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ORIGINAL ARTICLE

Creation of serious games in continuing education for prenatal care: Presenting a step-by-step guide

Criação de serious games na educação permanente para o pré-natal: apresentando um passo a passo

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DOI: 10.1590/2358-28982025E19960I

ABSTRACT This paper offers a structured approach to develop a serious game as a tool for Continuing Education in Healthcare. Our methodology provides a detailed step-by-step guide to create such a game. The result is a serious game co-created with primary healthcare providers, demonstrating a successful approach to ongoing health education. By openly sharing both the game and the development process, we aim to foster a community of serious game developers, driving innovation and sustainability in health education.

KEYWORDS Continued education. Educational technology. Primary Health Care.

RESUMO *Este artigo teve como objetivo oferecer uma estrutura para a criação de um serious game como uma tecnologia voltada para a Educação Permanente em Saúde. Em sua metodologia, exibe de forma detalhada o passo a passo do desenvolvimento dessa tecnologia. Como resultado, apresenta-se um serious game construído de forma participativa com os profissionais da Atenção Primária à Saúde, evidenciando um processo profícuo de Educação Permanente em Saúde. Em conclusão, destaca-se que, ao compartilhar livremente o jogo e a metodologia utilizada, incentiva-se a criação de uma comunidade de desenvolvedores de serious games, promovendo a inovação e a sustentabilidade da educação em saúde.*

PALAVRAS-CHAVE *Educação permanente. Tecnologia educacional. Atenção Primária à Saúde.*

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Introduction

The use of serious games can be considered a digital health strategy, especially in the context of Primary Health Care (PHC) in the Unified Health System (SUS). Serious games are digital games created to educate, train, or inform, and can be applied in the health field to promote learning in an interactive and engaging way. In PHC, serious games can train health professionals, since interactive games can be used to inform and guide doctors, nurses, and other PHC providers on new clinical guidelines, care protocols, or to simulate care situations.

Serious games are innovative tools widely recognized as having considerable potential to promote and support active learning. They are based on computer technologies with gameplay aspects that challenge and engage the player during interaction, as well as on logical and emotional responses, allowing the user to have greater integration with the technology[1,2].

However, serious games are not only about playing. The main point is to achieve the goal using lessons learned from the games. Similarly, it is not an easy and absolute solution to solve all problems, as the same technique applied in different contexts may not generate the same result[3]. It is not possible to separate this type of technology from learning objectives, as these are the basis and motivation for the development of teaching tools, with serious games playing a supporting role rather than being the main focus of creation[1].

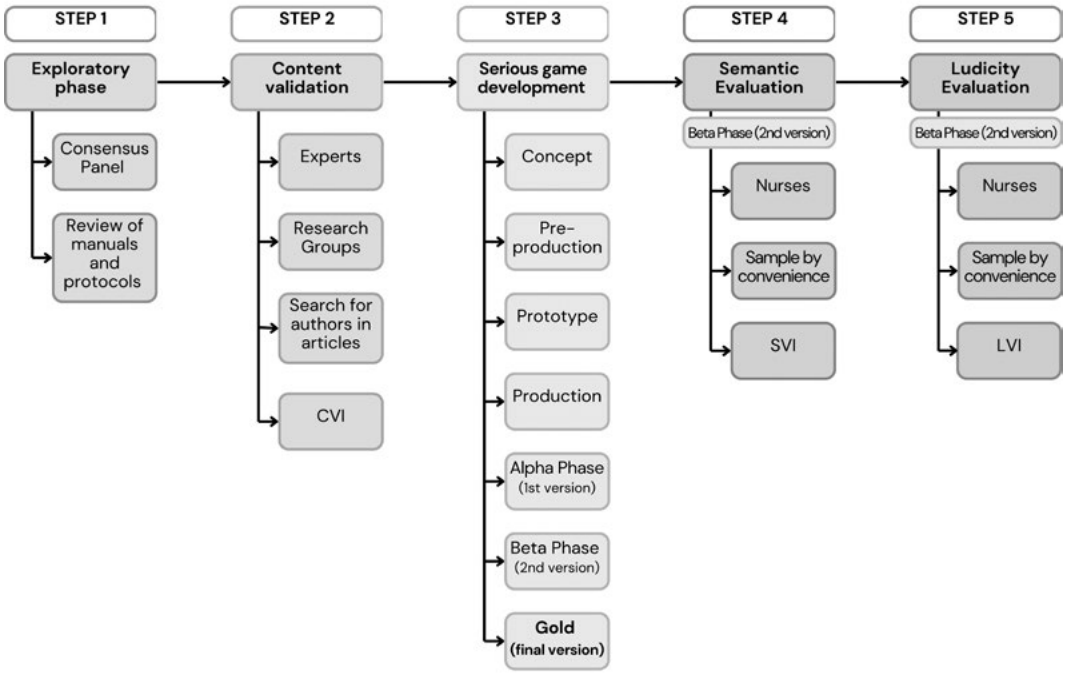
Contextualized learning focused on the concrete reality of the healthcare system is the main purpose of Continuing Education for Health Professionals (CE), defined as an educational process based on critical reflection on the daily practice of healthcare providers, aiming to transform these practices by addressing the challenges encountered at work[4]. Although practices based on the traditional CE for Health Professionals model still prevail, there has been significant progress in the use of technological resources and their incorporation into daily work[5].

This article aims to provide a framework for the creation of a serious game as a technology geared toward CE for Health Professionals. Below, we present a detailed and practical tutorial on the development process of this technology, which addressed topics related to prenatal care for pregnant women, aimed at reducing early infant mortality.

Material and methods

To develop a technology specifically geared toward CE for Health Professionals in PHC, a methodological study was conducted to build, validate, and evaluate tools[6]. The study was conducted in the following steps: exploratory phase, consisting of a consensus panel and review of manuals and clinical protocols; content validation; serious game development; semantic evaluation; and ludicity evaluation. These steps are shown in *figure 1*.

Figure 1. Flowchart of the steps of development, validation, and evaluation of the serious game



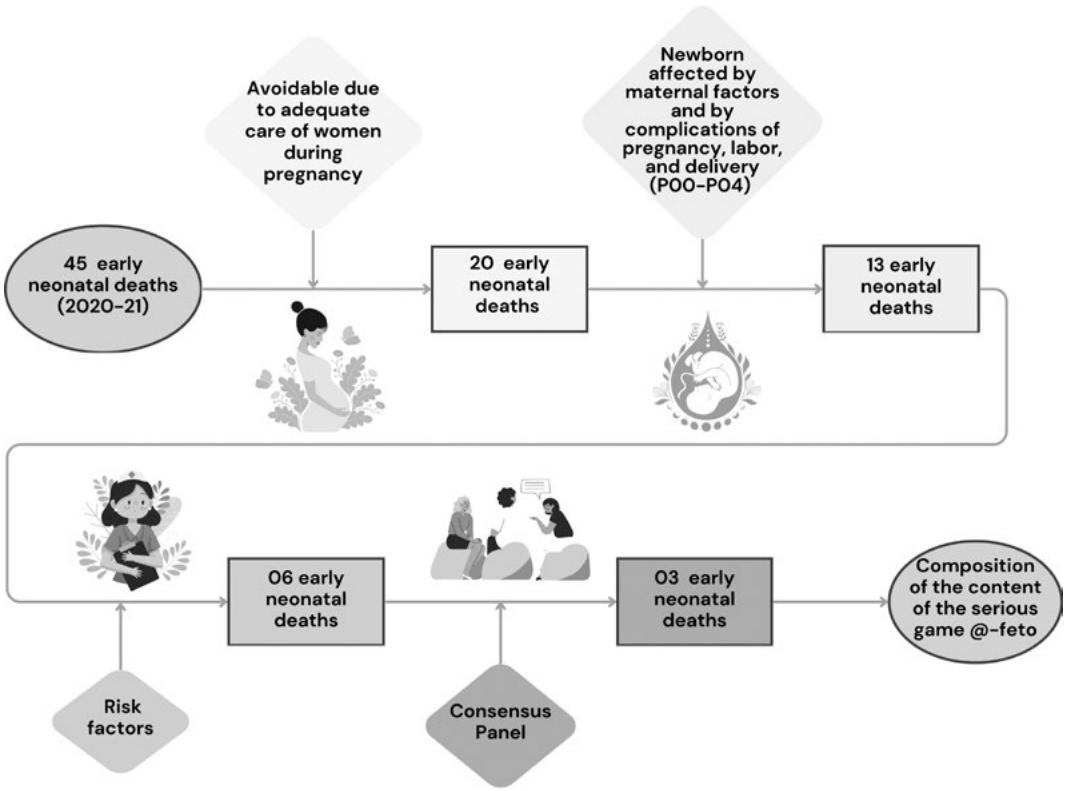
Source: Prepared by the authors.

Exploratory phase

CONSENSUS PANEL: CHOOSING THE CASES FOR THE SERIOUS GAME

To select the content for the serious game, cases of early neonatal deaths from the last two years were initially identified, which had already been investigated by the Municipal Committee for the Prevention of Maternal, Infant, and Fetal Mortality (CMPMMIF) in a municipality in southern Brazil. The causes of death were identified, searching for maternal conditions or complications that affect the newborn. Therefore, 13 cases were selected, including: 6 cases due to maternal hypertensive disorders; 3 cases due to cervicoisthmic incompetence; 2 cases due to urinary tract infection during pregnancy; 1 case due to maternal COVID-19; and 1 case due to maternal epilepsy. A detailed analysis of each death was then performed, reviewing all prenatal care visits to identify those with risk factors for the conditions in question. Thus, six cases were selected for analysis in the consensus panel. A detailed description of the selection system for cases of early neonatal death to compose the serious game is shown below (*figure 2*).

Figure 2. Diagram of the selection of cases for the serious games



Source: Prepared by the authors.

The consensus panel was composed of seven members of the CMPMMIF, including two gynecologists/obstetricians (GO), one pediatric neonatologist, three PHC nurses, and one high-risk prenatal nurse.

For each case analyzed, values from 0 to 4 were assigned and presented on a Likert scale: (0 – not relevant, I do not see the need to include this case; 1 – slightly relevant, but it can be included; 2 – relevant, but if I have to exclude any case, it could be this one; 3 – extremely relevant, it would be very good to include; 4 – essential, it must be included). In the analysis of the questionnaires, the three cases that obtained the highest number of responses 3 or 4 were considered.

REVIEW OF MANUALS AND PROTOCOLS: SEEKING BEST CARE PRACTICES

After defining the cases that would comprise the serious game, we conducted a review of the Ministry of Health (MS) manuals and clinical protocols used in Brazil that addressed the following topics: maternal hypertensive disorders, cervical insufficiency, and urinary tract infection during pregnancy. Then, all the material was read and analyzed in detail to support the conduct of each case based on official recommendations, lying as a foundation to develop the serious game content. The review of these documents is justified, as they guide health professionals on the conduct to be followed in PHC.

Content validation: elements for the serious game

After the content was structured, it was validated. To select the experts, a preliminary search was conducted in the research groups listed in the Directory of Research Groups of the Brazilian National Council for Scientific and Technological Development (CNPq), using the search terms: "infant mortality" and "maternal health". In addition, as an inclusion criterion, groups in the health field that had been updated in the last 12 months were considered. At the same time, a search was conducted for authors of articles published in the last five years in databases such as PubMed, Scopus, and the Virtual Health Library (VHL), using the terms "infant mortality" and "maternal health". The authors were then invited to participate in the validation. The invitation was sent to 60 experts, of whom 14 responded.

The validators evaluated the listed content, assigning a score to each item according to their level of agreement on a 4-point Likert scale (1 – strongly agree; 2 – agree; 3 – disagree; 4 – strongly disagree). Suggestions were also made, which were considered for inclusion in the serious game. The analysis of the variables included descriptive statistical calculations, using Google Sheets® to organize the results obtained from the questionnaires. The calculation was made based on the sum of responses 1 and 2 from each participant for each item in the questionnaire, dividing this sum by the total number of responses, as follows:

$$CVI = \frac{\text{number of responses 1 or 2}}{\text{total number of responses}}$$

After completing the definition and validation of the content, the development phase of the serious game began.

Serious game development: creation structure

In this step, the framework, which consists of a detailed and structured step-by-step guide for the development of the serious game, will be presented. This model aims to guide and facilitate the understanding and application of the process by different teams, ensuring a systematic and efficient approach to the creation of the educational tool.

The development of this serious game for CE for Heatlh Professionals in PHC followed the structure proposed by Novak[7], which comprises seven steps: Concept, Pre-production, Prototype, Production, Alpha Phase, Beta Phase, and Gold Phase, described below.

Step 1 – Concept: in this phase, after selecting the content to be addressed, the concept of the serious game was developed. Objective: to develop the idea of the serious game, defining the plot, objectives, basic functionalities, and target audience.

Document 01 – Concept of the serious game

Plot:

The serious game takes place in a primary healthcare setting, in which the player assumes the role of a nurse responsible for caring for pregnant women. The plot is built around different pregnancy cases, each presenting unique challenges and specific risk factors.

As the player progresses through the game, they are confronted with various clinical situations, such as high-risk pregnancies and obstetric complications, among others.

During the game, players must perform clinical assessments and make decisions based on scientific evidence. With each choice made, players receive feedback on their decision, including the strengths and weaknesses of their chosen approach.

The plot is designed to engage the player, presenting challenging stories that demonstrate the importance of the nurse's role in prenatal care.

At the end of the game, players will have the opportunity to reflect on their choices, learn from their mistakes, and improve their clinical skills in caring for pregnant women.

Objectives: to raise awareness among nurses about early identification of risk factors and appropriate interventions during pregnancy, seeking to reduce early neonatal mortality.

Step 2 – Pre-production: in this step, the game was detailed, including technical specifications, character descriptions, steps, plots, and the world of serious games. Thus, the Game Design Document (GDD) was created, which, according to Novak[7], is a reference guide in the development process and should specify the rules of the game with a sufficient level of detail for its production. Objective: to detail the game, specifying technical aspects, characters, steps, and plot.

Document 02 – Game Design Document (GDD) for the serious game

Game Description:

A serious game that aims to raise awareness among nurses about early identification of risk factors and appropriate interventions during pregnancy. To do so, the player must assume the role of a nurse in primary health care and use their knowledge and skills to make appropriate decisions when caring for pregnant women.

Overview:

The graphic design was developed using vector illustration style to create a modern, elegant, and attractive visual identity. This style allows for the creation of simple and clean images, with defined lines and vivid colors, which stood out on each of the game screens. We chose to work with shades of green and pink. Green is a color often associated with nature, health, and renewal, and was chosen because it represents the values of the game in question. Pink, on the other hand, is a color that suggests delicacy. This combination created an attractive and harmonious color palette and a modern and elegant look.

Category:

Educational Media; Educational Health Game; Serious Game.

Platform:

Web platform, accessible via desktop.

Characters:

1 – Nurse
Workplace: Primary Health Care

2 – Pregnant woman Ana
Clinical case: Maternal Hypertensive Disorder

3 – Pregnant woman Beatriz
Clinical case: cervicoisthmic insufficiency

4 – Pregnant woman Maria
Clinical case: Urinary tract infection

Scope of the Game:

1st: in a doctor's office setting, the player begins the game by receiving information about the game's objective and the role they must assume. Next, the player is presented with the clinical cases, with instructions on how to proceed, indicating that they should select the correct answers.

2nd: The player is presented with three medical records of pregnant women, with visual identification of each one. The player then selects the case they want. To aid in the learning process, under the item 'Learn more', the player can consult more information about each of the topics presented, consulting the diagrams on Prenatal Care—maternal hypertensive disorders, cervical insufficiency, and urinary tract infection during pregnancy.

3rd: When selecting a case, the medical record shows up, organized as follows:

- Description of the case and summary of the clinical history.

- Graphical representation of the pregnant woman, providing a visual assessment, in which important elements are highlighted, namely: age, pregnancy history, Body Mass Index (BMI), blood pressure, and symptoms.

4th: after reading the medical record, the player is presented with questions about the care of the pregnant woman. For each question, there are three alternatives, one correct and two incorrect. The player must click on the alternative they deem correct.

5th: when selecting the alternative, a new text box opens, showing the player an explanation of the selected alternative, whether correct or incorrect. The player can only move on to the next question when they chose the correct alternative. This mechanism aims to fulfill the teaching-learning role, making the player complete the questions, reflecting proper prenatal care.

6th: each case has five questions. Upon completing all questions, the player receives a message recognizing their vital role in preventing early neonatal deaths and emphasizing the importance of prenatal care.

Table 1 summarizes the game design representations, organized according to the steps described.

Table 1. Depictions of game design

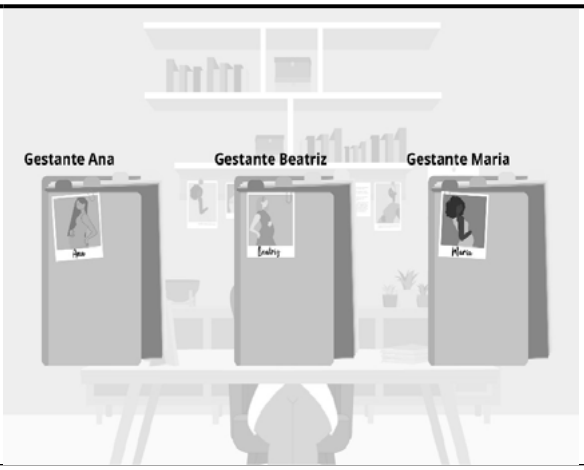
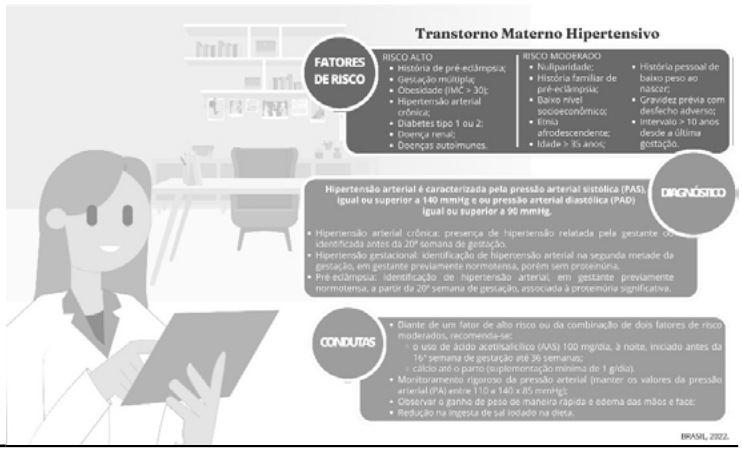
Introduction of medical records: the cases are introduced in the form of medical records, with visual identity. The player then selects the case they want.	

Table 1. Depictions of game design

Opening of the medical record: the player is presented with a description of the case and the summary of the clinical history, in addition to the graphic representation of the pregnant woman, showing a visual evaluation.	
Organization of the questions: the player is presented with questions about the pregnant woman's care. When selecting an alternative, a text box displays the corresponding explanation.	
Message at the end of the case: recognition of the player's role in preventing deaths.	

Table 1. Depictions of game design

Learn more: Prenatal Care diagram: the player can search for more information about each of the topics presented, such as risk factors, diagnosis, and conduct.	

Source: Prepared by the authors.

Step 3 – Prototype: at this point, software development began, and a prototype was created to facilitate understanding of the idea and proposed mechanics. The serious game was developed on a web platform divided into two fronts: the backend and the frontend, both built in NodeJS using the NextJS framework. A PostgreSQL instance was used for the database. The website, server, and database were hosted on a Heroku instance with public access via desktop. Axion was used to analyze and track user behavior. The project code is available on GitHub for free use. Objective: to develop a prototype for the game's mechanics/functionality.

After the prototype was finalized, it was possible to visualize the game and see the idea translated and transformed into reality. The team involved conducted primary tests and indicated adjustments related to game dynamics.

Step 4 – Production: this was the step in which the serious game was effectively developed and structured, including all game content. The elements and features detailed in the GDD were implemented and integrated to form the complete system. Objective: to implement and integrate all game elements, including content and features.

The following describes the initial presentation and guidelines.

Document 03 – Content for the serious game

Part 1: Introduction and guidelines

Introduction message

Welcome to the game!

This game aims to raise awareness about early identification of risk factors and appropriate interventions during pregnancy, seeking to reduce early neonatal mortality.

The player must assume the role of a Primary Health Care provider and, using their knowledge and

skills in prenatal care, make the right decisions to provide pregnant women with adequate care.

We wish you a valuable experience!

Guidelines on cases and game dynamics

The game presents clinical cases of pregnant women with maternal hypertensive disorders, cervicoisthmic insufficiency, and urinary tract infections.

In the game dynamics, five questions will be presented for each case, with multiple-choice alternatives, in which you must select the one you consider to be true. It is important to carefully analyze each option before making your choice.

Shall we begin?

Below there are descriptions of the three clinical cases presented in this study, as well as the questions, alternatives, feedback, and final message. Each case contains five questions, with three alternatives each, two of which are incorrect, and one is correct. For each alternative selected, there is immediate feedback with an explanation of the choice made. To better visualize each alternative, the incorrect ones have a pink background, and the correct alternatives have a green background.

Document 03 – Content for the serious game

Part 2: Case 01 – Pregnant Ana

Clinical case – Maternal Hypertensive Disorder

Ana, 41, is in her fifth pregnancy (G5 P3 A1) and lives with her partner and three children, aged 8, 6, and 3. She works as a cook and studied up to the fourth grade of elementary school.

She began prenatal care at the Primary Health Care Center in the 6th week of pregnancy and, due to her advanced age, was referred to specialized care – high-risk prenatal care.

The pregnant woman has a BMI of 34, indicating grade I obesity. She denies using cigarettes, alcohol, or other drugs. In the investigation of her clinical history, there is a previous diagnosis of systemic arterial hypertension (SAH) 3 years ago, with abandonment of treatment.

From the 12th week of pregnancy, Ana began to complain frequently of nausea and headaches, with a blood pressure reading of 140/100 mmHg. In the 23rd week, she had a hypertensive crisis with a blood pressure reading of 170/110 mmHg.

Part 3: Case 02 – Pregnant woman Beatriz Clinical case – Cervicoisthmic insufficiency

Beatriz, 22, is in her third pregnancy (G3 P1 A1). Five years ago, she had a stillbirth with no determined cause, and three years ago, she had a premature birth. She lives with her partner and her 3-year-old son from a previous relationship. She has finished high school and is a housewife.

At 5 weeks of pregnancy, she began prenatal care at Primary Health Care. She has a BMI of

30, indicating grade I obesity. She denies other comorbidities or use of cigarettes, alcohol, or other drugs.

In the first trimester of pregnancy, she began complaining of sporadic bleeding, a brown discharge, associated with discomfort in the lower abdomen, which persisted throughout the prenatal period.

At 16 weeks, Beatriz underwent a transvaginal ultrasound, which detected a short cervix, with a recommendation for biweekly monitoring. At 21 weeks, after lifting a heavy object, she experienced bleeding associated with severe abdominal pain.

Part 4: Case 03 – Pregnant woman Maria Clinical case – Urinary tract infection

Maria, 25, is a primigravida and lives with her partner. She has incomplete higher education and works as an administrative assistant.

She began prenatal care at Primary Health Care in the 5th week of pregnancy. She denies any history of illness or continuous medication use. She did not attend prenatal appointments regularly, and stayed 10 weeks without a consultation, but no active search was conducted.

At 15 weeks, she reported dysuria, pollakiuria, and lower abdominal discomfort, with a diagnosis of urinary tract infection (UTI). The complaints recurred in the 18th and 23rd weeks of pregnancy, with the last episode accompanied by hematuria. At 24 weeks of gestation, she presented with fluid loss for 4 days, lower abdominal pain, low back pain, dysuria, and fever.

Step 5 – Alpha Phase: in this step, with the cases and questions included, the serious game could already be played from start to finish. To detect flaws or unwanted behaviors, the game was thoroughly tested by the team involved in its development. To do so, they played on different computers and operating systems. The problems detected were carefully evaluated and corrected. Objective: to test the game internally to identify flaws and undesirable behaviors.

Step 6 – Beta Phase: in this phase, the serious game was made available for semantic and ludicity evaluation. Adjustments resulting from the evaluations were made and the production process was finalized. Objective: to evaluate the game with the target audience to verify understanding and ludicity.

Step 7 – Gold: this step represented the completion of the serious game's development and was understood as the final phase, in which the game was considered complete and ready to be implemented. This step only took place after the semantic and playfulness assessments had been completed. Objective: to complete development and prepare the game for implementation.

Semantic evaluation of the serious game

To verify the understanding of the items, the semantic evaluation phase began, which took place in the beta phase of the game's development. Twenty PHC nurses who work directly with pregnant women at this level of health care participated in this step.

A 4-point Likert scale was used to evaluate each item in the instrument, as follows: 1 – strongly disagree; 2 – disagree; 3 – agree; 4 – strongly agree. The calculation was based on the sum of responses 3 and 4 for each participant for each item in the questionnaire, dividing this sum by the total number of responses, as follows:

$$SVI = \frac{\text{number of responses 3 or 4}}{\text{total number of responses}}$$

The data obtained through the semantic evaluation tool were organized in Google Sheets® and obtained a Global SVI (Semantic Validity Index) of 1. There were no items with a score of 1 or 2, so no revision was necessary.

Assessment of the serious game's ludicity

After the semantic evaluation, the same group of nurses evaluated the game's ludicity using a questionnaire complementary to that step. The evaluation of this step was carried out following the dimensions proposed in the instrument 'Ludic-Quest to the ludicity of games in health: playability and emotions in the field'[8]. To evaluate each item of the instrument, a 4-point ordinal Likert scale was used, as follows: 1 – strongly disagree; 2 – disagree; 3 – agree; 4 – strongly agree.

The Ludicity Validity Index (LVI)[9] was used for data analysis. The calculation was

based on the sum of responses 3 and 4 for each participant in each item of the questionnaire, dividing this sum by the total number of responses, as follows:

$$\text{LVI} = \frac{\text{number of responses 3 or 4}}{\text{total number of responses}}$$

To evaluate the instrument, the total number of items considered relevant was divided by the total number of items, considering that the acceptable agreement rate among the target audience should be 0.70 or 0.80[9]. For this study, we used a minimum index of 0.75.

In this step, a quantitative analysis of the questionnaires answered by the target audience was performed. The data obtained through the ludicity assessment tool were organized in Google Sheets® and obtained a Global IVL of 0.9823, which was considered adequate in terms of ludicity.

Results

Serious games are developed on a web platform and are aimed at developing the process of continuing education for PHC professionals, with a focus on early identification of risk factors and appropriate interventions during pregnancy. To this end, the player must assume their role in PHC and apply their knowledge and skills to make appropriate decisions in the care of pregnant women.

Regarding the validation and evaluation steps, the content obtained a Content Validity Index of 0.98; the semantics reached a Semantic Validity Index of 1; and the ludicity, an index of 0.98, all of which were considered excellent. In addition to the quantitative evaluation, there were spaces in the questionnaires for subjective comments. Comments emphasized the importance of the serious game developed:

> *They are important to prepare the Primary Care team and serve as warning signs for the prevention of early maternal and neonatal mortality.*

> *These data indicate risks during pregnancy, so the team must be aware of and attentive to the symptoms.*

> *They are very good. Case studies are great.*

> *I loved it! There could be more cases.*

The serious game proved to be effective in terms of content, semantics, and ludicity, establishing itself as a technology with the potential to encourage healthcare providers to improve their knowledge in a playful and motivating way. Based on the identification of real cases and data analysis, the authors developed the serious game as a training tool for PHC professionals. In addition, the game is aligned with the Sustainable Development Goals (SDGs) for Good Health and Well-being (SDG 3.2)[10], contributing to the reduction of infant mortality by training nurses to identify and intervene early in risk factors for neonatal mortality. The serious game also supports Quality Education (SDG 4), promoting the continuing education of healthcare providers through an innovative approach that uses technology to improve knowledge and skills.

Finally, the serious game was implemented in the Continuing Education Program of the Health Department of the municipality where it was developed. It was also made available to several higher education institutions in the region and incorporated into the program content of the Regional Health Department's Habitual Risk Prenatal Course. The tool is available on the website of the Graduate Nursing Program at the State University of Santa Catarina (UDESC) and can be accessed by the public for free.

In the process of building and evaluating the serious game, it is noteworthy that the active participation of PHC professionals was essential. From the selection and analysis of the critical cases that made up the game, through the validation of the content and evaluation of the gameplay, this process took the form of a true CE for Health Professionals. During these

moments, there was an exchange of knowledge, reflections on the causes, and a search for the best courses of action. The conclusion is that it is possible to apply digital technologies to the development of CE for Health Professionals in PHC. To create a serious game, it is necessary to follow a few steps:

1. Define, with the team, the demands for care and study.

2. Describe the game content.

3. Select the game format, noting that there are many free platforms for creating games and images available on the internet; just search and choose.

4. Seek assistance, if necessary, from IT professionals working in health departments.

5. Implement it in the healthcare network and learn in a playful and fun way. It is important to mention that there are game platforms that allow you to update content, which is essential for keeping behaviors and resolutions up to date.

6. Share the game with educational institutions, in order to train future healthcare providers.

Discussion

The analysis of the results presented in the article reveals that serious games are not only effective in terms of content, semantics, and ludicity, but also represent a significant innovation in approaches to training PHC professionals. The identification of real cases and data analysis are elements that reinforce the relevance of the game as a practical tool for training, aligning with the SDGs, especially regarding reducing child mortality (SDG 3.2)[10]. ·In addition, the serious game contributes to Quality Education (SDG 4) by offering a methodology that integrates the continuing education of health professionals. Education should be a continuous and contextualized process, and the inclusion of technological tools in this process expands the possibilities for learning.

Serious games are educational games used for teaching, which use virtual simulation to mimic reality, becoming a tool for didactic innovation[11]. Their main objective is focused on learning, and, through their dynamic, responsive, and visual nature, they produce motivation, strong user engagement, and meaningful learning[12].

Serious games stand out for their relevance to teaching, as they encourage students to play an active role in their teaching and learning process[13]. Thus, educational games are increasingly proving to be a technology capable of encouraging healthcare professionals to improve their knowledge in a playful and motivational way. This tool can be a powerful ally in continuing education, as it provides an immersive and collaborative learning experience, contributing to the development of essential skills for healthcare practice, such as decision- making, teamwork, and complex problem-solving[14].

The active participation of PHC professionals in the construction of the game was a crucial aspect, as it favored the exchange of knowledge and critical reflections. This approach is in line with the Health Work and Education Management Policy, which emphasizes the importance of worker participation as essential to the effectiveness and efficiency of the SUS. In this context, professionals are seen as subjects and agents of change in their work environments and practices, assuming the role of protagonists in practices and knowledge development[15] .

Methodological innovation, which includes approaches such as the use of digital technologies and problem-based learning, also encourages worker autonomy. The use of digital technologies and collaborative learning enable critical reflection and the application of knowledge in a more effective manner[16].

The implementation of the serious game in the Continuing Education Program of the Health Secretariat, as well as its availability to higher education institutions, demonstrates the tool's potential for replicability and scalability. The accessibility of the game through the platform of the Graduate Program in Nursing at UDESC is an example of how technology can democratize knowledge and expand the reach of training initiatives. With advances in science and communication technology in recent years, digital technologies have come to be recognized as important tools that can facilitate and enhance this process. Access to equipment, devices, applications, and sources of information has become essential to reduce the differences between students regarding their different social backgrounds[17].

Final considerations

CE for Health Professionals gains new momentum with the use of serious games. The research shows that this innovative tool, through the collaborative creation of serious games, has the potential to promote the continuous and effective updating of PHC professionals. The active participation of professionals in the construction of the game ensured the relevance of the content and its applicability in practice, promoting interactive and engaging learning.

The feasibility of the framework lies in its detailed and organized step-by-step approach, which facilitates understanding and application by different teams, and in the use of accessible tools and platforms, many of which are free, contributing to reduced development costs and making the creation of serious games a reality for institutions with limited budgets. The proposal presented in this article, by providing a replicable model, demonstrates the feasibility of developing quality educational games with limited resources. The detailed structure for the creation of serious games aims to encourage health and educational institutions to develop their own games, adapting them to their specific needs.

Although the results of this study demonstrate the potential of serious games in continuing education for prenatal care, some limitations should be considered. The research was applied to a specific group of PHC professionals, which may restrict the generalization of the findings. Future research should seek to expand the investigation to larger and more diverse groups, in addition to exploring the application of this technology in other lines of care, such as child, adult, and elderly health, enabling the expansion of the use of serious games in CE for Health Professionals to various areas of care.

Collaborators

Silva PS (0000-0002-8602-4163)* and Ferraz L (0000-0002-2487-8614)* contributed equally to the preparation of the manuscript.■

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Received on 11/11/2024
Approved on 05/07/2025
Conflict of interest: Non-existent
Data availability: Research data are contained in the manuscript itself
Financial support: Non-existent

Editor in charge: Paulo Victor Rodrigues de Carvalho