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Development and validation of a board game for children with cancer

Desenvolvimento e validação de um jogo de tabuleiro para crianças com câncer

Desarrollo y validación de un juego de mesa para niños con cáncer

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Abstract

Objective: To elaborate and validate a board game for effective communication between health professionals and children with cancer.

Methods: This methodological research followed Vigostky's social-constructivist theory as a theoretical framework and the Child-Centered Game Development (CCGD) as a methodological framework. We carried out the study between February/2016 and July/2017 and followed these phases: analysis, concept, design, implementation, and evaluation. In the phases that we had children's participation, we included those who were between 8 to 12 years old and diagnosed with cancer. During the development of the game, we analyzed the collected data according to the objective of each phase. The Research Ethics Committee from a Higher Education Institute approved the research (Protocol number: 1.387.962/2014).

Results: The phase study revealed that the child wishes to be informed in an adequate language to their level of comprehension. In the concept phase, we defined the developing elements of the game. In the design phase, we propose a prototype of the board that subsequently was implemented so that the child could carry out a reliable evaluation of the game board design. In the evaluation phase, professionals evaluated the content of the cards with an average index of 0.95, the game designers approved the usability, and the children reported enjoying the game.

Conclusion: We considered the game board "Skuba! An adventure under the sea" valid. Thus, the game represents an important tool in the communication process with this target audience.

Resumo

Objetivo: Elaborar e validar um jogo de tabuleiro para comunicação efetiva entre profissionais da saúde e crianças com câncer.

Métodos: Pesquisa metodológica que utilizou a teoria socioconstrutivista de Vigostky como referencial teórico e o *Child-Centered Game Development* (CCGD), como referencial metodológico. O estudo foi realizado entre os meses de fevereiro/2016 e julho/2017 e seguiu as seguintes etapas: análise, conceito, *design*, implementação e avaliação. Nas fases que a criança participou foram incluídas aquelas com idade entre 8 e 12 anos, diagnosticadas com câncer. Durante a construção do jogo, os dados coletados foram analisados de acordo com o objetivo de cada etapa. A pesquisa foi aprovada pelo Comitê de Ética em Pesquisa de um Instituto de Ensino Superior (Parecer: 1.387.962/2014).

Resultados: O estudo de fase de análise mostrou que a criança deseja ser informada numa linguagem adequada ao seu nível de compreensão. Na fase de conceito foram definidos os elementos de desenvolvimento do jogo. Na fase de *design* foi proposto um protótipo do tabuleiro do jogo que, em seguida passou pela fase de

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implementação para que a criança pudesse fazer uma avaliação mais fidedigna do *design* do jogo de tabuleiro. Na fase de avaliação, o conteúdo das cartas foi validado pelos profissionais com índice geral de 0,95, os designers em jogos aprovaram a usabilidade e as crianças relataram apreciar o jogo.

Conclusão: O jogo de tabuleiro "Skuba! Uma aventura no fundo do mar" foi considerado validado. Dessa maneira, o jogo se constitui uma importante ferramenta no processo comunicacional com essa população-alvo.

Resumen

Objetivo: Elaborar y validar un juego de mesa para una comunicación efectiva entre profesionales de la salud y niños con cáncer.

Métodos: Estudio metodológico que utilizó la teoría socioconstructivista de Vigostky como marco referencial teórico y el *Child-Centered Game Development* (CCGD) como marco referencial metodológico. El estudio fue realizado entre los meses de febrero de 2016 y julio de 2017 y completó las siguientes etapas: análisis, concepto, diseño, implementación y evaluación. En las fases que hubo participación de niños, se incluyeron aquellos entre 8 y 12 años de edad, diagnosticados con cáncer. Durante la elaboración del juego, los datos recopilados fueron analizados de acuerdo con el objetivo de cada etapa. El estudio fue aprobado por el Comité de Ética e Investigación de un instituto de educación superior (Informe n.º 1.387.962/2014).

Resultados: El estudio en fase de análisis demostró que los niños desean ser informados con un lenguaje adecuado a su nivel de comprensión. En la fase de concepto, se definieron los elementos de desarrollo del juego. En la fase de diseño, se presentó un prototipo del tablero del juego, que luego pasó a la fase de implementación para que los niños pudieran hacer una evaluación más fidedigna del diseño del juego de mesa. En la fase de evaluación, los profesionales validaron el contenido de las cartas con un índice general de 0,95, los diseñadores de juegos aprobaron la usabilidad y los niños relataron que el juego les gustó.

Conclusión: El juego de mesa "¡Skuba! Una aventura en el fondo del mar" fue considerado validado. De esta manera, el juego constituye una herramienta importante en el proceso comunicativo con el público destinatario.

Introduction

In researches where there are children and adolescents with cancer, they have increasingly expressed their wish to be informed about their disease and treatment.⁽¹⁻⁵⁾ We know that the way the child faces the cancer diagnosis is influenced many times by the representation that he/she develops about the disease and by the existent interpersonal relations in this process.^(2,3)

The communication between the professional, the child, and their family is a relevant instrument to transform and reframe the attributed meaning to the disease. However, in most parts of this process, the child is allocated in the background or faces a complex language and an emotional difficulty to deal with so much information.^(3,5)

To effectively communicate with the child means to provide an environment that allows their expressions, questionings, and curiosities, implying, thus, a connection between the interlocutors that lighten the process through the security transmitted in this bond.

The utilization of playful resources adequate to the phase of their development amplifies the possibilities so that the child may understand the adversities of the treatment and, consequently, deal with them.^(6,7) That way, the games maintain a strict relation with the knowledge construction, exert in-

fluence as a motivational element, and provide a pleasant environment, planned and enriched, that allows them to learn many abilities.⁽⁸⁾

The use of games and playful activities may be a useful tool and well received by the children to achieve the goal of communication and sharing information in a clear and accessible language. With the use of the game, the child drives their behavior through the meaning that the experienced situation provides and engages themselves in activities in which may assume new identities, explore worlds and learn by playing.⁽⁸⁻¹⁰⁾

Thus, we may consider the board game as a two-way street in the interaction with a child, in which the professional may communicate more effectively with a comprehensive language at the same time that it constitutes a space for the entertainment of the child.

The search for a game that refers to situations in which the child will face during the cancer diagnosis and treatment became a gap that needed to be filled because we understand that we need to propose ways to helping the child with cancer to handle better the experience of the disease, such as the offer of materials with an accessible and interactive language.

Thus, the objective of this study was to elaborate a board game for effective communication between health professionals and children with cancer and

validate the content of the textual information and its images with the collaboration of children and judges from different fields.

Methods

This is a methodological research using the socio-constructivist theory of Vigostky⁽¹¹⁾ as a theoretical framework and the *Child-Centered Game Development* (CCGD),⁽¹²⁾ as a methodological framework.

The Social-interactionist theory of Lev Semionóvich Vygotsky has as a central point the social relations, in which the individual is molded through his or her relations and interaction with the environment.⁽¹¹⁾ The framework considers the player-game interaction in which the player may utilize actions such as decision-making, choice, prioritization, and problem resolution strategy reasoning through mediating tools.⁽¹³⁾

The Child-Centered Game Development (CCGD) framework considers that for the development of games, the child must participate in the entire creation and validation process so that their needs, beliefs, and perceptions are incorporated. Thus, the children are encouraged to assume the roles of informant, users, testers, and even design partners. The CCGD is structured in five phases: analysis, concept, design, implementation, and validation.⁽¹²⁾ The game construction occurred from February/2016 to July/2017 and followed the five phases as described ahead.

Phase 1 – Analysis

In this phase, we utilized the results of a descriptive study of a qualitative approach carried out by the authors to identify the information needs of children with cancer undergoing chemotherapy treatment.⁽¹⁾ We carried out the study in a reference hospital in the treatment of childhood cancer. Nine children from 8 to 12 years old with a confirmed diagnosis of cancer participated. We collected the data through semi-structured interviews and, for the data analysis, we utilized the Qualitative Content Analysis.⁽¹⁴⁾

Phase 2 – Concept

We carried out team discussion meetings composed by the researchers and a game designer, aiming to define the objective of the game and the elements for its composition, including the targeted audience, the scenario, the characters, the narrative, the dynamics, and the content of the cards of the game. We created some initial concepts through a brainstorm of individual and collective ideas of the team and the inclusion of contents related to the communication with the child and their information needs, based on the analysis study data.⁽¹⁾

Phase 3 – Design

We proceeded with the creation of a low-fidelity game prototype based on the discussions carried out in the concept phase. An illustrator carried out the development of the art through editing techniques and digital image drawing, and a game designer allocated the elements in the board utilizing computer game development techniques.

Phase 4 – Implementation

We carried out the projection of the prototype in the targeted chosen platform, in this case, the board, utilizing the Adobe Illustrator (Ai) program and printing a test version for the application. We carried out a semantic evaluation in the game implemented in the board with the targeted audience, that is, children with cancer. After playing a full game match, the children reported their comprehension regarding the cards, illustrations, and game dynamic.

Phase 5 – Evaluation

We carried out three studies: gameplay evaluation, content validation, and usability evaluation. For the gameplay evaluation by the targeted audience, we conducted an exploratory and descriptive study of qualitative nature to explore children's experiences during their interaction with the game. We adopted the following inclusion criteria: Child between 8 to 12 years old diagnosed with cancer for at least a month and undergoing outpatient chemotherapy treatment. We excluded hospitalized children for clinical/surgical treatment and/or diagnosed with

the possibility of cure. We collected the data in a pediatric hospital that assists children with cancer in São Paulo. We conducted the data analysis of the qualitative phases through the Qualitative Content Analysis.⁽¹⁴⁾

For the content validation of the board game, we submitted version 1 to the committee of specialists in the thematic field, which the methodological path we adapted according to Pasquali's established criteria.⁽¹⁵⁾ They evaluated the game regarding the objective, the structure and presentation, and the relevance. We utilized the Delphi technique to obtain agreement between specialists, establishing a degree of 80%. To determine the agreement between them, we considered the Content Validation Index (IVC) between the items of 0.8, presented as a value of excellence.⁽¹⁶⁾ Participated in this phase health or educational professionals that attended the following inclusion criteria: Experience in children care with cancer and/or regarding educational technologies, hold a masters or doctorate degree.

We carried out the usability evaluation by a committee of specialists in game design applying the Nielsen heuristics adapted to non-virtual board games.⁽¹⁷⁾ The authors propose ten design principles called heuristics: (1) system status, (2) system compatibility and the real world, (3) control and user freedom, (4) consistency and standards, (5) error prevention, (6) Recognition rather than remembrance, (7) Flexibility and efficiency of use, (8) aesthetics and minimalist design, (9) Help to the users with recognition, diagnosis, and error correction, and (10) help and documentation. To each evaluated heuristic, the severity of the problem found should be classified according to a scale from 0 to 4, where 0= no importance (does not affect the interface operation), 1= cosmetic (there is no immediate necessity of solution); 2= simple (low priority problem), 3= grave (high priority problem - it must be repaired) and 4= catastrophic (very grave, it must be repaired regardless).⁽¹⁷⁾ Thus, if the heuristics obtained three or four classifications, the problems should be corrected. To select the specialists, we adopted the following criteria: being a professional from the field of technology and digital media, with

experience in the field of educational games and/or audiovisual production for children.

In every phase of the data collection involving human beings, we requested a signature of the Consent and Assent Form for the child. The Research Ethics Committee from a Higher Education Institute approved the research (Opinion: 1.387.962/2014) (CAAE: 63057616.7.0000.5505).

Results

This study obtained, as a result, the development of a board game named by the authors as "*Skuba! An adventure under the sea*". The results of the development of the game are descriptive according to its phases.

In phase 1 – Analysis. A study carried out previously by the authors revealed that the child with cancer wishes to know everything that will happen during the treatment. Each one of them catalogs their priority according to what they experience. Commonly, every child thinks that it is important to tell them about the procedures and the effects of the chemotherapy.⁽¹⁾

In phase 2 – Concept. We defined the elements in the process of the game development: (a) Targeted audience: children from 8 to 12 years old diagnosed with cancer and undergoing chemotherapy treatment; (b) Game scenario: the sea, since its deepest regions representing the dark side and the unknown, to the beauty of its surface. Inside the defined scenario, we choose the game characters according to a selection of marine animals that have brought symbology to the targeted audience. Hence, we were able to work the content of the game with analogies, according to the animals' characteristics, such as the vampire squid's capacity of regeneration that reminded the growth of the hair after alopecia caused by the treatment, the jellyfish that provokes skin irritation as the extravasation of chemotherapy, or yet, the encounter with the seahorse resting, referring to the necessity in the child; (c) game dynamics: we included lucky and setback cards that would represent the progress and the retreat in the game, besides these we add the information and negotiation cards.

In phase 3 – Design. We incorporated the elements of the game and its contents approved by us, resulting in a low-fidelity prototype of the board and its cards of the game manufactured in A3 paper.

In phase 4 – Implementation. Through the prototype, we created a test-version, printed in heavier weight paper, laminated, and plastic, so the game was implemented in practice with the child. Participated in this phase two kids that played game matches and revealed the adequacy of illustrations on the board, considered attractive, the need to modify the position of some illustrations in the board, the necessity to describe the content of some cards utilizing a more accessible and clear language, and the maintenance of the game time, around 30 minutes. Embracing the suggested modifications, we came up with version 1 of the board.

In phase 5 - Evaluation. In the gameplay evaluation, five kids participated. In the data analysis, two analytical categories emerged that allow us to comprehend the child's experience while interacting with the game. The first category corresponds to the personal identification of the child with the game, in which she/he sees herself/himself in elements present in the board game. *“I found the vampire squid interesting because it is just like my hair when it falls”* (Nemo). *“And the vampire squid can regenerate, right? Like, someone cuts her tentacle, and it will grow again. Just like my hair too: if it falls, it will grow again”* (Marlin).

The second category corresponds to the child learning with the game. When interacting during the match, the child has the opportunity to access, through the cards, the information that makes analogies with the environment, to the marine animals, to the disease, and the chemotherapy treatment. Hence, she/he considers relevant the knowledge acquired relating to the characters of the game as well as the aspects of the disease and treatment. *“It was good because of the information it is a good board game”* (Gil). *“It is nice because it is very informative; it has a lot of information”* (Dory).

For the content validation, five specialist judges participated, of which three were nurses, one a pediatric oncologist, and one pedagogue. The overall content validity index was 0.95, as presented in table 1.

Table 1. Content validity index of board game cards by expert judges (n=5)

| Dimensions evaluation | IVC |
|---|------|
| 1. Objectives | |
| 1.1 Is coherent with the information needs of the targeted audience. | 1 |
| 1.2 Is coherent from the educational point of view. | 1 |
| 1.3 It may circulate in the scientific community in the field of pediatric oncology. | 1 |
| 1.4 Meets the goals of professionals and institutions that assist/work with children with cancer. | 1 |
| 2. Structure and presentation | |
| 2.1 The game is appropriate for children with cancer undergoing treatment. | 1 |
| 2.2 The information in the cards is presented in a clear and objective manner. | 1 |
| 2.3 The presented information is scientifically correct. | 1 |
| 2.4 There is a logical sequence of the proposed content. | 0.8 |
| 2.5 Information is well structured regarding the verbal agreement and orthography. | 1 |
| 2.6 The writing style corresponds to the level of knowledge of the targeted audience. | 1 |
| 2.7 The aesthetics of the game are attractive and adequate. | 0.8 |
| 2.8 The duration of the game is adequate. | 1 |
| 2.9 The board illustrations are expressive. | 0.8 |
| 2.10 The number of illustrations on the board is sufficient. | 0.8 |
| 3. Relevance | |
| 3.1 The cards portray key aspects that must be reinforced | 1 |
| 3.2 The board allows the player to acquire knowledge about oncology treatment. | 1 |
| 3.3 The board addresses subjects necessary for the knowledge of the targeted audience. | 1 |
| 3.4 The board is appropriate for use by any professional from the pediatric oncology field. | 1 |
| Overall | 0.95 |

In the expert judges evaluation, all instrument items had an IVC higher than 0.8 in the first round. Thus, we considered the content of the game valid. In the usability evaluation, three professionals in educational games design participated. The evaluators identified possible problems in the board game and classified them, according to the severity of the problem, as the table 2 shows.

Table 2. Board game evaluation regarding the severity degree of Nielsen's heuristics – First round (n=3)

| Heuristics | Not identified | Severity degree | | |
|---|----------------|-----------------|--------|-------|
| | | Cosmético | Simple | Grave |
| 1. System status | 3 | | | |
| 2. System Compatibility with the real world | 3 | | | |
| 3. User control and freedom | 3 | | | |
| 4. Consistency and standards | | | 1 | 2 |
| 5. Error prevention | | | | 3 |
| 6. Recognition rather than remembrance | 3 | | | |
| 7. Flexibility and efficiency of use | 3 | | | |
| 8. Aesthetics and minimalist design | 3 | | | |
| 9. Help to the users with recognition, diagnosis, and error correction. | 3 | | | |
| 10. Help and documentation | | 1 | 2 | |

In the ‘Consistency and standards’ heuristic, the evaluators considered the different coloration from some squares of the board as a problem, suggesting standardization. Regarding the ‘Error prevention’ heuristic, all of them have considered as a problem of grave severity the fact that some cards result in sequential punishments in the same roll, suggesting another text. For the ‘Help and documentation’ heuristic, they identified problems in the writing and the handbook illustrations, being suggested the utilization of more visual resources to facilitate the comprehension of the targeted audience. We accepted all the identified problems and forwarded them to the responsible designer for the modifications, being later submitted to a second roll with the evaluators that did not identify any problem of grave severity or catastrophic, and considered the board game able to be used by the target audience.

Thus, through the suggestions of the targeted audience, the committee of specialists judges in the thematic field, and the changes suggested in the heuristic evaluation by the game design specialists, we elaborated the final version of the board game presented in figure 1.

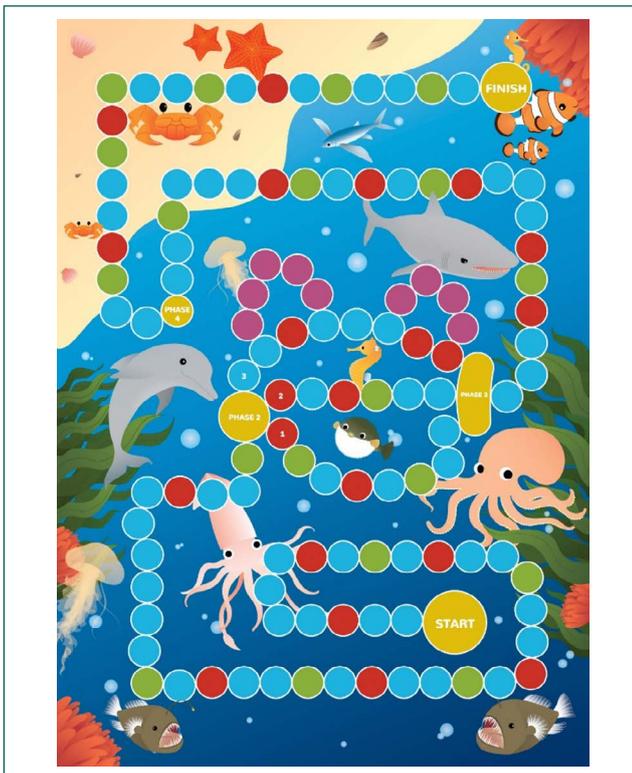


Figure 1. “Skuba! An adventure under the sea” board game.

The game is composed of a board, four pins of different colors, a dice, a guide for application, a rulebook, and 114 cards – 48 of luck, 48 of setback, 12 of information, and six of negotiation. We divided it into four phases that represent the pre-diagnosis, diagnosis, treatment, and post-treatment. We have some examples of cards in figures 2 and 3.



Figure 2. Example of lucky and setback cards of the board game “Skuba! An adventure under the sea”, front and back.



Figure 3. Example of information cards and negotiation of the “Skuba! An adventure under the sea” board game, front and back.

By experiencing adversities under the sea, the game refers to something similar to the routine of a child with cancer, in other words, win and loss situations. Immersed in this context, he/she will be challenged to utilize strategies to overcome the adversities faced by them.

Discussion

In this study, we listen to the child from the analysis phase, contributing to their needs concerning the information to be inserted in the game and bringing important contributions that have influenced the final version of the board game *Skuba! An adventure under the sea*.

Studies that utilized the methodological framework adopted have considered engagement as a fruitful way for the development of abilities of the child because it combines a series of actions that are

essential to the learning, contributing to the generation of significant learning.^(18,19)

Trust and the bond are primordial factors to minimize fear and anxiety. The children wish to be informed, but the communication needs to happen through parents and the health team.^(1,5) In this process, a study reveals that although the understanding of the disease from the clinic point of view is, in the majority of the time, minimal, the children comprehend the complexity of cancer and the treatment and the need for a team effort to win this battle.⁽⁵⁾

Hence, the adopted framework corroborates with the game development process in this study, whose purpose was not to encompass all the available information for the child with cancer but to consist in a means that we could intermedate the communication with them to the health professionals.

Studies carried out in the gaming field with ludic-educational aims have shown themselves to be an effective communication lane by the children.^(8,9,20) Games with narratives attract and approximate the children to the team, evoke the interest for the information besides being a motivation when presenting characters that they identify with and that they wish to perform similar actions.⁽⁹⁾

The game development process allowed that the final result was a product with simple and clear information, in a format of small doses on game cards approved by both children and specialists. The approached content was always intermedated by the ludic; making the path traveled of leaving the bottom of the ocean and reaching its surface as, in fact, an adventure for the child.

In this context, studies have shown that the games whose objectives overcome the entertainment constitute spaces that allow the child to increase their repertoire of reactions through the projection of what was experienced in the game and enable mediation between the ludic and the reality. Thus, the utilization of resources that make the communication with the child more ludic and interactive provides a better adaptation to the hospital environment and results in more socialization with the professionals that take care of them.^(1,8,20)

Therefore, this study advances because it highlights this tool in the communication process of the

child with the nurse that takes care of them, enabling attentive listening and the sharing of information regarding the disease and treatment through a differentiated, ludic, and dynamic environment. However, it is necessary training for the nurse to deal with the feelings and the questions that may emerge during its application.

Regarding the limitations of this study, we highlight the lack of opportunity to evaluate the game with a higher number of children that could validate its effectiveness. Thus, through the continuous use of the board game “*Skuba! An adventure under the sea*”, we expect the identification of aspects to be improved in a manner that could make it an important instrument of communication with the child with cancer. Besides, we suggest for future studies the inclusion of the family in the game to evaluate their participation during the matches with the child.

Thus, we expect that this research instigate the application of the board game in practice; in a way that there is a translocation of the resulting knowledge and that, the nurse practical role in the exempt child care with cancer must be mediated by interventions that provide beneficial effects to their physical, cognitive and emotional health.

Conclusion

The development of games that include the participation of children in the process of conception as well as in the evaluation allowed that the final product developed was adequate to their comprehension and their needs. Besides, different professionals of fields that exceed the hospital health context may strongly contribute with different perceptions increasing the discussions and bringing to the game elements that go beyond the information, but that makes it more dynamic and fun. The health team needs to see and listen to the child with cancer with their necessities and perceptions according to what they experience, and the board game “*Skuba! An adventure under the sea*” enables that the process occurs, allowing the child to become a possible participant in the decision-making regarding the process of health/disease.

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Collaborations

Amador DD e Mandetta MA collaborated with the conception of the study, analysis and data interpretation, writing of the article, critically revising and approving relevant intellectual content for the final version of the manuscript.

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