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Informational Video Gaming in the Waiting Room

Andrew Long
Missouri University of Science & Technology, ael34b@mst.edu

Mitchell Ramirez
Missouri University of Science & Technology, mjrg28@mst.edu

Coltin Shields
Missouri University of Science & Technology, ccsztb@mst.edu

Nathan Twyman
Missouri University of Science & Technology, nathantwyman@mst.edu

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ccsztb@mst.edu

Nathan Twyman
Missouri University of Science & Technology
nathantwyman@mst.edu

ABSTRACT

This study is testing the potential of a gamified method of conveying information and the ability of the game to influence people's sentiment towards immunization. The most popular way that medical information and awareness is spread is in the form of pamphlets or flyers, even though many people either ignore them or do not retain much information from them. Perhaps a game paired with intermittent quiz questions that influence the overall score will improve overall retention as compared with plain reading. To test this hypothesis, a game was designed to include identical information as a pamphlet commonly handed out in an office to see if it is more impactful and persuasive when used by patients in a waiting room.

KEYWORDS

Vaccination, Gamification, Human-Computer Interaction, User Experience, Human Papillomavirus (HPV), Information Retention, Patient Sentiment, Information influence

INTRODUCTION

Immunization has been a topic of dissent by many people who argue its benefits in recent years which leaves a lot of people virtually in the dark when it comes to facts on how important immunization really is. Many choose not to be immunized simply because they cannot see the benefit, but when presented with true data regarding its necessity and effectiveness, they may change their minds. The HPV (Human Papillomavirus Infection) virus is a dangerous virus affecting people of all ages. 79 million Americans are currently affected with some type of HPV. Nearly 14 million people a year are infected by the virus. The virus is so common that nearly all men and women will get some type of HPV at some point in their lives [1]. Even though the virus is so common, knowledge about the virus is not as common [6]. In order to alleviate this uncertainty, and educate the general population, a game was designed in effort to inform patients about the virus, the dangers of the virus, and why they should be immunized, while they are sitting in the waiting room. Since we are utilizing gamification as a catalyst for learning retention, we decided on a simple game type and chose an asteroids-style game because of its ease to reproduce and how well it ties into the theme of destroying the HPV virus.

IMMUNATOR

The Immunator game was the chosen path for gamification where the application would be on a tablet for use in the waiting room for those who already may need something to pass the time. Prototype discussion began with a meeting with medical professional at a dermatology office to understand what information is most important for patients to know in order to be fully informed to choose whether to receive an HPV immunization or not. Three pieces of literature from the Center for Disease Control (CDC) included all of facts about HPV that the public should know. This was the guide for the content that was included into the prototype, which is a key ingredient for the outcome. From there, after more research into gamification, we decided on a strategy to interpolate the game session with very short quiz questions to try to improve the learning process as the questions would count toward the overall score.

Version 1 of our prototype was a screen mockup of our game using a web application called Figma. The goal was simply to design the flow and general look of the game. The game was designed as a basic asteroid shooter style game, in which the user control a spaceship and was tasked with shooting HPV virus "asteroids" as they approached. Between each level, we designed a total of ten trivia questions regarding HPV and HPV vaccinations, as taken from our literature material. The questions and correct answers are as follows:

1. Missouri is the __ lowest state for number of HPV vaccinations. **Answer: 4th**
2. What is the most important reason for receiving the HPV vaccination? **Answer: To prevent cancer**
3. How many types of HPV are there? **Answer: 100+**
4. How many Americans are infected with HPV? **Answer: 79 million**
5. How many cancers are caused by HPV each year in the U.S.? **Answer: 33,000**
6. HPV causes what type of cancers? **Answer: Mouth, Throat, and Genital**
7. Is there any treatment for HPV? **Answer: No**
8. How many vaccinations do you need? **Answer: 3**
9. You may be eligible for free vaccines through the Vaccines for Children program before what age? **Answer: 19**
10. Adolescents and young adults between the ages of 15 to 24 account for as many as what of the total infected population? **Answer: 50%**

The prototype also included a title and instruction screen before the game began as well as a high score screen at the end of the game. Although this version of our prototype lacked significant gameplay ability, it provided good direction on content and general flow of the game as users were surveyed.

Version 2 of our prototype tied in the gameplay elements with the original content from Version 1. This version was created using a game development software that allowed us to develop for multiple platforms. The images and content were taken from Version 1 to incorporate movement, animation, and user controls to the game. The user is able to move their ship from left to right using the arrow keys on their keyboard and fire lasers using the spacebar. The enemies were programmed with random speed to

increase the challenge and variety of the game. As the game progresses, the user experience three different varieties of the enemy, denoted by their color (blue, yellow, or red), which each have a different difficulty level to shoot and destroy. The user's score was always displayed in the top right corner of the game window. If an enemy was a destroyed or a question was answered correctly, the user would gain point. Furthermore, if an enemy moved across the screen without being destroyed or a question is answered incorrectly, points will be deducted. There was a larger weight of points on the trivia questions more so than the asteroid levels. Since a challenge and competitive experience in our opinions was crucial to user engagement and investment in the game content, these features were necessary to implement in this version. By making the game more exciting to play than reading the literature, we hoped that users would be more engaged in learning, retaining, and being persuaded by the facts about HPV immunization.

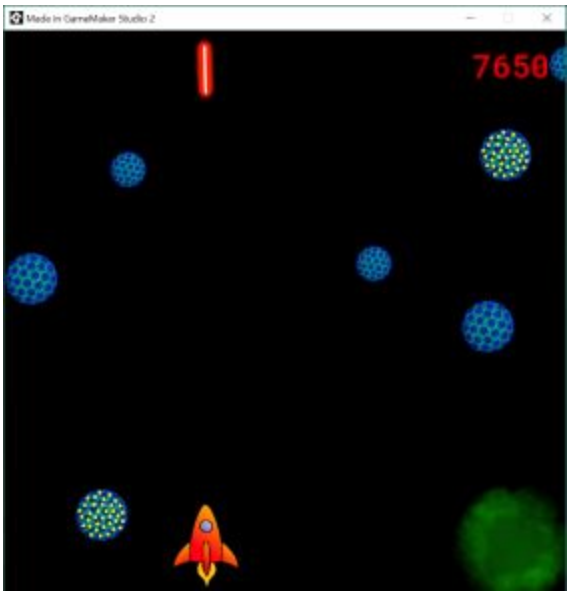

Fig 1. Screenshot of game

Fig 2. Screenshot of quiz page

METHOD

The initial research study method used our Prototype Version 1 to test retention of our ten questions and their impact on the us. The study using Prototype Version 2 used an A/B test method to still gauge retention, but also to measure the difference in sentiment and persuasiveness between the literature and the game. This testing took place either in a laboratory setting on the university campus or in the waiting room of a dermatology office. Each participant was asked to sign a consent form to begin the study and then prompted to take a pre-survey. The pre-survey was to collect basic demographic information, understand their history of being vaccinated, and to get a baseline of their feeling or concern about HPV. The pre-survey questions included the following questions regarding sentiments about immunizations and the problem of the virus itself:

1. How would you rate your attitude toward immunizations for HPV before this study? (1-5, with 1 being “Very much against” and 5 being “Very much for”)
2. How would you rate your feelings toward HPV before the study? (1-5, with 1 being “Completely unaffected” and 5 being “Very concerned”)

The participant was then either given the literature or the video game to use at their own leisure for up to ten minutes. This ability for the user to read or play as much or as little as they wanted is to try to simulate the casual interest in the content that one would have when sitting in a waiting room before their appointment.

When the participant was finished with the literature or the video game, they were given a ten question quiz with the same questions as above, in order to measure their retention of the knowledge. Following the quiz, they were given a post-survey. The post-survey questions asked about participant usability

(whether the literature was easy to interpret or the game was easy or enjoyable to use), and then ended with these key questions

1. How would you rate your attitude toward immunizations for HPV after the reading/game? (1-5, with 1 being "Very much against" and 5 being "Very much for")
2. How would you rate your feelings toward HPV after the reading/game? (1-5, with 1 being "Completely unaffected" and 5 being "Very concerned")
3. If any, which question changed your attitude the most toward HPV vaccinations and why?

During our prototyping and wireframing phases, we used two softwares that offered free and paid versions, Figma™ and Yoyo Games' Gamemaker Studio 2™. We used Figma to wireframe our informational game and demonstrate what the key features of the game would look like in the polished prototype. Using Gamemaker made certain steps easier, such as dropping enemy characters onto the screen. Implementing the code that made everything happen when a user inputs commands, an enemy is hit, or the level is over was also accomplishable when needed. Through trial and error and the use of video tutorials online, we were able to figure out the steps to make the game work how we had hoped, aside from implementing a score leaderboard and a boss battle at the end of the game.

ANALYSIS

In our initial A-B testing in the Laboratory setting, we had 15 participants, (5 game users, and 10 literature users). As this group is a very demographic and within a very different setting than the waiting room of the dermatology office, we analyzed this data first and separately and later added to the averages of our total testing. Lastly, we tested another 8 participants who were real patients in the waiting room of an actual dermatology office'. In reviewing the data from different rounds of testing, it was concluded that the waiting room participants yielded the most valuable and desirable data for analysis since they were the precise target audience that the Immunator is seeking to reach.

The first 15 users and their attitude and feelings on HPV before and after produced promising results. The columns on the right are the change in each specific user's response after compared to the pre-game/literature. The average change in user attitude after playing the game was a positive 0.4, however the reading actually had a negative effect on the users' sentiment. The question regarding feelings of users pertaining to the severity of the HPV problem saw an average increase of 0.8 across the board.

In the waiting room, the delta for sentiment was even higher. The question about attitude produced an average increase of 0.75, (15%), and the question asking about users' feelings increased by 1.625, (32.5%). None of the participants who played the game lowered their score from before to after playing. Of those who remained the same in their grading for attitude, 37.5% had already rated their feelings as 5 out of 5. With this in mind, no user selected "very concerned" (5) before the game, but 50% of users changed their answer to "very concerned" after the game while only 20% of the reading group did.

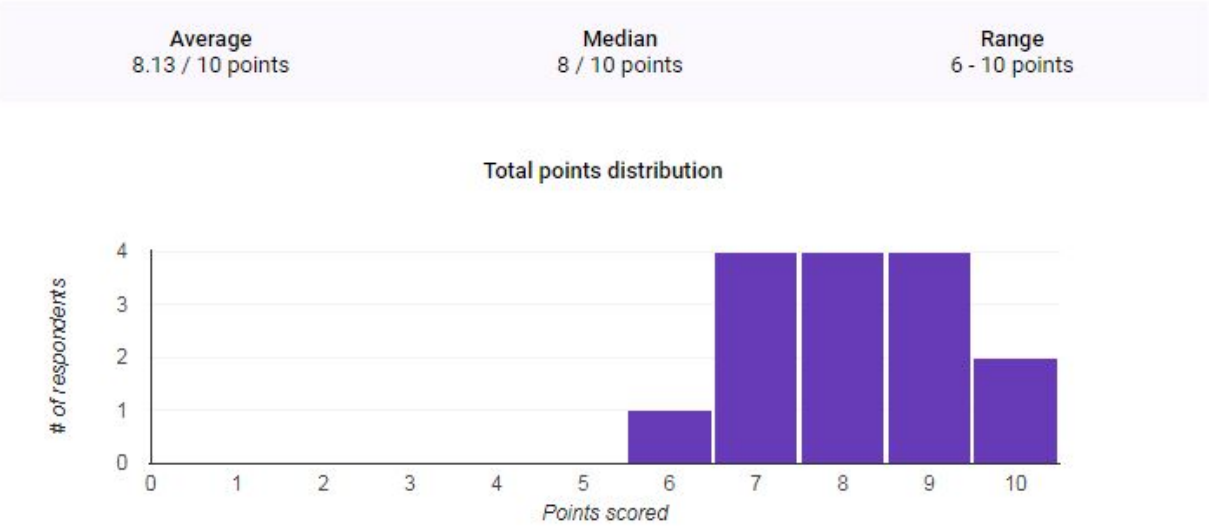

Fig 3. Initial Laboratory 15 Users' Post-quiz

Retention of material was impressive in both categories; far exceeding the scores on first-guess testing, thus indicating that the material was, in fact, learned. The literature user group saw an average of 7.7 points correct while the game produced slightly better results at an average of 8.38. Figure 3 shows a bar graph of the initial 15 participants' scores which fell into a tight left-tailed bell curve distribution.

DISCUSSION

After creating our prototype we ran into a couple limitations for data collection and testing. We needed to obtain approval of human testing in a medical environment before conducting our study which took a substantial amount of time. To overcome this, the team asked friends in our social circles to participate and when at the office, the team was as friendly and inviting as possible. With a little more time, we could have obtained a much larger sample group; however, we believe that more users would just further confirm our hypothesis because of how positive the first results have been.

This game, given the impressive results from our statistical analysis, has the potential to improve retention of information as well as adjusting sentiment, but there are still some major steps that would need to be taken before a finished product. As stated before, we would need to modify the game to be mobile-native so we can properly implement tablets as platform for the game in the waiting room. We would also need to adapt the scoreboard to save after multiple games. This may seem menial, but competitiveness is one of the key reasons that gamification is effective and desirable for developers. For the next iteration of testing, we would also want to implement randomization of questions to help ensure that serial positioning effect isn't influencing the outcome or successfulness of certain questions as we've seen in some of the preliminary testing.

From our analysis, we can draw that the game had a greater overall impact on user sentiment and the reading had only a slightly positive effect in general, but can negatively impact user attitude toward immunization. Our survey yielded very conclusive and supportive data that affirmed our initial posit that gamification would help more with retention and better change user sentiment toward HPV when compared to the use of traditional informational handouts.

CONCLUSION

Through multiple iterations of prototypes to test our initial hypothesis of an increase of retention and manipulation of user sentiment through gamification, we have been successful. Through anecdotal, observational, and survey data, we have determined that not only does our game better educate people about the dangers of HPV and influence them to be more inclined to be immunized, but it also does so better than a literature alternative which has been the solution for decades. We tested against a flyer as a baseline and thoroughly proved that the Immunator game is also viable in future iterations to be placed in a waiting room. We believe this prototype style can be applied to numerous applications. The prototype could be programmed to quiz and inform users about any number of diseases beyond HPV. If we can engage users when it comes to HPV, there is no telling what else our prototype could help teach future users.

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