

CZU: 37.026:004

DOI: 10.46727/c.v2.16-17-05-2024.p132-138

UTILIZAREA REALITĂȚII VIRTUALE ÎN PROCESUL DE PREDARE

USING VIRTUAL REALITY IN THE TEACHING PROCESS

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Rezumat. *Utilizarea realității virtuale ca o secvență bine stabilită în cadrul activității de predare, poate face predarea mai interactivă și în același timp adaptată vremurilor actuale, în care tehnologia are un ritm de dezvoltare foarte rapid. Educația este un proces care evoluează continuu și care necesită ca profesorii să învețe pentru a putea alege și utiliza un mediu de învățare care să îi plaseze cât mai aproape de interesul elevilor și studenților. Va fi împărtășită experiența pozitivă a unor proiecte care au presupus achiziția și utilizarea unor ochelari VR la Universitatea din Craiova. De asemenea, vor fi prezentate o serie de softuri educaționale care pot fi utilizate de profesori în procesul de predare.*

Cuvinte-cheie: *realitate virtuală, predare interactivă, tehnologie, cască, educație SMART, soft educațional*

Abstract. *The use of virtual reality as a well-established sequence within the teaching activity can make teaching more interactive and, at the same time, adapt to the current times, where technology has a very fast pace of development. Education is a continuously evolving process that requires educators to learn to choose and use a learning environment that places them as close as possible to students' interests. The positive experience of some projects at the University of Craiova that involved the acquisition and use of VR glasses will be shared. Also, a series of educational software that educators might use in the teaching process will be presented.*

Keywords: *virtual reality, engagement education, technology, headset, SMART Education, educational software*

Introducere

After 2020, it has become increasingly visible how the traditional education process is being transformed, with the impact of new technologies being felt more and more intensely. Education evolves, with the pandemic representing an excellent opportunity for change and a technological step forward. Innovative technologies have been incorporated into the learning environment, helping educators to develop professionally in a very short time.

Before the pandemic, distance learning was only an alternative option. Currently, online platforms have become commonplace and are used by most educators, making their lives easier and the instructional process more interactive. Consultations on any subject can be given online, especially when the student's journey to school involves precious time for all the 'actors' involved in teaching and substantial financial resources for the student's family.

Online courses can be organized anytime and from anywhere when the academic is attending conferences, on an Erasmus+ mobility, or when students are on a technical visit to another location. The pandemic has created the conditions for applying common approaches and methods in teaching innovatively. The wide application of technologies during and after the pandemic has allowed academics to appreciate more the opportunities that have arisen, leading to a more active involvement of students in individual study and project activities.

SMART education gains importance by being constantly infused with technology. It relies on SMART devices, creates SMART learning environments, and uses SMART technologies [1]. Virtual reality, augmented reality, and artificial intelligence are gradually making their way into education and are part of this SMART education. Chat GPT [2] is an example of a program that simulates human conversation through text or voice interactions. It is increasingly used everywhere, including in academia. If it was used reluctantly at first, when published in international journals, one of the key questions concerns the declaration of artificial intelligence in writing articles. Courses in Artificial Intelligence, Machine Learning, Robots, and Automation are present in most Master's programs offered by universities across Europe. One of the SMART technologies is VR.

Results and discussions

VR headsets are devices that create immersive simulated environments using VR technology. In terms of construction, the VR headsets include a display that attaches to the head with an adjustable strap. The device incorporates a screen for each eye. It also contains sensors that track the user's head movements. Also, depending on the price and time of purchase, the glasses may include audio speakers and headphone ports. Advanced models of VR headsets have additional sensors that track the movements of the hands or other body parts. The device connects to a computer or game console through two controllers. This allows the user to experience an authentic 3D experience in a computer-generated environment, making the user feel part of a genuine virtual reality.

The Department of Physics of the University of Craiova has purchased VR glasses in two projects: PREVENT and VR4Learning. The first was a volunteering project, which encouraged collaborative learning between medicine and medical physics students. In the same project, ophthalmological and ultrasound screening was carried out in schools in disadvantaged areas or the university to help students understand the importance of prevention in health and clinical practice. The second project is an Erasmus+ project and has organized training, workshops, and seminars on using VR glasses in education. This project produced videos on issues of interest such as circular economy, sustainability, waste management, pollution, and alternative energy sources. Virtual scenarios were also created to help the student understand a product manufacturing process, how an artisanal chocolate business is built, how a university is organized, or what a historic building looks like.

VR glasses are generally used in [3-7]:

- Video games: The experiences are quite realistic and make users feel part of the gaming universe. Games can be recreational or educational. Through games on various levels, students can learn how to use rare equipment, understand how resources are distributed in a particular business, or how products can be placed on the shelf from a marketing point of view.
- Simulations: in aviation, navigation, and military training, glasses can help the user develop a range of practical skills or create an experience in an unfamiliar environment where the user could conduct military exercises.

- Tourism: the glasses can be used by travel agencies to introduce tourists to experiences in exotic, historical places or with various attractive sights (hotel rooms, buildings, museums, parks, botanical or zoological gardens, amusement parks) to help them make the right choice for them and their families.
- Education: provides students with interactive and engaging learning experiences such as visiting museums, exploring complex concepts, and creating practical skills. For example, medical physics students can go into an environment where there is ionizing radiation without any approvals, visit a radiotherapy ward to see the components of a linear accelerator and how it works, see how quality assurance is carried out in the accelerator, visualize the stages of a treatment plan carried out with different techniques, etc. Athletes can learn to perform certain movements correctly using Virtual Reality.
- Architecture: the VR device allows viewing and interacting with architectural projects (buildings, parks, bridges) in a 3D way. Architects and constructors from the same company or different companies, as well as national and international work teams, can collaborate on developing a particular architectural project, using the team's creativity and knowledge of the conditions and location where the project will be realized in practice afterward.
- Therapy: used for exposure therapy in the treatment of conditions such as anxiety, post-traumatic stress disorder
- Remote work and collaboration: with these glasses, people can work together in virtual spaces, even if they are physically far away.

The issue raised by VR glasses is related to the price of the software. The price of educational software such as anatomy software is significant, several hundred euros per license. However, its components make it easier for the student to understand the relationships between anatomical systems and visualize the human body in CT sections. The software has an ultrasound component, too. Medical physics students have successfully tested the software [8-9]. To understand a radiotherapy treatment plan, students must understand the tumor's location and the organs at risk regarding the dose received. The software can also be used in anatomy and physiology, radiotherapy, and medical imaging courses. It can partly replace students' clinical practice in this specialization and is an essential first step, enabling them to move towards treatment plan simulators.



Fig. 1. 3D organon software presentation (<https://www.3dorganon.com/>)

Fig. 1. shows some images from this software, showing the images' quality. The software contains four modules that can be purchased separately: Ultrasound, Anatomy, Dicom, and Quiz. Also, each module contains theoretical information about each part of anatomical systems and their relationships; the anatomical system can be decomposed and then recomposed.

Fig. 2. shows the VR Mission: ISS software. Physics students can use it to experience the weightless conditions in space, the image of the Earth from space, the curvature of the Earth, the difficulties of handling objects by cosmonauts, their movement in the shuttle, how cosmonauts must drink water, consume food, brush their teeth or other everyday things. It is an application that develops students' practical skills and helps them understand the significance of low gravity in space.



Fig. 2. Mission: ISS software presentation
(<https://www.meta.com/experiences/pcvr/1178419975552187/>)

Another exciting software for VR glasses is Nanome. Students of Chemistry and Pharmacy can successfully use it, and even Medical Physics, to understand the mode of action of radioisotopes used in diagnosing or even radionuclides in treating cancer. As shown in Fig. 3, molecules and atoms can be visualized easily.



Fig. 3. Nanome software presentation (<https://nanome.ai/>)

For astronomy enthusiasts, the software list goes on. As can be seen in Fig. 4, the Universe Sandbox software shows how a star evolves, shows planets with their moons, provides images of how galaxies are created, what solar flares look like, and much more. There are various software programs for physics and chemistry experiments, and so on.



Fig. 4. Universe Sandbox software presentation
(<https://www.meta.com/experiences/pcvr/1475034132510246/>)

Using VR glasses in education can improve the quality and efficiency of learning. Among the advantages [10-12] we mention:

- It provides interactive and immersive experiences, allowing students to actively participate in a learning experience in a three-dimensional environment, helping them to gain a deeper understanding of the content.
- Users visualize 3D objects and complex concepts, such as those in anatomy and molecular structures.
- It allows users to take virtual tours from the classroom to historical, geographical, and science museums worldwide.
- In medical physics or medicine, glasses allow realistic simulations that enable the development of practical skills without the user being in a radiation environment. Also, in aviation, students can learn to fly different aircraft types. The same goes for handling ships on oceans and seas.
- Educational content can be adapted to each user's pace and level of understanding, facilitating individualized learning.
- VR glasses experiences increase interest and motivation for learning.
- Users can work in teams in the virtual environment, making collaborative learning with users from other universities.
- The virtual environment can create a focused learning atmosphere, removing distractions from the environment.
- The VR glasses allow different teaching styles to be adapted to the student's predominant communication channel, from visual and auditory to kinesthetic learning.
- The VR environment increases student attraction to a particular discipline.

Conclusion

In general, VR goggle software contains a game component (gamification), allowing the user to answer a series of questions while earning points that motivate the user to move to a higher level.

It is up to each user where, when, and how much they use the software, which makes learning individualized and tailored to the student's needs.

VR glasses also have disadvantages [13-17], like price or students losing more time than they should. Moreover, if the glasses are not securely fastened to the head, they can cause a series of issues, such as fatigue, dizziness, and nausea. There are also several technical limitations related to resolution, visual field, and movement limitations. It can lead to social isolation and increase the risk of accidents or injury if users are focused and do not notice environmental hazards. Another disadvantage is that it can affect the mental health of younger or more sensitive users who are unable to separate themselves from the virtual environment. VR technology is evolving at a fast pace, which requires frequent updates.

Acknowledgment

The authors gratefully acknowledge the support received in the Prevent volunteering project sponsored by OMV PETROM and in the VR4Learning project, 2022-2-SE02-KA220-YOU-000100999, funded by the European Union under the Erasmus+ program. [18].

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