

What Previous Research Says About Virtual and Augmented Reality in Higher Education

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Abstract: Virtual reality is a computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings. It is not a recent technology, nor is its application to education. Despite its popularity, it is not widely used in education because of its limitations including required technologies, the cost and etc. In order to gain a better understanding of how it is used in higher education so far and what the trends regarding courses and teaching methods in which virtual and augmented realities are integrated are, it is thought that it may be helpful to conduct a systematic review of the use of virtual reality in higher education. This paper aims at contributing to an understanding of using virtual reality in higher education in the context of technology enhanced learning. So, it is designed as a systematic literature review with five steps. Those steps are description of research questions, searching for relevant published research, screening of those research, coding of them, and lastly analysing and mapping the data. Based on the data, it can be said that virtual and augmented realities in higher education have been mostly implemented in the medicine courses and simulations have been mostly implemented in virtual and augmented realities in higher education as teaching strategies.

Keywords: virtual reality, augmented reality, higher education, systematic review

1. Introduction

Virtual reality is a computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings. It is not a recent technology, nor is its application to education. When the studies on the advantages of VR and AR are examined, it can be said that VR-based content helped students better understand the subject matter and allowed the instructor to design the course without the need for costly laboratory upgrades (Syed et al., 2019). In terms of motivation and engagement, AR-based learning modes may attract and motivate learners to learn (Chu et al., 2019) and boosts their confidence (Al-Hatem, 2018). Last but not least, several advanced tools for ICT-supported pedagogical practices, such as gamification and the use of virtual and mixed reality, as well as social media, can help university students develop collaborative skills online (Martinez, 2018).

Despite its popularity, it is not widely used in education because of its limitations including required technologies, the cost and etc. In order to gain a better understanding of how it is used in higher education so far and what the trends regarding courses and teaching strategies in which virtual and augmented realities are integrated are, it is thought that it may be helpful to conduct a systematic review of the use of virtual and augmented realities in higher education.

This paper aims at contributing to an understanding of using virtual and augmented realities in higher education in the context of technology enhanced learning. To accomplish this, the current study began with the formulation of research questions. The following are the study's research questions:

- 1. What are the trends in publications related to virtual and augmented realities in higher education, including courses and teaching strategies in which virtual and augmented realities are integrated?
- 2. What are the difficulties experienced in the integration of virtual and augmented realities in publications related to virtual and augmented realities in higher education?

2. Method

This study is designed as a systematic literature review with five steps. Those steps according to Petersen et al. (2008) are description of research questions, searching for relevant published research, screening of those research, coding of them, and lastly analysing and mapping the data. Gusenbauer and Haddaway (2020) conducted a recent review in which they evaluated the retrieval performance of 28 well-known databases for evidence synthesis and concluded that, some databases, such as Google Scholar, are useful for cross-checks,

while they are not suitable for reviews. For this reason, Web of Science database was selected among the principal sources they listed. The study was framed with articles in English published in the last 5 years. After an advanced search, it was seen that there were 70 studies, but since 6 of them could not be reached and 4 of them have only abstract in English, the study has been carried out with 60 studies. After screening the related research, it has been seen that 57 of them are relevant for that review.

3. Findings

3.1 RQ1

After screening relevant published research, we wanted to see how articles are distributed based on the research methods in order to weigh in on the experimental design and reveal the courses which virtual and augmented realities are integrated.

Table 1: The distribution of research methods in relevant published research

Research Methods	Frequency
Theoretical Studies	9
Survey Studies	10
Experimental Studies	31
Qualitative Methods	2
Systematic Reviews	5

Based on the information presented in the Table 1, it can be said that experimental studies have been most frequently used in virtual and augmented realities research in higher education. The shorting of the research methods follows experimental researches (31) as survey studies (10), theoretical studies (9), systematic reviews (5), and qualitative methods (2). After mapping the research methods in relevant published research, we wanted to see if there is a distribution of the courses the studies conducted in experimental studies. For this reason, for that part, we focused on experimental studies (n=31).

Table 2: The distribution of the courses the studies conducted in relevant published research

Courses	Frequency
Teacher Education	4
Medicine	9
Engineering	8
Tourism	3
Business	2
Social Sciences	5

After screening process, it can be seen that there is a distribution of course in virtual and augmented realities research in higher education. Based on the information relevant published research provided (Table 2), it can be said that virtual and augmented realities in higher education have been mostly implemented in the medicine courses. Those courses consist of medicine, surgery and nursing subjects. The shorting of the courses the study conducted follows medicine (9) as engineering (8), social sciences (5), teacher education (4), tourism (3) and business (2).

After mapping the courses studies conducted in relevant published research, we wanted to see if there is a distribution of the teaching strategies in virtual and augmented realities research in higher education in experimental studies (n=31).

Table 3: The distribution of teaching strategies in relevant published research

Teaching Strategies	Frequency
Simulation (Scenario-based learning)	11
Digital learning environment	8
Field trips	4
Assessment	2
Classroom replica	2
Virtual lab	2
Drama	1
Library	1

After screening process, it can be seen that there is a distribution of teaching strategies in virtual and augmented realities research in higher education. Based on the information relevant published research provided (Table 3), it can be said that simulations have been mostly implemented in virtual and augmented realities research in higher education as a teaching strategy. The shorting of the teaching strategies follows simulations (11) as digital learning environment (8), field trips (4), assessment (2), classroom replica (2), virtual labs (2), drama (1), and library (1). Simulations are explained as a scenario-based learning in some researches and students were expected to complete some tasks based on the scenario. Besides that, virtual and augmented realities in higher education have been mostly used to create a virtual environment for students to access digital learning environments.

3.2 RQ2

Lastly, when we looked at the limitations of the relevant published studies, it can be said that there are a bunch of limitations of using virtual and augmented realities in higher education.

The first is that, as Kim et al. (2017) point out, the number of participants was small. Larger samples were required to draw a conclusion about successful use virtual and augmented realities in higher education.

Another limitation of use virtual and augmented realities in higher education was that the majority of the participants had never tried immersive VR or AR before; thus, the positive results favouring the immersive platforms could be due in part to the technology's novelty (Makransky & Lilleholt, 2018).

VR and AR are still a relatively new technologies, and some of the participants were unfamiliar with it (Alahmari et al., 2019), this situation makes it difficult for the researcher to obtain data from an exploratory source.

Another limitation of use virtual and augmented realities in higher education is availability and accessibility of the enabling technologies, and the supportive resources (Ip et al., 2019; Fransson et al., 2020). Sustainability, maintenance and outreach are very critical issues for the universities and they are also limitations of use virtual and augmented realities in higher education.

4. Discussion

Despite the popularity of virtual and augmented realities, they are not widely used in education because of their limitations including required technologies, the cost and etc. In order to gain a better understanding of how they were used in higher education so far and what the trends regarding courses and teaching strategies in which virtual and augmented realities were integrated were, it was thought that it may be helpful to conduct a systematic review of the use of virtual and augmented realities in higher education.

In this short paper, we tried to present trends on both the courses the studies conducted in relevant published research on virtual and augmented realities in higher education and teaching strategies on the use of virtual and augmented realities in higher education. Based on the findings, it can be said that virtual and augmented realities in higher education have been mostly implemented in the medicine courses. Those courses consist of medicine, surgery and nursing subjects. Medicine courses are followed by engineering and teacher education courses, respectively. Regarding the teaching strategies, it can be said that simulations have been mostly implemented in virtual and augmented realities research in higher education as a teaching strategy. The shorting of the teaching strategies follows simulations as digital learning environment, field trips, assessments and virtual labs.

In terms of interaction and collaborative learning, the teaching strategies used with virtual and augmented realities do not provide the interactive environment and opportunity for collaborative learning for students, contrary to expectations. Simulations have been mostly implemented in virtual and augmented realities research in higher education as a teaching strategy, but those simulations do not give any chance to students to interact with their peers, even though research shows that any increase in environment interactivity will increase user's confidence (Al-Hatem et al., 2018).

Based on those findings, it can be recommended that virtual and augmented reality tools should be used carefully in higher education to give students more interactive learning environment and let them to work collaboratively, not just a new tool.

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