GIT Physical: Project Proposal and Literature Review

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Introduction

Covid-19 is a global pandemic that has uprooted and rewritten most parts of our lives. Our team is looking to offer an alternative solution to fill the gap in children's physical education. Within this project, we will design an app that addresses the issue of online learning and hopefully provide interesting and engaging ways to combat sedentary behavior in children even after schools return to normal.

Literature Review

We conducted a literature review of relevant articles as well as comparable educational technologies. Through this review, we strengthened our understanding of the learning environment, the target learners, and the ways to promote transfer. We synthesized several positive elements to include and negative elements to avoid in our own educational technology.

Relevant Existing Educational Technologies

In this section, we describe and analyze each technology that we reviewed. This analysis involved experiencing the platform firsthand as well as observing a true or proxy user's experience with it. From these observations, we elucidated the benefits and drawbacks of each technology.

FitBit Coach. FitBit Coach is a smart phone app designed for FitBit users, though it is free for anyone to download. It has a vast collection of workouts and four different workout "programs," or schedules, to choose from. Each workout is a series of moves which are previewed and described by a trainer before the round and completed by another trainer during the round. While its target user is likely adolescents and older, it still revealed several important components of virtual physical education.

First, there is a moderate degree of customizability in the app, which was important for users. While users cannot create their own workout from scratch, they can pick from a vast array of workouts, pause or end the workout easily, and skip moves that they do not enjoy. Second, there were no assessments or feedback embedded in the app design. While users could provide feedback to the app on different exercise preferences, the app had no personalized feedback mechanism about the user's form, fitness, or progress. Lastly, the app lacks connectivity to a larger network of users or even to the trainer. The descriptions of each exercise are prerecorded, and the occasional encouragements and tips can become repetitive and, therefore, meaningless or even irritating. In our project, we will strive to create a platform that is customizable, includes feedback, and engages the user in a broader community.

GoNoodle. GoNoodle is a free online platform designed for young children, primarily elementary schoolers. It is designed to be used both at home and in the classroom. GoNoodle has a variety of videos and games aimed at encouraging physical activity. The platform provides important considerations for us since its target audience is young children.

A strength of the GoNoodle platform is that it is geared towards children and has child-friendly content. The videos have varying degrees of difficulty and incorporation of technical components, but there are age-appropriate videos for any child in elementary school. The content is aimed to be engaging for children, and users reported overall enjoying the themes of the videos and games. Additionally, the videos touched on other components of education and health, such as mindfulness and mental health, in an age-appropriate manner. A limitation of the technology is that the videos don't have an assessment or feedback embedded in the design, and the game component only has limited feedback. The game component provides an opportunity to compete with others through a leadership board and earn points by performing movements; however, the amount of movement required to earn points is minimal. Furthermore, some users reported difficulty navigating the video portion of the platform and finding desired video on the platform.

Sweat Deck. Sweat Deck is an iOS mobile application designed with the goal of increasing physical activity in the daily routine of adolescents. Users can assign specific exercises to each card suit and choose the

number of cards to include in their custom deck. The system will create a deck of cards based on the user's settings. The value of the card indicates the number of repetitions of the exercise that corresponds to the suit. If the user assigns push-ups to hearts, and the user encounters a ten of hearts in their deck, then the user must complete ten push-ups. If the user is unfamiliar with a particular movement, the user can watch a short, animated tutorial, which is valuable as a form of scaffolding to support the users as they discover and learn new exercises. Similar to FitBit Coach, the target demographic of Sweat Deck is older than primary school children, but Sweat Deck still contains valuable features that enable children to improve their physical fitness.

Aside from its strong visuals, a key strength of Sweat Deck is the room for user input. As the user constructs a workout plan, the user can select from various system options such as burpees, planks, and Russian twists. Moreover, with the two joker cards, the user can type in any exercise that is not currently listed in Sweat Deck's system. This feature contributes to a learner-centered learning environment because it considers the user's prior knowledge, interests, and skills. Features that allow creativity make the platform more enjoyable, and therefore, make the user more inclined to use it. However, the main limitation of Sweat Deck is its lack of feedback. Proper form is crucial to the effectiveness of an exercise. Since advancing through cards is solely in the user's discretion, the system allows the user to progress regardless of their performance, and the user may be unaware about the correctness of their performance.

Habitz. Habitz is an IOS mobile application. It was created to teach children healthy habits, such as exercising, eating well, making their beds, or brushing their teeth, through a fun rewards-based app. The app is intended for use from both parents and children. Parents create a profile where they can manage their child's goals and rewards. Children also create their own profile where they can check off their daily tasks, interact with the in-app friend "Viki," and use their rewards to request items from the shop.

During our study, participants were intrigued by the app, navigated it well, and were excited about it. The success of the app lies in the ease of navigability and intriguing content for both parent and child. The app provides a strong framework for real-world experiences that build habits and knowledge to carry on long after the app has been deleted. Through its rewards system and giving parents the ability to check on completed tasks through their own profile, the app makes assessment-centered learning easy and fun. Though the app has many positive elements, it does have some downfalls that suggest it is still in the early phases of production. Due to the poor explanation of some of the tasks, the environment makes assumptions that the child will know how or what each healthy habit is. It fails to consider the unique circumstances of different children and homes. Additionally, the tasks only have a very brief description of benefits. These descriptions are not fully explaining the "why" behind the healthy habits, leaving a gap in the users' understanding. Though these lapses exist, the app is a good example of how to integrate parent and children's interactions into one platform for effective learning.

Sworkit Kids. Sworkit Kids exists as both a mobile and web application and is meant to encourage fitness for children ages four to eighteen. This is an add-on to the existing Sworkit application, meant for adults, and contains more kid-friendly exercises. The overarching objective of the Sworkit platform is to provide children with a guided exercise routine with set parameters (i.e. duration, type of activity, age of user) to promote fitness and a healthier lifestyle. Currently, the kids portion of the application is entirely free.

The main strength of the Sworkit application is the simplicity of the design and functionality. The application is focused on delivering workouts, so navigating to the correct portion of the app was never confusing for the user. The application provides both a visual and auditory aid to the children, which ensured that the users knew exactly what they were supposed to be doing. Upon completing a workout, the application recorded the details from the workout, including data like duration and day completed. Despite these strengths, there were a few weaknesses we noted while demoing the application with a participant. Since the application was originally designed with adults in mind, there is not much included in the design to indicate that the app is meant for children. It is important to keep in mind who the application is being designed for in order to provide a functional application. Finally, the application did not provide much feedback to the user, which is a critical aspect of learning. The Sworkit application provided a good example of a bare-bones approach to providing a user with guided workout routines.

Relevant Research

In this section, we highlight relevant literature regarding virtual physical education technologies for children. We focused part of the research on exergames, which are video games that include physical movement from the user, and the elements within them, including rewards and avatars. The other part of our research described the impacts of "introjective" exercises in physical education on the personal wellbeing of elementary schoolers and how the use of healthy language and encouragement is critical in establishing and maintaining healthy lifestyles in children.

The literature about exergames addresses the benefits and drawbacks as well as the components necessary for successful transfer in exergames. First, Staiano and Calvert (2011) examined the benefits of for youths. Since many children play video games and pediatric obesity rates have substantially climbed, exergames are aimed to improve children's health by capitalizing on their enjoyment of video games. Playing exergames can result in light to moderate cardio and increase the user's heart rate while playing. In addition to health benefits, exergames can foster social connections like other videos games can. Additionally, video games have some intrinsic motivation, which may lead to children being more willing to use exergames as a form of physical activity than other forms of physical activity. Furthermore, limited results showed exergames may provide educational benefits such as improved spatial awareness. Since the paper is a decade old most of the research was conducted on older exergames. Thus, advancements in technology and more current research could alter the findings.

Second, Lyons (2015) named three components requisite to exergames: feedback, challenge, and reward. Feedback is defined as any "informative or evaluative" description of the user's behavior, and it has been shown to increase user self-efficacy, motivation, and learning (Lyons, 2015, p. 12). Feedback can come in a variety, and often multiple, forms; for example, if a user performs a move incorrectly, the controller could vibrate while the color red flashes onscreen and a verbal warning sounds. A proper amount of challenge is also necessary for users to engage with and enjoy the exergame: a game that is too easy becomes boring, and a game that is too difficult becomes frustrating. When the game properly strikes the balance between these two, the user enters a flow state, which is a "highly intrinsically motivating experience" (Lyons, 2015, p. 13). Moreover, variations in difficulty rather than a constant increase in difficulty have been shown to immerse the users more deeply in the game experience. Lastly, rewards are a major, if not controversial, element of exergames. Like in creating a sufficiently challenging game, including rewards to a proper extent is a balancing act. Too many rewards decrease intrinsic motivation, whereas too few may make the game unappealing or unengaging.

Examining the efficacy of rewards, Ahn, Johnsen, and Ball (2019) studied how points-based rewards systems in gamified physical activity platforms can impact children's strategies and performance in these physical activities. The study isolates the points-based reward system and examines the causal effect it may have on physical activity. Two groups of children both interacted with the same interactive digital platform, but one group was provided with points as a reward for completing their activities. It was shown that initially, children in the points condition outperformed the other group. However, they soon developed strategies that garnered them more points while not engaging in overall increased physical activity compared to the other group. One such strategy was to exercise for a longer duration at decreased intensity. This result shows that the extrinsic reward associated with a points-based reward system did not have much of an overall effect on physical activity when isolated.

A popular feature in exergames is customizable avatars. Research by Li and Lwin (2016) investigated the role of virtual self-representations on children's engagement in exergames and likelihood of them transferring this engagement into real-life physical activities. The study involved adolescents rating their self-presence (measure of how much the participant felt immersed in the virtual environment), identification (measure of how much the participant felt connected to their virtual character), exergame intention (participant's interest in playing the game again), and exercise intention (participant's interest in becoming active outside of the game) after playing Just Dance 3 and Kinect Spots, which are games with high avatar salience. The study yielded statistically significant results ($p < .001$) that indicated a positive correlation between self-presence and identification, identification and exergame intention, and exergame intention and exercise intention. These results suggest the more the user identifies with their avatar, the more likely they will want to play the exergame again and to want to become active in general. In accordance with the results of the study, incorporating an avatar into our new physical education platform can help the users to feel more immersed in the platform, and thereby increase their engagement and physical activity. Despite statistically significant results, one must be cautious to interpreting correlative results because confounding variables could have influenced the results. Furthermore, studying correlation between multiple variables with the motive of discovering patterns can be misleading and are vulnerable to false positives..

Another important element of children's wellbeing is their mental health. Cañabate (2020) found that introjective motor practices (IMP), activities such as Yoga, Tai Chi, Eutony, Active Global Stretching, Qi-gong, and Corporal Dance Expression, helped students achieve higher rates of emotional self-regulation (Cañabate et. Al, 2020, p. 4). Physical education classes have been shown to be an "appropriate educational setting for the acquisition of emotional competencies" (Cañabate et. Al, 2020, p. 2). In this sense, the inclusion of IMP is a logical progression for physical education programs. Further, IMP activities do not require direct physical interaction with others and provide a great medium for online physical education. This study was conducted on 90 fourth-year P.E. students. They were given the Trait-Meta Mood Scale (TMMS), which measures their emotional attention, clarity of feelings, and emotional repair over 24 questions. The participants completed this survey before and after 6 weeks of participating in IMP activities in class. Through this study, participants were

found to have a 20.1% improvement in the areas of emotional attention, clarity of feelings, and emotional repair. This study focused on our project's target age-group, but elements like the small sample size and limited measurements in the effectiveness of the activities make this information only cautiously credible. For example, the survey had students answering questions on a scale of 1 to 5 which does not provide for a lot of qualitative commentary that might be necessary in measuring introspective emotional abilities. Even so, the effects of the IMP are impressive, and the low social requirements are useful for virtual learning.

A study done in collaboration with the American Dietetic Association (2003) also shows children's need for healthier messaging and communication about the details of an active lifestyle. In this study, researchers aimed to assess attitudes and perceptions related to healthy lifestyles and weight loss in both children and adults. In phase 1, investigators created focus groups including children 8-12 years old, parents, and teachers. In the focus group, it was found that children often connect the idea of being "healthy" to what they eat rather than physical exercise. They also associate negative experiences to the concept (such as having to eat their vegetables or having their parent criticize them). Some children even expressed that they would skip meals to reach what they believed was a healthy body (Borra et al., 2003). The results of this focus group reveal that many children do not know what healthy practices look like or how to implement them in their lives. This gives us an insight into the importance of not only encouraging exercise but also educating children on why their exercise is important now and later in life. Looking to investigate what methods of encouragement would be perceived best, the study asked children to evaluate a series of concepts about a healthy lifestyle. Children communicated that they would like help making attainable goals and being encouraged to achieve them. They also noted that they struggle with self-esteem and would be interested in some sort of platform to where they could communicate or keep up with other children also trying to adopt healthier lifestyles (Borra et al., 2003). This information is helpful for us to understand the children's perspective on the purpose and usefulness of the app we are proposing.

Research Proposal

Design Context

As we contemplated the ways in which education has changed due to the COVID-19 pandemic, our team coalesced around the changes that have occurred in physical education, particularly for children. Before the pandemic, the physical health community was already concerned about rising child obesity and excessive sedentary screen time. Now, the pandemic has made it even more difficult for children to exercise. Virtual school has left many children without a dedicated time and area, such as the school gym during P.E. class, to exercise each day. Restrictions on public gatherings and outdoor spaces like playgrounds has also limited the ways children can be active. Moreover, with parents juggling virtual school in addition to their own work, adult supervision and facilitation of activities is difficult as well.

In this context, we seek to create an online platform to enable children to stay physically and mentally healthy. This will take the form of a phone app geared toward elementary school children in grades two through five. Children of this age range are in the concrete operational stage of development, so they have increased logical understanding (Piaget, 1954). Thus, children at this age should have the requisite literacy skills to use the app and be able to follow a short series of instructions. However, it is important in the design that the instructions are straightforward and that the number of separate instructions at once is limited. Users also need to be sufficiently attentive and independent to be fully engaged in the virtual environment. To help guarantee this engagement, the app must be designed with both simplicity and vibrance in mind.

The app will create an immersive, virtual community, modeled after a small village or environment, in which AIs and potentially real-life users of the app are represented visually as customizable human avatars. Upon opening the app, the user will enter their age, height, and weight and customize their own avatar. They can then explore the village community and chat with the NPCs by tapping around the screen to move their avatar. Within the village, they can discover and participate in various activities that other villagers are doing, which are listed and described in Table 1. While completing the activities, the phone's front-facing camera activates in order to record the child's movements, and the avatar onscreen reflects the child's motions. Feedback, which, as discussed above, is an essential element in games, is given during and after each activity to help the child improve their movements and physical fitness (Lyons, 2015). Depending on the child's performance and engagement in the activity, varying amounts of gold are awarded. The gold can then be used to purchase new clothes for the avatar or new amenities for the village. Use of a reward to achieve secondary goals will hopefully not distract from the overall goal of exploring the village and engaging in the activities (Lyons, 2015). The activities are automatically escalated to be more challenging depending upon the child's skill level and age.

Table 1. Physical Activities Included in the App.

Target	Physical Movement	Possible Virtual Representation	Escalation
Cardio	Jumps	Logs flowing down a river; Dodging obstacles	Faster pace; More reps
Cardio	Dances	Village jamboree; Dance-off with an AI character	Longer or faster songs; More complicated moves
Strength	Planks, squats	Surfing or (water) skiing; Avoiding tripping lasers in a boobytrapped room	More reps; Longer holds
Mindfulness	Yoga, meditation	Relaxing by a lake or in a spa; Flying in the clouds; guided thought practices	More complicated moves

Learning Goals

1. Students will be able to describe the importance of physical activity in creating healthy practices.
2. Students will be able to accurately move their body according to instruction.
3. Students will be able to demonstrate spatial awareness.
4. Students will be able to describe the importance of emotional health in creating healthy practices.
5. Students will be able to regulate their emotional state more easily.

Our learning goals will focus on both physical and emotional capabilities. Through the variety of activities offered within the app, we will be able to curate experiences that lend to both categories. Assessment of these goals will vary. Completion of goals that indicate the child's ability to describe the benefits or importance of certain activities may come from outside assessment, such as the child's guardian, while goals focusing on movement and spatial awareness will be assessed using real-time feedback during each activity.

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