

# VIRTUAL REALITY

What areas of the digital competence of the students can I support with the knowledge I have gained in this module?

- Operate commonly used digital devices, applications and services; their use in learning and engagement with school and society.
- Use digital technology to make work easier, automate routine activities, become more efficient or simplify their workflow and improve the quality of their output.
- Understand the importance of digital technologies for human society, familiarise themselves with new technologies, critically evaluate their benefits and reflect on their risks.

This module aims to:

- Define the concepts of virtual, augmented and mixed reality.
- Introduce the possibilities of using virtual reality in education
- Highlight approaches to the use of augmented reality in education
- Introduce the concept of mixed reality

Which digital teacher competences does the module support?

- Continuous professional development
- Creating and editing digital resources
- Introducing digital tools and resources into the classroom
- Developing and experimenting with new teaching formats and didactic methods

## Introduction

Virtual Reality. Cutting-edge innovation in education. The future of teaching and learning. The latest trend.

Are these the ideas that come to mind when you think of virtual reality in education? If so, you're going to be disappointed. The first articles on the phenomenon of virtual reality in education on Google Scholar date back to the 1980s, while the term itself first appeared in the 1960s.

Indeed, would you have guessed that this article [https://www.jstor.org/stable/44428033?casa\\_token=O5ktfkjM-AIAAAAAA%3Axc-NPdxgnKCUWDA\\_bjxUDdh4CwCodUOpDhv4j\\_fqcv2P3KA2JyiKd4GItVUbFaq9KfUegqe8Laax9gOUzalNa\\_MMuUwjmd4AH8vTI1pFNLhH5GjAE-N&seq=1](https://www.jstor.org/stable/44428033?casa_token=O5ktfkjM-AIAAAAAA%3Axc-NPdxgnKCUWDA_bjxUDdh4CwCodUOpDhv4j_fqcv2P3KA2JyiKd4GItVUbFaq9KfUegqe8Laax9gOUzalNa_MMuUwjmd4AH8vTI1pFNLhH5GjAE-N&seq=1) was published in the early 1990s? Of course, the virtual reality described in these articles is far from what we mean by this term today.

**Virtual reality** = user interface (simulation) that mimics the real perception of space

**Augmented reality** = direct or indirect view of real world supplemented by digital information

**Mixed reality** = technology that combines virtual reality and augmented reality to project virtual visualizations into the real world



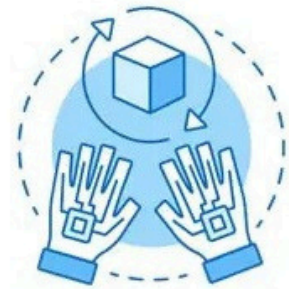
### Virtual Reality (VR)

Completely digital environment.  
Fully enclosed, synthetic  
experience with no sense of the  
real world.



### Augmented Reality (AR)

Real world with digital  
information overlay. Real world  
remains central to the experience,  
enhanced by virtual details.



### Mixed Reality (MR)

Real and the virtual are  
intertwined. Interaction with and  
manipulation of both the physical  
and virtual environment.

## Virtual reality in education

(The module is based mainly on texts on the website  
<https://o2chytraskola.cz/>)

In recent years, there has been a massive growth of virtual reality (VR) systems that allow users to enter an interactive three-dimensional environment based on real or artificially created.

The main purpose of the interface is to make the computer-generated environment as close as possible to the real world as perceived by our senses. In this 3D environment, the user can navigate through special glasses (called headsets.) Although virtual reality is mainly used for entertainment (e.g. in the gaming or film industry), it is also actively used in healthcare (3D models organs, removing phobias in psychiatry, simulating operations), in architecture (visualisation of buildings, city districts), in the army (training in risky situations, training), etc.

In particular, using virtual reality in education helps to achieve the following:

- faster learning
- experiential learning - a journey through a cell or bloodstream, a possibility to experience a job interview
- hands-on experience - simulating real-life situations
- collaboration across the globe
- interaction with 3D models
- easy prototyping

VR is usually based on special headsets connected to a computer or mobile phone that project a stereoscopic image to the user, creating a 3D experience. At the same time, VR is complemented by sensors that monitor the position and orientation of the head (and correct the image in the glasses accordingly).

To control the 3D world interactively, these headsets are complemented by sensors in the hands. The most popular 3D VR systems today include the HTC Vive, Oculus Rift, Oculus Go and Oculus Quest.



If you want to try virtual reality (VR), the easiest and cheapest option is mobile virtual reality. You need a smart device (smartphone) with an Android or iOS operating system and built-in sensors such as an accelerometer and gyroscope. In addition to the device for processing VR content, you also need VR headset designed for smartphones, which can be bought in most electronics stores or e-shops (e.g. Retrak or ColorCross). Then all you need is a suitable app labelled "VR" or "Virtual Reality".



*Glasses ColorCross VR Park*

## Getting to know the world

Virtual reality is an ideal tool for teaching. You can easily supplement your explanations with visual demonstrations that help students remember the material better. As we mentioned in the introduction to the module, virtual reality doesn't just provide an artificial environment. You can view real-world photos and 360° videos through a number of applications. You can start with the well-known Google Street View application. The technology is created by taking panoramic photos, which you can also view through VR headset. If you prefer to watch videos, you don't have to look far for a suitable app. YouTube has a huge database of 360° videos. Most mobile phones come with the YouTube app pre-installed. So just search for a 360° video in your area of interest and rotate the screen to watch the video in its entirety.



<https://www.youtube.com/watch?v=14O7AxqjiVY-6&t=47s>

## History and geography

When teaching history, students can be transferred into a virtual environment and gain an insight into a specific historical period. Students can have a first-hand look at the thematic objects of the time and, thanks to their experience, they can better remember the information they have learnt.

It is also possible to "relive" a particular historical event. Titanic VR or Apollo 11 VR are interesting examples. They allow students to explore the wreck of the Titanic or take control of the Apollo 11 Lunar Module.

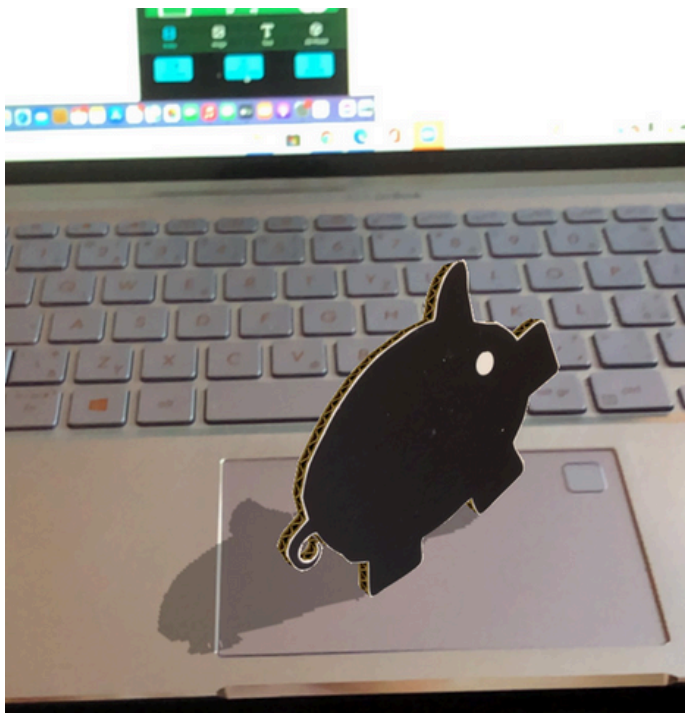
## Other subjects

The use of 3D interactive environments in teaching is possible, for example, in science when discussing underwater animals. Thanks to the Oculus Rift and the Ocean Rift app, pupils can take a peek into the underwater world. There are several space simulators that are very interesting. Oculus Go offers the opportunity to explore the International Space Station (ISS) using the Mission:ISS app, to look at Mars, etc. You can explore the human body with the Human Anatomy app. Take a virtual tour of different cities and see Chernobyl, for example, with the Chernobyl VR Project app. You can also find a number of VR applications that can be used in other subjects. For mathematics, for example:

- **VR Math** - focuses on the visualisation of solids and allows you to explore their individual elements (edges, faces, sides, vertices).
- **Number Hunt** - a fast-paced VR multiplayer shooter that uses basic mathematical operations - addition, subtraction, multiplication, division - as mechanics to defeat opponents.
- **Medieval Math VR** - a table lies on the floor in front of the player and displays math problems - examples of addition, subtraction, division and multiplication. The player can solve these problems by selecting one of four options to gain a more powerful weapon or additional ammunition.

# Augmented Reality (AR)

Augmented Reality is a very interesting technology that can be used for a wide range of educational activities. The principle of augmented reality is basically very simple - we integrate virtual elements - e.g. 3D model, video, text or graphic description, animation, etc. - into the image of the real world that we capture with a mobile phone, tablet or other device. We then add a digital layer, which can be not only visual, but also audio or even tactile, using special gloves.



*My companion for writing an AR module thanks to the RakugakiAR app*

Mobile phone or tablet are the basic display technologies for AR. However, this can be limiting as the user is not hands-free. This problem is solved by more advanced types of devices, called HMD (Head Mounted Display) glasses, which the user wears on their head. Their hardware and software is very similar to that of smartphones. The most popular HMDs are Google Glass and Microsoft HoloLens.

**Did you know that...** Augmented reality is gradually making its way into all areas of human society? One of the first companies to integrate augmented reality into its product catalogue is IKEA. The paper version of the catalogue was supplemented with interactive 3D models of furniture that users could virtually place in their homes. Other global brands are using AR in similar ways. A few years ago, Converse offered customers an application that allowed them to try different styles of shoes on their feet from the comfort of their own home. All they had to do was point the camera's viewfinder at their foot and select a shoe and its colour.

**Augmented reality** can be used to increase the effectivity of teaching. According to some studies, students who use AR retain new information better than students who only use traditional teaching media (printed book or video). Another undeniable benefit is the motivation of students who prefer technologies such as AR to traditional ones.

A great application that enables the integration of AR in education is **Corinth** (a Czech company based in Brno). This visual library contains over 1400 educational interactive 3D models for primary and secondary schools. These are not only models for teaching human, animal and plant biology. It can also be used for teaching chemistry, physics, mathematics, geology, astronomy, palaeontology or history.

Corinth offers blind map functions for testing knowledge, the possibility to add your own notes to models, integration with MS Office for using models in presentations, etc. The app is free from the Microsoft Store, but only includes four models. You will need to purchase a licence to view all of them.

## TIP:

Try the **Human Anatomy 4D** app or the great Czech Radio app **Návrat '68**, which tells a story based on the real events of the summer of 1968 and uses augmented reality technology.

Not only in physics or geography class, you can use the Star Chart app to learn more about how to better navigate the universe. Simply use a mobile phone or tablet with GPS, point it at the sky and the display will show different planets, constellations and galaxies.

## Hybrid (Mixed) Reality

Microsoft HoloLens is an advanced hybrid (mixed) reality device that allows you to combine the real world with virtual objects in a very realistic way.



HoloLens consists of a headset containing transparent displays through which 3D virtual elements (holograms) are projected into the human field of vision. These elements are fully interactive and can be held in the hands, rotated in space, moved, etc. In addition to gesture control, HoloLens also allows voice control, with voice commands working even in noisy environments. HoloLens contains no wires or external drives, it is essentially a stand-alone computer with a wifi connection. Its equivalent is Google Glass.



*Human Body Model in Human Anatomy 4D*



*A replica of a vintage radio in the Návrát '68 app*