International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 8 Aug 2023, pp: 568-571 www.ijaem.net ISSN: 2395-5252

Application of Virtual Reality in Technical Technology Training

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Date of Submission: 15-08-2023 Date of Acceptance: 25-08-2023

ABSTRACT: Virtual reality (VR) technology has advanced dramatically in recent years and has become a powerful tool in technical and vocational training. The significant growth of VR has created new opportunities to enhance training quality, improve learning efficiency, and create authentic, interactive learning environments. In the field of technology, the adoption of VR is helping students and staff in the industry learn and work more efficiently and safely.

Keywords: Virtual Reality,VR, Technicaltechnology training, Training in technology.

I. INTRODUCTION

Training using virtual reality technology (VR) is commonly known as the process of learning in a simulated or artificial environment. This technology is applied to improve the quality of education and training because of its advantages, especially in the fields of health, engineering, military, culture, tourism, scientific research, and aerospace. pillars and space...

Virtual reality is a technology that creates a simulated environment like the real world. It has many applications in the fields of entertainment, education, and training. In this article, we will discuss the application of virtual reality technology in technical and vocational training.

One of the key benefits of virtual reality training is that it provides a safe and realistic environment in which to practice skills that are difficult, dangerous, or expensive in the real world. For example, VR can be used to train pilots, astronauts, soldiers, surgeons, firefighters, and other professionals to face high-risk situations. VR helps them learn from their mistakes without significant consequences for themselves or others. [1] [2]

Another advantage of virtual reality training is increased learner engagement and retention. VR creates immersive and interactive experiences that capture learners' attention and motivation. It provides instant feedback and personalized guidance that helps learners improve their performance. Research has shown that VR training can increase knowledge retention by up to 75% compared to traditional methods. [3] [4].

A third benefit of virtual reality training is the reduction in training time and costs. VR eliminates the need for facilities, equipment, instructors, and travel costs often associated with conventional training. It allows learners to access the training anytime, anywhere, if they have a VR device and an internet connection. VR also shortens learning time by helping learners primary skills faster than in real life [1] [2].

As an inevitable trend in the rapidly evolving technology landscape, educators are starting to rely on VR simulations to develop learning experiences. The application of VR technology in teaching in general and in engineering provides learners with a new and more effective learning platform than traditional teaching methods.

The application areas of virtual reality are different, to a certain extent due to the emergence of Industry 4.0, but the main approach of these technologies is based on modular learning and training. For automotive technology training and immersive virtual reality applications, some examples include driving simulation software, automotive design, and virtual car dynamics. The great advancement of automotive technology has created an increasing demand for high-quality human resources in this industry. At the same time, ensuring safety, efficiency, and accuracy in training becomes a challenge forvocational training schools and related businesses. However, with the development of virtual reality technology, vocational training in the automotive industry has become easier than ever.

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II. APPLICATION OF VIRTUAL REALITY IN EDUCATION AND TRAINING IN TECHNOLOGY

2.1. Virtual reality trips

Field trips have long been an integral part of the educational landscape. They help teachers and students better understand real-world concepts, make learning more effective, and motivate concepts in the classroom. However, organizing field trips is not simple, requires high costs, and is often difficult to schedule in a challenging environment. Fortunately, many organizations today have moved their field experiences online, while others have created new virtual rides to explore everything from shipwrecks to amazing works of art. great literature.

Virtual field trips are a great option for students when they do not have the necessary equipment to access the library. All these opportunities are free and do not require any special technology. These 11 exciting field trips can be closely linked to the curriculum, helping students open the world at home.

VR helps students go to places they cannot go to in person, like museums, monuments, or even other countries [5]. Students can explore and learn about different cultures, environments, and terrain conditions in a lively and interactive way. For example, Google Expeditions offers a series of virtual field trips on a variety of topics, such as science, history, and geography.

Fig 1. A free virtual reality trip to see the world of students

1.2. Design and prototyping:

VR can help students design and visualize their own mechanical products and systems using 3D modelling tools. For example, the Immersive Virtual Reality Lab at Qatar University allows students to create and test their own mechanical designs using VR gloves and CAVE monitors.

This is an excellent example of how VR can assist students in designing and visualizing their own mechanical products and systems through 3D modelling tools. The Immersive Virtual Reality Lab at Qatar University is one of the leading VR hubs in the region, providing innovative research and training opportunities for students and faculty [6].

Using VR gloves and CAVE monitors, students can create and test their mechanical designs in real and interactive environments. VR Gloves allow them to manipulate virtual objects using their hands, while the CAVE display creates immersive 3D spaces across multiple walls and floors [7].

Fig 2. Virtual Lab

With these tools, students can enhance their creativity, problem-solving, and teamwork skills and get feedback and insights into their designs. For example, they can test a product's performance, durability, and safety under a variety of conditions and situations, such as stress, temperature, vibration, and more. They can also adjust. design instantly and see the impact of those changes right away [8].

Moreover, VR also helps students present their work to potential employers or customers in a more attractive and impressive way than using conventional methods. At the same time, VR helps them communicate their ideas more effectively and clearly by explaining product features and benefits using visual aids.

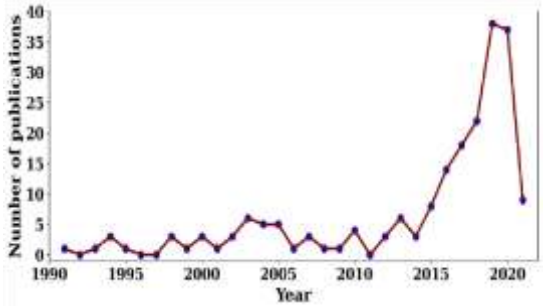

Fig 3. Distributing published literature over time on the use of Virtual Reality in education and training in the automotive industry

According to the graph above, the publication of documents from about 1991 to 2012

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shows very little, with a slight increase from 2003 to 2005. From 2013 to 2014, documents related to the model 3D simulations for training in virtual environments, e.g., car driving simulators, working on assembly lines in the automotive and aeronautics industries, and training for astronauts, The pinnacle of publications in 2019 with 38 documents.

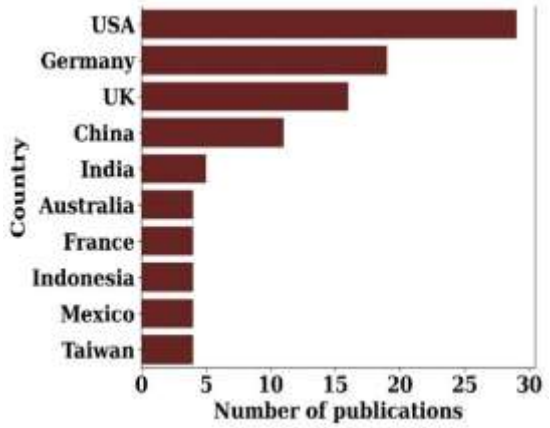

Fig 4. Distribution of publications documenting the use of Virtual Reality in education and training by the automotive industry

According to statistics, the country with the highest number of publications is the United States with a total of 29, followed by Germany with a total of 19, and in third place is the United Kingdom with 16 documents. It is important to note that these countries have a very developed automotive industry, so it is common to find new techniques for education or training in this area [Figure 4].

1.3. Simulation and testing

It is an excellent example of how VR can assist students in simulating and testing the performance and functionality of their mechanical products and systems under different conditions and situations. The Virtual Reality Centre at Michigan Technological University is one of the most advanced VR facilities in the country, providing innovative research and education opportunities for students and faculty.

Fig 5. Visiting virtual reality at Michigan Technological University [9]

By using haptic devices and motion platforms, students can simulate and analyze the behaviour of mechanical systems in real and interactive environments. The haptic device helps the user receive haptic feedback such as force, vibration, or temperature, while the motion platform allows the user to move in a virtual motion such as acceleration, rotation, or tilt.

Thanks to these tools, students can enhance their understanding, evaluation, and optimization of their mechanical products and systems and gain valuable feedback and performance insights from them. For example, they can test the effectiveness, reliability, and safety of the product under different conditions and situations, such as load, speed, friction, etc. They can also compare different design options and see the impact of those changes right away.

VR can also help students collaborate with students or professionals from different industries or locations, as they can share their simulations and data in a common virtual space. VR also helps them communicate their results more effectively and clearly, as they can present their findings using visual aids.

1.4. Advantages of VR application in training:

The application of virtual reality (VR) technology in training institutions brings many important advantages, as follows:

Create a safe, realistic, and controlled environment for learning and practicing skills, especially in dangerous or complex situations. For example, VR assists in training pilots, astronauts, soldiers, surgeons, firefighters, and other professionals, helping them to cope with high-risk situations. [9][10].

Enables distance learning, saving time, money, and the environment. VR eliminates the need for facilities, equipment, instructors, and travel costs commonly encountered in traditional training [9], [10], [11].

Enhance information retention, increase engagement, and increase motivation by providing immersive and interactive experiences. For example, VR creates virtual reality experiences that help learners integrate language and study skills and participate in experiments, attracting attention and excitement. [10][11][12].

Provides repeated exposure and control in stressful situations, helping learners develop confidence and resilience. For example, VR simulates and tests the performance and functionality of mechanical products and systems under different conditions and situations [10].

Skills assessment and insights based on learner performance and progress data, thereby improving training outcomes. For example, VR tracks and measures various metrics of learning performance, such as accuracy, speed, error, response, etc. [9][11].

Applied virtual reality has evolved, making this technology a useful tool to meet current needs in several knowledge areas such as education [13–16], industry [17], music [17], medicine [18, 19], architecture [20], and Virtual Labs [21, 22], where the conditions of a real environment can be reproduced.

III. CONCLUSION

The application of virtual reality in training brings many benefits. It creates a safe, real-world environment to learn and practice skills, saving time and money and providing an immersive, interactive experience that improves learning efficiency. VR also helps students collaborate, share knowledge, evaluate skills, and improve training quality.

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