emphasis on nursing activities involving child development assessment. Future nurses can benefit from the software functionalities to strengthen their skills and capacities required during pediatric care, obtaining the ability to early identifying risks and developmental delays.

A study indicates that the use of communication and information technologies in education and training in nursing has been progressively increasing over the years and bringing with it learning effects in teaching. This same study highlights that these technologies have been applied more frequently in the lessons of basic concepts and skills of nursing, obstetrics and gynecology, revealing a lack in the use of these technologies in other domains of nursing education[37].

Another study pointed out that 95% (N = 375) of students perceive the usefulness and ease of use of technology in learning during undergraduate nursing. Such study reinforces the need and importance of incorporating technological tools to successfully support learning, overcome challenges and invest in content innovation in teaching[38].

A randomized clinical trial showed that the group of students who had a hybrid learning approach (teacher supervision + content through online educational technologies) scored higher in terms of motivation, attitudes and knowledge compared to the group of classes only online. This combined learning supervised by teacher/moderator provides greater pedagogical weight and adds value to the students' training process[39].

The software developed in this research goes against what is exposed in the literature, reinforcing teaching in nursing through educational technology without dispensing with the presence of a teacher for the students' training process. The technology seeks innovation in the teaching-learning process, aims to foster knowledge, skills and attitudes aimed at assessing child development and promoting the health of this public.

In this context, Piaget's cognitive-constructivist approach drives the development of innovative teaching and learning methods that address emerging needs from the advent of the digital age, such as the insertion of IT resources in educational environments[40].

The development of software like WID through a cognitive-constructivist conception allows the construction of knowledge through mental representations loaded with meanings, in which students act actively in the learning process. In this sense, technology can enhance internal, personal, or social knowledge when structured under a theoretical framework[40].

Amidst the technological transformation, WID emerges as an alternative to rethink teaching about child development assessment. The learning environment provided by WID enables the user to self-organize learning, build knowledge through intellectual mechanisms, create new concepts through the establishment of relationships, and raise hypotheses and possible solutions. The acquisition of knowledge will take place through the evolution and maturation of cognitive processes.

Authors claim that the use of the software through Piaget's cognitive-constructivist theory allows conceiving knowledge constructed by the subject through his action and interaction with an object. This interaction is dynamic because, as the subject acts on the object, he transforms himself by elaborating relationships between what he knows and what will be learned using processes of organization, adaptation, and accommodation, allowing the subject to generate new constructions from previous situations[41].

Starting with the quality requirements used for the software development in this research, the functional adequacy is directly linked to the software's ability to provide functions that meet the implicit and explicit needs of the user, being one of the main points that affect the quality of the software[42].

Reliability is the probability that the system will work without failing according to the expected characteristics for a certain period of time. According to the literature, reliability provides enormous gains for the products under study and consequently increases readiness for the market[42-43].

The usability feature is essential, as it is associated with user experience. Usability is compromised when the user has difficulty interacting with the system or when the system has a poorly planned interface leading to discontinuity. The software must meet the objectives with effectiveness, efficiency, and satisfaction in a given context of use[22].

Authors reinforce that performance efficiency is a crucial point for software development and implementation. Performance efficiency adds agility and advantages in performance concerning the number of resources used under pre-established conditions[42-43].

Regarding the compatibility feature, WID can exchange information with other products, systems, or components performing its functions while sharing the same environment, thus meeting this quality requirement[22,42].

Security-related issues have a major impact on software quality. Security standards have positive effects in reducing costs

and loss of information and are essential for supporting security management in organizations/institutions[44]. WID was developed to maintain good security criteria, meeting the requirements of data authentication and backup.

Based on previous research, the maintainability characteristic is essential for software development as the guarantee of a system maintenance is a fundamental criterion for its use in institutions[45].

WID was developed considering the ease of modification, corrections, and adaptations, adopting good coding practices during its development that facilitate maintenance and reduce costs and time used to create new features or error correction[45].

Portability is another feature of software quality gaining ground and increasing interest in the business field and the academic community. It is critical to enable the broad, efficient, and effective adoption of cloud technologies. Its lack constitutes a problem in the quality of systems and interferes with software development and subsequent application. Furthermore, when development is carried out under the Java programming language, there are better quality indicators due to its portability and dynamism[42].

In this sense, WID is portable and has a system architecture developed using JavaScript (a high-level programming language), which establishes programming connections with server and database. In addition to this, the software is hosted on a cloud server on AWS.

Study limitations

The software content was developed based on child development monitoring guidelines that are currently being used in Brazil, which may differ from the guidelines used in other countries.

Contributions to nursing

The use of software in teaching and learning can favor knowledge acquisition and gap filling in traditional approaches to assessing child development. WID is a technology that values nurses' work in promoting child health, and aims to enhance child development surveillance in Brazil as well as the early detection of problems for an adequate management of children in the health care network. The technology can also be used on a large scale to train professionals working in the field of child health.

FINAL CONSIDERATIONS

This study resulted in the development of an educational software focusing on the teaching-learning process on child development, embracing the physical, cognitive, and psychosocial domains. The software follows ISO/IEC 25010 quality standards.

The WID stands out due to its emphasis in child health promotion considering that most technologies in this field are aimed at diagnostic support. Through refinement and implementation, the software can consolidate itself as a tool to enhance interactive learning, making knowledge less complex for students. Furthermore, the software allows the pedagogical monitoring of students' progresses by teachers, promoting a teacher-student bond.

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The WID was registered in the Brazilian National Institute of Industrial Property (INPI - *Instituto Nacional da Propriedade Industrial*), under the number BR512020002175-1. This registry is valid in Brazil and other 176 countries that signed the Berne Convention (1986). This registry is valid for 50 years according to Law 9.609 of February 19, 1998.

This research was developed as part of a master's dissertation. The software was produced, but it is not in commercial use.

The WID is still not being used commercially, was developed as part of a masters' dissertation, thus there is no conflict of interest to report.

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