

Doctoral Colloquium Paper—Immersive Media in Remote Schooling: “I Was Surprised at How Engaged I Was”

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Abstract—With protracted school closures forcing young people to learn remotely, schools are in urgent need of innovative approaches that can keep students engaged in their education and support their learning. Immersive technologies like virtual reality (VR) and 360-degree videos may increase motivation to learn and improve student focus, but little is known about their effectiveness in a remote schooling model. This doctoral colloquium paper describes work-in-progress using 360-videos and cardboard viewers in remote high school classes. Emergent themes from interviews and focus groups indicate students find 360-videos engaging through increasing focus, control, and interest, and useful for facilitating observational learning.

Index terms—remote learning, virtual reality, 360-video

I. INTRODUCTION

Educators and policymakers are concerned that remote schooling due to the COVID-19 pandemic is not engaging students, potentially resulting in increased dropout and learning loss and pointing to an urgent need for innovative approaches for remote schooling [1], [2]. Immersive technologies such as Virtual Reality (VR) and 360-degree videos have the potential to increase student motivation and engagement in learning activities [3], but little is known on the feasibility and effectiveness of using such materials in a remote schooling model. This paper presents early results from a pilot study using 360-videos and Google Cardboard viewers, investigating in what ways they may engage students and support their learning. The findings shed light on how VR may be a helpful tool to increase engagement via students’ focus, control, and interest, and providing opportunity for observational learning in remote schooling. They also point to challenges of implementing and evaluating immersive technology in fully remote contexts.

II. THEORETICAL APPROACH AND RESEARCH QUESTIONS

In line with prior research on remote learning, initial interviews with students pointed to the difficulties they face learning and engaging in a fully remote schooling model [4], [5]. Students expressed feeling it was “harder to learn” (Maya) and remote school felt more like “self-teaching” (Jack). Decreased class time meant less opportunity for helpful interactions with teachers and peers and increased difficulty following fast-paced material or going in-depth. They also described challenges related to motivation and engagement, describing how they felt

distracted, “unmotivated” (Diana) to show up for remote school, and miss active and hands-on learning opportunities.

Technologies such as VR and 360-videos have been shown to increase student motivation, focus, and attention because they surround the user in a digital image that creates a sense of “being there,” a heightened sense of immersion in a different place [6]. Feeling immersed can increase engagement in learning because it evokes a strong emotional reaction that can increase interest in a topic and promote positive attitudes [7], and by providing a virtual experience that encourages a student to commit sustained attention to the material presented in it [3]. Because of this, immersive technologies such as 360-degree videos may be a useful tool for increasing student engagement at a time they are struggling to learn online [5]. However, engagement is a broad concept that encompasses behavioral, emotional, and cognitive dimensions [8], and it is not yet well known how these technologies may or may not affect different types of student engagement in a remote learning context.

Therefore, this study asked how high school students experience 360 videos in their remote classes to understand whether and in what ways they find them engaging. In doing so, the emergent findings about students’ experiences with these technologies and how they relate to the challenges they described can shed light on further research into whether and how they are useful tools for engaging students in remote learning. Additionally, as a pilot study it assessed the feasibility of conducting research on learning with immersive technology in a fully remote high school context.

III. METHODS

This paper describes early stages of a case study to pilot the use of 360-videos and Google Cardboard VR viewers in a fully remote schooling model, reporting emergent findings from student interviews and focus groups. The school is a public charter school in a Boston-area midsize city serving students of whom 100% are eligible for free/reduced-price lunch, 87% are Black or Hispanic, and 13% are English Language Learners.

A. Participants

This study was conducted in two engineering classes, 16 of 30 students opted in to the research: seven 12th-grade and nine 11th-grade students, 3 identify as female and 13 as male. 14

students' parents, and 2 students themselves, were born outside the United States. Students are referred to here by pseudonyms.

B. Procedure

Initial pilot activities were conducted with five students from one engineering class as one-on-one virtual interviews with the author. These students participated in a pre-interview, watched videos with a Google Cardboard, then completed a post-interview. The videos were intended to spark ideas about different types of buildings around the world. Students were given a list of 14 places and asked to choose 3-5 for which a 360 video was provided from the BBC, National Geographic, and the New York Times.

The second phase of research consisted of whole-class activities in which all students viewed a 360-video followed by discussions in Zoom breakout rooms, which were recorded and facilitated as focus groups by the research team. These activities included a Google video about Tiera Fletcher, an aerospace engineer, and The Hydrous virtual dive about climate change and coral reefs. The final activity asked students to work in small groups to choose from the 14 place-based videos used in the one-on-one activity to watch and discuss in Zoom breakout rooms.

Interviews and focus groups were semi-structured. The one-on-one pre-interview asked students to discuss their interests and remote schooling. The post-interviews and focus groups asked students to discuss what they thought, how they felt in the VR, if anything surprised them, and what they learned.

C. Analysis

Interviews and focus groups were transcribed and analyzed using Atlas.ti qualitative data software, following a flexible thematic coding procedure [9]. Interview data was first indexed by broad themes and research questions, memos written for main themes within each transcript, then cross-participant comparisons conducted to devise specific analytic codes. This paper describes findings from conducting index coding and memos on the "big picture" themes that emerged related to engagement and learning, suggesting analytic codes to be applied to further data collection. Coding and memos were conducted independently by the author and a research assistant, then compared and consensus reached on the main themes present in the data.

IV. PRELIMINARY FINDINGS

A. Students describe feeling immersed and engaged via focus, control, and interest

Students generally described feelings of presence, or "being there" in the virtual environment, such as "it feels real, like you're really diving" (Logan), "it makes you feel like you are really there" (Ryan), and "it's the closest thing I would say to like being somewhere" (Marc). Some students explicitly described feeling immersed, and emphasized motion (on a boat, plane, or moving through water) and social context (surrounded by and following other people) as facilitating factors.

Without explicitly asking about engagement, most students described the videos as "more engaging" (Nora) than other educational materials. What emerged from their descriptions were specific ways they defined being engaged. For some, it was

related to focus and attention, because "you can't take your eyes off of it...you have to give your complete attention to it" (Diana) and "because it's everywhere, it's all you can see" (Nora), they felt less distracted. Others described engagement in terms of feeling more "interactive," because "you can control it, and there's multiple stuff to look at" (Matthew) and "I can look at what I want to" (Logan). Finally, they also described engagement in terms of enjoyment and how the videos related to their interests, particularly travel, careers in engineering, and the environment. They described these videos as opportunities to see new places related to field trips and study abroad opportunities, and to see how engineers work in real life. Despite not being very passionate about climate change, Logan said, "I was surprised at how engaged I was" in the virtual dive. Increased focus and attention may align with behavioral measures of engagement while feelings of control and increased interest relate to emotional engagement [8].

It is important to note students also discussed the limitations of the media. Students who had tried other VR equipment noted it would feel more immersive if the image was a higher quality and if it were more interactive. Others commented on discomfort from having to hold their phones, and also feeling dizzy or motion sickness.

B. Immersive media may facilitate observational learning

A theme that emerged from students' discussion of the 360 videos was the potential for such media to facilitate observational learning. Students described being able to see in more "vivid detail" (Marc, Maya), or notice details about the environment or people in the videos than from other online class activities. They attributed this to their ability to control where they could look and for how long, possibly indicating increased agency: "I found it more interesting to be able to look around and look at specific things I want to look at," (Logan) and "I want to observe about these things [we are learning about]" (Jack). Nora described this in contrast to more typical instruction: "You just kind of follow them around and just observe... instead of talking at you, you get to see for yourself." Matthew also noted this as a sense of "control" in the 360 videos, and that you did not have to only look at one person talking but could observe "the surroundings" as well.

This may indicate 360 videos are particularly helpful for facilitating observational learning similarly to social learning via other media [10]. Students indicated the increased opportunity to observe from different angles and being surrounded by the image made it easier for them to understand places and people. In the case of Tiera Fletcher's career, the students learned more about how big her workspace is, that she is not only in an office but working with different machines, and the many people she works with in a team. In the virtual dive, students expressed being able to see more of the movement of fish and changes to coral over time. And in travel experiences, students felt they understood the social environment surrounding these places, going "deep into the culture" (Diana). These opportunities for observation may be particularly scarce due to the pandemic. Logan described the virtual dive as useful because "during the pandemic VR gives us—closer to reality, to a more interactive experience," and for Maya it made her feel "okay with the

quarantine... especially now that we can't [travel], this is like the next best thing."

C. Implementing and evaluating immersive tech in remote contexts is challenging

Researchers can also learn from this work to better plan implementing and researching immersive technology in remote schooling in the time of COVID-19. First, we found the process of setting up the activities and research to be time consuming. Researchers should allow time to work with their institution and the school to gain permission for distributing materials and obtaining consent safely. We were able to distribute the cardboard viewers through the school's process of giving books and computers to their students, which only occurred at specific times of the semester. Gaining parental consent via email was also a challenge that required additional time to follow up with students and parents via the students' advisors.

Time was also a challenge in implementing the activities and collecting data. The school limited the amount of screen time for students, shortening lessons to only 45 minutes, making it difficult to conduct the equivalent of in-person activities in which we could also pull students out for interviews or issue surveys. Initially we met with students one-on-one outside of class time, which limited the number of students consenting to the process. When conducting whole-class activities we found we needed a breakout room on Zoom for troubleshooting, and three adults to facilitate teaching, data collection, and troubleshooting at the same time. In whole-class activities, Zoom breakout room discussions served as focus groups, rather than conducting interviews, changing the type of data collected but allowing broader participation and activities better aligned with the class. We also collected survey data, but the small sample and challenge of ensuring students completed them remotely resulted in insufficient data on most measures. This model may work for other researchers, who should plan a slow start to set up the research and a small pilot with a few students to understand what will work in each specific class and context.

V. CONCLUSION AND FUTURE DIRECTIONS

Emergent findings from this pilot using 360-degree videos and cardboard VR viewers point to the ways such activities may improve learning experiences for students in remote schooling contexts. The ways students described the videos as more engaging than other activities shed light on the mechanisms through which VR could engage remote learners, via behavioral engagement that increases their attention on a task, and via emotional engagement related to their attitudes and interests [8]. Further, the potential for observational learning emerged from students' descriptions of what they learned, and the ability to look at places and people more deeply and from varied angles helped them notice details about spatial and social contexts difficult to understand from other online learning activities. This suggests 360 videos may address some of the challenges they described feeling "harder to learn" and less motivated in remote schooling. Finally, the process of using and evaluating immersive technologies in remote schooling sheds light on the difficulty of conducting such research, pointing to the need for

more time, resources, and innovative data collection to understand learning this context.

As early stages of work-in-progress, the pilot also points to limitations of these findings. First, procedures did not have specific learning goals related to the curriculum, and future work should attempt to influence and measure learning as well as student perceptions. Further, not only is this a small sample, but these students are not likely to be representative of students more broadly. They are in the final two years of a rigorous three-year engineering program, and they also opted in to a study requiring time, effort, and for them to engage in Zoom with their cameras on, which likely deterred many students. Going forward, we aim to devise alternative data collection methods to capture a more representative sample of students, and to assess the variation in students' backgrounds and remote learning context that may influence their experiences with immersive technology. Finally, while students' subjective experiences helped illuminate potential mechanisms through which VR could increase engagement and observational learning, further work is needed to test these mechanisms as well as investigate alternative explanations such as its novelty effect.

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