

360° Storytelling for Immersive Teaching Online and in the Classroom for Secondary and Tertiary Education

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Figure 1: 360° experience for a virtual field trip teaching tectonic plates and glaciers. The interactive experience allows students to access additional information during the experience (Right).

ABSTRACT

In this work, we present the findings of a study designed to investigate the impact of 360° storytelling on student engagement and learning outcomes in both secondary and tertiary educational contexts. The research focused on two distinct scenarios: Teaching Science to Secondary School Students and Hybrid University Courses integrating On-campus and Distant Students. The study employed a multifaceted approach, combining video production, test protocols, and evaluations to assess the efficacy of 360° storytelling.

1 INTRODUCTION

Recent developments in Virtual Reality (VR) allow the use of immersive 360° videos as a new viable pedagogical tool for teaching at secondary and tertiary levels. These videos offer the potential to enhance student engagement and learning outcomes by providing immersive experiences from either outside the classroom (virtual field trips) or by bringing remote students into the classroom in a way that other forms of online teaching cannot. Here we test the potential of 360° videos for (i) engaging secondary school students in science at Year 12 and (ii) providing virtual field trips for off-campus tertiary students. If proven successful, 360° videos will provide an exciting new teaching format with the potential, for example, to help arrest the declining numbers of students taking science, while also exploring a cost-effective way for universities to teach online.

2 BACKGROUND

The COVID-19 pandemic and its associated lock-downs have highlighted the need to develop effective means of digital teaching at all levels in the education system. 360° videos are an emerging pedagogical resource that can provide immersive, experiential learning [2, 4], which could potentially benefit students both physically within the classroom or virtually online. However, there is a lack of research in evaluating the value of 360° videos in the education system.

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360° videos are immersive spherical video recordings where a view in every direction is recorded simultaneously. Three recent developments have now made 360° videos, which can be viewed on mobile devices and computers, a viable option for teaching: (i) the availability of inexpensive cameras and apps that enable easy production of high-quality 360° videos and photographs, (ii) the ability to readily distribute and live stream 360° videos on platforms such as YouTube, Facebook and Vimeo, and (iii) the incorporation of gyroscopes and accelerometers into smartphones that allows for the viewing of 360° videos via the movement of their phones.

The utilization of 360° videos in educational settings holds promise to improve students' digital literacy and competency. This is particularly relevant as students increasingly rely on smartphones and other connected devices for accessing on-demand online videos, which have become their primary media consumption source [1]. We have shown that the use of mobile devices in the classroom can have a positive effect on the engagement of secondary school students [3], especially when combined with environmental immersion. However, the challenge with providing immersion outside the classroom, such as field trips, is that they are not only expensive and time-consuming but consequently also do not scale well across the education system. 360° videos offer the potential to provide immersion and increase student engagement while being highly cost-effective, scalable and easily distributed.

In this work, we present a proof-of-concept study using one of the 360° videos' primary use cases in teaching: bringing students to places outside of the classroom to experience the subjects they are learning about. We designed a study to explore the potential of 360° videos in enhancing engagement and learning in both secondary and tertiary education settings.

3 HYPOTHESIS

For our study, we hypothesize that 360° videos can enhance engagement and learning both inside and outside the classroom, regardless of whether it is secondary or tertiary teaching. We examine this hypothesis in two exemplars. 1) Teaching science to secondary school students and 2) university courses to distant students.

4 TEACHING SCIENCE TO SECONDARY SCHOOL STUDENTS

Our first study aimed to address the challenges around science education in New Zealand, particularly the declining interest in core

science subjects among secondary school students. The study was approved by the ethics board of the University of Otago.

4.1 Content Production

We produced a 20-minute 360° video set in a National Park (Fiordland National Park, New Zealand, Figure 1 Left), covering the action of tectonic plates, emphasizing a major fault line (Alpine Fault in New Zealand). Experts in geology and Mātauranga Māori (traditional knowledge of the Māori people of New Zealand) ensured the accuracy of the script. The 360° video was enhanced by interactable elements that allowed the participants to explore the content with more depth and personalization (Figure 1 Right).

4.2 Evaluation

We worked together with teachers at a local school and had 14 Year-11 students at a local high school using the 360° video for high school assessments, investigating geological processes and examining an Earth and Space Science issue. Five of the students experienced the 360 content on a VR headset and 9 experienced it on a mobile device.

Within an online survey conducted after the experience, we measured students' engagement, satisfaction with the subject, attitudes toward science, satisfaction (quality) with 360° videos, and likelihood of pursuing science in the future.

4.3 Results

Students using headsets to watch the 360° video reported being more immersed in the virtual world and less aware of the real world than those watching on mobile devices. Even so, mean satisfaction scores with the 360° video on a 7-point Likert scale and ratings of effectiveness of the video as a learning experience were similarly very high, irrespective of whether students engaged with the video on mobile devices (satisfaction: $x = 5.22$; effectiveness: $x = 5.89$) or headsets (satisfaction: $x = 5.20$; effectiveness: $x = 6.20$) (Figure 2). While we did not apply statistical tests on the data due to the small sample size, the results indicate the potential for 360° videos consumed on mobile devices to enhance learning by bringing field experiences into the classroom.

Preliminary support for the hypothesis was found in improved engagement, increased standard achievement, enhanced attitudes toward science, and a higher likelihood of pursuing science in the future among students exposed to 360° videos.

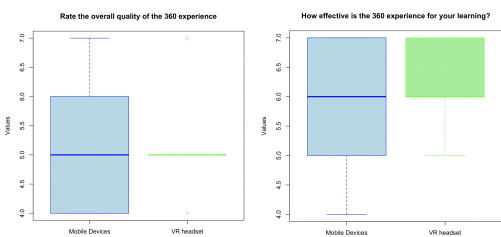


Figure 2: Questionnaire results by the high school students.

5 HYBRID UNIVERSITY COURSE

Our second study explored how 360° experiences can address the challenges faced by universities in providing engaging content to off-campus students in hybrid courses.

5.1 Content Production

We produced a 360° video of a local historic site to support off-campus students in a creative non-fiction writing university course, mimicking the experience of a field trip taken by on-campus students.

5.2 Procedure

We conducted online surveys with 15 students to assess their experiences with the 360° video virtual field trip capturing questions like quality and effectiveness. Students completed the surveys after each lecture, providing satisfaction scores. In addition, we analyzed download viewing statistics and conducted additional in-depth interviews with the students further to explore engagement patterns.

5.3 Results

Even though over 90% of the students viewed the virtual field trip on a laptop or desktop computer, on a 7-point Likert scale, they rated the quality of the field trip as very high ($x = 5.6$) and they did see its effectiveness as a tool to enhance their learning ($x = 5.0$) (Figure 3).

The collected data supported our hypothesis, indicating increased engagement among off-campus students exposed to 360° streaming and comparable engagement between on-campus and off-campus students in the creative non-fiction writing course.

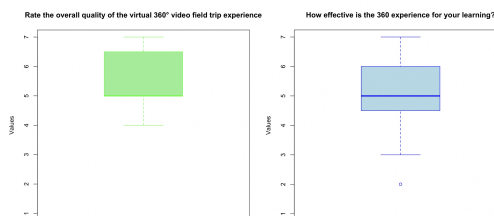


Figure 3: Questionnaires results by the university school students rating the quality and the effectiveness of the 360 experience.

6 CONCLUSION

The two study results suggest that 360° videos have the potential to enhance engagement and learning outcomes in both secondary and tertiary education settings. The findings provide valuable insights for educators, institutions, and curriculum designers looking to leverage immersive technologies for improved educational experiences. Despite that, further research and implementation strategies are required to fully understand the impact and integrate 360° videos into educational practices. We are also exploring the potential for other types of applications such as tourism.

ACKNOWLEDGMENTS

This work was supported by an University of Otago Research Grant and by an MBIE Endeavour Fund.

REFERENCES

- [1] L. S. Davis and B. León. New and old narratives: changing narratives of science documentary in the digital environment. *Communicating science and technology through online video: Researching a new media phenomenon*, pp. 55–63, 2018.
- [2] A. Dengel and J. Mägdefrau. Immersive learning explored: Subjective and objective factors influencing learning outcomes in immersive educational virtual environments. In *2018 IEEE international conference on teaching, assessment, and learning for engineering (TALe)*, pp. 608–615. IEEE, 2018.
- [3] K. Martin, L. Davis, and S. Sandretto. Students as storytellers: mobile-filmmaking to improve student engagement in school science. *Journal of Science Communication*, 18(5):A04, 2019.
- [4] J. Reyna. The potential of 360-degree videos for teaching, learning and research. In *INTED2018 Proceedings*, 12th International Technology, Education and Development Conference, pp. 1448–1454. IATED, 5-7 March, 2018 2018. doi: 10.21125/inted.2018.0247