AMERICAN JOURNALS
Open Access, Peer Reviewed Journals

American Journal of Technology and Applied Sciences
ISSN (E): 2832-1766| Volume 19, December, 2023

USING VR/AR TECHNOLOGIES IN THE PROCESS OF TEACHING PHYSICS

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A B S T R A C T

Aspects of the use of virtual and augmented reality technology in the school education system are considered. The advantages and limitations of using these technologies are given. Directions and examples of the use of virtual and augmented reality technologies in the educational environment are offered. When used correctly, these technologies can help create an effective modern educational environment, individualize the learning process, and expand learning opportunities.

K E Y W O R D S

Innovative education, virtual reality, augmented reality, Virtual Reality, Augmented Reality, interface, VR platform, educational content.

Introduction

Virtual reality (VR) and augmented reality (AR) have enormous potential for application in the education system. They offer new and innovative ways of learning that complement or even replace traditional teaching methods. In this article we will look at the possibilities of using VR/AR technologies in the learning process, and also provide several popular VR platforms and programs, AR technologies and applications, examples of research and practical applications that significantly improve learning efficiency, stimulate active participation and increase motivating students to learn materials.

Virtual reality (VR, Virtual Reality) is an artificially created projection of real or fictional objects in the form of a three-dimensional scene, with which the user interacts in various ways. Virtual reality involves the user's complete immersion in it with isolation from the real world. To perceive content, special helmets, glasses, or specially equipped rooms and even cars are often used [1].

Methods and Results

Unlike virtual reality, AR interfaces allow users to see and manipulate virtual objects integrated into the real world in real time [2]. Augmented reality is an intermediate link between reality and the virtual environment.

VR and AR provide students with a unique opportunity to visualize abstract and complex concepts that may be difficult to present using traditional teaching methods. Using 3D models and simulations, students can explore physical phenomena in a virtual environment or see augmented visual elements in the real world. This promotes deep understanding and better mastery of physics concepts.

Students will have the opportunity to simulate physical phenomena, change parameters and observe the results of virtual experiments. This allows them to experiment, make mistakes, and learn the consequences of their actions.

VR and AR also provide the opportunity to create interactive challenges and game elements, making learning more fun and engaging. Students can participate in built-in virtual games and activities, solve physical puzzles, and take on challenges to encourage active participation and develop problem-solving skills.

VR and AR help improve distance learning and promote interaction between learners and teachers. Using a VR environment, students can join virtual classes, communicate with other students and teachers from different locations, and collaborate on projects and assignments.

VR and AR provide the opportunity to create personalized educational content that can be adapted to the level of knowledge and needs of each student. Using machine learning algorithms and data analysis, it is possible to develop individual educational programs, taking into account the characteristics of each individually.

All these VR and AR opportunities in education allow schoolchildren to dive deeper into the study of physics, actively interact with educational material and develop their skills. They open up new perspectives for educational processes and can significantly improve the quality of teaching in the field of physics.

Virtual reality (VR) also provides a unique opportunity to create immersive environments in which students can interact with 3D objects and visualizations to recreate various physical phenomena. There are several popular VR platforms and programs specifically designed for teaching physics.

Augmented reality (AR) is a technology that allows you to add visual elements and information to the real world using special devices such as smartphones or AR glasses. In education, AR technologies can be used to create interactive educational content and improve understanding of physical phenomena.

Conclusion

Let's consider some AR technologies and applications, as well as popular VR platforms and programs used in teaching physics:

Google Cardboard is an affordable and easy-to-use VR platform. It allows you to turn your smartphone into a virtual reality headset. Using special applications such as " Cardboard" Theater " or " Titans" of Space ", students can explore 3D models of planets, stars and other space objects, as well as learn physical laws related to space.

Oculus Rift is one of the most popular and advanced VR platforms. With its help, students can immerse themselves in virtual laboratories and simulations specifically designed for teaching physics. For example, the " NewtonVR " application allows students to conduct virtual experiments with physical objects and observe changes in real time, and the " Universe " application Sandbox " makes it possible to explore and simulate space objects and physical processes in the Universe.

HTC Vive is another popular VR platform that features high visual quality and deep immersion. Using applications such as " The Body VR" or " Nanome ", students can explore the internal organs of the human body or molecular structures in a 3D environment. This allows them to better understand anatomy and molecular physics.

PlayStation VR is a VR platform developed for PlayStation game consoles and can also be used for educational purposes. For example, the Statik app challenges students to solve physics puzzles, while Apollo 11 VR lets you recreate the historic Apollo 11 mission to the moon.

These VR platforms provide a wide range of capabilities for visualizing abstract physics concepts and conducting virtual experiments. They create a more visual and interactive educational environment, stimulating students' interest and allowing them to gain a deeper understanding of physical principles and laws. Virtual reality complements traditional teaching methods and opens up new avenues for physics education.

ARCore and ARKit: Google 's ARCore and Apple 's ARKit are platforms and toolkits for developing AR applications on smartphones. They provide the ability to add visual elements to the real environment. They can be used to create visualizations of physical phenomena such as gravity, electromagnetism or optics and integrate them into the real world. These applications allow students to observe and interact with 3D models and animations, promoting a deep understanding of physics concepts.

AR glasses like Microsoft HoloLens or Magic Leap, allow you to project visual elements directly onto the user's field of view, creating an augmented reality effect. They can be used to create 3D models of physical objects such as molecules, electrical circuits or mechanical systems and place them around students. This allows students to literally “see” and interact with physical phenomena in their environment, which greatly improves their understanding of physics concepts.

One of the main advantages of using augmented reality in school education is the ability to add an additional layer of information to the real world during the educational process. This can help students better understand and remember course material. For example, students can use augmented reality to overlay virtual markers on animals and plants in the landscape to learn more about their lives and behavior [3].

There are many apps specifically designed for teaching physics using AR. For example, the application " PhET Interactive Simulations " offers a wide range of interactive simulations of physics phenomena that can be visualized in the real world using AR. These applications allow students to conduct virtual experiments, change parameters and observe results in real time, which promotes deeper understanding of physics concepts.

AR technologies provide opportunities to create interactive educational content and improve understanding of physical phenomena. They allow students to visualize abstract concepts, observe and interact with 3D models, and conduct virtual experiments in the real world. This promotes more active and visual teaching of physics, helping to increase students' interest in science.

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