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Exploring the Pedagogical Potential: Virtual and Augmented Reality integration in education

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Manuscript Details	Abstract

Abstract

AR and VR are two technologies that are gaining popularity in the technology world. AR and VR are gradually replacing, or enhancing, the real-life environment with a virtual one. This technology is having an impact on many aspects of life, including gaming, marketing, e-commerce, education, and many others. We will be focusing on virtual and augmented reality in education in this research paper. In the field of education, this technology has the potential to significantly improve students' skills and knowledge. In this paper, we will examine how far AR and VR have progressed in education, as well as the benefits and drawbacks, as well as the challenges that have been encountered.

Keywords: Augmented reality, Virtual Reality, Pedagogical Potential

1. Introduction

AR (Augmented reality)/VR (Virtual Reality) are the recent advancements in the field of technology. Augmented Reality in simpler terms means it creates an experience where designers augment or enhance a person's physical world with a computer-generated input. Whereas, VR, that is virtual reality is a three-dimensional environment that is computer-simulated, which can be interacted with using a special electronic equipment. Augmented Reality and Virtual Reality has already demonstrated its efficacy and use in various fields such as Fashion, Gaming, Medical, etc. Likewise, AR/VR has great potential in education also. the term "Virtual Reality" was proposed in the United States in the 1980s by Jaron Lanier [20].

Virtual Reality dips you into the virtual world by using the headset with some type of screen which will display the virtual environment around you through the headset. The headset will also show the environment around you by just physically moving your head by giving you the experience as if it is really

around you. The display will move in the direction you move, giving you a 360-degree view of the virtual environment. Some Examples would be Oculus Rift, Vive, etc

Augmented Reality on other hand allows you to perceive the world around you with digital images. AR can be used without the headset also. There are various apps that are built using AR. For example, we can translate the text using the camera. AR shows virtual images into the physical world by using the phone camera or video viewer. Some examples would be Microsoft HoloLens.

2. Literature Review

This research paper tells you that many academics have started adopting VR technology for doing their research and for teaching the students. VR gives the immersive visual using 3D data, it provides a very realistic view like it's a new real world. VR is not limited to small markets. As illustrated by the diversity of participants and applications, it has broad potential to change the world and has become more mainstream in a variety of situations. By doing findings they have come to some more features they can add for a variety of people mainly focusing on people with disabilities. Also trying to find different ways of teaching using VR technology [1].

More affordable and technically greatest mass-market VR headsets became widely available in 2016 with the release of the Oculus Rift and HTC Vive systems. Because of this AR/ VR technology, students' attitude towards studies is changing, they are becoming more confident and self-sufficient. The features can also assist teachers in clearly explaining concepts to students. Participants and students who have expressed an interest in using AR technology have also given positive feedback about their education procedures [2].

This research also compares AR to conventional systems (such as e-learning and courseware) and conventional teaching approaches (chalk and talk and traditional books). A review of the literature, however, finds that the majority of the limitations are technical in nature. These obstacles will be addressed over time as research on the integration of AR in education is replicated and polished. When the full potential of AR technologies is achieved, its beneficial functions can be widely implemented in all disciplines of education, resulting in greater teaching and learning efficiency [3].

The perspectives of students in three areas regarding utilizing AR as a learning aid were addressed in this cross-case study. The findings imply that augmented reality (AR) can improve a student's learning experience. Students were not only fascinated by the technology, but they also found it relevant to their employment prospects even outside the classroom. Instructors in each field included in this research expect to modify their subsequent AR course projects as a result of the outcomes of this study [4].

This research used a data analysis method to examine 105 institutional AR papers from the ERIC, EBSCOhost, and Science Direct collections. According to the findings of the research, augmented reality (AR) is a technology that is applied in education in a variety of sectors. The most common applications of AR are in science, engineering, and medical training. Likewise, AR is used in training distinct sample levels, which can also be explained by an AR feature: mixing the real and the virtual [5].

The evaluation of VR and mobile applications in the field of education is carried out. To achieve the most accurate and objective outcomes, they had to ensure that both applications were examined on the very same criteria. In the initial review process, VR includes mainly, the interactive experience, in which the user can become a member of the virtual environment. They observed in the second review phase that the benefits of adopting VR are that it generates a view of the topic, in our case of astronomy, it allowed people to experience the scale of the planet [6].

It can be seen that VR and AR are frequently incorporated into Block chain-based systems as

technological solutions capable of improving how users engage with virtual media. Many times, psychological consequences are associated with how users interact with such content in interactive, 3D settings. The economic benefits of incorporating Block chain into VR/AR solutions lay in the ability to link digitizing currencies where commodities and payment processes may be administered in an innovative and comprehensive manner inside unified platforms [7].

In this study, the authors offer an algorithm to assist marker-based augmented reality teaching techniques. After that, the given lecture is compared to traditional teaching methods. The findings demonstrated that the new method can be used for instructional purposes. Their method introduces a new manner for students to study chemistry quickly and effortlessly [8].

The authors of this study discovered that using virtual reality technology enhances student participation and attentiveness, while the comprehensive and dynamic experience motivates students to become better learners. Exposing students to this technology in the teaching and learning systems will help educate them to use it constructively outside of the classroom [9].

Researchers discovered that AR may be utilized to improve language instruction, mechanical skill training, and spatial ability training. Nonetheless, AR should not be regarded as a panacea in educational settings. Because each AR application is unique in its own manner, the benefits listed may not apply in every situation [10].
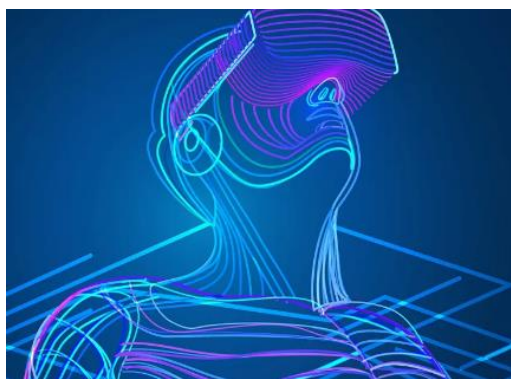

Figure 1. Virtual reality

3. Use Cases

Immersive technology has the ability to change the way people learn. AR VR improves our ability to learn and teach by demonstrating how and why lessons are taught. Here are a few examples of how AR and VR can be used in the real world.

Virtual field trips: Using virtual reality, kids can experience what it would have been like to live in the past and see a historic event. VR headsets can be utilized in the classroom or at home to take virtual field trips to museums and nations. This will allow students to participate in historical events and will help them have a better knowledge of the subjects.

The SkyView app allows pupils to explore the universe through augmented reality night sky overlays. Anyone may use SkyView to identify stars, constellations, planets, and even satellites by just pointing their mobile device upward.

Medical education and training: Immersive technology can be employed in chemistry, biology, physics, and other subjects. In digital reality, applications can depict complex processes such as the human brain and visualize abstract concepts. It enables pupils to combine theoretical and practical components of lessons. Immersive realities can pique students' curiosity in novel solutions that are more engaging than lecture-style explanations. It also allows for safe and effective medical simulations to be used to instruct trainee doctors and paramedics, lowering risk and enhancing confidence.

In biology class, students had to dissect frogs to learn about animal internal parts. That method was revolting to them, and it was even worse for the frogs! Students can now use the Froggipedia app's augmented reality technology to explore a frog's interior organs.

Medical students and professionals can learn about the human body via mixed reality thanks to Microsoft HoloLens. Students can go inside the human body, flow

through the bloodstream, isolate, enlarge, and even flow through the bloodstream to learn not just anatomy but also how to cure various medical diseases.

Using augmented reality to bring science concepts to life We can now employ augmented reality to build a tornado and then bring the funnel right into the classroom, allowing kids to see these catastrophic storms up close. Students can also take an augmented reality tour of a beehive to learn about its inner workings and how bees collaborate to help the community.

Police Training: In professional scenarios, training organizations can use extended reality. In an effort to make streets safer for both civilians and policemen, police agencies are increasingly utilizing virtual reality to train cops on how to deal with riots or arrest people in specific situations.

Classroom Education: In the classroom, AR VR may transform routine lessons into dynamic and engaging experiences. Immersive technology assists pupils in comprehending and remembering information. For example, the AR software can allow children to view dinosaurs in action and learn about different birds and animals in a real-world setting.

You may now put on your virtual reality goggles and practice a speech in front of a simulated audience before heading out on a real stage. With immersive, realistic virtual reality simulations, Virtual Speech helps you enhance your public speaking skills.

When studying languages through books, it can feel quite theoretical, but virtual reality educational software firms like Mondly can deliver an immersive language-learning experience without the need to fly to another place. You can have actual discussions with real people in Mondly's VR settings, enhancing your language learning and increasing its likelihood of sticking.

Student Recruitment: Virtual tours allow students to travel around the world and visit any school or university campus. The cost of these virtual tours is lower. Students' involvement is increased, and they are better able to make decisions regarding their university as a result of their VR experience.

4. Advantages

By using AR VR in education students feel more connected to students than the previous ways of learning. The avatar that is used in education for teaching, makes the students connected to them. Because of visual learning, it has become easy for the students to enhance their memory retention.

It will be a great advantage for the students who have difficulties in learning, like regarding the concepts or any other thing. By using AR VR in education, it will become easy for students to better understand the difficult concepts by visualizing learning.

It will make the learning very engaging and interesting remotely also. It will make the students feel confident about themselves by using this great learning tool.

AR-enhanced classes can help students become more involved. An interactive learning environment allows for the implementation of hands-on learning approaches, which can boost engagement, enhance the learning experience, and encourage students to learn and practice new skills.

5. Challenges

1. **Cost-effectiveness**
Given that education is typically a government-funded effort, the cost-effectiveness of integrating AR/VR technologies is the most frequently asked question.

To make the VR solution available, you will need to invest in equipment (helmet or glasses + controllers). Fortunately, there are some excellent low-cost solutions accessible (for example, Google Cardboard). A business analyst can assist you to figure out what the equipment should be capable of, and then it's up to you and your investors to decide.

You will need to invest in the creation of true AR/VR content. While some solutions provide building blocks, others particular training may necessitate starting from scratch.

2. Content Development

One of the most significant barriers to widespread adoption of VR and AR solutions in the educational process is purely practical: it requires a significant amount of effort to generate quality AR/VR material that meets the needs of educational programs.

Basic VR and AR solutions available on the market are insufficient for creating interesting content. They can be used as a supplement but not as a replacement; teachers cannot create immersive experiences on their own, hence there is a need for outsourced developers.

Finally, the material must be adjusted in response to feedback from the target audience.

6. Real Life Examples

Children at Moorkanad, a town close to Valanchery, erupted in excitement as their instructor brought an elephant into the room. There wasn't, however, a true elephant in the room. Instead, the school, which is still forced to use virtual instruction because of the COVID-19 predicament, makes use of augmented reality's potential to make its classroom teachings engaging and innovative despite the physical distance.

In Smt. Godavari Devi Saraf Senior Secondary School in Vizianagaram District of Andhra Pradesh, paid about 4-5 lakhs to obtain VR headsets. You could see some pupils during school hours crowded around a computer wearing enormous spectacles. To learn about the functioning of the human heart more effectively than through a simple textbook chapter, these students are utilising virtual reality (VR) headsets to watch how a human heart pumps blood. For example, if the teacher wants to talk about some animals, let's say dog, then he/she can show the virtual simulation of a dog walking around.

HoloLens for example allows medical students to manipulate and visualize the human body with unprecedented accuracy [21].

7. Findings

Any learning programme that makes use of cutting-edge learning technologies should be prepared for technical difficulties. We advise starting an experimental programme with a small group of students to address technological issues. Your company can then identify problems that students encounter and develop solutions before implementing them across the entire corporation.

To encourage professor and student interest in VR, employ demonstration tactics. Create reproducible processes that a range of stakeholders can use. Create management strategies for 3D/VR hosting facilities that involve hiring student help to manage the maintenance of VR technological facilities and the production of VR content.

The cost-effectiveness of AR and VR is comparable to a one-time technological investment. Even if we don't have enough money to purchase VR and AR headsets for every student, we can still purchase some that can be easily cleaned and reused. VR headsets typically range in price from $400 to $1200 plus shipping. There are new cardboard headsets available for $10–$20 if you cannot afford this.

8. Conclusion

VR and AR are very big advantages in the education sector. The purpose of this research paper was to examine where AR and VR is being used in other sectors and mostly in the education sector. How VR and AR usage is growing in the education sector. The teacher needs to change the way of studying students by accepting the different ways to teach using AR and VR. Teachers can improvise the way of learning to students and also engage the students in learning which will be changed after using AR and VR. It should also

not be used for many hours as it can affect the health. There are some challenges faced using AR and VR in education, but we need to overcome and increase the usage of technology in education. Indeed, it cannot replace physical education, but we have an added advantage in teaching.

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