**Research VR/AR in Education**

\*със сив цвят е отбелязана допълнителна информация, която би могла да се окаже от полза при защита на идеята

**Metaverse, Augmented/Virtual Reality and Education**

**- Imagining the future of learning**

## What is already done?

* [**Virtual Medicine**](https://www.medicinevirtual.com/student.html) - the world’s first fully-featured portable virtual reality anatomy platform with tens of thousands of users in more than 180 countries. Benefits- reduction of expenses for operating costs of anatomy wet labs and possibility of conducting remote multi-user lessons;
* [Real world examples Of VR And AR In School Education, presented by Forbes](https://www.forbes.com/sites/bernardmarr/2021/07/23/10-best-examples-of-vr-and-ar-in-education/?sh=16480d621f48)
  + **SkyView** app allows students to explore the universe using AR overlays of the night sky
  + the **Froggipedia** app allows students to explore the internal organs of a frog via the app’s AR technology
  + **Microsoft HoloLens** has developed a way for medical students and clinicians to learn about the human body using mixed reality
  + **1943 Berlin Blitz in 360°** uses real-life footage from a nighttime raid of Nazi Germany to help students understand what it was like to live through a significant historical event
  + **Google** **Expeditions** for school trips that are too expensive
  + **Steam’s VR Museum of Fine Art** allows users to view world-class paintings and sculptures up close without fighting with crowds or protective glass
  + **Mondly** can provide an immersive language-learning experience without having to travel to a foreign country
* В България
  + [МУ-Плевен - VR студио](http://telec.mu-pleven.bg/index.php/bg/vr) - 360-градусово наблюдение на хирургични манипулации във виртуална реалност (VR) с помощта на VR очила в реално време или на предварително записани видеа.
  + [Медицински Симулационен Тренировъчен Център (МСТЦ)](https://mu-plovdiv.bg/za-nas/tsentrove/simulatsionen-tsentar/simulatori/) в МУ-Пловдив- единственият комплексен обучителен център за медицински специалисти в страната с възможности за интерактивно медицинско обучение посредством високотехнологични манекени, лапароскопски, артроскопски, ендоскопски и ултразвукови симулатори за виртуална реалност
  + [ClassVR](https://www.classvr.com/bg/?fbclid=IwAR2pLq_j4eWF_iofXx9ep2mp2K3tcaBXmHNx1JWTXw5dcxeRhICSUoAaywM), [ClassroomTech.bg](https://classroomtech.bg/arvr/?fbclid=IwAR1m384l4RXq48axU9GW0vvsJ2OHF0i3Y_bweppvdhY8aYVrJXyEAtoIX2w) - VR/AR в училище
* The University of Maryland School of Medicine (UMSOM) is the joint recipient of $4.75 million in funding from the National Science Foundation to establish a new Center for Medical Innovations in Extended Reality.

## VR/AR inD**ental** E**ducation**

1. <https://pubmed.ncbi.nlm.nih.gov/31003184/>

Research on [augmented and virtual reality in dental medicine](https://pubmed.ncbi.nlm.nih.gov/31003184/) from 2019 shows that AR/VR-technologies were predominantly used for educational motor skill training.

Their conclusion:

“AR/VR-applications are of increasing interest and importance in dental under- and postgraduate education offering interactive learning concepts with 24/7-access and objective evaluation. In maxillofacial surgery, AR/VR-technology is a promising tool for complex procedures and can help to deliver predictable and safe therapy outcomes. ”

1. <https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-022-03543-z>

There is also a [study to investigate the effectiveness of the application of virtual reality technology in dental education](https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-022-03543-z) in Iran.

This randomized trial was conducted at Kermanshah University of Medical Sciences, Iran in 2019. The study sample consisted of 50 six-year dental students who were randomly divided into experimental (n = 25) and control (n = 25) groups. Students’ performance in both groups was assessed using tests.

The results showed that the mean scores obtained in each end-of-course test were significantly higher in the VR technology teaching group than in the traditional teaching group.

Impact, Benefits and Challenges from the study above

The necessity and importance of using digital technologies in medical education have become an undeniable fact. This necessity became even more pronounced during the Covid-19 pandemic. Due to the high capability of virtual reality technology, this technology can be used in teaching many skills such as dental surgery, periodontics, endodontics, and implantology.

Some of the most important benefits of using a VR system, which has led to high satisfaction among students:

* possibility of self-assessment
* rapid acquisition of knowledge and skills by students
* reducing the risks that negatively affect the patients’ health
* increasing the level of safety of students

Challenges:

* reduced face-to-face communication
* learning-related challenges
* lack of familiarity of students and faculty members with the VR technology
* user attitudes
* cost challenges
* teacher-student challenges
* faculty members challenges (therefore, technical and educational support for instructors is very important)

## VR/AR inM**edical** E**ducation**

<https://www.researchgate.net/publication/324092965_Virtual_and_Augmented_Reality_in_Medical_Education>

There is [research, published by INTECH,](https://www.researchgate.net/publication/324092965_Virtual_and_Augmented_Reality_in_Medical_Education) about Virtual and Augmented Reality in Medical Education, which studies the applications of these technologies in different education fields.

It shares that:

“Although expensive to buy, VR/AR simulators provide a relatively costless opportunity for reproducible training under various environments and difficulty levels. Moreover, they do not raise ethical issues, compared with other animal and living tissue simulation models.”

Although significant progress has been made, there is still a need for more processing power, higher resolution, better design of the scenarios, and more advanced haptic devices in order to achieve highly realistic environments

## VR/AR in Engineering Education

Virtual Reality in Engineering Education: The Future of Creative Learning

<https://www.researchgate.net/publication/275938848_Virtual_Reality_in_Engineering_Education_The_Future_of_Creative_Learning>

“CONCLUSION: Interactive and immersive 3D visualization virtual reali-ty technology is an emerging technology that is promising for the engineering education and training. It represents a tool that can create a pipeline for cooperation with indus-try to prepare the next generation of graduate engineering with the skills required for business. The authors demonstrate through real-life practical case studies how the innovative technology can be employed to produce creative learning and training engineering materi-al and environments. The adopted technology in research and education meets the expectation of today’s up-to-date student generation. Although cost is recognised as a key challenge, leading educational institutes have already implemented the tech-nology for research and education purposes. However, the more the technology advances, the more affordable it becomes. Thus, it is expected that additional institutes will implement the necessary hardware and software level for virtual reality to be strategically adopted in the future of engineering education.”

Experts' View on AR/VR in Engineering Education at Universities

<https://www.researchgate.net/publication/364011514_Experts'_View_on_ARVR_in_Engineering_Education_at_Universities>

After the content analysis, it was possible to identify the three most mentioned reasons for using AR which are listed below, further significant reasons are shown in Table 3:

1. students get a better understanding of the object

2. to get students familiar with the technology

3. give the students direct experience

Discussion:

Currently XR is used in higher education through pioneer work mostly by educators already having a background in XR.

There is a lack of standardized frameworks or platforms for teaching experiences where educators might have access to easy to use XR experiences.

As the beneficial usage of XR is acknowledged by the conducted interviews of experts in this study it is crucial for future research to work on standardized guidelines and tools for creating XR experiences as well as elaborate platforms for sharing and exchanging XR experiences throughout the university landscape.

The Application of Virtual Reality in Engineering Education

<https://www.mdpi.com/2076-3417/11/6/2879/htm?fbclid=IwAR15gx0gnOXrK-2zUkVENY9RXmL8Tv9hUES5NVc2tDqs6LgDsweTmcsfxLY>

The use of VR is concluded to be beneficial to both the students and the university alike.

* an increase in students’ performance and grades (as a result of the VR application design , focused on the learning objectives, alongside the integration of learning theories).
* students’ active engagement using VR
* the university/institution benefits from cost reductions by replacing existing expensive laboratories with VR, reduced infrastructure requirement for lab spaces, safer lab working environment for the students
* a market-edge in terms of distance learning VR support and students with special needs

In the bigger picture, VR is a cutting-edge technology in education that can transform the educational system. With the current COVID-19 Pandemic, and the requirement of social distancing and remote learning, the use of VR is an additional tool the value of which is likely to become even more evident in the coming years, rather than an education novelty. The race towards an optimal continuum of an outstanding education to university students will be heavily dependent on the use of technologies like VR, and the universities/institutions that are early adopters will have an edge and provide educational excellence and quality assurance to its students.

## VR/AR at School

ClassVR

<https://www.classvr.com/bg/?fbclid=IwAR2pLq_j4eWF_iofXx9ep2mp2K3tcaBXmHNx1JWTXw5dcxeRhICSUoAaywM>

ClassroomTech.bg

<https://classroomtech.bg/arvr/?fbclid=IwAR1m384l4RXq48axU9GW0vvsJ2OHF0i3Y_bweppvdhY8aYVrJXyEAtoIX2w>