Teacher's Re-design of Virtual Reality Based Curriculum in an Elementary Classroom

Insook Han, Temple University, insook.han@temple.edu

Abstract: This is a qualitative study that explored teacher's use of VR contents in an elementary classroom using a case study approach. Based on the thematic analysis of written reflections, interview transcriptions, and field notes along with teacher-produced artifacts, I provided in-depth descriptions of the entire process of teacher's planning, implementing, evaluating, and revising lessons for using VR. The preliminary analysis revealed that a teacher developed his TPACK of using VR while re-designing VR-based curriculum.

Introduction

In technology-enhanced learning environments, teachers are often considered adopters of technology and executors of ready-made curricular materials. However, the teacher's active role in developing a technology-enhanced curriculum has become increasingly important because the meaningful transformation of learning with technology requires extensive teacher knowledge of technology, pedagogy, and content (TPACK) (Mishra & Koehler, 2009). While teachers' design of curriculum is not entirely new (Kirschner, 2015), bringing emerging technologies into classrooms demands teachers consider variables that have not been essential previously. Especially, the rapid development of virtual reality (VR) technologies has brought new possibilities to education and needs of teachers' professional development. However, research on the adoption of VR in real classroom settings is still immature, and little research has explored the process of curriculum design that involves VR and how teachers develop their understanding about the use of VR in classroom practices. The complex nature of designing curriculum using emerging technologies does not seem to have been well facilitated by traditional forms of one-time out-of-context professional development (Liu, 2013). Instead, teachers' curriculum design practice as a form of professional development has recently gained scholarly attention (Voogt et al., 2015). Despite this increased attention, there is scant empirical evidence that demonstrates how teachers develop their knowledge towards emerging technologies while designing technology-enhanced lessons. Therefore, in this study, I explored an experienced teacher's use of VR in an elementary classroom and tried to describe how the teacher developed TPACK while designing VR-based curriculum.

Methods

Context of study

In this study, I worked with one elementary teacher who worked in a private elementary school located in a metropolitan area in South Korea. Mr. Park was a 43 years old male teacher with 19 years of teaching experiences and was currently working on a doctoral degree. He was a homeroom teacher for 4th graders with 28 students (14 boys and 14 girls), that were divided into two groups of 14 students for a class. The teacher was the head of the research department at school and had extensive experiences of researching and designing curriculum incorporating various innovations. As part of the study, Mr. Park was introduced to Google Expeditions and suggested to incorporate it into his teaching. Google Expeditions is a mobile application that provides over 500 three-dimensional virtual field trips that can be downloaded on a mobile device and viewed with a low-cost VR headset.

Data collection and analysis

This study is a qualitative one-case case study that has a bounded system of teacher's work including lesson planning and teaching, and his interaction with me. Within this bounded system where the teacher designed two units of lessons, qualitative data was collected in forms of teachers' written reflections during planning, video recordings of teacher's classroom teaching and field notes, and follow-up semi-structured interviews after each teaching. Also, lesson materials that Dr. David created, such as PowerPoint presentation slides, and student activity sheets were also collected. All written reflections, interview transcriptions, and field notes were coded using a thematic analysis method and triangulated with data from other sources. The results extracted from the preliminary analysis was reorganized to present the teachers' development of TPACK.

Teacher's development of TPACK through re-designing VR curriculum

Preparing technologies and reorganizing a physical space

When designing the initial lesson, Mr. Park spent most of his time gathering information and researching about VR, and concerning technological aspect of using VR in his classroom. As he searched more about VR, he began to realize that the use of VR required specific technical specifications and entailed the students' physical movement and reactions to viewing the VR, which needed to be adequately addressed and accommodated. The technological knowledge he developed includes not only the knowledge about VR but also necessary physical setup for using VR in his classroom. Based on this knowledge, he reorganized the classroom setting to accommodate students' movement during VR experiences as well as prepared two extra chairs at the corner of the classroom for students to be able to take a rest when they feel uncomfortable. During the enactment, he continuously reflected on some problems emerged, such as Wi-Fi connection, battery shortage, etc. and addressed them in his second lesson. Instead of having 14 students using VR simultaneously, in the second VR lesson, seven students used VR at a time, and a couple of extra sets of devices were prepared. The classroom was also reorganized to have an ample open space in front of the classroom for seven students.

Modifying learning content for pedagogical use of VR

Another aspect of teacher knowledge developed was content knowledge with combining pedagogical and technological knowledge. During the design of the second lesson for Korean literacy, Mr. Park modified existing learning objectives and textbook contents to be better aligned with VR contents. While reviewing 'The use of information' in the Korean elementary curriculum, he realized that their Korean textbook only focused on traditional media, such as books, newspapers, internet search, and television as information sources. However, he developed his knowledge about a new medium during the design of this lesson and learned that VR is an emerging technology that can certainly bring a new type of information in education. Thus, he designed that particular week's lesson to include VR and how the information presented in VR is different than the one delivered by other media that students were already familiar with.

Pedagogical understanding of VR for instructional interventions and student activities

Based on his understanding of VR and resources available, Mr. Park devised instructional interventions and student activities that were implemented in teaching. During the design, he developed the understanding of the pedagogical aspect of using VR. Guided exploration was applied to maximize the purpose of VR experiences by utilizing the guide mode in the Google Expeditions that allowed students to experience the same content with the same sequence. On the second lesson, a compare/contrast group activity was designed for experiencing two different mediums as information sources.

Discussion

Throughout the instructional design process, the teacher was actively involved in curriculum re-design by modifying a space, content, and activities to incorporate VR. The process of modification was based on the design process that follows gathering information, diagnosing what is best for the learners, determining an effective course of instruction, enactment and evaluating the teaching (Kirschner, 2015), which again led to another cycle of the designing process. During the iterative processes of designing and redesigning lessons and activities responding to emerging learners' needs as well as constraints and affordances in educational contexts (Matuk et al., 2015), the teacher developed new TPACK around the use of VR in the elementary classroom.

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