Original Paper

Integrating AR and VR in Teacher Education: What Pre-service Teachers Perceive

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Abstract

Augmented Reality (AR) and Virtual Reality (VR) are two of the most important technologies nowadays. Both had brought significant changes to education. Recognizing that these technologies have become two of the most powerful scaffolds in education is important to better train pre-service teachers with the use of these technologies. By doing so educator preparation programs provide opportunities for their candidates to practice newly learned skills, imagine new ways of thinking and teaching, and build confidence. At the same time is important to gather the pre-service teachers perceptions with the use of both technologies. This paper focuses on a research that sought to determine the perception of pre-service teachers with the use of AR and VR. It found that pre-service teachers believe in the potential of both technologies for the teaching and learning process and at the same time recognize the need to confront the lack of access and digital divide that students might face. It also showcases the need for more training, resources and research of these technologies in teacher education.

Keywords

augmented reality, virtual reality, teacher education, immersive technologies, instructional technologies

1. Introduction

In education, Augmented Reality (AR) and Virtual Reality (VR) applications are rapidly changing the way we are providing K-12 and university students' experiential learning opportunities by simulating real-world environments. According to Kang and Yang (2020), AR refers to a simulated, but enhanced, reality that combines both computer-generated virtual and real-world data to allow users to complete real-time interactions with computer-generated graphics, imagery, and objects, in a smooth way and with an illusion of these layers of information coexisting in the same space. In other words, is the ability to layer data and images over materials and actual spaces. On the other hand, VR is defined as a technology which allows a user to interact with a computer-simulated environment, be it a real or imagined one (Guazzaroni & Pillai, 2019). Both technologies are particularly interesting as a tool for preparing future teachers, especially those that will support bilingual and ESL students and special education students as it affords alternative modes of more traditional teaching methods (Liu, Salisbury, Vanhabzadeh, & Sahin, 2017).

Today, simple AR and VR applications are readily available and the needed tools already in the hands of young people, with over 80% of K-12 (McFarland et al., 2017) and over 95% of university students either owning or having access to a smartphone or tablet (Dahlstrom & Bichsel, 2014). This makes AR and VR a feasible learning tool for K-12 and university students. With AR and VR learning can occur at any time and from anywhere—making it extremely flexible. Research has shown that AR and VR activities and materials increase university student engagement (Bursztyn, Walker, Shelton, & Pederson, 2017; Hsu, Lin, & Yang, 2017). Additionally, using AR and VR in educator preparation allows for in-depth learning experiences not possible in the past (i.e., virtual classrooms with virtual interactive students, manipulating and rotating the solar system while developing related lesson plans, or using interactive flashcards that use sign language to work with deaf students). AR and VR provide pre-service teachers with an insight into what they will experience when they enter the actual classroom helping them be better teachers from day one.

This paper showcases a qualitative study that targeted n=27 pre-service teachers' on their perceptions of the strengths and limitations of AR and VR. To be more specific, they reflected on the following research questions:

RQ1. What are the strengths and limitations of integrating AR in the classroom?

RQ2. What are the strengths and limitations of integrating VR in the classroom?

It also presents how they envisioned using both technologies as possibilities to strengthen student engagement and keep them motivated. Besides, it mentions how access to these technologies continues to be the most significant limitation.

2. Theoretical Background

The teaching and learning process has transformed dramatically since the arrival of the Information and Communication Technologies (ICT's) and the Internet. Also, the increase in the use and development around the world of smartphones and other equipment with access to an internet connection has resulted in developing immersive technologies. In this group are augmented reality (AR) and virtual reality (VR). Researchers like Milgram et al. (1995) proposed the reality-virtuality continuum to address these concepts from fully real to entirely virtual environments.

Pre-service teachers have lived the transition and evolution of the Web 2.0 to using immersive technologies. In this group, we find AR and VR. These technologies applied to education have proven their potential by making students feel engaged and motivated through active learning and decision making activities (Kerawalla, Luckin, Seljeflot, & Woolard, 2006; Martín-Gutiérrez, Mora, Añorbe-Díaz, & González-Marrero, 2016). Some of these include promoting individual exploration and understanding of complex concepts. Also, the students have a real-time interaction that enables them to make adjustments or decisions based on results. They can explore or manipulate objects and collaborative experiences in virtual environments that would typically be difficult or impossible for them to experience in real life. Also, both technologies are non-linguistic, allowing the students to use mental images and detailed knowledge. Furthermore, VR promotes learning because students understand the subject matter much better than if they saw two-dimensional images (Sala, 2016). Due to its experiential nature, it is a multi-sensory experience, enriching learning by fostering curiosity.

3. Methodology

This research study followed a qualitative method and used an exploratory design. It is based on Grounded Theory (Glaser & Strauss, 1967). According to Chun Tie, Birks, and Francis (2019), Grounded Theory sets out to discover or construct theory from data, systematically obtained and analyzed using comparative analysis. The data collection instrument included guided reflections using the study questions, and the main categories and subcategories were classified. Upon data collection, answers were coded, and a Content Analysis was carried out. According to Krippendorf (2004), Content Analysis is the systematic reading of a body of texts, images, and symbolic matter, not necessarily from an author's or user's perspective. This approach was used to analyze and interpret the reflections written by pre-service teachers.

All pre-service teachers participating in the study received 6 hours of specialized training in AR and VR educational use. It included f2f and online presentations with examples, tutorials, potential classroom activities, alignment with state standards, and exploration of AR and VR mobile applications. All students were provided with iPads and Google Cardboard goggles. Some used their own devices (iOS and Android, smartphones, iPads, or Android tablets). For data collection, the technique of guided reflections was used. After the 6 hours of instruction, they were given a worksheet with the two study questions for them to reflect. These questions were:

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RQ1. What are the strengths and limitations of integrating AR in the classroom?

RQ2. What are the strengths and limitations of integrating VR in the classroom?

4. Results

To answer RQ1 the results were categorized into two groups, titled *strengths of AR* and *limitations of AR*. For *strengths of AR* a total of 203 entries were coded. The participants highlighted the following: enhanced classroom engagement with 46%, motivated students to learn with 28%, new and find ways to learn 11%, promotes a visual learning experience with 9%, inclusive technology with 6%. On the other hand, in the group *limitations of AR*, 71 entries were coded. The participant highlighted: access to technology with 46%, access to the internet 25%, access to mobile devices with 14%, teachers not familiarized with the technology with 4%.

To answer RQ2 the results were categorized into two groups, titled *strengths of VR* and *limitations of VR*. For *strengths of VR* a total of 195 items were coded with 41% for student engagement, 18% for excellent visuals, 12% for student motivation. For *limitations of VR*, a total of 80 items were coded with 44% indicating access to the technology, 31% costs, 15% time to integrate in the classroom.

5. Discussion and Conclusions

This study has shown the power of AR and VR and how pre-service teachers perceive these technologies as great tools to integrate into their classrooms. Both can serve as scaffolds to promote student engagement and motivation. At the same time we need to be careful on how we and when we integrate them. A very important detail is that access continues to be the most important rival to use these technologies. If students don't have the access or school districts can't afford them no process could be performed. More research needs to be done in this area.

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