Redesigning the Incentive Spirometer

(Technical Paper)

Ethics of Gamification

(STS Paper)

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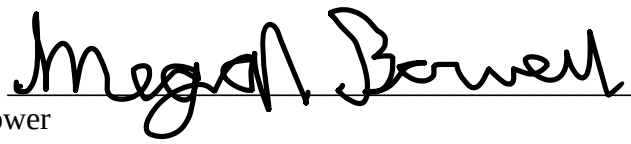
Signature  Date 10/28/2022
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Introduction

Respiratory health is foundational to the health of the individual. Particularly in the setting of the hospital, preserving the respiratory health of patients is of utmost importance. It is not uncommon for patients to come to the hospital for a respiratory illness or abdominal surgery and develop secondary bacterial pneumonia (Melamed et al., 2020). One solution to this problem is use of the incentive spirometer (IS). One study conducted in a hospital post-surgical ward, showed that the use of an IS reduced incidence of post-surgical pneumonia by 81% (Wren et al., 2010).

While incentive spirometers are effective at preventing lung illnesses such as pneumonia, the device is often not used in accordance with provider instructions. A study of IS users discovered that over one-third of patients prescribed an IS for post-operative care reported not using the device after leaving the hospital (Martin et al., 2018). A similar study of healthcare providers revealed that more than 86% of providers believe that patients do not use the IS after being discharged (Eltorai et al., 2018). Given the value of the IS to patient health, it is important that methods are employed to increase adherence to the IS.

The reasons for the lack of patient adherence to IS exercises are varied and include forgetfulness, lack of understanding, incorrect use, and need for additional assistance (Pangborn et al., 2020). We hypothesize that some of these factors also tie back to a lack of engagement with the device itself. For that reason, this problem will be addressed through Gamification. Gamification is implementing game-like elements into a design other than a game (Bassanelli et al., 2022). It is a way to work with an individual's attention and direct it toward a desired action, such as use of the IS.

Gamification, however, is not free from ethical concerns. Gamification can be seen as a form of manipulation, since it redirects your attention to encourage your performance of a task. This is just one of the many ethical perspectives. These perspectives should all be weighed and considered, in order to find an ethical means of gamification.

Increasing Patient Engagement with the Incentive Spirometers

The IS is a simple deceive. It consists of a body section with a volumetric tube and a flow rate indicator, along with a detachable mouthpiece. An example of an IS is shown in Figure 1. When a patient inhales, the piston inside the volumetric tube rise proportionately to the amount of air inhaled. Additionally, a plastic chip in the flow rate indicator rises in proportion to the rate at which air is being inhaled. Patients will inhale either for a prescribed number of seconds or until the piston rises to the goal level set by the provider (*Incentive Spirometer*, 2022).

Figure 1: Incentive Spirometer (IS) with labeled parts (*Spirometer Incentive 4000ml - Pediatric Home Health Care in MN | Pediatric Home Service Online Ordering*, n.d.).

The IS's simple design is practical, but lacks engaging features. There have been attempts to solve this gap but primarily through patient reminders and accountability from the provider. Our project aims to address this gap head on through gamification.

Gamification has been successful in prior healthcare applications. A review of gamification studies showed that adding gamified elements to lifestyle change education was effective in encouraging compliance with selected goals (Blok et al., 2021). The use of the IS is not too dissimilar from the lifestyle interventions studied. Both require individuals to build new habits in order to further their physical health. This constant of regular patient engagement leads us to believe gamification will be a valid approach to increase patient adherence.

To achieve this goal, the team will design and prototype multiple potential gamified incentive spirometers. In addition to having a gamified element, our design must perform the function of an IS. This means our product must have the same functional features to measure inhalation volume and flow rate. We also aim to keep the basic size, weight, and cost similar to that of existing ISs. This is so that our new design will not create a burden on providers who wish to implement it.

Once prototypes are made, we will survey patients and providers. We will start with patient surveys. In this survey, patients will be asked to rate our designs in comparison to the existing design. We will also give the opportunity to give comments on the elements they like or dislike in the design. Next, we will bring the preferences of the patients to a group of providers. They will be asked for their feedback and comments on the designs. The feedback that is gathered will be used to make improvements to our designs and to settle on a final design.

After finalizing the design, both FDA approval and patenting will be pursued. FDA approval may be a lengthy process, given that the IS is a FDA class II device (*CFR - Code of Federal Regulations Title 21, Volume 8*, 2022). This means that our device must go through general and special controls in the FDA regulatory process (Health, 2022). Since much time will be invested in the FDA approval process, the provisional patenting of our device will occur concurrently with FDA approval.

Ethics of Gamification

Gamification is an effective technique to redirect people's attention. In the context of my project, this direction of attention will be for the benefit of the end user. However, it is still important to consider the ethical considerations surrounding the use of gamification.

In this digital era, Gamification has come to be a multi-billion dollar industry (Palmer et al., 2012). However, gamification has not always been popular. For much of history games of all kinds were shunned by western, Christian societies as forces of evil. Accusations of participating in games or gambling were used as a way to falsely shut down businesses, and game burnings would happen in the public squares (Fuchs, 2014). This attitude began to shift, in the early modern period, allowing for some forms of gaming, while still shunning gambling (Leone, 2018). In the centuries following, gamification expanded into new realms. Composers like Mozart created games to inspire musical composition, modern magic tricks were developed, and learning was adapted to be fun and more memorable (Fuchs, 2014).

In our present time, Gamification is ubiquitous, and almost everyone is impacted by such technologies. However, the ethics of gamification is complex. There are many people who regard gamification as a tool of empowerment. They claim that the transformation of unpleasant tasks into games increases people's willingness to follow through with that task (Goethe, 2019). This is backed up by the studies that show an increase in adherence to treatments presented in a gamified manner (Brown et al., 2016). However, this perspective makes many assumptions about its users and the developers of systems. The first most basic assumption is that the task being gamified is beneficial to the user of the product. It is entirely possible that developers could gamify the wrong habits and lead to worse outcomes for individuals. Additionally, gamified systems make assumptions about how people view fulfillment. But for many people the task being reinforced by gamification isn't the action that will bring fulfillment, but the means to some other fulfillment, such as health or happiness (Sicart, 2015).

On the other side of the gamification conversation are people who claim that gamification can be unethical because it is a manipulation of people's attention. This argument claims that by

giving people “game reasons” to engage with a non-game task, you are inherently manipulating them (Gorin, 2022). Both of these perspectives bring light to the issue of ethics and gamification. I believe that this intersection of ethics and gamification deserves more attention, especially as gamification becomes more prevalent. Through exploring this topic, I aim to understand the ethical concerns of gamification. I also aim to work through these concerns to bring ethical gamification to my technical work.

Research Question and Methods

In my STS research, I hope to explore the ethical implications of gamification. My research will evaluate different ethical perspectives as well as different modes of gamification. This will be accomplished by first compiling the basic ethical arguments for and against gamification. From there, each argument will be evaluated and their merits and demerits weighed. During this process, case studies and surveys about different methods of gamification will be used as evidence in crafting complete arguments. This nuanced look at gamification will hopefully highlight the key ethical concerns with such technologies. My STS work will also aim to suggest solutions to these concerns, with the goal of finding an ethical method of implementing gamification technology.

Conclusion

In order to better respiratory health for patients, my team and I will work to redesign the incentive spirometer (IS). Our new design will include a gamified element that will hopefully increase patient adherence to IS exercises. Before finalizing a design, multiple solutions will be considered and presented to patients for feedback. This feedback will guide the process to making effective design choices. In addition to this technical project, I will research the ethical perspectives on gamification. This research will consider differing viewpoints, address ethical

issues, and hopefully guide the technical design in an ethical direction. The creation of an ethical, gamified IS will hopefully make an impact on patient outcomes and the overall landscape of medical devices.

Word Count: 1557

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