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A Systematic literature review on implementation of virtual reality for learning

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Abstract

Learning in this modern era can use various kinds of technology. One of them is virtual reality. Virtual Reality is an environment generated by a computer that makes the user feel immersed with the object that is generated in their surroundings. This paper presents a previous review to understand the implementation of virtual reality in learning. This paper uses SLR as a research method. The study concludes that there is one device for implementing virtual reality called Head Mounted Displays (HMD) and Google Cardboard, two types of user experience, and how far virtual reality has been applied in learning so far. To this day the implementation of virtual reality for learning is still a bit difficult to do because the lack of suffice facilities due to limited funds.

Keywords: virtual reality; learning; implementation; systematic literature review;

1. Introduction

Virtual Reality is an environment generated by a computer that makes the user feel immersed with the object that is generated in their surroundings.Virtual reality often relates to objects like a helmet or headphone-like object that helps the computer visualize the environment for the user[1]. These devices will help the computer to visualize the generated environment for the users to interact. The output of visualization can be objects of options and animation floating in front of the user to interact with or even a 3600 room, allowing the user to walk around and interact in it[2][3].

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Because of the after effect of the pandemic COVID-19 in this era of education, most of the students are learning remotely from their home mainly[4]. Although the institution and government has declared that the pandemic is already over, most parents and even the students are still afraid of getting into contact with other people. Therefore, most of the institutions have given the student free will to choose whether they want to attend class onsite or online. Students who choose to have classes on site are required to comply with the health protocol based on the national standard and must illness-free, while students who choose to have classes online use media that is set by each institution[5][6][7].

Although the benefits of Virtual reality (VR) in education are much imposed by educators, but there is also still reluctance to use them in the classroom. Additionally providing students with deep learning experiences, other benefits of Virtual Reality (VR) in education include the ability to inspire student creativity and trigger their imagination[8][7][9][10]. And this can motivate them to explore new academic interests[6]. AR and VR in education can assist students who have difficulty understanding difficult academic concepts, such as, geometry students can see the 3D geometric form from various perspectives by using AR; Their interaction with the shape to look it from a different angle and even catch sight of it from within[11][12].

This research is necessary to know how Virtual Reality (VR) works knowing that it is going to be using them in a routine basis of teaching and learning activities and not less important, the application needed to run Virtual Reality in advance to future developments in education (VR)[13][14].

To assist students and educators in teaching and learning activities, Virtual Reality has developed in more ways[15]. Beside makes learning activities more fun, Virtual Reality also assist in visualizing various parables that usually makes the teachers in distress trying to explain what that parable would be[7][9][10][16].

The important key in implementing Virtual Reality is understanding how it works, and the development of its progress will decide the outcome of Virtual Reality's competency in the current condition of teaching and learning activities.

Therefore, the main purpose of this research to know what virtual reality is, devices that is commonly used in learning activities, user's experience with virtual reality in the past view years, and virtual reality progression through out the years[17][18].

Last but not least, this research also need to know how far does Virtual Reality has already changed the ways of learning in our current education system, and what will it changes.

2. Research Methodology

2.1. Systematic Literature Review

Systematic literature review or SLR is a literature review method that identifies, assesses, and interprets all findings on a research topic, to answer research questions that have been determined before.

In order to allow the literature review process to avoid bias and subjective understanding of the researchers, the SLR method is systematically carried out by following stages and protocols.

The purpose of this research is to understand the application, user experience, and how far virtual reality has been implemented in learning. By using SLR, data from hundreds of papers can be got quickly without having to read the whole thing.

2.2. Research Question

The purpose of this research question is to help understand what will be done in this literature review. Research questions also help make it easier to collect data. Table I shows the research questions for this research

Table 1. Research Question

No	Research Question	Purpose
1	What devices can be used for learning using virtual reality?	To identify the devices that can be used for learning using virtual reality.

No	Research Question	Purpose
2	How is the experience in using virtual reality in learning?	To identify the experience in using virtual reality in learning.
3	How far has virtual reality been applied in learning?	To identify how far virtual reality has been applied in learning.

2.3. Result Finding

To answer existing research questions, this research will look for pre-existing research papers with a keyword "the application of virtual reality in learning". Table II show the result of the research.

Table 2. Search Result

No	Database Journal	Number of Article
1	IEEE Xplore	14
2	SpringerLink	7
3	Other sources	10
Total		31

The research papers which are looked for is based on several inclusion and exclusion criteria. Table III show the criteria

Table 3. Inclusion and Exclusion Criteria

Criteria		
Inclusion	I1	Articles published from 2018 to 2022
	I2	Articles are written in English or Indonesia.
	I3	Full-text Articles.
	I4	Articles are related to implementation of virtual reality on learning.
Exclusion	E1	Articles are not related to implementation of virtual reality on learning.
	E2	Similar articles from different database.

I1 so that there are not too many papers and also this paper be relevant to present time, I2 for variations in learning experiences from English and Indonesian writers, I3 so that the paper is more critical and detailed, I4 and E1 so that the discussion of the paper is focused, and E2 so that there are no similarities between the papers with each other

3. Research Result

3.1. Devices for Learning Using Virtual Reality

Virtual Reality (VR) is a computer-generated environment where scenes and objects looks realistic, giving the user the feeling of being immersed in their environment. It can be divided into 3 types of immersion, that is non-immersive, semi-immersive, and immersive[2][3].

Virtual Reality devices that mostly used are Head Mounted Displays (HMD) which are categorized as Immersive-Virtual Reality which have tools such as 3D mouse, wired glove, motion controller, and optical tracking sensor for more immersive experience. With data collected from all previous literature reviews, Oculus is the most mentioned device used with 13 to 29 in the study scale in an institution, especially for cognitive skill development[19][20].

Another device VR wearable is the Google Cardboard which makes use of the user own phone to support low quality 3D immersion. Device for learning Virtual Reality is the Oculus Rift VR headset which can provide a vivid experience and an increase sense of immersion, or the Google Cardboard[21].

The results of the analysis that this research found are that there are many devices that can be used for learning with virtual reality, but the most popular devices used are head mounted displays (HMD).

3.2. User Experience Using Virtual Reality in Learning

Virtual Reality (VR) has made significant innovation in both of customer and professional sectors. As VR has old enough as a technology, its whole practicality for use in education also increased[17][18][22]. Virtual Reality (VR) has also gained popularity in the educational environment in recent years[13][14]. The results showed that the use of Virtual Reality greatly increased the effectiveness of experimental or practical learning activities[8][20], while cognitive learning outcomes showed a slight increase in the effectiveness of future learning results[23][15]. Virtual Reality also provides authentic learning. Authentic learning is a concept to bring the real world or real experience closer to students in the classroom. The use of authentic learning that presents reality in the classroom is more contextual with students' daily activities[11][12]. Application of Virtual Reality in the educational domain have many benefits: they engage students, increase student curiosity, facilitate the communication of information, and motivate students to improve their learning as well as their performance[24][25].

The development of Virtual Reality-based applications that are getting better is very useful in the education, because it will help teachers in conveying various materials, such as science material regarding the excretory system in the human kidney. With the help of the development of Virtual Reality applications, learning for students or ordinary people becomes more interesting and more understandable, because the application visualizes three-dimensional objects the parts being studied, such as the human kidney. The long-term benefits of learning that are understood by students / ordinary people will increase knowledge, increase awareness and can change the way people think about their health, for example kidney health and the excretory system, so that health is maintained properly[26].

3.3. Virtual Reality Application in Learning So Far

From the literature review data thats has been collected, this research know that although the level of interest in the use of Virtual Reality is quite high[27], the readiness of Virtual Reality to be applied in learning systems is still questionable[2], not in terms of effectiveness results but mainly due to the lack of suffice facilities and understanding of how Virtual Reality work[28][29].

One of the applications of Virtual Reality in learning is in learning about the solar system. In order to make learning interesting, virtual reality educational games are made so that students can learn about the solar system by understanding and attracting their curiosity. The results of the research and application of virtual reality-based educational games, it turns out that students become more enthusiastic in learning, so that learning becomes interesting (not monotonous), but the weakness in the implementation of this educational game is that the Virtual Reality Controller only supports certain tools, so it needs to be considered in making applications and supporting media such as smartphones that are used so that virtual reality can be run when the application is installed on the smartphone[30].

However, virtual reality also has its flaw. The addition of redundant form of the verbal materials will actually have a negative impact on learning which will increase the workload of students so that it will reduce the effectiveness of their understanding[31].

Although Virtual Reality is developed more ways to assist students and educators in teaching and learning activities to be more fun, but the implementation is still not ready because virtual reality’s maturity in the world of education is still questionable.

The results of the analysis that this research found were that virtual reality had actually been tried to be used for learning. However, due to lack of suffice facilities due to limited funds and lack of investmen , this is difficult to implement at this time.

4. Conclusion

Virtual reality is an environment where the user is taken into a 3600 computer-generated room. The device that is mainly used for supporting the Virtual reality is the Head Mounted Display(HMD) where the most popular device that is used for learning using virtual reality in most of the university that has implemented it is Oculus. Although virtual reality has been implemented in the past years, it is still not been implemented in many universities. The reasons behind this phenomenon is because virtual reality's maturity in the world of education is still questionable because addition of redundant form of the verbal materials will actually have a negative impact on learning and most universities is still not ready to implement it due to lack of knowledge and funds to support in implementing virtual reality in their studies.

This research's is made in hope that further research will find how to make virtual reality applicable in learning even with suffice facilities and limited funds.

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