Evaluating Social Games for Kids and Teenagers Diagnosed With Cancer

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Abstract— **Serious games for health are interactive games with a focus on health care, physical and mental fitness. As it is assumed that social support can also indirectly influence patient's health condition, multiplayer online health games present an innovative approach of improving the player's health condition. In this paper we present the health game prototype "Adventures in Sophoria" developed at the University of Duisburg-Essen with the goal of facilitating the intercommunication of teenagers during cancer treatment. Two versions of the game were implemented, one explicitly referring to cancer and an implicit version with no cancer content. In a between-subjects experimental study with a clinical sample, both versions were compared. Additionally, parents and nursing staff were interviewed in order to evaluate the demand regarding health games. Results suggest that the implicit game version yielded higher enjoyment and acceptance compared to the explicit version.**

Keywords-serious games, social games, health games, childhood cancer, game experience, evaluation

I. INTRODUCTION

Every year, about 160,000 children and teenagers are diagnosed with cancer worldwide [20]. Even in industrialized nations with highly developed medical care systems, the disease is one of the most prominent causes of death among juveniles. While common treatments generally focus on fighting cancer on a physical level, disease consequences for young patients' psycho-emotional development play a fundamental role in the process of coping with cancer [12], [19]. Moreover, cancer treatment is known to usually weaken the affected persons' immunological system, forcing patients to be isolated from their social environment and therefore affecting their psycho-emotional development [13].

In this context, digital media offer a possibility of equipping juvenile cancer patients with a communication tool for staying in touch with classmates and friends during treatment periods and hospitalization [14]. In addition, new friendships with other patients may also be established to further support psychosocial coping [19]. In this paper, we present a social health game prototype and a community-based approach to enforce patients to maintain relationships with friends, family and classmates. Furthermore the results of an empirical study conducted to evaluate the acceptance and demand for the developed social health game are presented. Findings from the game evaluation suggest that most patients enjoyed playing the implicit and explicit game. Additionally, interviews with parents and nursing staff show a generally positive perception of digital media as a means of improving the quality of life of juvenile cancer patients and facilitating communication about the disease.

II. RELATED WORK

The design of digital entertainment systems to ease the life of chronically ill patients has already been addressed in the past [10]. Although digital games may simply be used to entertain patients and distract them from pain [16], they also have been demonstrated to be a useful method for conveying disease-relevant information and positively influencing patients' self-efficacy [2], [5], [11]. Furthermore, as research results suggest that patients engaging in online platforms show higher treatment compliance, experience less pain, and develop better coping strategies, several information platforms, online communities and digital games have been developed for juveniles with chronic medical conditions [8]. For example, STARBRIGHT World is an online community for chronically ill children offering supervised chat rooms, bulletin boards and mini games [18]. The CanTeen Interactive Village [3] and Onko-Kids Online [15] are web portals specifically developed for children and teenagers diagnosed with cancer, providing information about cancer and offering basic interaction features such as bulletin boards or chat rooms. Additionally, positive effects of online communities in order to overcome social isolation have also been discussed for older patients during breast cancer treatment [17].

Besides information platforms and online communities created for patients with chronic diseases, health games can also be employed to address motivational aspects and to facilitate patients' communication and discussion about their medical condition. "Re-Mission" is a health game specially developed for juvenile cancer patients in order to strengthen their motivation to adhere to medication plans. In this game, the user steers a nanobot in order to fight cancer cells allocated in the patient's organism. A clinical study [11] showed that the game intervention significantly improved treatment adherence and cancer-related self-efficacy of teenage patients undergoing cancer therapy. Although the effectiveness of the game has been well demonstrated and empirically secured, the game does not address communicational aspects through the integration of multiplayer features. However, Click Health Inc´s interactive health game series has taken such an approach by providing various health games with a two-player option. By this means, cooperation and social interaction between players is automatically fomented due to the players' shared game goal

achievement. A prominent example of such health games is "Packy and Marlon", which puts the players in the role of two young elephants who suffer from diabetic disease and have to cooperate while controlling their blood sugar level in order to stay fit for their adventures. Research results report that after playing Packy & Marlon for a six-month period, participants showed an improvement in diabetes-related self-efficacy, communication with parents about diabetes, and a decrease in unscheduled urgent doctor visits compared to the control group who played a videogame containing no diabetes-related content [2]. Although perceived social support in this game (and in the game series) is stated to be one of the mediators for patients to engage in healthier behaviors [2], the game series unfortunately does not feature an online multiplayer mode that allows an interaction of remote players. Because perceived social support has been proven to be an important mediating factor in order to improve health behaviors and health outcomes [1], a health game prototype focusing on the integration of game elements and social support enhancement was designed and tested at the University of Duisburg-Essen.

III. Adventures in Sophoria

"Adventures in Sophoria" is a Massively Multiplayer Online Role Playing Game (MMORPG) prototype developed based on the Microsoft Role Playing Game Starter Kit and Microsoft XNA Game Studio. In the game, the player is invited to enter a fantasy world that has been attacked by an alien force: Dark crystals have covered the land "Sophoria", severely harming life on the planet. The player is offered the role of a warrior who fights hostile goblins that seem to guard the crystals and is equipped with sundew, which may be applied to support the recovery of infected areas.

Figure 1. The game prototype Adventures in Sophoria.

During the course of the game, the player is accompanied by a personalized pet, which carries the inventory and is designed to support the player throughout the journey that starts with a short tutorial.

Apart from the aforementioned in-game features, "Sophoria" offers a personal area, allowing the player to use a chat client and different bulletin boards, keep a diary, send messages to friends, use Twitter from within the game and share links with others. By this means, communication beyond in-game collaboration is encouraged.

In order to evaluate the influence of cancer disease perception on game likeability, an implicit game version of "Adventures in Sophoria" was also programmed. Depending on the version of the game, a different background story is told. In the explicit version, the player is directly confronted with the cancer disease within the introduction of the characters and the game story. In this version, an analogy between game elements (crystals, goblins and their impact on the game world) and cancer treatment (symptoms and treatment) is presented. The implicit version has no such references to cancer. Based on prior research findings [5], a higher likeability of the explicit game version was expected due to its higher meaningfulness and likelihood of players to identify with the game character and background story.

IV. Evaluation

The study was conducted in order to explore possible differences between the implicit and explicit health game version in regard to acceptance and enjoyment. Furthermore, the demand for a socially orientated health game was also inquired.

Participants were recruited with the cooperation of oncologists from the Essen and Hannover university hospitals. The study was a between subjects experiment in which stationary and ambulant patients with cancer were randomly assigned either to the explicit or the implicit game version. The experimental procedure consisted in playing the game during a single session for a 15 minutes interval followed by a questionnaire with three parts. In the first part of the questionnaire participants rated their media consumption and described their social network behavior (e.g. "Are you member of a social network site?"). Afterwards, game likeability and player experience was assessed based on the Game Experience Questionnaire (GEQ [9]) using a 5-point rating scale. In the third part of the questionnaire, participants were asked about their physical and psychic health condition (KINDL) and their experienced social interaction (e.g. "How often do you have contact with other children from the hospital"). All variables were assessed on a 5-point rating scale. Additional to the game usability tests, qualitative interviews with nursing staff and parents were conducted, in order to evaluate their attitudes in regard to health games and inquire about the existing demand for social orientated health games.

A. Quantitative Evaluation

The sample (N = 26) is composed of 19 boys and 7 girls with cancer ranging between the ages of 7 and 19 (M = 13.54; SD = 3.17) years. 20 of 25 participants reported to possess an own personal computer or laptop. Furthermore, 92% of the sample described to have experience with computer games. No shared preferences for specific game genres were found (e.g. Action & Adventure, Jump´n´Run, Sport-Simulations, Strategy, Role-Playing Games). Over half of the sample (15 of 25 participants) reported to be registered in a social network site. The most visited social

network sites were SchülerVZ and Facebook being frequented by 12 and 10 participants, respectively. There was no statistical difference between treatment conditions (n = 13) concerning any of the above-mentioned variables.

In order to analyze the influence of game version on likeability ratings, a t-test for independent samples was conducted. Children in the implicit game condition (M = 3.92; SD = .77) as well as children in the game condition with cancer content (M = 3.48; SD = .951) enjoyed playing the game. No statistical significant difference between both conditions was found [t (24) = 1.28; p = .212]. Nevertheless, Cohen´s effect size d analysis revealed a medium effect (d = .052) suggesting the superiority of the implicit game over the explicit game version regarding likeability ratings. The analysis of the positive affective GEQ dimension supported this notion (Figure 2). Here, the implicit game version was shown to induce significantly higher positive affective reactions among participants (M = 3.65; SD= .66) than the explicit game version (M = 2.88; SD = 1.19; $t_{(24)}$= 2.01; p = 0.55; d = 0.82). Furthermore, participants seemed to like the game story (immersion dimension of the GEQ) more, when the cancer condition was not mentioned (M = 4.07; SD = 1.03) than when it was explicitly presented (M = 3.38; SD = 1.48). Despite of no significant difference between conditions ($t_{(24)}$= 1.37; p = .454), Cohen´s d effect size analysis revealed a medium size effect (d = 0.58) on the above mentioned dimension.

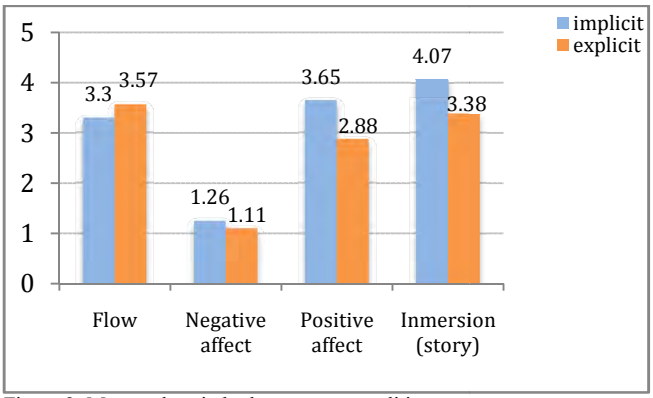

Figure 2: Mean values in both treatment conditions

Neither the explicit nor the implicit game version induced negative affective reactions among participants. While no significant difference between conditions was found ($t_{(24)}$= .76; p = .454), Cohen's d analysis only revealed a small effect (d = .03). In congruence to these results, the explicit game version also seemed to stimulate a higher flow experience (M = 3.57; SD = 1.25) than the implicit game version (M = 3.3; SD = 1.16). However, Cohen's d effect size analysis revealed only a small effect (d = 0.23).

The results of the social interaction questionnaire revealed that most children (76%) were not motivated to speak to other children about their medical condition. Furthermore, participants reported to have only little contact with other children from the same nursing station (M = 2.39; SD = 1.55 on a 5-point rating scale). When asking about with whom children would like to play, 63.7% of all participants preferred their home friends over the option of playing with home friends and other patients together. In congruence with prior findings regarding the game evaluation, these results suggest that juvenile cancer patients are rather willing to engage in activities that distract them from their medical condition than activities that reminds them of it. Despite the sparse interaction with other patients, most juveniles reported to miss their school friends (M = 4.25; SD = 1.15) and revealed the desire to have more contact with them (M = 4.00; SD = 1.31).

The assessment of the patients' health condition (KINDL) was necessary in order to assess if the designed game suited the targeted group needs and restrictions. In general, almost all participants reported having no difficulties in operating a mouse (92%) or a keyboard (88%). The results of the KINDL questionnaire only revealed a marginal significant correlation between participant's psychic health condition and experienced game immersion (r = .377; p =.063), suggesting that with patients declining psychic health the capability of immerging in the game story was also affected.

B. Qualitative Evaluation

Ten of the patients' parents agreed to participate in qualitative interviews, which were conducted in order to explore their perception and acceptance of digital entertainment for children diagnosed with cancer. When questioned about the use of digital media among their children, 6 out of 10 participants reported to restrict their children's access to the computer. However, a majority of 8 out of 10 parents agreed that playing games specifically designed for cancer patients would be beneficial in terms of learning about the disease and developing adequate coping strategies. The most frequent argument for a cancer related health game was augmenting children´s understanding for their medical condition (4 of 8 parents). Furthermore, parents claimed that games might be used to initiate discussions about the disease and generally foster an optimistic, open approach to dealing with cancer. However, this was also the main argument from two parents opposing to cancer related games, highlighting that their kids were sufficiently burdened due to their disease and did not need to be reminded by means of a game. In congruence to these assertions, several hospital nurses also manifested the children's desire of being distracted from their medical condition. However, medical staff interviews (N =5) unanimously revealed the need for a social health game that entertains and interconnects juveniles while learning about their medical condition.

V. Conclusion and Future Work

The main goal of the present study was to assess the demand for a social oriented health game and evaluate the acceptance of two different game versions. In order to minimize juvenile reactance towards cancer related issues, an

additional game version with no disease reference was tested. Qualitative interviews with nursing staff and parents revealed an existing demand for a multiplayer online health game that fosters social interaction of children. Furthermore, most juveniles expressed the desire of having more contact to their friends, preferring interaction with them to the option of playing with other hospitalized children.

Contrary to prior research findings, which demonstrate that a health game is perceived more positively if the disease is directly addressed [5], study results revealed that the game version with no cancer related content was better evaluated than the explicit version. Due to the small sample size, only participant's positive affect was found to be significantly different between the game versions. Still, results analysis pointed towards the superiority of the implicit game version in most GEQ dimensions. Furthermore, interviews with nursing staff suggest that juvenile cancer patients would rather prefer to engage in activities that distract them from their medical condition than activities that remind them of their disease. However, parents' interviews also suggest a need for an online environment especially designed for children with cancer, revealing a positive attitude towards an explicit health game version. Hence, the advantages and disadvantages of explicit and implicit health game versions have to be investigated within future research before study results can be further generalized.

Future work in the context of digital game design for kids and teenagers with cancer includes the evaluation with a larger sample size, and the creation of an online game without direct references to disease-related content to offer an accessible leisure activity for juvenile cancer patients. Additionally, it is planned to integrate information about cancer through mini games and a community-based information portal, thus offering reliable information upon the user's individual request. Thereby, it is possible to integrate positive aspects of games without explicit disease references and information about the disease in a virtual environment specifically addressing juvenile cancer patients.

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