OBJN
ONLINE BRAZILIAN JOURNAL OF NURSING
ISSN: 1676-4285

TECHNOLOGICAL DEVELOPMENT REPORT

Redesign of a Role-Playing Game for adherence of adolescents on hemodialysis: experience report

Redesign de um *Role Playing Games* para aderência de adolescentes em hemodiálise: relato de experiência

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Submission: 09/18/2024
Approved: 03/24/2025

ABSTRACT

Objective: To describe the process of redesigning the first version of a role-playing game designed to promote therapeutic adherence in children and adolescents on hemodialysis. The redesign was prompted by the results of an alpha test conducted with the initial version of the game. **Method**: This report outlines a technological innovation developed through the following stages: an initial brainstorming session among researchers, a literature review, reorganization of the game's mechanics and dynamics, a second brainstorming session, creation of new maps using Inkarnate and Dungeon Painter Studio, addition and removal of characters, and the layout design of the instruction manual and narrative book. **Results**: The process led to a second version of the role-playing game that is more engaging, visually appealing, and functionally improved in terms of mechanics and gameplay dynamics. **Conclusion**: The redesign of the first version of the game followed essential steps to enhance the original version, resulting in a product better suited to its target audience. The two brainstorming sessions facilitated the exchange of ideas and helped clarify feedback obtained during the initial testing phase.
Keywords: Renal Dialysis; Gamification; Child; Adolescent; Play and Playthings.

RESUMO

Objetivo: Descrever o processo de *redesign* da primeira versão de um jogo de *Role Playing Games* que visa favorecer a aderência terapêutica de crianças e adolescentes em hemodiálise. A experiência foi realizada após submeter a primeira versão do jogo ao teste alfa, que suscitou a necessidade de se fazer o *redesign*. **Método:** Trata-se de um relato de inovação tecnológica de realizado a partir das seguintes etapas: primeiro *brainstorming* entre pesquisadores, revisão da literatura, reestruturação das dinâmicas e mecânicas do jogo, segundo brainstorming entre pesquisadores, produção de novos mapas, usando *Inkarnate* e *Dungeon Painter Studio*, exclusão e criação de personagens e diagramação do manual de instruções e do livro de narrativas. **Resultados:** A experiência resultou na segunda versão do jogo de *Role Playing Games*, mais clara, envolvente e apresentando melhorias estéticas, de mecânica e dinâmica. **Conclusão**: O *redesign* da primeira versão do jogo seguiu etapas de reestruturação essenciais para aprimorar a tecnologia e viabilizou a apresentação de uma segunda versão mais adequada ao público-alvo. Em adição, a realização dos dois brainstormings contribuiu para a partilha de ideias e a compreensão dos registros e experiências advindos da aplicação do teste.
Descritores: Diálise Renal; Gamificação; Criança; Adolescente; Jogos e Brinquedos.

INTRODUCTION

Chronic health conditions involve many pathologies that share some characteristics, including the need to adapt to a new lifestyle. People living with chronic kidney disease (CKD), need a series of changes to their lifestyle habits, such as strict diet control, water restriction, rigid treatment schedules, fistula/catheter care, among others[1].

How to cite: Costa FNA, Silva PLC, Pimenta AGD, Teixeira E, Araújo STC, Delage PEGA. Redesign of a Role-Playing Game for adherence of adolescents on hemodialysis: experience report. Online Braz J Nurs. 2024;24:e20246815. https://doi.org/10.17665/1676-4285.20246815

The health education practices that have been used with people living with CKD have not helped in the process of adherence to therapy, particularly with children and adolescents. The authors indicate that this specific population deals with information in a dynamic and pragmatic way, such that traditional pedagogical models do not have the expected effect, regardless of the type of technological artifact used[2].

In this context, the use of gamification is one possible way of making the learning and engagement process more likely and even reducing dissatisfaction with the disease itself, which is a process of making activities into games to provide game-like experiences[3]. Therefore, consideration of the principles of gamification in the production of technological artifacts for use with children and adolescents living with CKD emerges as a possibility to enhance the success of health education interventions.

Development research on technological artifacts has been growing in the health sector, especially in nursing. Such research has guided the development of products, processes and tools in the educational, management and caring disciplines[4], and involves three processes: (1) production-construction, (2) validation-evaluation and (3) testing-application.

Furthermore, the Role-Playing Game (RPG) is a game of role interpretation, which has three main elements for its execution: (1) the player, who performs a different role from their everyday life - such as a wizard who controls the elements of nature - and is responsible for choosing the actions their character will perform; (2) the die, which indicates whether the action the player has chosen for their character is successful or not; and (3) the master/ narrator, who is in charge of describing the world the character is in, as well as describing the outcome of the actions performed by the player, based on the result on the die[5].

Taking these premises as a reference, we highlight the research of one of the authors of this report[6], who developed a role-playing game entitled Nefro Hero®, a narrative game based on a simplified role-playing model, developed to improve the adherence to therapy in children and adolescents undergoing hemodialysis. The analogue-based system used maps and character sheets printed on paper, and game pieces including dice, pawns and miniatures. The game incorporates elements of gamification as the characters' attributes are directly affected by the children's and adolescents' adherence to therapy.

The first version contained a story that was set in seven different territories, called kingdoms. In each kingdom, work occured on one aspect related to the adaptation of children and adolescents to new behaviors. The game was based on Sr. Calista Roy's adaptation theory, a nursing theory which states that individuals are adaptable beings and are in constant interaction with internal and external stimuli. When properly stimulated, individuals respond positively by developing favorable behavioral changes, known as feedback[6].

The seven kingdoms focus on the difficulties faced by children and adolescents with CKD and their need to adopt different health care behaviors: *kingdom of the desert*, which addresses water restriction; *kingdom of the black needles swamp*, which addresses punctures and invasive procedures; *kingdom of chips*, which addresses food restriction; *kingdom of garbage*, which addresses hygiene care; *kingdom of troubled waters*, which addresses the need to keep the catheter dressing dry; *kingdom of vertigo*, dealing with the adverse effects deriving from treatment; *kingdom of giants*, which relates to the short stature of children and adolescents living with CKD in relation to their peers.

The game was used with eight children and adolescents undergoing hemodialysis[7], to obtain quantitative, qualitative and observational measures of the educational technological product (alpha test). The quantitative measures were part of a quasi-experimental study that used repeated measures of pre- and post-testing in a single group of a health-related quality of life questionnaire. The game proved to be effective in achieving significant improvements in health-related quality of life scores, especially in the emotional score.

During the game, the researchers recorded what the participants were saying about the game on an instrument they developed that contained all the game's kingdoms and a space for what the participants had to say about the kingdom or any other element of the game, which served as qualitative measures. In addition, observations relating to the time of each game, the participant's behavior towards the game's narratives and images, and their involvement throughout the games were recorded in a field journal. The partici-

pants showed interest and good acceptance of the game, demonstrating the relevance of this type of strategy for this group.

The test also revealed weaknesses in specific aspects of the game, namely: unattractive game images (maps and characters); narratives with limited player involvement; complex mechanics that compromised the participant's understanding.

The results obtained in the alpha test with the characters' speech and the observations recorded in the field journal identified the need to redesign the game. Redesigning a game is the process of rethinking several elements, making changes in an attempt to improve it, both in terms of aesthetics and functionality, producing a new version of the game without, however, losing the identity of the original version[8]. Therefore, the aim of this report is to describe the redesign of the first version of the Nefro Hero® role-playing game, which was designed to improve adherence to therapy in children and adolescents undergoing hemodialysis.

METHOD

This is a descriptive report on the redesign of the first version of the prototype of a Nefro Hero® role-playing game aimed at promoting adherence to therapy in children and adolescents undergoing hemodialysis. The redesign process was conducted after an alpha test consisting of an intervention with the game for a group of eight participants, including children and adolescents. The qualitative data recorded in an instrument and the observation of the participant's behavior recorded in a field journal, were analyzed using seven steps, resulting in a second version of the game to be submitted to the validation process.

RESULTS

The results include a description of the seven steps that guided the redesign of the game, as shown in Figure 1 and described below.

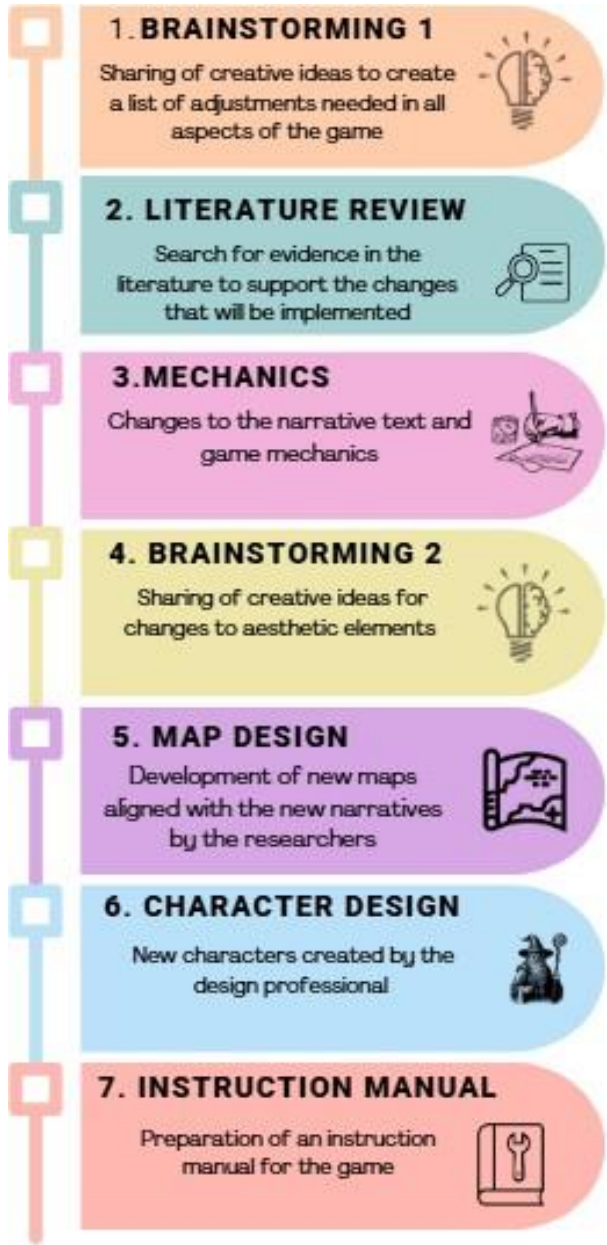

Figure 1 - Description of the redesign steps, Belém, PA, Brazil, 2024

Step 1 - First brainstorming among researchers

The first brainstorming was conducted with two authors and two members of the research group, Gamification Applied to Teaching Methods and Health (G.AM.E.S.), from a public university in the northern region of Brazil, online via the Google Meet platform.

The qualitative data collected in the instrument and in the field journal was transcribed into two separate spreadsheets and organized by kingdom. The records were first read by one of the members. Then observational data was presented, reported by the two authors who participated in the test, providing additional context. The data was categorized together by all the participants, and a third spreadsheet was made, categorizing the problems identified as follows: mechanics; dynamics; aesthetics; narratives; start time. The discussions and reflections on these aspects outlined a list of possible changes (key points), necessary for the technological product to meet the needs of the target public.

Step 2 - Literature review

An integrative literature review was conducted in six steps: (1) development of the guiding question: **what are the main difficulties faced by children and adolescents undergoing hemodialysis?** (2) definition of the databases Medical Literature Analysis and Retrieval System Online (Medline), Latin American and Caribbean Literature in Health Sciences (LILACS), Nursing Database (BDENF), using the Virtual Health Library (VHL); definition of the search strategies:"adolescentes OR adolescente AND hemodiálise OR diálise renal AND enfrentamento OR ajustamento psicológico"; "adolescents OR teenager AND hemodialysis OR renal dialysis AND coping OR psychological adjustment" and inclusion and exclusion criteria. Original articles available in their entirety in open access in Portuguese and English were included. Duplicate articles in the databases were excluded. (3) This search identified 410 articles, whose titles and abstracts were read, and the inclusion and exclusion criteria were applied, resulting in 10 articles. The reasons for exclusion were 10 repeated articles, 60 were not review articles and 340 did not meet the research question, (4) The 10 studies were read in their entirety and eight were excluded as they did not meet the scope of the research question, remaining two studies that were read in their entirety. (5) The results identified in the studies were organized in a table according to the key points identified in the first brainstorming. (6) The summarized results corroborated the discussion among the researchers and supported the aspects that would be modified in the game.

Step 3 - Restructuring the game's dynamics and mechanics

A redesign began after the previous two steps. The rules, combats, attributes and dice rolling still needed to be adjusted in order to achieve a simpler structure for a role-playing game. A new model was adopted for the game's mechanics, based on Tormenta 20, an intuitive and flexible RPG system normally used by beginner players. In relation to the dynamics of the game, changes were made throughout the narratives to make them more interactive and to promote better player participation. The narratives of a role-playing game need to include the interaction of the player, who can make choices and receive instant feedback on the consequences of his choice.

Certain parts of the narratives showed the need to strengthen the educational-adaptive aspects, enabling the player to make more choices, and later interaction between the master who is driving the game (professional) and the player (patient), making the narratives more dynamic. The game's prelude includes a general storyline that revolves around a mission assigned to the patients with the aim of stimulating reflection on themselves and their treatment. The negative points identified during the redesign included aspects associated with the statements of the two kingdoms, which showed little or no relation to the behavioral changes that should be developed with the game. The narratives that occurred in these kingdoms were the least interesting for the players, generating little involvement from them. In addition, these kingdoms presented an impaired educational-adaptive function precisely due to the lack of connection with the children's reality.

Although some kingdoms, such as the "*swamp of black needles*", were easily perceived by the children as something related to the different invasive procedures for their pathological condition, others in which they had to negotiate products with the characters of that reality were unclear in terms of what was intended to be worked on, such as in the "*kingdom of garbage*", which related to fistula hygiene. As a consequence, specific moments were incorporated into the narrative

texts in which real elements of the player and the character were highlighted, such as the location of the fistula/catheter, the player's age, the character's name, as well as indicative moments where combat began or where it was necessary to give the player directions.

Step 4 - Second brainstorming among researchers

After the changes in the mechanics and dynamics of the game, the second brainstorming session was conducted with the same members online via the Google Meet platform. First, the members of the research group presented the changes made to the narratives and mechanics of the game, which were appreciated and adjusted by the two authors. The members then focused on defining those that would be included in the game's aesthetic elements.

Aiming to bring alignment and coherence between what is described in the narratives and the elements of the maps, it was decided that all the maps would be redesigned by the team, and that the less appealing characters would be redesigned by a design professional. In addition, the team decided to design a manual with the rules and objectives of the game and an illustrated book with all the narratives to guide the player through the game in a dynamic way. The age range in the first version was 8 to 18 years, so the age range for the game's target public was redefined as 10 to 18 years. The age range of the first version was found to be very diverse, and during the alpha test, it could be seen that the level of understanding of the narratives varied greatly. In the new age group, participants could have a better understanding of the game's narratives and mechanics.

Step 5 - Production of new maps

The game's maps were redesigned by three team members using the Inkarnate and Dungeon Painter Studio programs. All the maps were later examined by the other members, in an attempt to identify possible adjustments to better suit the new RPG narratives. Three maps were developed for each kingdom, in addition to the map of the main village and the world map, which can be seen in Figure 2, with a total of twenty-three maps.

Figure 2 - World map before and after redesign, Belém, PA, Brazil, 2024

Step 6 - Deleting and creating characters

In an RPG system, there are characters who support the stories in the narratives, who are called non-playable characters (NPCs). In addition to these, characters representing villains and enemies who are involved in battles and conflicts with the protagonist are also part of the narratives. As the narratives changed, it was necessary to create some characters and exclude others that no longer aligned with the new storyline and were not visually appealing or engaging, which is extremely important to complement the involvement and participation in the stories being told. The characters of the second version were developed by a design professional (Figure 3).

Figure 3 - Game characters before and after redesign, Belém, PA, Brazil, 2024

Each character included in the new version has well-established functions, such as helping the characters on adventures, improving their armor or even providing more energy potions during adventures. This addition brings more functionality to each element included in the game and makes the narrative more diverse.

Step 7 - Layout of the instruction manual and narrative book.

The narratives of all the worlds were organized into a book that was diagrammed (Figure 4). The book of narratives was organized with guidelines for the RPG master, pointing out the fragments of the narrative that present the player's choice and the feedback on these choices, with a view to promoting educational-adaptive aspects. The manual explained the rules and objective of the game in a clear and easy-to-understand way for health professionals (who will be using the game with the target audience). Even if they are not skilled in the mechanics of a role-playing game, we hope that the professionals who work in hemodialysis services will be able to use Nefro Hero® with children and adolescents during their treatment, not just as a recreational resource, but as an opportunity to use the elements of the game to provide health education information and engage this audience in behaviors that encourage adherence to the hemodialysis treatment plan.

Figure 4 - Cover and page 7 of the narrative book, cover and page 3 of the instruction manual, Belém, PA, Brazil, 2024

DISCUSSION

The experience of redesigning the Nefro Hero® enabled us to reflect on the complexity of producing technologies in the form of games. The redesign emerged as a method of reformulating Nefro Hero® to improve both its aesthetic and functional parameters[9].

The brainstorming events enabled the researchers to discuss and comment on the content of the narratives. The contributions indicated lack of interest in specific parts of the game, apparent incomprehension of other parts, as well as the need to record the participants' comments on words or phrases contained in the narratives. The discursive strategy that emerges from brainstorming, along with field journal notes, encourages creative and collaborative work and stimulates the creation of new ideas for solving problems[9].

The findings of the literature review showed that adolescents on hemodialysis experience difficulties in terms of physical, social and emotional aspects. These aspects can be minimized if the strategies developed during the treatment consider their needs. The studies indicate the need to develop strategies to encourage adaptive behavior in line with the therapeutic treatment plan. The negative aspects of adolescents' lives are multidimensional and complex, as they are influenced by the characteristics of a stage of life that is usually full of vulnerabilities[10-11]. The findings in the studies that were part of the review helped to expand the researchers' view on the phenomenon and strengthen parts of the narratives that showed weaknesses during the test application.

The results of the qualitative analysis identified improvements in the mechanics and dynamics of the game, bringing new challenges to confront in the narratives, as well as immediate feedback on a player's actions in the game. These elements improve the player's experience and engagement. Game mechanics and dynamics are considered promising interventions for the self-management of young people with chronic health conditions[12].

The proposed new narrative attempts to detach itself from the biomedical viewpoint, ensuring that patients are fully involved in the activity, constructing their experience and sharing their experiences and discoveries. The different moments of the redesign enabled reflections on the emancipatory content of the narratives that needed to somehow positively intervene in the participants' perceptions of their health condition and, consequently, to facilitate their adaptive process. The positive aspects reinforced during the redesign included: good receptivity from the participants, the game's potential to improve the emotional aspects of the participants, as well as improving adherence to therapy. The game's success can be explained by the "magic circle"[13], defined as the temporal and spatial delimitation of the game in which a new reality is created, and events take on a new dimension and meaning. Even almost 100 years after this original proposition in 1934, authors[14] still demonstrate this effect produced by games. Regarding the issue associated with children's reality[6] identified in some game kingdoms, it is important that educational technologies reflect the reality of the target population, so that they can act in an emancipatory manner. A major challenge is promoting the transfer of knowledge acquired in the virtual space to the real environment while guaranteeing autonomy in this process, so that patients play a leading role in managing their treatment[15].

With the redesign, graphic elements were revised, because although they served the function of linking players to the narratives in the original version, in a reasonably good way, they were still very rudimentary and generic. Graphic elements are important for increasing players' immersion in a game and their acceptance of the narrative as plausible and interesting[16]. Thus, during the process, the reformulation of the game's maps, scenarios and characters was important to achieve greater involvement of the target audience with the game's elements, in order to awaken adaptive behavior to the hemodialysis therapeutic regimen.

Regarding the game itself, the test identified that some elements did not work as intended, such as the cosmetic aspects of the armor, represented by accessories to customize the avatar's clothing, which were tied to the completion of tasks and the accumulation of gold coins collected throughout the adventures. Others caused unnecessary confusion, such as basic materials for building items, or even served as a source of imbalance in the game, such as quick-healing potions. Concerns regarding the use of excessive or unclear mechanics and components are in line with a previous study[16] which stated that for a cohesive and enjoyable gaming experience, it is necessary that game mechanics are well balanced and have clearly established functions.

Another aspect identified in the process was the fact that the game application was only possible because the researchers had previously been trained. The question then arose as to how the game would be applied by other professionals, given that there was no manual explaining the main elements of the game to new users. The identification of this factor suggested the need to prepare a manual with game instructions, which was reinforced by other authors[16], who state that if you want to play a game it is essential to know its rules, which are usually presented in printed format for analog games.

According to the authors, the manual works as a set of classified and hierarchical data with the aim of improving the player's experience. The manual was developed by the authors and designed by a graphic designer to provide fluidity and balance between the text and the illustrations needed to add clarity to the material.

Another problem identified in the redesign was the quality of the maps. Firstly, there was a huge difference in the maps of each kingdom, because each one was made by different researchers, so some were richer and more elaborate than others. Another problem was the lack of proper workmanship on all the maps, as the original design was done by the authors themselves without the help of a graphics professional, which was reflected in the final version of most of the maps. The maps play the role of contextualizing the player and giving meaning to the story being narrated. Thus, a good map should present harmony between colors and aesthetic pattern so that the game elements can converge in the same direction[17].

During the process of aestheticizing the game's elements, it was possible to enhance the game's imagery and appeal, so the team decided to recruit a design professional to create the game's images. A design professional plays an important role in the production of game elements as they have the aesthetic skills to enhance the player's experience[18].

This technological development study has the potential to contribute to nursing care for adolescents receiving hemodialysis treatment, by improving a product aimed at developing adherence to the treatment plan, a measure that contributes to better health outcomes.

The redesign process was conducted using a test administered to eight participants from a single reference nephrology institution in the northern region of Brazil, which can be considered a limitation of this study.

CONCLUSION

The redesign of the first version of the game followed essential restructuring steps to improve the technology and made it possible to present a second version that was better suited to the target public. In addition, the two brainstorming sessions contributed to the sharing of ideas and the understanding of the records and experiences from the test application. The participation of a design professional enabled improvements to the aesthetic features of the game by harmonizing the colors and features of the images.

The aim of this report was not to establish a standard for redesign, but rather to share the experience of the team and to encourage designers of educational technologies, with an emphasis on games, to adopt similar approaches. Finally, it is worth highlighting the need for content validation with experts and evaluation with the target audience of the game, children and adolescents, which has been ongoing since January of 2023, as part of the doctoral thesis of one of the authors.

CONFLICT OF INTERESTS

The authors have declared that there is no conflict of interests.

FUNDING

This paper was carried out with the support of the Amazon Foundation for Support of Studies and Research of Pará (FAPESPA).

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Final approval of the version to be published: Costa FNA, Silva PLC, Pimenta AGD, Teixeira E, Araújo STC, Delage PEGA.
Responsibility for the text in ensuring the accuracy and completeness of any part of the paper: Costa FNA, Silva PLC, Pimenta AGD, Teixeira E, Araújo STC, Delage PEGA.