Clendening Summer Fellowship 2013
Proposal
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Feasibility and Acceptability of Interactive Digital Learning for Children with Diabetes Mellitus Type 1

Introduction

The prevalence and popularity of video games has led to its usage in a variety of treatments: physical therapy, chronic disease maintenance, and smoking cessation. The utilization of a video game, an interactive medium that addresses the disease process and treatments in children with diabetes mellitus type 1, presents a prime opportunity to educate and modify behavior. It may be possible to develop a video game that can successfully impart the importance of strict self-management to give children a better understanding of their diabetes and the disease process.

Background

In the past few years, video games have transformed from a subculture to casual entertainment for the masses. It is estimated that over 97% of children play video games and a growing number of adults play as well. Despite this acceptance, video games are commonly cited as predisposing players towards violence or sedentary behavior. As a former professional competitive video game player and amateur game designer, I have found that video games have great potential as a conduit for educational purposes.

After working for Dr. Mark Clements in his type 1 diabetes research at Children's Mercy Hospital in Kansas City, I became aware of the importance for adherence to treatment and gaps in education that can occur in children with diabetes. We brainstormed whether games could be

used to teach children how to better manage their condition, and whether these lessons could also be applicable to type 2 diabetics.

The greatest current drawback to educational and informative games is that they are often poorly designed or are made by people with inadequate knowledge of the subject matter. One of the largest hurdles in treating children and adolescents with diabetes is that they often fail to understand the gravity of their condition and the extreme negative effects that can occur if they are not stringent in their treatments and diets. As children, they can be managed by their parents but they must eventually learn to keep track themselves. While there are many ways of teaching responsible behavior to children, interactive teaching can be an encouraging method.

Description

The aim of the project is to design a game that will not only be fun to play, but will also reinforce the necessary steps for managing diabetes. Players will be taught to care for themselves by being consistent in checking their blood sugar, carefully managing their diet, and learning the negative side effects that come with not being diligent with treatment. Non-diabetics can also benefit from seeing the negative effects that having diabetes can cause and can understand how difficult it can be for diabetics to manage their condition.

The development of this project has three stages. The first stage is design of the game and gameplay. Much of the necessary information will be gathered before the summer that the project begins. Scientific elements of gameplay such as the impact of food, exercise, and insulin on blood sugar and overall health will have to be calculated and standardized to scale properly beforehand to ensure that they are representative of an accurate treatment or lifestyle plan. At the same time, elements of gameplay must be developed, such as concept art for characters, a basic

coding structure for a game level, and a background code to gather data generated by the player's actions. The planned build for the game is centered on a player character represented by a fantasy creature that has diabetes. The creature will have a stronghold that will be attacked by enemies. The player must use the creature to fight enemies to defend their stronghold. Fighting enemies will require energy, which can be replenished by consuming food that defeated enemies drop. The food will be representative of two factors – carbohydrate content and 'healthiness'. For example, corn would have a high carbohydrate content but would be 'healthy', whereas cake would have a high carbohydrate content and be 'unhealthy'. Players will have to periodically check the blood sugar of their character and inject insulin at proper times to maintain the health of their character. Otherwise, negative effects will be felt, such as blurred vision to represent retinopathy, or slowed movement to represent ketoacidosis. The average blood sugar and food choices that the player makes will be monitored and recorded. For the sake of simplicity and consistency of testing, there will only be one game 'level' for the player. Designing the art assets should require one week and the design of gameplay should require one week.

The second stage is actual creation of the game. This requires creation of an alpha build, where artificial intelligence for characters will be programmed, the user interface will be created, and information recording will be integrated with the game. The art assets will have to be fully created. They will be modeled and textured, then animated and incorporated into the game. The second creation phase will be a beta phase where extensive testing to make sure all parameters respond correctly and that data measurement functions. The creation stage should require three to four weeks.

The final stage is testing the game on patients to assess feasibility and acceptability. The aim is to determine if it is possible to successfully develop an interactive game that seems

relevant and will be played by youths. Ideally, a group of ten subjects between the ages of eight and twelve would be recruited to trial the game for three weeks. They would be given a download link and then allowed to play the game on a home computer at their leisure. The game will record the amount of time they spend playing and their performance based on blood sugar and negative effects encountered. Feasibility will be gauged on least 70% of the subjects accessing the game at least once during the time period and that there will be at least thirty minutes of access per time they play. Acceptability will be assessed by a post-experimental satisfaction questionnaire, asking the subjects to report their thoughts on relevance and how they felt about the game. Their answers will be compared to the data gathered during their gameplay. Recruitment, testing and follow-up should take between four and six weeks.

Methods

The game creation stage will require contact with mentors at Bannermen Games LLC. Matthew Barker and Robert Kuhn are professional game designers who will oversee the process. My current computer is sufficient to run all the software necessary. Basic game programming and database creation can be done on the Unreal Engine at any time since it is free for non-commercial purposes. Purchasing art and animation software will allow for creation of art assets and gameplay elements.

The experimental test stage will require contact with Dr. Mark Clements at Children's Mercy Hospital. He will be the main contact during two stages of the project. The first will be writing a proposal for the Institutional Review Board for approval of human subjects testing. This stage will be done months in advance of the game design. The second stage will be patient recruitment and experimental setup. Having a physician mentor present will ensure that patient

recruitment abides by all regulations. He will also be able to help during data processing from the information gathered by the game and by the patients' own responses in the survey.

Budget

Adobe Flash - $700

    This software is required to animate game elements.

ZBrush - $700

    This software is necessary for creation of art assets.

Unreal Engine 3 - $0

    This software integrates all gameplay and art assets together to allow play. Usage is free unless the game is commercially marketed.

Total - $1400

Contact Information

Children's Mercy Hospital - maclements@cmh.edu

    Dr. Mark Clements – For consultation on patient recruitment and IRB

Bannermen Games LLC – bannermengames@gmail.com

    Matthew Barker – For consultation on art asset creation

    Robert Kuhn – For consultation on game and database programming

Bibliography

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