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Work-in-Progress—Review of the Application of the Spherical Video-Based Virtual Reality in Education: A Case Study of EduVenture-VR and Its Use in Chinese Language Education

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Abstract. With the rapid development of technology and online education, the application of virtual reality (VR) in education has been an important research direction in recent years. VR technology has been developed; spherical video-based virtual reality (hereinafter referred to as SVVR) is one of its new sub-categories. SVVR can easily be produced by a 360-degree camera and accessed with a mobile phone and head-mounted display (HMD) such as low-cost goggles. SVVR has been applied in various fields in recent years, such as medical treatment and education. In the field of education, studies related to the application of SVVR in Chinese language education for Chinese learners (L1) are limited. EduVenture-VR is an integrated SVVR learning platform for enabling frontline teachers to incorporate SVVR-supported teaching in classrooms. This work-in-progress paper reviews the existing studies pertaining to the adoption of EduVenture-VR in Chinese language education.

Keywords: Spherical Video-based Virtual Reality (SVVR), Virtual Field Trip, Chinese Language Education, EduVenture-VR.

1 Introduction

Educational technology represented by VR has developed rapidly in recent years. In traditional teacher-center classes, students are more likely to passively listen to the teacher's lecture and understand learning content through words only. Field trips are sometimes used in teaching and learning as alternative methods. However, Makransky & Mayer [1] argued that there are many restrictions on going outside the school in person, but with the assistance of educational technology, virtual field trip in the class is the most convenient and cost-effective way at present. They further conducted research on comparing 102 middle school students' learning performance of a virtual field trip to Greenland via a head mounted display (HMD) with a 2D video as an introductory lesson within a 6-lesson inquiry-based climate change intervention. They found that the HMD group scored higher than the video group on presence, enjoyment, interest and retention in an immediate and delayed post-test. Their research supports VR-based environments do have educational value on the premise of incorporating virtual design principles. In fact, the multimedia principles proposed by Mayer [2] claimed that people learn better from words and pictures than from words alone, especially for low-knowledge learners on transfer tests. This is because the goal of instructional messages is to assist learners in selecting, organizing and integrating information (knowledge construction) rather than information delivery. With the increased use of novel technologies, these pictures have turned into animations, and then immersive virtual environments. In order to explore the application of SVVR in the field of education in a more targeted manner, this study chooses the platform of EduVenture-VR as the case and explore its application in Chinese language education. This is because EduVenture-VR, a newer platform developed by a university in Hong Kong, has partnered with some secondary schools in Hong Kong. At the same time, there are already some SVVR studies focusing on Chinese education based on the EduVenture-VR, which can provide a reference for the authors' future research.

1.1 EduVenture-VR

The learning platform EduVenture-VR enables teachers to easily and confidently design their own VR teaching content for their students [3]. EduVenture-VR is composed of EduVenture-VR Composer and EduVenture-VR App. Teachers can use the Composer to create and design interactive VR content without coding requirement. With the EduVenture-VR App and HMD(s), learners can experience an SVVR environment and learn different subjects. Each student can then engage in the learning space, which immerses and directs them to undertake a virtual field trip, using their own smart phone (iOS or Android) and a costless VR cardboard. To be more specific, this platform can assist in designing an immersive virtual reality learning system based on spherical videos, combining video-based virtual reality with real scenes and learning content. The platform structure includes a learning material editing system module, hands-on design system module, VR system display module and database module. Teachers can add and modify 360-degree graphic themes through the learning material editing system module, and students can use the hands-on design system module and virtual reality system display module to design and experience virtual reality scenes. The database module includes a VR learning database, learning archives, student personal database and test database. The platform makes it easy and efficient to create virtual reality projects for non-tech-savvy educators who want to provide learners with an immersive experience while teaching.

1.2 SVVR Applications in Chinese Education

Existing research using the EduVenture-VR on Chinese language education has primarily explored its use in Chinese composition writing and focused on school students who are Chinese native speakers (see Table 1).

The research conducted by Li, Chen, Zhang, Wu, and Huang [4] focused on fourth-grade students in China and found that a double-loop SVVR-based learning approach can potentially enhance students' Chinese writing learning through changing the social and behavioral engagement of the students. Similarly, the comparative research conducted by Chen, Li, Huang, Han, Hwang and Yang [5] concluded that students learning with the SVVR approach which improved their deep writing abilities exhibited writing performance that is superior to the non-SVVR approach students in terms of linguistic expressiveness and creative thinking in Chinese composition writing. However, the research by Yang, Chen, Zheng, and Hwang [6] used the comparative method and concluded that the SVVR learning method only improved the participants' writing performance but not creative thinking.

Apart from the students whose native language is Chinese, Jong et al. [7] focused on the motivation of ethnic minority students in Hong Kong to learn Chinese culture and concluded that the students are motivated to learn local Chinese culture in Hong Kong with the use of Eduventure-VR. Zhao and Yang [8] used a mind-mapping learning strategy in Grade 10 Chinese language courses in Thailand and found that the students' Chinese vocabulary and making sentence, problem-solving ability, and self-efficacy have significantly improved. Their research expanded the scope of the participants and proved that Eduventure-VR is also suitable for the foreign students or ethnic Chinese students to learn Chinese.

Apart from that, some researchers focus both on the research perspective of students and the importance of teachers' role in this technology-enhanced teaching and learning process. Chen, Chai, Jong, and Jiang [9] conducted the phenomenographic research about teachers' conception of teaching along with the use of interactive spherical video-based virtual reality (ISV-VR) in L1 Chinese descriptive writing. They interviewed twenty-one secondary Chinese teachers from a school in Hong Kong and summarized seven conception categories and then analyzed that these categories formed from skill-oriented to community-oriented, and finally to identity-oriented conception. Chen, Chai, Jong, and Chao [10] conducted quantitative research to model secondary school students' self-concept in Chinese descriptive writing with the affordances of SVVR underlying the self-determination theory. According to the experimental results, they found that self-efficacy and satisfaction directly predict students' writing self-concept, while relatedness indirectly predicts writing self-concept. These findings revealed that SVVR-supported learning and teaching could be harnessed in Chinese writing education. These studies indicated that SVVR can be applied not only to Chinese students but also to students who are not native Chinese speakers.

Table 1. Research related to Chinese language education using Eduventure-VR.

Authors and Title	Year	Country/ Region	Participants	Theoretical Lens (including	Research Direction

				learning/teaching strategy)	
Li, Chen, Zhang, Wu and Huang [4] Investigating Learners' Engagement and Chinese Writing Learning Outcomes with Different Designs of SVVR-Based Activities	2022	China	Primary school students, 82 fourth-grade students in China (whose average age is about ten years old)	Learning Engagement: cognitive, behavioral and emotional	Chinese writing learning
Chen, Li, Huang, Han, Hwang and Yang [5] Promoting deep writing with immersive technologies: An SVVR-supported Chinese composition writing approach for primary schools	2022	China	Primary school students, 59 fourth-grade students from China	Experiential learning and Deep learning	Chinese composition writing
Yang, Chen, Zheng, Hwang [6] From experiencing to expressing: A virtual reality approach to facilitating pupils' descriptive paper writing performance and learning behavior engagement	2021	China	40 Fourth-grade pupils in China, whose average age was 10 years old	Experiencing learning theory	Chinese pupils' descriptive Chinese paper writing performance and learning behavior engagement
Jong et al. [7] Motivating Ethnic Minority Students in Hong Kong to Learn Chinese Culture with EduVenture VR	2021	Hong Kong	Secondary school students, 63 ethnic minority students from Grade 7 to Grade 9	ARCS model of instructional motivation	Motivational effectiveness of the Chinese culture learning

(conference paper)					
Zhao and Yang [8] Promoting international high-school students' Chinese language learning achievements and perceptions: A mind mapping-based spherical video-based virtual reality learning system in Chinese language courses	2023	Thailand	International high school students, 66 Grade 10 students ranging in age from 17 to 19	Constructivism learning theory, Mind mapping learning strategy	Chinese learning achievements, learning motivation, problem solving ability, and self-efficacy
Chen, Chai, Jong and Jiang [9] Teachers' Conceptions of Teaching Chinese Descriptive Composition With Interactive Spherical Video-Based Virtual Reality	2021	Hong Kong	Twenty-one secondary teachers	Conception, Phenomenographic study	L1 instruction, Chinese descriptive composition writing
Chen, Chai, Jong, Chao [10] Modeling learners' self-concept in Chinese descriptive writing based on the affordances of a virtual reality-supported environment	2021	Hong Kong	Secondary school students, 143 boys and 157 girls aged 14–15 years	Self-determination theory	Chinese writing self-concept
Chen, Jong and Chai (2020) [11] Teachers' conceptions and uses of interactive	2020	Hong Kong	6 Grade-9 students		Students' conceptions of SVVR supported Chinese writing learning

spherical video-based virtual reality in teaching Chinese writing (conference paper)				
Chen, Jong, Chai, Zhou, [12] Students' Conceptions of Interactive Spherical Video-based Virtual Reality Supported Chinese Writing Learning (conference paper)	2019	Hong Kong	21 Chinese teachers who teach Grade 7-9	Teachers' conceptions of using SVVR to teach descriptive Chinese writing

2 Future Research and Conclusion

There has been scholarly evidence showing desirable learning effects pertaining to the use of EduVenture-VR in various subject domains, including English language education [13-14], natural science education [15-17], and some other disciplines in higher education and professional training [18-21]; nevertheless, the present review unfolds that scholarly studies on the application of Eduventure-VR in Chinese language education are very limited and narrowly focus on the composition of Chinese writing. In addition, the application of Eduventure-VR in the field of Chinese language education can also consider the students in Southeast Asia, where the proportion of ethnic Chinese is large. The differences in Chinese culture between various countries or regions are also new directions that can be studied using Eduventure-VR in the future.

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