Handbook for the course on the use of VR/AR

Introduction

This manual is one of the outputs of the VReduNet project. The purpose of this manual is to recommend a schedule for the implementation of a VR course, i.e. for trainers at schools and companies. Next, provide a basic overview of working with VR. It was created as a support tool for a 3-day educational course, which was piloted with the participation of actors from the Czech and Austrian sides. The result of the piloting reflected the materials and its incorporation into the final version of the course. Target groups, educational institutions that prepare teaching staff for their future practice, small and medium-sized enterprises that have, or want to have experience with AR/VR participated in the methodological and didactic preparation of the educational course, as well as in the pilot testing. The goal of the course is to familiarize participants with AR/VR technology, learn to work in existing programs and, in the final phase, be able to program their own educational elements for teaching.

The manual contains links to the most used and didactically appropriate materials for education. It is necessary to emphasize that the development in the field of VR is very dynamic and therefore some links may become outdated over time.

The pilot 3-day course can be changed as needed, according to the level of knowledge of the participants. In the practical part, only short notes are written for the individual lessons, which serve rather for the lecturer, and the participant is left with space for notes that arise during the discussion.

In the following points, we summarize the basic idea of the individual days and thus also the principles of the entire course.

- Day 1: participants learn basic terminology, learn something about the history of VR, hygiene and technical specifications of individual solutions.
- Day 2: It is focused on trying different applications, information on where to get content for VR and how to implement the technology in the educational process
- Day 3: Participants try to create content themselves and teach using VR.

This handbook that you are holding in your hand has plenty of space for notes from the course. So, feel free to take notes. Above all, we recommend making notes in matters related to the preparation of the deployment of VR technology in education and in the practical part

HAVE FUN

Table of content

Day 1

Basics of VR (40 min) 8:50 – 9:30

What is VR?

This immersive medium creates a three-dimensional, virtual, imaginary and interactive media environment that is perceived and mentally processed in a similar way to the real environment. Put simply, users usually wear a type of goggles that represent a fictitious world as realistically as possible. In contrast to AR, users in VR are therefore largely completely sealed off from reality. Today, the Duden dictionary defines virtual reality as a computer-generated reality. A simulated reality, an artificial world into which the user can place himself with the appropriate technical equipment.

Virtual Reality - Short and Compact

- Virtual reality is a reality simulated by computers. It is a 360-degree virtual environment in which one can move freely and interact with virtual content.
- Immersion is the feeling of being immersed in a virtual world. When the VR user is fully engaged in the virtual interaction, VR experiences feel close, immediate and realistic.
- VR tracking captures real movements and transfers them to the virtual world. This is achieved with the help of cameras and sensors built into VR goggles, controllers and accessories. The head and hands are usually tracked, but eye tracking or even full-body tracking are also possible.
- VR controllers are usually used for interaction in VR. Some VR glasses also support hand tracking, there are VR gloves and even research is being done on mind control and brain-computer interfaces.
- Haptic feedback to simulate feeling in VR. Vibrations and impulses are used to simulate physical contact. Heat, cold or smell can also be integrated into the VR experience with appropriate accessories.
- VR goggles differ into self-sufficient and non-self-sufficient. Self-sufficient VR glasses have all the technology in the glasses and usually have an integrated battery. Non-autonomous VR glasses must be connected to an external computer (PC, laptop, console, smartphone) via cable for operation.
- Motion sickness can affect the VR experience. VR nausea occurs when the eye sees something different than what the inner ear perceives. There are methods to avoid or mitigate the discomfort. Choosing the right VR goggles and applications is critical.
- VR is used in companies, research, medicine and education. Companies train employees in VR applications, medical students practice delicate procedures in VR, and special therapies are performed in VR.

Source: https://mixed.de/virtual-reality-starter-guide/

Virtual reality (VR), the use of computer modeling and simulation that enables a person to interact with an artificial three-dimensional (3-D) visual or another sensory environment. VR applications immerse the user in a computer-generated environment that simulates reality using interactive devices, which send and receive information and are worn as goggles, headsets, gloves, or body suits. In a typical VR format, a user wearing a helmet with a stereoscopic screen views animated images of a simulated environment. The illusion of "being there" (telepresence) is affected by motion sensors that pick up the user's movements and adjust the view on the screen accordingly, usually in real time (the instant the user's movement takes place). Thus, a user can tour a simulated suite of rooms, experiencing changing viewpoints and perspectives that are convincingly related to his own head turnings and steps. Wearing data gloves equipped with force-feedback devices that provide the sensation of touch, the user can even pick up and manipulate objects that he sees in the virtual environment. VR initially refers to an artificial reality created by special hardware and software.

Source: https://www.britannica.com/technology/virtual-reality

Virtual reality (VR) refers to a process for computer-generated real-time representations with interaction. In this process, computer-generated virtual objects, graphics or information are superimposed on the three-dimensional virtual space surrounding the user. Closely related are 360-degree media, which reproduces recorded content in virtual space without the possibility of interaction.

In augmented reality (AR), the virtual objects are superimposed on the real space, for example on the live camera image on the smartphone. VR and AR differ primarily in terms of display devices and control - their advantages in modern teaching are similar.

Source: https://www.conrad.at/de/ratgeber/education/virtual-reality-im-unterricht.html

Augmented Reality (AR)

Augmented reality (AR) is a computer-aided representation that adds virtual aspects to the real world. AR is currently mostly used via smartphones: Using the device's camera, additional information or objects are superimposed on the image of the real world. This ranges from simple text overlays to video and sound output to animated 2D or 3D content. To experience AR, users must download a software application. There are numerous apps available for AR, ranging from information to help with orientation in foreign cities to detecting planets and satellites in the sky. The technology is already in use in many museums to add information to exhibits.

Virtual Reality (VR)

In contrast to augmented reality, virtual reality uses computer graphics to create a world of its own in which users are immersed as intensively as possible. The immersive experience currently still requires data glasses, a so-called head-mounted display (HMD), and a high-performance computer or a current game console (PS4 or XBox 360). In VR, interaction of the user with his artificial environment is mostly possible, for example by head and hand movements.

Mixed Reality (MR)

There is also mixed reality (MR), a combination of AR and VR that further blurs the boundaries between the physical and digital worlds. Under the new umbrella term Extended Reality (XR), applications of VR, AR and MR are visibly reaching a larger target group - in both the B2B and B2C segments. Augmented reality (AR) and mixed reality (MR) are now attracting widespread public interest as innovative technologies.

Differences VR/AR/MR – show examples

First, we need to distinguish the two kinds of realities because they are different in their purpose. AR is designed to be a supplement to real-life situations, be it to make a diagnosis, find data, or enhance the understanding of a phenomenon. VR is designed to simulate real life, and accordingly it is not in direct relation to the given situation, but rather it immerses the user in another context/reality. Of course, simulation, and hence VR, is effective in enhancing different skills, such as driving a car or piloting an airplane, but it is important to keep in mind that it separates its user from the actual situation. This characteristic of VR makes it effective mostly in individual enterprises. AR that can be similarly multi-sensory, interactive, and rich in detail is capable of providing a shareable framework within which cooperation in real time is possible.

Virtual reality (VR) and augmented reality (AR) are innovative technologies that represent a virtual and augmented world, respectively. Augmented reality expands access to information and creates new learning opportunities. Virtual reality refers to computer-generated environments that simulate the physical presence of people and objects to create real-world experiences (see Johnson et. al. 2016). Combined these represent a mixture of virtual and real worlds, referred to as mixed reality (MR). Here, physical and digital objects can be displayed together and interact with each other in real time (cf. Kind et. al. 2019).

Although VR and AR are always referred to as related technologies, they are suitable for different media-didactic point of view, they are suitable for different application scenarios in the educational context. While VR environments are characterized by fully simulated virtual learning locations or learning situations, AR environments are particularly suitable for practical and workplace-based learning directly in the work process. The implementation of particularly complex teaching and learning scenarios takes place in an MR learning environment, which offers interaction between the real and virtual worlds and enables the experience of realistic immersion to a higher degree.

Example project - Virtual Reality

HandLeVR

Trainee vehicle painters learn various techniques for applying individual layers of paint to automotive workpieces in a VR application. Here, a paint shop is fully simulated in the VR environment. A physical controller in the form of the familiar paint spray gun is used to virtually displayed 3D workpieces are painted by trainees. For health and economic reasons as well as due to long drying times or the lack of possibilities of evaluation of important aspects such as the thickness of the applied paint VR training is the ideal solution.

Example project - Augmented Reality

FeDiNAR

Learners stand at a real machine and can interact with it directly. However, some of the actions (and their effects) take place exclusively in the virtual world, so that, for example, a wrench forgotten on a milling machine only flies virtually through the workshop and this is visualized to the learners visualized by means of AR. For these the learners' interactions are transferred to the virtual world and their effects are simulated there.

Example project - Mixed Reality

KoRA

On a physical assembly line, the assembly process is carried out by trainees together with cobots (collaborative robots). Dangerous situations caused, for example, by improper operation of the assembly line or a warning in the event of a collision with the cobot, are outsourced to a virtual reality. With the help of trackers, physical objects such as a tool, a cobot or a part of the working environment (e.g. table) are integrated into the MR learning environment, which enables the interaction between the real and virtual world is made possible.

Source: https://www.uibk.ac.at/iup/buch_pdfs/9783903187894.pdf

Most common phrases in VR (Summary & vocabulary)

360° videos are immersive (all-encompassing) video recordings created using omnidirectional cameras. The images are captured from all directions in a 360° range both horizontally and vertically. The viewer is given freely selectable viewing angles of the viewed video recordings using VR glasses.

3D audio: 360-degree sound for VR glasses. Sounds are output via headphones in such a way that they come from directions matching the VR world.

Augmented reality (AR) is the computer-based extension of the perception of reality. This information can address all human sensory modalities. Frequently, AR is understood to be merely the visual representation of information, i.e., the addition of computer-generated supplementary information to images or videos by means of superimposition or overlay (e.g., soccer broadcast, superimposition of free kick distance). In so-called augmented reality, the real-world mixes with the virtual world. The image or video material of the real world is enhanced with additional information in real time.

Avatar: An avatar is a virtual proxy, an artificially created figure that is assigned to a user in a virtual reality.

Eye tracking: Eye tracking is the recording of a person's exact focus and eye movement. Sensors detect exactly what the person is focusing on. In VR glasses, special sensors detect the eye movement and transmit it to virtual reality.

Frame rate / FPS: The number of frames per second (fps) displayed by a pair of glasses. Depends on the Hz number of the installed display. The more, the better. To maintain a pleasant and realistic illusion, a VR headset should be able to display at least 75 frames per second per eye, even during fast movements in complex 3D environments.

Gyro sensors: With the help of these sensors (magnetometer, gyroscope, accelerometer), electronic devices such as smartphones can measure position, orientation in space, as well as acceleration and movement. VR glasses can, thanks to these, implement the movements of the user's head in VR, see Head Tracking.

Haptic feedback: thanks to haptics, devices and controllers can let users feel when they interact with the virtual world. This can be done using anything from simple vibrations to harmless pulses of electricity.

Head Tracking /Rotational Tracking: Refers to the detection of the user's gaze direction and tilt. Must be as accurate and lag-free as possible so that the user's rotational movements can be transferred 1 to 1 to the virtual world.

HeadMountedDisplay: HMD is the abbreviation for head-mounted display. These can be video glasses or VR glasses. The video glasses show images on a screen directly in front of the eyes. A VR headset has both additional sensors to detect the movements of the head and lenses that create the largest possible Field of View.

Immersion describes the effect caused by a VR environment, which makes the user's awareness of being exposed to illusory stimuli fade into the background to such an extent that the virtual environment is perceived as real - usually interaction with the virtual environment. Immersion describes the transfer to a state of consciousness (impression) in which the perception of oneself in the real world is diminished and the identification with the "I" (the avatar) in the virtual world is increased.

Latency / Delay: Describes the delay between user movement and VR response. The lower the latency, the more realistic the VR experience.

Mixed Reality (MR): Mixed reality refers to the combination of real worlds with virtual worlds to create a new kind of environments and visualizations in which physical and digital objects coexist and interact with each other in real time. You can think of it as a mix of AR and VR.

Motion Sickness: the term simulator sickness, or simulator sickness in English, refers to a feeling of discomfort (dizziness, nausea, etc.) that can result from an irritation of the sensory organs in humans because the human sense of balance in turn tells the brain that there is no reality-based motion, or no motion at all. This can be caused in virtual reality by a high latency of the tracking systems.

Motion Tracking: Motion tracking or motion capture is a tracking method that allows any kind of movement to be captured and converted into a format that can be read by computers so that they can analyze, record, process and use the movements to control applications.

Positional Tracking: The detection of the VR HMD in space. Often using external optical sensors that detect the position of the headset in space. Just like head tracking, this should take place without much delay so that the user's spatial movements can be transferred 1:1 into the virtual world.

Presence / Telepresence: Describes the state of feeling present in a distant environment. The higher the degree of immersion, the more the user feels in the remote environment.

Room Scale VR: Room Scale VR refers to a virtual reality setup that allows you to move freely in a certain area of a room. Typically, a Room Scale VR setup consists of a PC, VR goggles, sensors that sense the room, and motion controllers.

Virtual Reality (VR): (digital world replaces real world) is the simultaneous perception of reality in a real-time computer-generated, interactive virtual environment. One approach to this is 360° videos, which have been increasingly popular in social media since late 2016 are becoming increasingly popular. Virtual reality refers to the creation of what appears to be a computer-generated world that viewers can immerse themselves in and interact with.

Sources:

https://www.vrnerds.de/vr-glossar/

https://projektzukunft.berlin.de/fileadmin/user_upload/images/VR/VR-AR-Bestandsaufnahme-Stand-112019.pdf

https://worldofvr.de/glossar/

https://360stereo3d.com/glossar/

Notes from lesson

History of VR (15 min) *9:30 – 9:45*

Defining Virtual Reality

Before we can consider the virtual reality development timeline, we have to briefly consider that the point of VR is to trick someone’s brain into believing something is real, even when it isn’t. If we focus more strictly on the scope of virtual reality as a means of creating the illusion that we are present somewhere we are not, then the earliest attempt at virtual reality is surely the 360-degree murals (or panoramic paintings) from the nineteenth century. These paintings were intended to fill the viewer’s entire field of vision, making them feel present at some historical event or scene.

In 1929 Edward Link created the “Link trainer” (patented 1931) probably the first example of a commercial flight simulator, which was entirely electromechanical. It was controlled by motors that linked to the rudder and steering column to modify the pitch and roll. A small motor-driven device mimicked turbulence and disturbances. It was a possibility for safer ways to train pilots During World War II over 10,000 “blue box” Link Trainers were used by over 500,000 pilots for initial training and improving their skills.

In the mid 1950s cinematographer Morton Heilig developed the Sensorama (patented 1962) which was an arcade-style theatre cabinet that would stimulate all the senses, not just sight and sound. It featured stereo speakers, a stereoscopic 3D display, fans, smell generators and a vibrating chair. The Sensorama was intended to fully immerse the individual in the film.

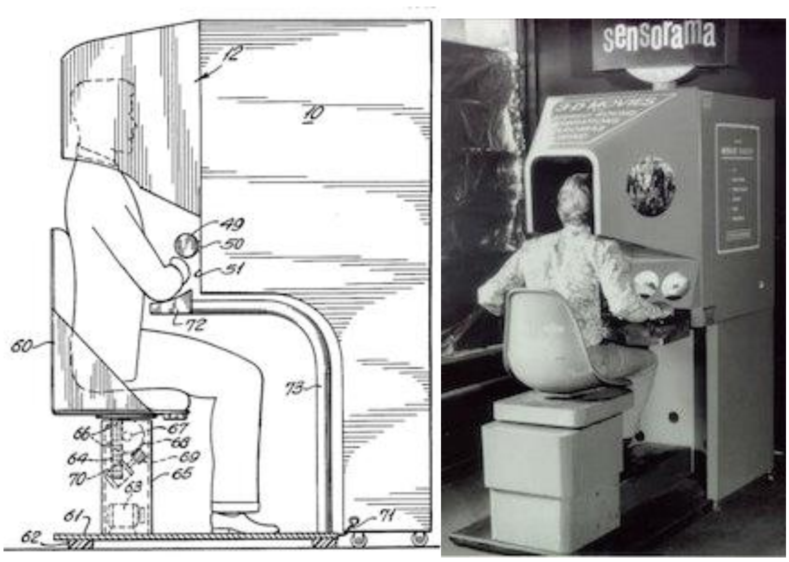


Image source: mortonheilig.com

Next invention was the Telesphere Mask (patented 1960) and was the first example of a head-mounted display (HMD), albeit for the non-interactive film medium without any motion tracking. The headset provided stereoscopic 3D and wide vision with stereo sound.

There were several steps in between. Even after all of this development, there still wasn't an all-encompassing term to describe the field. This all changed in 1987 when Jaron Lanier, founder of the visual programming lab (VPL), coined (or according to some popularised) the term "virtual reality". In 1989 NASA, with the help of a Crystal River Engineering, creates Project VIEW. A VR sim used to train astronauts. VIEW looks recognizable as a modern example of VR and features gloves for fine simulation of touch interaction. Interestingly, the technology in these gloves leads directly to the creation of the Nintendo Power Glove.

In 1991 we began to see virtual reality devices to which the public had access, although household ownership of cutting-edge virtual reality was still far out of reach. The Virtuality Group launched a range of arcade games and machines. Players would wear a set of VR goggles and play on gaming machines with realtime (less than 50ms latency) immersive stereoscopic 3D visuals. Some units were also networked together for a multi-player gaming experience.

The Lawnmower Man movie introduced in 1992 the concept of virtual reality to a wider audience. It was about a scientist who used virtual reality therapy on a mentally disabled patient. Real virtual reality equipment from VPL research labs was used in the film.

In 1999 the Wachowski siblings' film The Matrix hits theatres. The film features characters that are living in a fully simulated world, with many completely unaware that they do not live in the real world. The Matrix has a major cultural impact and brought the topic of simulated reality into the mainstream.

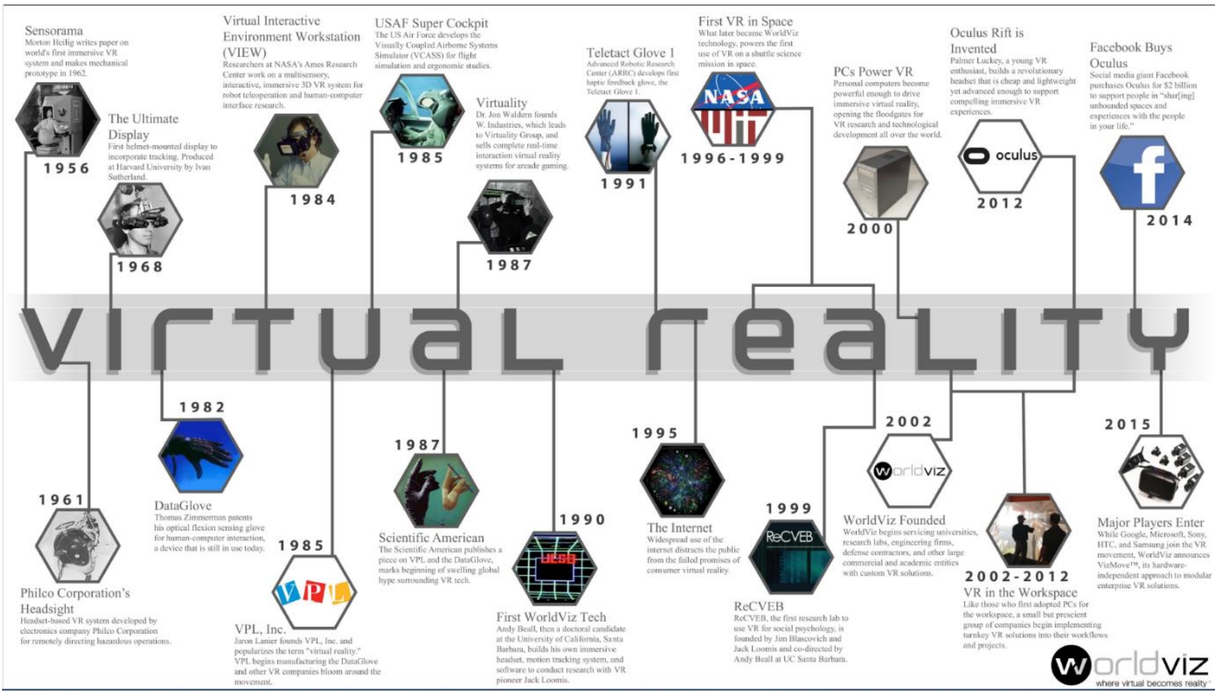


Image source: worldviz.com

EG: Mixed.de: Virtual Reality Geschichte): https://mixed.de/virtual-reality-geschichte/
EG: Maxi-Wissen.de: Geschichte der Virtual Reality und Meilensteine: https://maxi-wissen.de/virtual-reality-definition-anwendungen-step-by-step/virtual-reality-geschichte/

Notes from lesson

How VR works on human brain

Scientific research in the fields of neuroscience and psychology has revealed the brain creates a mental map of an environment from information that is absorbed through the five senses. The information subsequently becomes our perception of reality and the more information we take on-board the more our cognition develops. When we see something that is familiar, the brain predicts what will happen next.

However, when the brain does not have any practical experience of a situation, what prediction will it make? The reaction will be based on information that is stored in the memory.

VR has the ability to rewire the brain and enhance neural connections that are needed for learning and memory. In a simulated environment, the brain is seeing and doing exactly what is required – it is not filling in the gaps. As a result, students and trainees can learn quicker and more effectively.

VR headers are designed to totally immerse users in the virtual simulation. Their sight, hearing, smell and touch are absent from the real world thus the brain thinks the virtual world is real. Because of this the cells take in information and create “schemas” that impact how students will react to a real-world environment. Furthermore, new synapses are formed which could help students improve how people learn in other areas of their life.

Why is there an experience in VR

In a virtual reality experience, there must be at least some degree of sensory immersion. How much sensory immersion is required to induce mental immersion is still an open question and one that is the focus of current research. What are the necessary components for a user to feel as if they were immersed in the environment and believe that they were actually interacting with the virtual world? In the rest of this section, we'll discuss the content itself, the user's life experience and attitudes, interactivity, and the technological requirements of the display as components of immersion.

Our definition of mental immersion is that the participant is engaged to the point of suspending disbelief in what they are experiencing. Given a compelling presentation, this can be caused by the content of a medium alone. Physical immersion is not necessary when reading a novel, nor is it desired.

Many factors come together in creating the VR experience, and a particular confluence of factors can persuade the participant of the existence of the world. The first of these factors is that the world has to be personally meaningful. If the participant does not find the topic or style in which the content is conveyed absorbing, there is little hope of engagement. A particular point of view from which the world is presented (e.g., first person) might be more effective than another. The amount of suspense in a narrative might heighten the participant's relationship with a protagonist. A participant's mental willingness to believe combines with the other factors to put the person in the world … or not.

Interactivity is an element brought to various media through computer technology. After all, if the content were not interactive, then it could generally be presented in some strictly linear medium. However, like some real-world experiences, interactivity may be limited in some respects. A rollercoaster experience is pure sensory input, with no physical interactivity between the ride and the rider, other than the rider's ability to look around by moving their head. In virtual reality, the onus of creating an experience sufficient to allow the participant to achieve mental immersion lies not just with the application's content, but also with the capability of the VR system. A few display qualities that have an impact on immersion include resolution, lag, and field of regard.

Low resolution of one or more of the display modalities (either spatially or temporally) can also result in reduction, or loss, of immersion. Spatial resolution is how much information is presented in a single "image." Each sensory display has its own measurement format: visually we may refer to pixels per inch; sonically to bits per sample or the number of independent channels displayed. Temporal resolution is how fast the display is able to change in terms of the *frame rate,* or sample rate. Again, each sense has a particular range of acceptable rates. The desired rate for each sense is the point at which the brain switches from perceiving several discrete sensory inputs to perceiving continuous input.

Another important factor in providing mental immersion is the amount of sensory coverage. This includes both how many of the sense displays are presented to the user and how much of each particular sense is covered. In the visual sense, the field of regard and field of view of a particular VR system may have variable coverage depending on the particulars of the display hardware.

Probably the most important technological factor that must be addressed for mental immersion is the amount of time between a user's action and the appropriate response by the system—the *lag time.* Each component of the virtual reality system adds to the amount of lag, or *latency.* High latency between an action and its reaction causes several problems for the user. The most problematic is nausea (a not uncommon symptom of simulator sickness). There can also be difficulty dealing with interfaces that rely on body motion to interact with virtual controls.

EG: Understanding Virtual Reality (2018) - https://www.sciencedirect.com/book/9780128009659/understanding-virtual-reality

Notes from lesson

Studies about VR (15 min) 10:15 – 10: 30

Actual studies about VR/AR – quick view on outputs from studies about VR

1. Lernen in immersiven virtuellen Welten aus der Perspektive der Mediendidaktik https://journals.univie.ac.at/index.php/mp/article/view/3643
2. Biz-Up: PwC Studie
3. Biz-Up: Input by university contacts (e.g. Hagenberg)
4. VR Soft Skills studies - Virtual Reality Training Improves Operating Room Performance. Surgeons 29% faster and 6x less mistakes (Yale University School of Medicine and Queens University, Belfast)
5. Development and Analysis of VR Technician Training and Methods - Same results as classic training, Advantages of VR training (costs, scalability, modifications), 85% prefers VR training (Brigham Young University)
6. VR-learning participants are 275% more confident in what they have learned. They learn the necessary skills 4x faster and have 4x more attention during training than e-learning or classroom learning students. They are almost 4x more emotionally involved in the content of the training than in other types of teaching, which is a significant factor affecting the ability to retain information. And last but not least, VR-learning is 52-64% more cost-effective than e-learning. Such practical experience is confirmed by a detailed study by PWC (The Effectiveness of Virtual Reality Soft Skills Training in the Enterprise 2019)

Burdea, Grigore C., and Philippe Coiffet. *Virtual reality technology*. John Wiley & Sons, 2003.

Gregg, Lynsey, and Nicholas Tarrier. "Virtual reality in mental health." *Social psychiatry and psychiatric epidemiology* 42.5 (2007): 343-354.

McCloy, Rory, and Robert Stone. "Virtual reality in surgery." *Bmj* 323.7318 (2001): 912-915.

Pan, Zhigeng, et al. "Virtual reality and mixed reality for virtual learning environments." *Computers & graphics* 30.1 (2006): 20-28.

Sherman, William R., and Alan B. Craig. "Understanding virtual reality." *San Francisco, CA: Morgan Kauffman* (2003).

Wohlgenannt, Isabell, Alexander Simons, and Stefan Stieglitz. "Virtual reality." *Business & Information Systems Engineering* 62.5 (2020): 455-461.

Zheng, J. M., K. W. Chan, and Ian Gibson. "Virtual reality." *Ieee Potentials* 17.2 (1998): 20-23.

Many others can be found on Google Scholar

Motion sickness

VR makes people feel sick because it could trigger a motion sickness. When your brain thinks you are moving, but your body is static, it creates a disconnect between the two that causes enough confusion to make you feel ill.

While some VR apps have you walking in place or standing still to avoid this, others rely heavily on immersion, which means you'll be walking from place to place using a thumbstick or by swinging your arms. The latter can help because moving your body around some while your environment appears to be moving helps combat motion sickness. Because VR has been getting better and better, immersion is also improving, which means that more people feel like their brains and bodies are arguing during what should be a fun experience. The result is sweating, dizziness, headaches, and even nausea.

What can you do about motion sickness?

1. Reduce the length of your virtual reality sessions a buildup tolerance
2. Choose your applications wisely
3. Set up VR headset correctly
4. Be aware of your surroundings

How to use VR with normal glasses

You can wear a standard VR headset with glasses on. Learners with glasses will need to complete a few extra steps to ensure their headset is comfortable and displays a clear virtual environment. By putting on a headset, learners with glasses on may feel burdened by the hardware. Learners may experience any of the following feelings of discomfort with a VR headset:

- Extra pressure on a learner's face
- Heavy weight of the headset on their head
- Disorientation from having their senses cut off from real life
- Eye strain due to the bright light in the program

There are few ways how to make wearing VR headset with glasses more comfortable:

1. **Take extra time to adjust the headset straps** — Before putting on their headset, learners should take extra time to adjust their headset straps and make sure it comfortably rests on their face.
2. **Consider buying spacers that provide more depth** — With a spacer, learners simply take out the inner cushion in the headset and replace it with a plastic spacer that creates more

depth. Most headsets actually come with a spacer to make extra room for a learner's glasses.

3. **Use clip-in insert lenses** — These lenses are typically under $200 and simply snap into place inside of the VR headset. With clip-in lenses, learners eliminate the possibility of scratching the headset lenses or the lenses on their glasses.
4. **Position your glasses correctly on your face** — Make sure your glasses are resting comfortably on your face in their normal position. Double check to make sure they aren't lopsided or too low or high
5. **Position the headset so your glasses lenses and headset lenses are touching** — Learners should make sure there isn't too much space between their lenses and the headset's lenses. These should line up with each other so that images in the virtual environment won't appear skewed or blurry.

How VR affects your eyes

Most VR headsets contain two small LCD monitors, each projected at one eye, creating a stereoscopic effect which gives users the illusion of depth. These monitors are positioned very close to the eyes and have caused experts to wonder about possible negative effects, especially when used for long periods of time. These concerns are real, because eye strain is likely whenever one focuses on an object for an extended period of time, like when we watch a long movie or stare at our computer or smartphone all day.

Some of the problems cause by eye strain include:

- Eye pain, Headaches, Neck, shoulder and back pain
- Sensitivity to light
- Double vision, Blurry vision
- Dry eyes, Watery eyes
- Difficulty concentrating
- Difficulty keeping your eyes open

These issues are temporary and will go away once your eyes have been given a chance to rest. **No long-term consequences of using VR have been proven**. Still, there are few ways to minimize your risk of eye strain:

- **Blink more frequently** - Blinking keeps your eyes moist and prevents dry eye symptoms from developing.
- **Take breaks -** Giving your eyes a chance to rest after a long period of VR use will prevent them from working too hard.

- **Use artificial tears -** These lubricating eye drops can supplement your body's natural supply of tears and help keep your eyes from drying out.
- **Wear your glasses or contact lenses when using VR** - Using this technology without your corrective eyewear will force your eyes to work harder and increase your risk of developing eye strain.

- EG: Der Spiegel: Virtual-Reality-Brillen: Gefährdet die virtuelle Welt unsere Augen? https://www.spiegel.de/gesundheit/diagnose/virtual-reality-was-macht-die-virtuelle-welt-mit-unseren-augen-a-1093908.html
- EG: Ingenieur.de: Virtuelle Realität, reale Gefahren https://www.ingenieur.de/technik/fachbereiche/mikroelektronik/virtuelle-realitaet-reale-gefahren/
- cleaning of glases https://roundtablelearning.com/how-to-sanitize-vr-equipment-the-right-way/

Notes from lesson

In this section, it is appropriate to show the specific headset with which the participants will work. Oculus Quest glasses were used in the pilot testing. Their advantage for educational purposes is primarily the mobility of the participants. It is not necessary to connect the glasses to the computer with a cable, nor to have tracking stations.

Describing the Oculus Quest 2 hardware

In this chapter we will show you the most important things about the hardware which is used during the pilot: Oculus Quest 2 by Meta.

Graphics: Whether it's multiplay games, productivity apps, or 360° videos, the graphics are always stunning thanks to 1,832 x 1,920 pixels per eye.

Processor : Optimal performance thanks to 6 GB RAM and Qualcomm's ultra-fast Snapdragon XR2 platform.

Touch control Touch controllers make your virtual hands feel like your real ones. You can even play with your own hands via hand tracking

Technical specifications

HARDWARE

- PC optional
- Enjoy an advanced all-in-one VR experience with just the headset and controllers (smartphone app required). Or connect to a gaming computer with the Link cable to access Rift titles. *Facebook account required for use.

TRACKING

- Six Degrees of Freedom (6DOF).
- With 6DOF, the headset senses your head movements and your body's movements, then transmits them into VR with realistic precision. All without external sensors.

CONTROLLER

- Redesigned Touch Controller
- The ergonomics of the Meta Quest 2 touch controllers have been significantly improved. The new thumb rest gives you the stability you need when you need it.

HEADSET STRAP

- Soft strap
- The design of the strap offers lightness and comfort for all players*. The soft strap can be easily adjusted and combined with other Meta Quest accessories.

OPTICS

- Fast-switch LCD display , Resolution: 1,832 x 1,920 pixels per eye
- Supported refresh rate: 60, 72, 90 Hz
- Suitable for eyeglass wearers

SOUND

- Positional 3D audio is built right into the headset so you can hear everything around you. 3.5mm audio jack lets you play with or without headphones.

APPS AND GAMES

- Meta Quest Store
- Discover new adventures, conquer epic challenges, or relive classic moments in your favorite all-in-one games, shows, and experiences.

MEMORY

- 128 GB | 256 GB

Source: https://store.facebook.com/de/quest/products/quest-2 bzw. https://store.facebook.com/de/quest/products/quest-2/tech-specs#tech-specs

First step (30 min) 11:15 – 11:45

In this lesson you will learn how to:

- Use headset
- Setting up a guardian
- First steps app

Charging the headset

Plug the power cable into the Oculus Quest headset and connect the power source. The headset will start charging. When fully charged, the charging light will turn green.

Customize the headset

1. Release the side straps and then the top strap.
2. Put on the headset from back to front.
    - The back strap needs to be pulled down so that it wraps around your head.
    - If you wear glasses, start from the front when putting on the headset.
3. Tighten the side and top strap.

Be careful not to tighten the straps too much. The headset should sit comfortably on your head. It should not put too much pressure on your face or head

Putting on glasses

Put the glasses on the back of the head and pull them down to the eyes. Loosen the velcro on the top of the head and move the headset up or down to fit the glasses to the eyes so that the image is sharp. Hold the Oculus Quest headset with both hands. Move it slowly up and down until the image is sharp and the headset sits comfortably on your head. The lenses can be moved apart or towards each other in three positions.

Sound

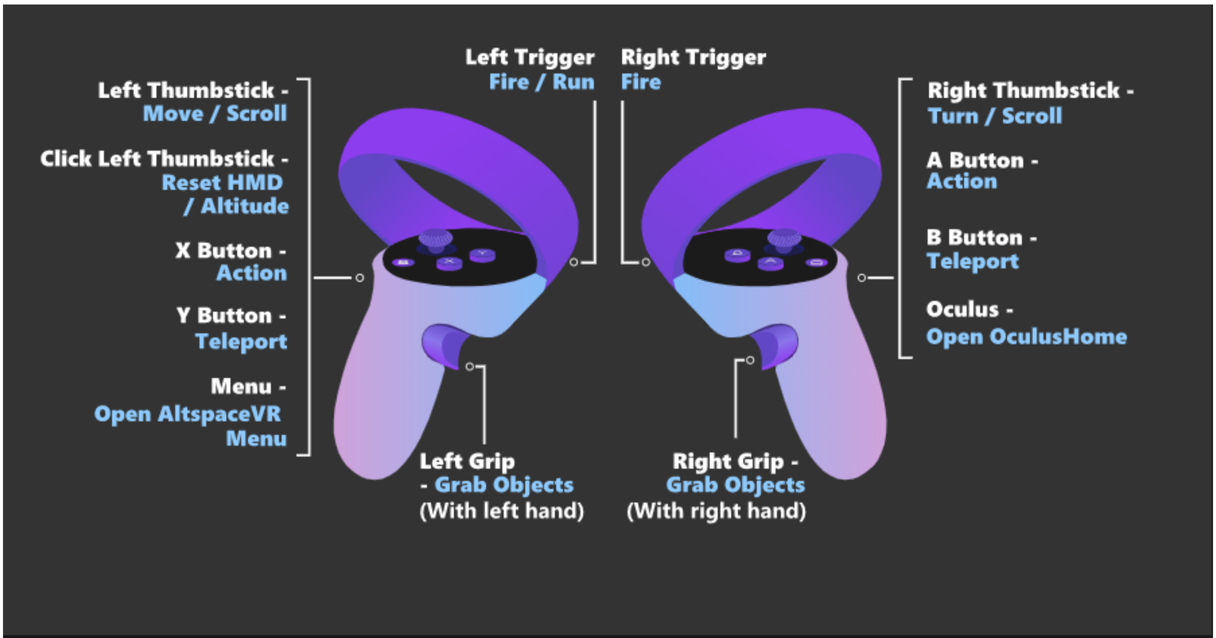
You can control the volume with the + or – button on the bottom of the headset.

Controllers

Batteries:

Classic AAA batteries are used in the controllers. To reveal the battery compartment, press the outer part of the cover downwards from the arc on the controller.

General functions of individual buttons on the controller



Levá ruka	**Pravá ruka**
Levý palec – Přesunutí/posouvání	Pravý palec – otočení/posouvání
X – akce	A – akce
Y - Teleport	B - Teleport
Nabídka – Otevřít nabídku AltspaceVR	Oculus - Open OculusHome
Levá rukojet - uchopte objekt levou rukou	Pravá rukojet - chytit objekt s pravou rukou
Levý trigger – aktivace/spuštění	Pravá aktivační událost – aktivace
Kliknutí na levý palec – Resetování HMD a výšky	

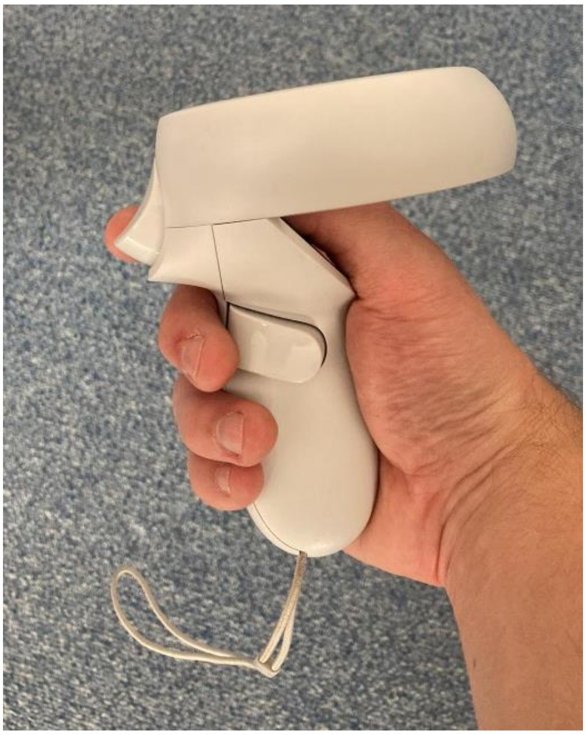
Disinfection

Glasses can be disinfected with any product for cleaning plastics and electronics. Apply the product to a napkin and wipe the surface of the glasses with it. Then wipe dry with a dry cloth so that the product does not flow into the device.

Attention, DO NOT disinfect the lenses of the glasses!

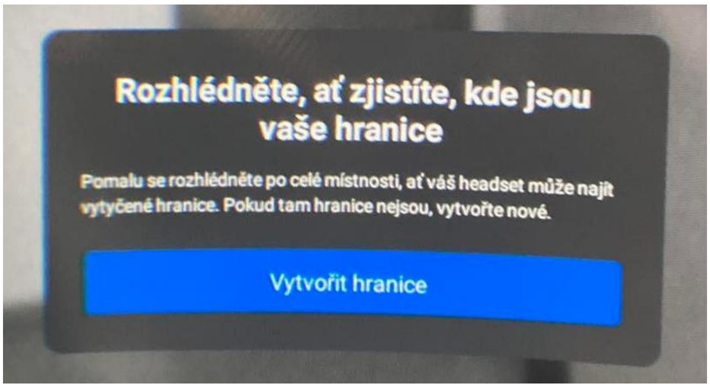
To clean the lenses, it is advisable to use a microfibre cloth WITHOUT any product. Finally, we also wipe the controller. And the glasses are ready for safe use

After turning on the glasses, you need to reserve a space where you will move. The glasses will ask you about it themselves. You will confirm all actions with the button under the index finger. You can understand this button in the same way as the left mouse button on a PC.



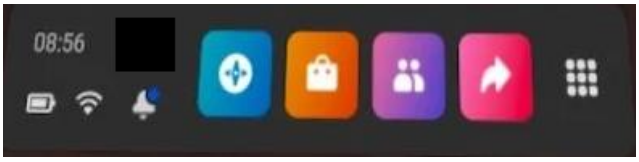
Then the space setup wizard will start. Continue as instructed.First, we choose to create borders.

1. You confirm the floor by touching the ground with the controller in your hand.
2. Next, you need to draw an area around you in which you can move.
3. You can draw a border using the button under your index finger. Point the controller at the ground, press and hold the button (under the index finger) and draw a square in which you can move without problems. You can also select the stationary boundary variant. With this option, a small circle will automatically be created around you, in which the glasses will monitor your movement.



Then you just confirm your selection

You have now appeared in the main menu, where you need to find the app. First of all, you have to select a library that is located in the right part of the panel in front of you



As the first app we recommend using FIRST STEPS FOR OCULUS 2

Malfunction

1. If the glasses do not respond to the button on the controller, you can hold down the power button directly on the headset.
2. After a short hold (approx. 2 seconds), a menu will appear in your glasses with the following options: Restart, Turn off, Continue.
3. If the glasses do not respond to even a short hold, you can turn them off by holding this button for 5 seconds.

VR classroom (120 min) 12:30 – 14:30

In this lesson you will be able to try whatever you want in VR. Try different apps.

Tips for interesting apps for beginners:

Wander – https://www.oculus.com/experiences/quest/2078376005587859

Mondly - https://www.oculus.com/experiences/quest/4214902388537196/

VR Edu Lab Classroom – https://virtual-lab.cz/edupack/

Ocean Rift - https://www.oculus.com/experiences/quest/2134272053250863/

Nature Treks - https://www.oculus.com/experiences/quest/2616537008386430/

It is good to make notes of your thoughts about use of these apps in education process

Notes from lesson

Day 2

Recapitulation (30 min) 8:45 – 9:15

Recapitulation of previous course (day). What were your takeaways from the last course?

Write down 3 useful information or skills you learned:

Notes from lesson

VR/AR Hardware (30 min) 8:45 – 9:15

An overview of the different types of VR/AR hardware and which is what each one is useful for. Possibility to try different types of hardware. This section is very important for those considering of buying first VR. Don't hesitate to ask a lector for more detailed specifications, advantages and disadvantages and make some notes

- Oculus Quest:
    - Company belongs to Meta (Facebook)
    - Different types – 2, Meta Quest Pro.(One of the most used in the world)
    - Built-in computer – doesn't need a cable connection to PC
    - relatively cheap (500€)
    - Good for education purposes
- HTC Vive
    - Different types: Vive, Vive Pro, Cosmos
    - One of the most used in the world
    - Need connection to PC via cabel
    - Ideal for development, Hitech-apps
    - Relatively expensive (900€)
- PICO NEO 3 PRO:
    - rear bateries (balancing),
    - 360° video,
    - Biggest competitor Oculus Quest (approx. 450 EUR)
    - version "4" is already available,
    - focuses on business, eye tracking.
- HP reverb
    - very good resolution,
    - 4K for one eye.
- PIMAX
    - outside in tracking,
    - extreme resolution for 1 eye (8K),
    - a powerful computer needed (graphics card).
- Valve Index
    - the largest portal with games (Steam VR),
    - more expensive than HTC,
    - touch controls,
    - comfortable – used by many players.
- XTAL
    - Czech glasses – used for example by US Air Force, price of 1 glasses: CZK 250 000,
    - extremely good resolution,
    - wired.
- VARIO XR 3
    - EUR 8 000 + EUR 18 000 a year subscription,
    - It connects VR and AR,
    - resolution of the human eye.
- NEOS
    - engine for VR (close to the idea of Metaverse)

Notes from lesson

VR Software (30 min) 9:15 – 9:45

We distinguish different types of software for different purposes

- Closed application - specific use on a specific topic with a predetermined experience (https://www.oculus.com/experiences/quest/2046607608728563/)
- Open App – An app that has a specific use but lets the user choose the experience as they see fit (https://www.oculus.com/experiences/quest/2078376005587859
- Creative app – the app lets users create their own experience in a VR environment (https://www.oculus.com/experiences/quest/2322529091093901)
- Metaverse - a virtual reality environment that lets users create almost anything (https://neos.com)

An important division of applications is also into:

- Multiplayer application - the experience is possible in more people
- Singleplayer application – the user is alone in the VR environment

There is a lot of push for multiplayer VR apps these days. Most of the world's most popular apps are multiplayer.

When choosing software, it is also important to observe aspects related to hardware:

- Is this software that can only be run on PC VR (PC connected VR)? If so, you need to have enough computers and VR devices that you can connect to them. At the same time, it is necessary to find out how big the computer performance requirements are for the given software.
- Is this software that can only be run on Standalone VR (independent VR devices)? If so, you need to find out which devices the software is made for and if you have such a device.

You also need to make sure of other requirements for the software, such as WiFi connection requirements. How many devices do you have connected to one WiFi network and whether your infrastructure can handle it.

Subsequently, it is also necessary to think practically about the space that will be needed for the given VR application (whether the users will want to physically move or they just need to sit on a chair).

Demands on software and how to save money on it.

Licenses for software – types and subscriptions etc.

- ENGINE – software designed for content creation (application creation and software) - unity, unreal; both equally useful,
- APP – a specific developed application with a given purpose of use
- METAVERSE – has its own content, without limitations, anything can be created.

Practical try of different software – Metaverse, VR training, 360°, Unity

Notes from lesson

When it makes sense to start with VR (15 min) 9:45 – 10:00

Free discussion

- Future of VR: size, power, resolution
- Basic questions when you thinking about start using VR/AR
  - What is the goal of VR for your school/company?
  - Is infrastucture good for implementing VR (hardware, network etc.)?
  - Who will be the user?

- Don‘t forget:
  - Cost comparsion of different types of headsets.
  - Search for ideal use case (examples of good practice)

Notes from lesson

In this section is important to prepare a right use cases. In pilot we discussed about specific applications for specific subjects in education. We recommend to participants write notes on specific applications

Languages:

- https://www.mondly.com/vr
- https://www.oculus.com/experiences/quest/3853074761443238/ Travel the Words!

Mathematics:

- https://xr-graph.vercel.app/
- https://skillpreparevr.itch.io/math-world-vr -> https://itch.io/games/tag-maths
- https://www2.ual.es/neotrie

Physics:

- Projekt PhyLab - virtuall Laboratory https://eduthek.at/mitmachen/PhyLap%202/
- https://fielddaylab.org/play/thermovr/
- https://kosmosschool.com/
- https://sciencevr.itch.io/faraday

Natural sciences:

- https://www.victoryxr.com/
- Human Body: https://www.sharecare.com/pages/vr
- Environmental Issues: https://media-and-learning.eu/type/featured-articles/teaching-in-virtual-reality/
- Wonderful you https://www.oculus.com/experiences/rift/1571751676192063/
- Cat Flight https://www.oculus.com/experiences/rift/1211584462259537
- BBC: Is Anna okay? https://www.oculus.com/experiences/rift/1717687071655033
- Dementia Yn Fy Nwylo I / First Hand https://www.oculus.com/experiences/rift/2496339380383114
- Google Earth VR https://www.oculus.com/experiences/rift/1513995308673845

Chemistry:

- LAB SAFETY: VR FOR CRITICAL DECISION MAKING https://www.centre4innovation.org/stories/lab-safety-practising-protocol-based-decision-making-in-critical-situations-in-virtual-reality/
- https://nanome.ai/

History:

- Flight over ancient Rome https://www.oculus.com/experiences/rift/1956900951038026
- Roman Forum https://www.oculus.com/experiences/rift/1813744415328590
- Anna Frank House VR - https://www.oculus.com/experiences/go/1596151970428159
- The Holocaust History and Memory (360 video): https://artsandculture.google.com/story/bwVReA5AY3zn9g
- BBC: 1943 Berlin Blitz https://www.oculus.com/experiences/rift/2178820058825941
- Migration - Clouds over Sidra (360 Videos): https://reimaginingmigration.org/clouds-over-sidra/
- History and Arts Education: Smithsonian Journeys: Venice https://www.oculus.com/experiences/rift/1830344467037360

360 videos and photos:

- Youtube VR needed for 360 Youtube Videos: https://www.oculus.com/experiences/quest/2002317119880945
- National Geographic 360-Videos Youtube-Playlist: https://www.youtube.com/playlist?list=PLivjPDlt6ApRq22sn082ZCC9893XtV8xc
- Google: Arts and Culture Project: https://artsandculture.google.com/project/360-videos
- CNN Specials VR-Archives: https://edition.cnn.com/specials/vr/vr-archives
- VRtuallyThere https://www.youtube.com/c/VRtuallyThere

OHS and other:

- https://aatevr.com/cpr-simulator
- https://www.chalkbites.com/ Fire Extinguisher Simulator
- https://www.digitalengineeringmagic.com/
- Digitale Empathie. Virtual reality as a medium for developing social skills https://journals.univie.ac.at/index.php/mp/article/view/6202
- Virtual apprenticeship taster: https://www.berufe-vr.at/
- Nature Treks VR https://www.greenergames.net/nature-treks
- Wander https://www.parklineinteractive.com/
- Notes on Blindness - http://www.notesonblindness.co.uk/vr/ https://www.oculus.com/experiences/quest/1946326588770583
- VR, a powerful new tool in soft skill development https://media-and-learning.eu/type/featured-articles/vr-a-powerful-new-tool-in-soft-skill-development/
- Art Education: Dreams of Dali https://www.oculus.com/experiences/rift/1873099679429920

General Sources:

- Educators in VR – Connecting educators and students with education in virtual reality, augmented reality, and extended reality https://educatorsinvr.com/
- Immersive Learning Research Network – iLRN https://immersivelrn.org/
- EU-Project Viralskills - Viral Skills E-Thek: 25 free apps reviewed by the Viral Skills partnership: https://www.viralskills.eu/en/e-thek/

https://vroodl.es/

Notes from Lesson

VR/AR health risks

Virtual Reality (VR) and Augmented Reality (AR) are gaining momentum as promising new technologies. They can potentially expand the field of human knowledge by changing the way people learn, work, play and have fun. If people are immersed in a fully imaginary environment, health risks can arise, which can affect their physical and emotional well-being. Here are some of them:

1. Anxiety

The immersive nature of virtual and augmented reality can induce stress or anxiety after wearing a full occlusion headset for more than a few minutes.

Depending on what images they see, virtual reality can bring waves of emotion more than just looking at photos or watching videos. For example, virtual reality footage of a war in can create a feeling of fear, stress and shock in the viewer.

This anxiety can take a while to overcome as the audience experiences everything as if they were in the scene.

2. Nausea

Some people who use VR headsets complain of dizziness and nausea. Its realistic simulated movements can affect the human perception of time and space and can induce fatigue, nausea or dizziness.

It is recommended that users take frequent breaks from virtual reality to avoid nausea. They can adjust the fit of the headset, tighten or loosen the straps, as well as fix the focal length or eye distance.

3. Eye strain

VR headsets can cause severe eye strain to users. They strain their eyes to focus on a pixelated screen that uses a single refractive optical element. Headsets usually don't solve the optical problems of devices close to the eyes, and they quickly become uncomfortable after a few minutes.

Headsets should also mimic how human vision actually works to provide the most comfortable viewing experience for both 2D and 3D content. Physiologically, headset manufacturers must resolve this tension known as the "accommodation/convergence conflict" and eliminate eye fatigue.

4. Radiation exposure

Wearable technology such as VR headsets potentially exposes users to harmful electromagnetic frequency radiation. These devices use wireless connections such as Bluetooth or WiFi to connect to your smartphone or computer; and are equipped with smart sensors that allow you to immerse yourself in the VR experience.

* https://www.vesttech.com/4-health-risks-from-using-virtual-reality-headsets/

Notes from Lesson

Cleaning

Sanitation is necessary for the following reasons:

- Reduces the growth of viruses, fungi, and various types of harmful bacteria.
- Keep you, your colleagues and pupils safe and in good health.
- Helps to avoid financial losses. Thanks to disinfection, employees/pupils are less prone to diseases.
- Extends the life and functionality of your workplace equipment.

As Covid-19 changes the way organizations operate and conduct training programs, it is now more important than ever to properly disinfect VR equipment that comes in direct contact with the user's skin. Both the inner foam of the face interface and the outside of the VR headset are susceptible to harboring harmful bacteria. Over time, dust, oils, sweat, bits of food, drips from drinks, and a myriad of substances can come into contact with VR hardware. This contact can not only make users nauseous, but also damage the system by affecting image clarity, sound quality and even functionality.

3 Best Disinfection Practices for VR Devices

Wash your hands and wear gloves before using the VR device

Before you even touch the VR device, you should wash your hands thoroughly. This helps rid your hands of harmful bacteria that could directly contaminate the surfaces of your VR hardware. Hand sanitizer also works, but washing your hands with soap and water is more effective at removing certain bacteria.

Clean the device with non-abrasive antibacterial wipes before and between each use

Between each use, you should disinfect your face, nose area and controls with lightly moistened non-abrasive antibacterial wipes. Alcohol-free antibacterial wipes will do the job for most headsets and their controls.

Simply wipe down all hard surfaces, paying particular attention to the areas most in contact with students. Key areas to wipe down include the top and bottom of the eyepiece, the adjustment ring on the back, and the surface and buttons of the controls.

Alcohol wipes should not be used on lenses but can be used on other parts of the headset. Alcohol wipes can damage the lenses, so use them carefully. An ordinary glass cleaning cloth is enough for your lenses

Use face shields

One of the biggest harborages for infection is the soft areas of a VR headset, which includes the headband and the foam interface that sits inside. Disposable Hygienic Covers for Universal VR Headsets are a good choice to keep the inner foam area of the headsets clean.

Face shields are an effective VR hygiene accessory for your VR device that eliminates indirect face contact between students. These covers are easy to use, absorb moisture and are quick to install and replace. These hygienic covers are a practical and effective way to ensure that every headset user stays fresh and clean.

Conclusion

If it's your first use of VR, it's best to take some time to read the included safety guides. Be aware of the health risks of VR and decide if it's something you want to expose yourself to.

* https://roundtablelearning.com/how-to-sanitize-vr-equipment-the-right-way/

Notes from Lesson

Requirements of using VR (30 min) 13:15 – 13:45

If you decide to use virtual reality, we will most likely need to create accounts associated with this use.

For PC VR, having a Steam account is most useful. Even if you decide not to use any apps on this platform, there is still the very useful SteamVR app, which can run the vast majority of VR headsets. Thanks to this, you can then run other software.

For Standalone VR, the question is what solution you use. However, account creation is always required. At Meta (Quest) and Pico and others. Apps

For the applications you decide to use, you need to think about the payment policy.

Free: Applications that are free are often intended for personal use, you need to check this with the application.

Paid:

- One-off payments -example Beat Saber (29€)
- Subscription – example MedicalHolodesk (500€/year)
- School license - it is useful to find out if the application provides licenses for schools or if the developers will be willing to provide you with such a license

Space

With a VR application, you always need to think about how much space will be needed to use the application. If it is an application where movement is necessary, we recommend a space of approx. 3x3 meters.

If the user is sitting on a chair, so that he does not have objects around him that he can accidentally drop or break.

Glasses management

There are software solutions that can be used to remotely manage a VR headset. Currently, there are only solutions on the market that allow the user only basic management such as:

- Upload new software
- Connecting to wifi
- Restarting
- Switch the glasses to the so-called Kiosk mode - which immediately starts the desired application for the user without the possibility of further setting the glasses.

Updates

The world of virtual reality is very dynamic and rapidly developing. For this reason, VR software and hardware providers are constantly updating the systems. It is important that the glasses are switched on or used regularly so that they are always up to date. Most providers do these updates in the background and the user doesn't even know anything is happening.

Notes from Lesson

Where to find VR apps (15 min) 13:45 – 14:00

Websites and sources.Good practice is that you search for key word and use VR app (biology, VR app)

Each solution has their own platform to share content

HTC: https://store.steampowered.com/ - lots of content but PC VR only

Oculus: https://www.oculus.com/experiences/quest/ - interesting content. So far, the focus is only on games, but it contains a lot of applications that can be used in education. PC VR and Standalone VR.

https://sidequestvr.com - Source of a lot of other apps that are not on the official Meta stores. Standalone VR.

Another source of VR content is the sites of specific VR application developers.

Notes from Lesson

How to successfully implement VR (30 min) 14:15 – 14:45

What needs to be solved when implementing VR:

- Goal – you need to decide for what purpose you want to use VR. The so-called The ideal scenario of how you want VR technology to serve you.

Using VR in regular teaching is quite difficult. It is particularly time-consuming, both during preparation and implementation. Before purchasing the technology itself, it is advisable to cooperate with the school (university) where this technology is already used and to consult which solution is suitable for a specific school (finance, maintenance, use, technology). VR has different requirements and a different purpose in technical high schools and different ones in elementary or art schools.

The following basic approaches can be identified:

1. Teacher's (1 glasses)
   a. The teacher uses VR to demonstrate the issue and has an explanation. Pupils observe through the projector.
2. Teacher-Student (1-5 glasses)
   a. The teacher/student prepares audiovisual material for teaching, seminar work.
   b. Workshops or optional classes - The aim is to teach students how to control technology. The teacher will demonstrate the appropriate procedure -> the students take turns using 1-3 headsets (more demanding on organization). When changing the headsets, the teacher helps and interprets at the same time
   c. School tournaments – e.g.: tournament in Beat Saber or movement in the map
3. Student (1-15)
   a. Class in VR. The teacher controls the teaching via PC and the students are in VR.
   b. Seminar and course work (high school camp)
4. Public
   a. Therapeutic
   b. Propagation etc.

- Hardware - based on this, you need to choose the appropriate hardware - Standalone or PC, Meta or other manufacturers, storage size, resolution, performance, etc...
- Software – accordingly, it is necessary to make sure that the corresponding software works on the given hardware. What is the price of the software and its sustainability.
- VR administrator – ideally an in-house person who will be in charge of both the device and the software. If possible, he can solve any problems or knows who to communicate with to solve them.
- Updates – use VR regularly and keep it up to date.
- Storage – have prepared spaces for storing VR equipment.

Notes from Lesson

Write down 3 usefull informations or skills you learned today:

Day 3

Recapitulation (30 min) 8:45 – 9:15

Recapitulation of previous course (days). What were your takeaways from the last course?

Notes from Lesson

Connecting VR to the PC (30 min) 9:00-9:30

Requirements and how to

- The first step before connecting VR to your computer is to make sure your computer has enough power to run VR applications. It is always defined by the manufacturer of VR equipment. Eg: https://www.meta.com/help/quest/articles/headsets-and-accessories/oculus-link/meta-quest-link-compatibility/
- Furthermore, you need to make sure whether the given headset already contains the appropriate cables for connecting to the PC, or whether the given cable needs to be purchased additionally. And if the computer contains the necessary connectors for connecting these cables.
- You will always need to have the appropriate software installed on your computer to run the VR experience (SteamVR, Oculus Software, VivePort, …)

Notes from Lesson

How VR platform works (15 min) 9:30 – 9:45

What is the idea behind VR Metaverse?

Briefly described Metavers as the Internet in VR. The true metaverse is an environment in which almost anything can be created directly in the VR environment.

Often these metaverses are used as a second life, where a person can create a world in his own image, meet friends and experience new experiences.

Notes from Lesson

Where to find 3D content (45 min) 10:00-10:45

Discussion about where you can find content and where you can create content for VR

Make it:

- PC: Blender, Cinema 3D, https://www.vectary.com/...
- VR: Tilt Brush, Gravity Sketch, …

Download it

sketchfab.com, https://www.turbosquid.com, https://free3d.com

- FREE: examples
- PAID: examples

3D scanning-

• Special hardware - https://structure.io/Phone/ tablet (Lidar) (iPhone 12 Pro and Pro Max, iPhone 13 Pro and Pro Max, and iPad Pro with LIDAR scanning)

Create 360 video/ photo- https://www.airpano.com/360photo_list.php, momento360.com

Notes from Lesson

Importing 3D content into VR (30 min) 10:45 – 11:15

If you use a platform for importing 3D objects, it certainly contains a very simple and intuitive way to upload such a model directly into VR.

The main question is what 3D model formats the given platform supports. There are hundreds of different formats and you need to make sure you have the right one.

Among the most used are FBX, OBJ, STL, GLTF, STEP.

Notes from Lesson

Adjusting 3D content in VR (30min) 11:15 – 11:45

Subsequently, it is then possible to edit the content in VR on the platform. We currently use Metaverse Neos VR as part of the educational program. In it, it is possible to finish the given model, animate it, add labels, recolor it, and much more.

Notes from Lesson

How to get content ready for VR Education (30 min) 12:30 – 13:00

Neos VR includes some very interesting features that allow VR content to be modified to be useful for education.

E.g. Creating labels - you create labels for individual parts of the model and then you can automatically test students in the VR environment.

Notes from Lesson

In this part, the participant's task is to use all the knowledge received in the past 3 educational days and create their own content, which they can then use for VR education.

Notes from Lesson

Moderate your own VR Class + Funtime (30 min) 14:00 – 14:30

As a final step, users can try using their own VR content for education.

Notes from Lesson