Wearable Technology and Gaming

A Study of Teacher Perspectives

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Abstract— **This study examines teachers' thinking on wearable gaming for educational purposes. The following research questions guide the research: 1) What do teachers believe about wearable gaming in terms of pros, cons, and challenges? 2) What do teachers envision of using wearable gaming for educational purposes? In this case study, data were collected from 31 teachers who enrolled in a graduate course. The analysis of the data showed that conveniences, flexibility, social emotional development, etc. were considered pros, while over reliance on technology, hazards, and inequality, etc. were cons. Interestingly, several other themes were articulated by teachers as both pros and cons. Specific ways to apply wearable gaming for educational purposes were also discussed.**

Keywords- wearable technology; teachers; games; beliefs.

I. INTRODUCTION

The great potential of digital game-based learning is now widely accepted as reflected, for example, in well recognized publications including the Federation of American Scientists' (FAS) report [7] in which games are considered as a powerful tool with great educational potentials [4]. Various studies have demonstrated that games can enhance learners' conceptual understanding (e.g. [9]), motivate students (e.g. [10]), and positively influence players' attitudes (e.g. [1]). On the other hand, wearable technology has increasingly attracted attention from researchers and developers for its power to enhance student learning anywhere and anytime.

Despite the growing interest and increased number of studies in the field, how to best design wearable technology for learning in general, and how wearable technology on Game-Based Learning (GBL) can be optimally used remain to be underexplored [11]. The adaptation of wearable game-based learning in classrooms is scarce due to various reasons. For example, teachers often found challenging to connect wearable games with existing curriculum [3]. The technical skills required to use wearable gaming can be another roadblock for teachers [2]. Using wearable tools can be too complicated for teachers [3].

This study, therefore, aims to bridge this gap by examining teachers' thinking and envisioned use of wearable gaming for educational purposes. Understanding of what teachers concern the most as they consider wearable games for instructional purposes can help us not only better design instructional and training practices for teacher education, but also identify effective approaches for educational wearable game design that are aligned with existing curriculum and meet the needs of the teachers and their students. The following research questions guide the research:

1. What do teachers believe about wearable gaming in terms of pros, cons, and challenges?
2. What are teachers envisioning of using wearable gaming for educational purposes?

II. METHODS

This study was a case study framed in a qualitative, naturalistic research perspective [5]. Aiming to capture teachers' thinking, the focus was on investigating teachers' beliefs about wearable gaming and their envisioned educational use of wearable gaming. Complying with the case study design, this work used a range of data collection approaches to gather detailed information over extended time [5].

The participants were graduate students enrolled in a graduate course involving online learning. A total of 31 students participated which constituted the sample of this study. The course was aimed to provide students with foundational understanding of online education.

The majority of the participants were practicing teachers or formal teachers in k-16 educational institutions with about 20% of them being active or previously worked as trainers in different organizations or businesses. These 31 participants, with about 15% males, were referred to as teachers and pseudonyms were used in this paper. This study was part of a larger research project focused on teacher digital game design experiences. The initial data collection included class observations, assignments completed by teachers, instructor's reflective journal and learners' feedback after class. Other data sources were the teacher created digital artifacts. This paper focuses on participants' reflections, although other data provided information for the context of the study and triangulation of the results.

III. RESULTS

A. Teacher Beliefs

The first research question focused on teacher beliefs about wearable gaming in terms of benefits and drawbacks.

Benefits described by the teachers included: conveniences, flexibility, "[wearable] provide people with convenient, on the go solutions to their everyday dilemmas" (ST). Many argued that wearable gaming would allow highly personalized learning to meet diverse learner needs.

Helping with social emotional development was an advantage cited by many teachers. Some teachers, who initially did not like the idea of wearable technology due to various reasons such as too much screentime, etc. later realized how wearable gaming could help social-emotional development. LT's following comment exemplified this:

- So, my first thought was, give the kids a break. We are inundated with technology as it is... But, as I thought of my students with specific needs during stressful situations, it dawned on me how successful a wearable device would be vs. a timer or adult reminder. It would build personal capacity, independence, and self-awareness way more than an adult reminder or cue would.

Cons and challenges included reliance on technology, hazards, and inequality. The inequality related challenges could be brought by knowledge or language barriers, cost-associated issues as nicely summarized by ST:

- In terms of cons, some include gradual complete reliance on technology, potential hazards, and costs. Potential challenges include inability of some populations to navigate systems due to lack of technological knowledge or language barriers, as well as cost challenges related to obtaining and maintaining the wearable over time (ST).

An interesting observation was that several themes were identified both as pros and cons. The first example was health related topic. From the positive side, teachers articulated how wearable gaming could be used to monitor and thus promote healthy behaviors, but at the same time caution that this might cause "hypervigilance of targeted behaviors" (EF). Additional con included the unknown impact on health from using wearable gaming since "health effects of wearables are unclear" (TB).

The engagement value was the second theme that teachers considered as both beneficial and detrimental. On the one hand, teachers believed wearable gaming would attract students' attention, thus leading to effective learning. On the other hand, concerns were raised about how wearable gaming "could be a distraction" (CP).

The concept of convenience and accessibility was a third topic discussed both as a pro and a con. The teachers repeatedly stated that a benefit of wearable gaming was "being able to be warn provides a sense of convenience" (SM). At the same time, several participants deliberated that a con of wearable gaming was students could suffer from too much exposed to technology, as exemplified by SM: "some parents may not want their children to be exposed to technology consistently."

The last theme that was taken up as both positive and negative related to equity. Wearable gaming was perceived as a tool that could level the playing field because it could allow anyone to access it any time and any place. In contrast, it might create inequality due to various factors such as cost, visually impaired users, social divide, etc.

B. Teacher Envisioned Use

How did teachers envision wearable gaming to be used for educational purposes? The highest number of teachers discussed how they foresaw the use of wearable gaming in helping with daily life skill and functioning. Diverse ideas, ranging from calendar to alarm-type programs, to behavior reminders, were shared as meaningful application of wearable gaming.

One theme that emerged was the integration of wearable gaming with Augmented and Virtual Reality (AR/VR). Examples included "glasses could integrate AR to run scavenger hunts. VR headset could be used for simulations" (TB), or "virtual reality for history (seeing events as they happened)" (MM).

Health related topics, including mental health, were discussed by many participants. How to use wearable gaming to encourage healthy lifestyle both in schools and other workplace settings were mentioned repeatedly.

- Reviewing logs for mood, etc. may allow users to gain insights into times of day or activities that are particularly challenging or health-promoting across their day (EF).
- In a larger workplace setting, challenges between peers would be a great way to use [wearable gaming]. A fitness challenge between coworkers might provide opportunities for involvement in a healthy lifestyle (SF).

A closely related theme identified related to social emotional development. They articulated how wearable gaming could be a valuable tool to help students manage their emotions and improve their social-emotional wellbeing.

- I would love to see a wearable device that supports social emotional well-being by providing breathing techniques with visuals for students to follow. It could encourage who struggle with sharing their emotions to have private opportunity to work on and show those skills (KP).
- In the context of social-emotional development, a built-in reminder to breathe or use a variety of calm down/sensory activities when heart rate increases

due to stress, overstimulation, etc. tailored to specific students (LT).

Content learning, of course, was discussed by some teachers. Examples that were shared by the teachers included:

- Content-based games that are brief & fast paced (e.g. quick math games based on telling time, sight word games, etc.) (SC).
- As a math teacher, I would love to access wearable gaming for educational purposes. If the wearable gaming device allows students to track their speed and time, we could measure a multitude of different scenarios. Using this data...students could solve for equations in relation to their data tables. This type of learning activity would change the way students view algebra concepts (TK).
- In a formal setting I could see using it as a way to incorporate some games into the lesson, such as that one game where the person wears their identity on their head and other people give them clues about it to enhance their social and team building skills (SM).

Equity was another theme identified. Teachers explained how they could use wearable gaming to provide differentiated learning to help diverse learners such as those with special needs.

- In classrooms, students with attention challenges could be quietly prompted to monitor if they are on task or not. I could imagine building reward systems or a game-related component to earn points (EF).
- Wearable gaming could be a great way to seamlessly bring differentiation into a lesson and level the playing field for all students (SR).

Heightening social connection and collaboration to break the brick and mortal boundaries was a salient theme that emerged.

- Students could connect in group activities without having to physically sit next to each other.

IV. CONLUSIONS

The gaming market is still growing with an expected value of US $545.98 billion dollars by 2028, according to the 2021 Fortune Business Insights [8]. Further, gaming is becoming more and more diversified: being played pervasively (e.g. AR games), on new platforms (e.g. VR, mobile games), being played by different groups (e.g. different age levels, both male and females, etc.) [12]. Wearable gaming undoubtedly has its advantages including but not limited to, enabling more flexible user experience through embodied control, and promoting social connections. Yet, wearable game-based learning has little success in education, and we have limited understanding of best practices of using this tool, largely due to its recent emergence. This study addresses the gap in the literature related to wearable gaming and teacher perceptions, adding valuable information to help us understand the value and design considerations of wearables in the context of wearable gaming. Practically, the results of this study are readily understandable by practitioners, which can help guide game designers, developers and educators to best design and use of wearable gaming for educational purposes.

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