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Collaborative Learning Experiences in Virtual Environments

A Guidebook for Teachers

 Metropolia

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This guidebook has been created in the Erasmus+ project Augmented Agile Teamwork for Hybrid Learning at Schools (Agile XR). The project's goal was to learn how to connect with and engage students in online teaching using the combined power of agile rituals and web/XR technology. The project was realised by RHIZO Lyceum and CollectiveUP from Belgium, Universidad Francisco de Vitoria in Spain and Metropolia University of Applied Sciences in Finland.

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Introduction



YOU WILL LEARN
HOW TO CONNECT
WITH AND ENGAGE
STUDENTS IN ONLINE
TEACHING USING
THE COMBINED
POWER OF AGILE
RITUALS AND WEB/XR
TECHNOLOGY.

This guidebook supports teachers who would like to learn how to use XR technologies in distance learning lessons. It will give you an understanding of why to use VR as well as guide you in the onboarding process and in choosing what software and hardware to use. We provide our recommendation of how to use these technologies for educational purposes.

The guidebook has been done in the Erasmus+ project Augmented Agile Teamwork for Hybrid Learning at Schools (Agile XR). By reading you will learn how to connect with and engage students in online teaching using the combined power of agile rituals and web/XR technology. We focus on supporting teachers and students from upper secondary schools in Europe.

Our task was to provide teachers and students with digital tools and skills for distance learning. The COVID-19 pandemic made the social challenges of distance learning visible and students, especially those in a vulnerable position, were left without support.

The study presented in this guidebook focuses on the potential of virtual learning environments, and how they can perform and support collaboration. The study is based on knowledge gained during the Agile XR project and was conducted by Metropolia UAS. Students and staff from the XR Design study program collaborated with Helsinki XR Center.

A big part of the study was a testing phase of hardware and software, which we present in Part 1 of this guidebook. The testing part of the project has been greatly beneficial. Thus we encourage teachers and students to have an open mind towards new equipment and start learning about it by using and testing it while developing their digital skills. Part 2 of this guidebook includes step-by-step instructions on how to get started with XR hardware and software.

Terminology in XR

These terms encompass the key concepts and technologies within the realm of Extended Reality (XR) and its various immersive technologies. Extended Reality (XR) is an umbrella term that encompasses various immersive technologies, including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR).

Virtual Reality (VR)

A technology that immerses users in a computer-generated, three-dimensional environment, typically through a headset or goggles. Users can interact with and navigate this virtual world.

Augmented Reality (AR)

AR overlays digital information or virtual objects onto the real world, often viewed through a smartphone or AR glasses. It enhances the user's perception of the physical environment.

Mixed Reality (MR)

MR blends aspects of both VR and AR, allowing virtual and real-world elements to coexist and interact in the same space. Users can interact with digital objects while still being aware of the physical environment.

Immersive Technology

A general term for technologies that create immersive experiences, including VR, AR, and MR.

Haptic Feedback

Technology that provides tactile sensations to the user, such as vibrations or force feedback, to enhance the sense of touch in virtual environments.

Headset

A wearable device, often in the form of goggles or glasses, used for viewing VR, AR, or MR content. It typically includes a display, sensors, and audio capabilities.

3D Modelling

The process of creating digital representations of objects or environments in three dimensions. 3D models are commonly used in XR applications.

Teleportation

In VR, this refers to a method of moving the user from one location or viewpoint to another within the virtual environment, often to prevent motion sickness.

Field of View (FOV)

The extent of the observable world or digital content a user can see through an XR device, typically measured in degrees.

Motion Tracking

Technology that captures and records the movement of a user's body or XR device. It's crucial for tracking user movements in virtual or augmented environments.

Spatial Computing

The integration of digital content into the physical world, allowing users to interact with virtual objects as if they were real.

Hand Tracking

A form of motion tracking that specifically tracks the movement and gestures of a user's hands, enabling natural interaction with XR content.

Simulator Sickness

A phenomenon similar to motion sickness that some users may experience in VR due to a disconnect between visual and physical motion cues.

Avatar

A digital representation of a user in a virtual environment, often customizable to reflect the user's preferences.

Hologram

A 3D projection or image that appears to be suspended in space, commonly associated with AR and MR technologies.

Locomotion

Methods and techniques for moving within a virtual environment, such as walking, teleporting, or using hand gestures.

Latency

The delay between a user's actions or movements and the corresponding response in the XR environment. Low latency is crucial for a smooth and immersive experience.

XR Content

Digital assets, applications, or experiences designed for XR platforms, including VR, AR, and MR.

Gesture Recognition

Technology that identifies and interprets hand or body movements as input commands within XR applications.

Spatial Audio

Audio that is positioned and adjusted in real-time to match the user's location and orientation within a virtual environment.

Simultaneous Localization and Mapping (SLAM)

A technology used in AR and MR to map and track the user's physical environment while placing virtual objects within it.

Immersive Learning

The use of XR technologies to create educational and training experiences that offer a higher level of engagement and interactivity.

360-Degree Video

Video content that captures a panoramic view of a real-world or virtual environment, allowing viewers to look in any direction within the video.

XR Development Kit

A set of tools, hardware, and software provided to developers for creating XR applications and experiences.

XR Interface

The user interface and interaction design principles specific to XR environments, considering gestures, gaze, and voice commands.

Part 1. The Potential of Virtual Learning Environments

Part one will give general information about using VR in education and talk about the findings of the study made in the Agile XR project.

Why use VR?

Distance learning has led to a state of polarisation where students of all ages are facing difficulties in learning due to a lack of support from teachers and fellow students. Communication in distance learning is missing elements that exist in physical interaction and our mission was to find out whether we can create a sense of community with the aid of technology and to strengthen students' capacity to learn.

VR is a good tool to add value to and enrich school lessons. It is not a substitute for normal classroom teaching but more of an extra tool to support and improve learning engagement with the help of three-dimensional environments.

Our experience and several studies^{1 2 3} show that 3D engagement in a distance learning improves students' motivation. These studies show that students can have a better understanding and ability to utilise the knowledge learned in a 3D environment. Utilisation of 3D models and objects and special virtual environments can support learning. As a learning experience,

learning in VR is also more entertaining, and more complex tasks are noticeably easier to understand.

Advantages of using VR in education

- ▶ immersive experience and focus, especially when using a headset
- ▶ improvement of digital skills
- ▶ global accessibility
- ▶ ecological realisation
- ▶ ability to create environments to fit needs and purposes
- ▶ verbal and non-verbal communication

Disadvantages of using VR in education

- ▶ relying on virtual connections rather than real-life social interactions
- ▶ difficulty in recognising empathy
- ▶ lack of emotional and facial expressions
- ▶ high price of devices
- ▶ motion sickness (VR can create a loss of spatial awareness, nausea, dizziness, disorientation, and nausea. This is also known as simulator sickness.)
- ▶ time consuming onboarding process
- ▶ slower execution of tasks, i.e. sha-

- ▶ ring ideas by placing sticky notes
- ▶ simultaneous use of sight and headset needed when installing programs

What is possible in VR?

Virtual environments offer a computer simulated environment that can be joined globally by many users who have created an avatar at the same time. Virtual environments are well known in the gaming industry. However, there are a number of other social possibilities that VR can offer users, such as training, learning, conferencing, events, convenience and communication.

Virtual learning environments can offer learners immersive engagements, content management, as well as assessment that promotes and supports learning. In a virtual classroom learners and educators can connect allowing students and professionals to learn in a virtual environment that is professional, realistic and not just theoretical. Seeing how something looks before executing it creates trust and confidence

while reducing cost of training as well as operational costs.

There are three main types of virtual learning environments depending on the level of interaction. They differ in how learners and instructors interact with each other, at the same time, or studying independently or a combination of the previous. When both learners and instructors are online simultaneously they interact with each other in real-time through features like video conferencing, chatrooms, and virtual whiteboards, communicating in a virtual environment by avatars or virtual and simulation environments.

VR is also a safe environment for testing dangerous environments such as laboratories, fire elements and aeroplanes. It is safe to explore new places, observe objects and cities around the world, national parks, museums, and historical places.

Plenty of activities can take place in VR. Instead of viewing a 2D screen, users can interact with 3D worlds. You can

- ▶ use and share content like text, slides, Google documents, videos

- ▶ use a whiteboard, last pointer or browser, take notes, import and export files from your desktop, observe 3D objects
- ▶ record or take pictures of your sessions.

Pedagogical content

VR learning can be roughly divided into two types:

1. for training-type VR learning, where the object of learning is various functionalities, e.g., using, assembling, working, and
2. for community learning, where VR platforms offer the opportunity to learn more conceptual things.

An example of training-type VR learning are Mandatory Trainings, a digital training platform for aviation and maritime compliance using VR, AR, adaptive learning and gamification in the Metaverse developed at Helsinki XR Center. The certifications will be International Air Transport Association (IATA) certified and can in the future be reused for multiple aviation companies.

Events and co-working in Metaverse are an example for community learning. Metaverse helps you connect with people when you aren't physically in the same place. It can get us even closer to that feeling of being together in person.

Pedagogical theories are usually divided into behaviourist, cognitive constructivist and sociocultural theories. Behavioural learning means learning an activity, e.g., sports performance or the use/assembly of a device. Behavioural learning is already widely done with VR assistance.

The other pedagogical theories mentioned refer more to linguistic communication and are based on concepts. To apply linguistic and conceptual communication in virtual realities, we need to look for Metaverse platforms developed for community and cooperation.

In our work we found new pedagogical tools and methods made possible by virtual reality.

Student activity

Passive

- ▶ listening to a lecture
- ▶ reading texts
- ▶ watching a video

Active

- ▶ writing notes
- ▶ drawing diagrams, mind maps

Collaboration

- ▶ discussing with others
- ▶ working together on assignments
- ▶ using Mural, Figma and other coworking platforms

Play

- ▶ role play with drama
- ▶ dance
- ▶ exercise
- ▶ New VR abled
- ▶ viewing 3D models
- ▶ visiting virtual environments
- ▶ using, modeling and editing 3D models

Teacher activity

Active

- ▶ speaking
- ▶ writing to whiteboard
- ▶ showing pictures and videos
- ▶ showing movements

New VR abled

- ▶ showing 3D models
- ▶ modeling, editing 3D models
- ▶ assembling, operating 3D models
- ▶ showing virtual environments

Our study: Understanding the potential of XR technologies to facilitate teamwork

Metropolia UAS's task in the Agile XR project was to test new technologies to create an understanding if XR technologies are able to create a sense of community, increase collaboration and teamwork in distance learning.

We began our study by creating a list of different features of virtual platforms that support teamwork. This was followed by benchmarking twenty-three (23) different XR-based solutions, identifying and selecting those that foster teamwork and collaboration in distance learning and that are suitable for upper secondary level schools. We then selected four platforms for further testing and development. The testing was done with different groups of students and with other users as well.

Double Diamond

We used the Double Diamond process in this study. Double Diamond is a tool for a design process where the design brief

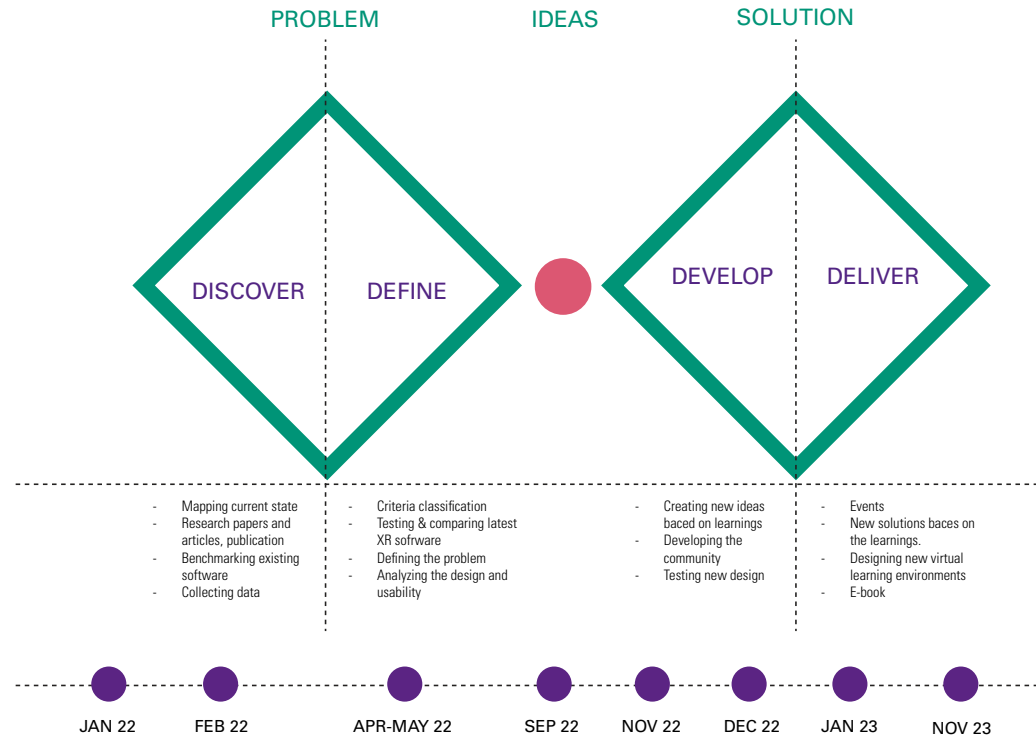


Image 1. Double diamond process

is explored through four stages: discover, define, develop and deliver. In the following paragraphs we describe the activities we included in each of these phases of our study.

Discover

In the Discover phase our research and benchmarking focused on discovering and analysing the existing data and the current stage of distance learning. Our research included mapping the material on distance learning as well as analysing the needs and demands of virtual distance learning. We focused on how to improve interaction and on what is lacking in the existing tools and equipment. Data was collected by observing existing situations in distance learning. From these experiences we were able to define the existing levels of interaction and clarify the need for further development.

Define

During the define phase we first created a list of criteria to guide us on choosing software. This phase also included testing

and comparing the latest XR software and the latest XR related technologies for distance learning. Based on the outcome of the study we were able to focus on the existing and new software and technologies on the market and analyse the qualities and usability of different solutions with different teaching scenarios. We compared the platforms using XR equipment such as VR headsets and also used virtual environments with conventional desktop and mobile computers. Metropolia UAS has been collaborating with several software companies and the results of this study will give input on development of new software.

Develop

Current state of distance learning is lacking the elements of community. The development phase focused on the possibilities of increasing the sense of community and creativity in distance learning. We gained a lot of information from our software testing phase: what was working and what elements were missing. Towards the end of this project we were able to create our own spaces on the Spatial platform. These spaces had the qualities to support

||| WE USED THE FOUR STAGES OF THE DOUBLE DIAMOND DESIGN TOOL FOR OUR EXPLORATION.

distance learning and enable student engagement.

Deliver

This guidebook is one part of how we deliver our results. It includes short instructions to support new users. Furthermore, we will suggest a variety of improvements to existing XR learning environments and share our outcomes by using virtual tools to guide both teachers and students to use the XR solutions to improve distance learning.

Choosing VR hardware

There were multiple types of headsets available when we were choosing VR hardware for our project in the spring of 2022.

3DOF (3 degrees of freedom) headsets track the orientation of your head but not your physical position or movement in space. They can sense when you turn your head left, right, up, or down, but they cannot detect movements like leaning forward, backward, or side-to-side. They are suitable for viewing 360-degree images and videos for example. Oculus Go, Samsung Gear VR and Google Cardboard are examples of 3DOF headsets that were available when we were choosing what hardware to use.

6DOF (6 degrees of freedom) headsets offer full tracking of your head's rotation as well as your physical position and movement in a 3D space. This means you can not only look around but also lean, crouch, and walk within the virtual environment. 6DOF headsets are often used in "room-scale" VR setups, where users can move freely within a defined physical space. This allows for more dynamic and

immersive experiences. Pico Neo HTC Vive Focus and Oculus Quest 2 are examples that were available in spring 2022.

A **standalone VR headset** implies that it's basically a self-contained headset. It has a screen processor and battery inside, and it contains many viewfinders on its body that provide the necessary spatial orientation according to the objects around and its distance from them. It is found most commonly with one or more controllers which can be moved in six directions, allowing maximum mobility.

For using VR headsets with a PC a capable graphic card is needed. Examples of such headsets are HTC Vive Pro and Oculus Rift S.

We chose to use the **Oculus Quest 2 headset** in our study because it's most widely used, it is a standalone headset and it has 6 degrees of freedom properties and it's reasonably priced. We recommend using this headset in distance learning lessons at secondary schools when utilising XR technologies.

||| THE OCULUS QUEST 2 HEADSET IS THE MOST WIDELY USED HEADSET. IT IS A STANDALONE HEADSET AND IT HAS 6 DEGREES OF FREEDOM PROPERTIES AND IT'S REASONABLY PRICED.

Choosing software through benchmarking

The base for choosing what software to use was our benchmarking study that included twenty-three different platforms that existed on the market at the time, and that fit our scope. We chose software that is designed for collaboration and educational purposes. We excluded ready-made VR learning applications because they usually only offer behavioural skills based learning. Our focus was on collaboration.

The software was divided into two categories:

1. learning environments
2. meeting and collaboration.

All platforms that we benchmarked were listed by their criteria features to guide our choosing for further testing. The key findings of the benchmarking was that available platforms in the market are designed mainly to improve the qualities of remote meetings. They simulate office-like environments and platforms that are designed for educational purposes are designed for behavioural learning.

The complete results of our benchmarking can be found in Appendix 1.

Our criteria for selecting platforms

- ▶ purpose of platform
- ▶ key features
- ▶ pricing and subscription options
- ▶ accessibility with VR headsets, desktop, mobile devices
- ▶ headset support
- ▶ usability features such as wayfinding, object selection and manipulation, visual output, comfort, simulation-sickness, presence and immersion
- ▶ hardware requirements and technical specifications
- ▶ platform requirements
- ▶ ease of use
- ▶ target, best for
- ▶ max users for simultaneous use
- ▶ customisation with 3D objects and environments
- ▶ broadcasting and recording features
- ▶ design
- ▶ default or customisable avatars
- ▶ game engine support

Comparing and testing chosen platforms

Our benchmarking led to a test phase based on criteria that fit our purposes. For testing we chose platforms that had free access, supported collaboration and teamwork, had the necessary subscription type, headset support, and a minimum of ten users. AltspaceVR (discontinued by Microsoft in March 2023), Horizon Workrooms, Glue and later Spatial.io were selected for further testing with students and staff of Metropolia UAS.

Most software allows test use to a certain number of participants. For example the maximum number of users to access a free session can be up to ten persons.

The platform testing phase that started in spring of 2022 was first done among the Metropolia Agile XR project group to gain more knowledge of how user friendly the platforms were. Students, teachers and other staff participated in the testing. Further testing was then done with bigger groups of students and pilots were carried out with

upper secondary school students. All testing sessions are listed in Table 1.

4-15 persons were involved in each session. Sessions started with the onboarding process and included different activities, like sharing content, text, pictures or video, meeting, teamwork or just playing, on selected platforms.

Pilots with upper secondary school students included an organised learning experience and included learning material such as videos, instructions and teamwork among students. During a Learning, Training, Teaching Activities LTTA event staff from all of the Agile XR project partners participated in testing of chosen platforms. This allowed us to gain collective experience of the virtual environments themselves as well as activities in them

During a Learning, Training, Teaching Activities LTTA event staff from all of the Agile XR project partners participated in testing of chosen platforms. This allowed us to gain collective experience of the virtual environments themselves as well as activities in them.

Table 1. Timetable of comparing and testing events

Date	Platform / group / activity
31.3.2022	Testing Altspace VR with Metropolia group
12.4.2022	Testing Horizon Workroom with Metropolia group
19.4.2022	Testing Glue with Metropolia group
25.4.2022	Testing Horizon workroom with Metropolia group
10.5.2022	Testing Horizon workroom with Metropolia group
25.10.2022	Testing Glue for Pilot with Metropolia group
4.11.2022	Pilot in Glue with upper secondary school students
17.2.2023	Assignment and test in Spatial with Metropolia group
9.3.2023	Testing Spatial with Metropolia group
5.5.2023	Pilot in Spatial with Metropolia group
20.3.2023	Testing Spatial with Metropolia group
28.3.2023	Session in Spatial with partners
4.10.2023	LTTA in Helsinki, pilot in Spatial with partners and teachers

FOR TESTING WE CHOSE PLATFORMS THAT HAD FREE ACCESS, SUPPORTED COLLABORATION AND TEAMWORK.

Testing different platforms gave us more understanding of their usability. We rated platforms on different features like how easy the signing in process was, how well the user interface worked, or what kind of functionalities they offered, avatar qualities or the graphics of the environments. Students rated their favourite platforms.

Registration

Most software can be installed in both Mac and Windows environments and allow different ways to register and create an account or profile by using different and multiple user devices, desktop, VR-devices or mobile.

Graphics

Many of the platforms still have cartoon-like graphics. This is due to many reasons, one being the capacity to perform screen pictures. Cartoon like environments suit well in the game industry but for work purposes it might disturb the credibility.

Audio

Virtual spaces people are able to hear in three dimensions. Within the virtual space it is also possible to control audio.



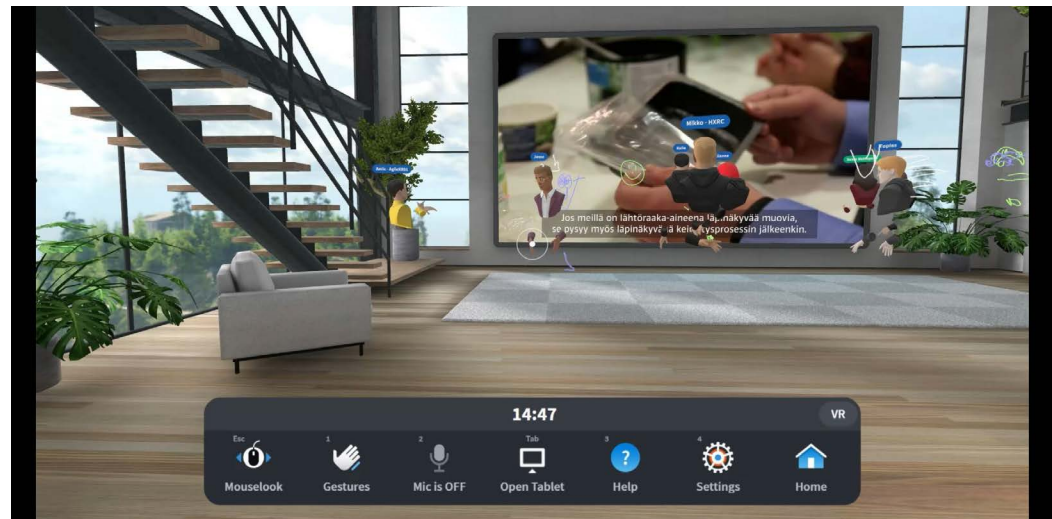
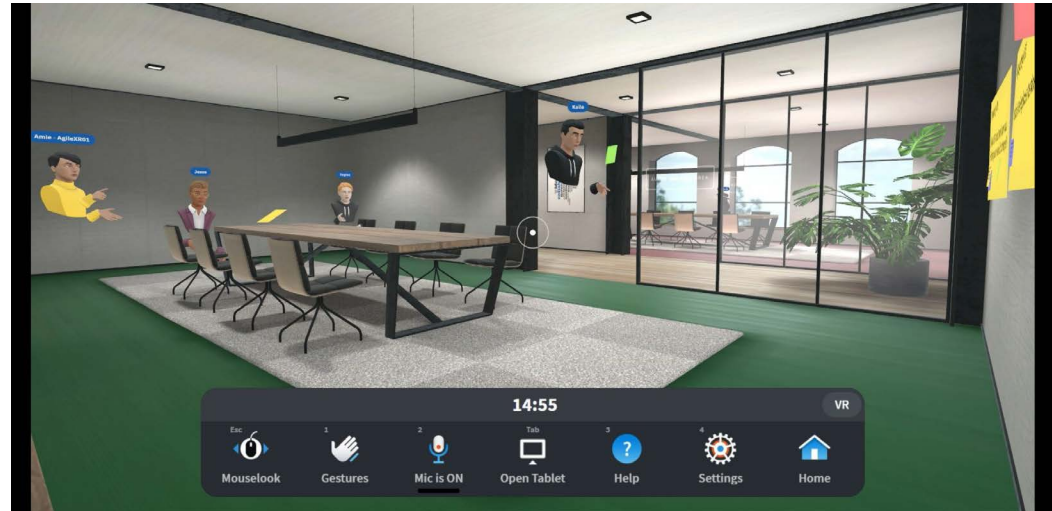
Pilots with upper secondary school students

Pilots with upper secondary school students were organised to gain more knowledge about a classroom situation. Sixteen students and a teacher attended a pilot session.

Students were using headsets and controllers and they performed different activities in a virtual environment. During the pilot sessions students had to answer questions about the content of a video in groups that they had just watched in the VR environment. After the session students answered a questionnaire.

The pilots showed us that XR technology can aid learning and enhance student motivation.

During the first pilot session students were excited and also played in a virtual environment which disturbed the learning experience a bit.



Images 2 and 3. Pilot session in Glue with upper secondary school students.

Designing virtual environments for VR learning

Starting from autumn 2022, designing of Metaverse environments suitable for VR learning were explored by implementing and testing different sketches of 3D spaces and refining the sketches based on testing. Different space programs, optimal sizes of spaces for different numbers of people were defined and tested.

Spatial perception in the VR world differs from the physical environment; space is no longer needed to protect, but to give some kind of sense of security and scale. Likewise, one can think about whether the surfaces that define the space must resemble the real world or whether they can be made more abstract.

On the Metaverse platforms, the so-called polygon and texture budget largely determines the detail and number of 3D models and thus affects the visual outfit. In the instructions for several Metaverse platforms, it is desired to limit the number of polygons to 500,000 and the textures to 2K size.

Factors affecting visual quality include lighting, materials and details. Especially indoors, Global Illumination lighting (simulating light's physical behaviour) should be used to achieve realism. Materials and details also add visual interest to 3D models and views.

||| SPATIAL PERCEPTION
IN THE VR WORLD
DIFFERS FROM
THE PHYSICAL
ENVIRONMENT;
SPACE IS NO LONGER
NEEDED TO PROTECT,
BUT TO GIVE SOME
KIND OF SENSE.



Image 4. Coralie Island has been created in Spatial by Pedcharat Cheremnykh.



Images 5 and 6. Saara Myllylä's Early Dusk Gathering created in Spatial.

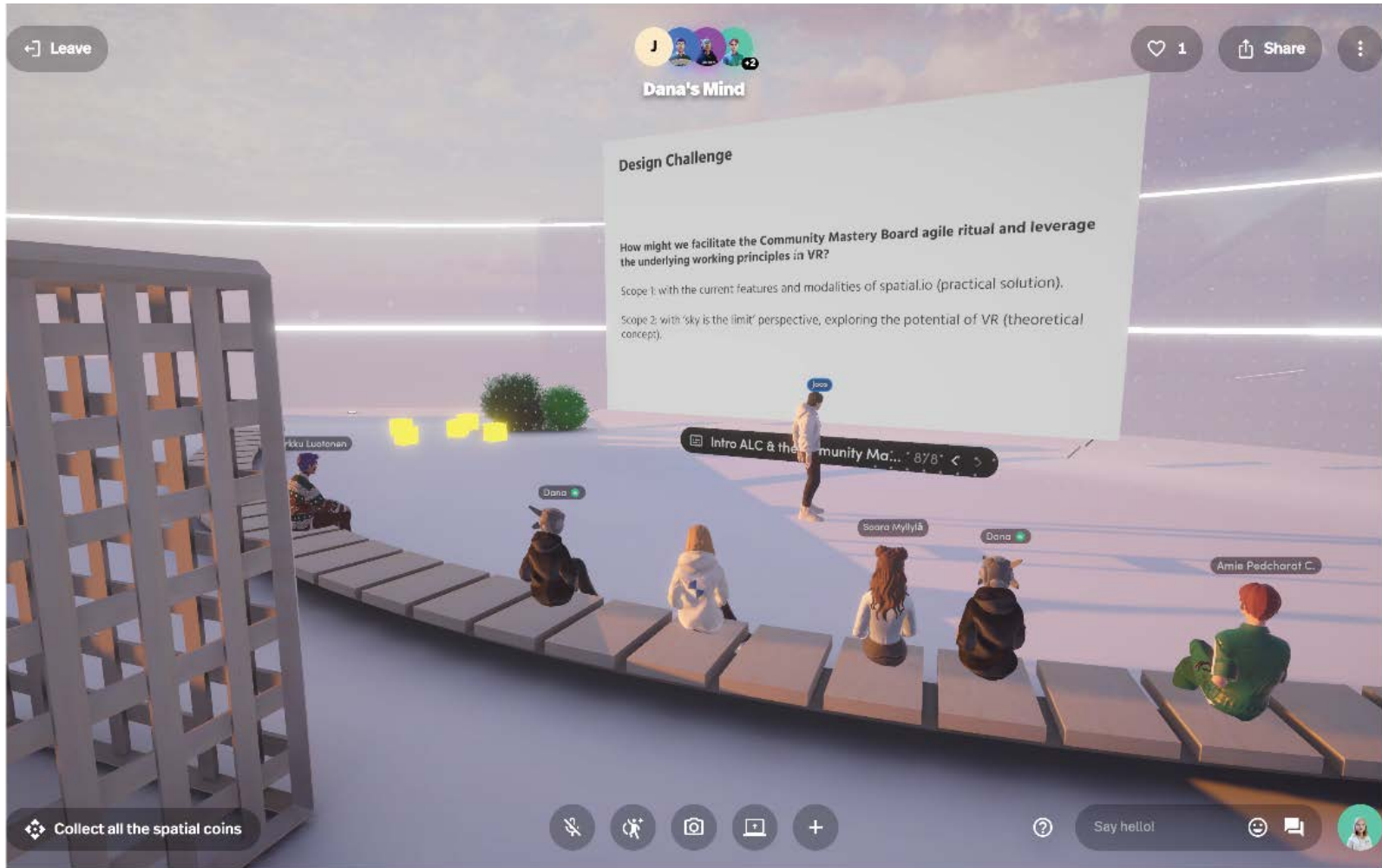
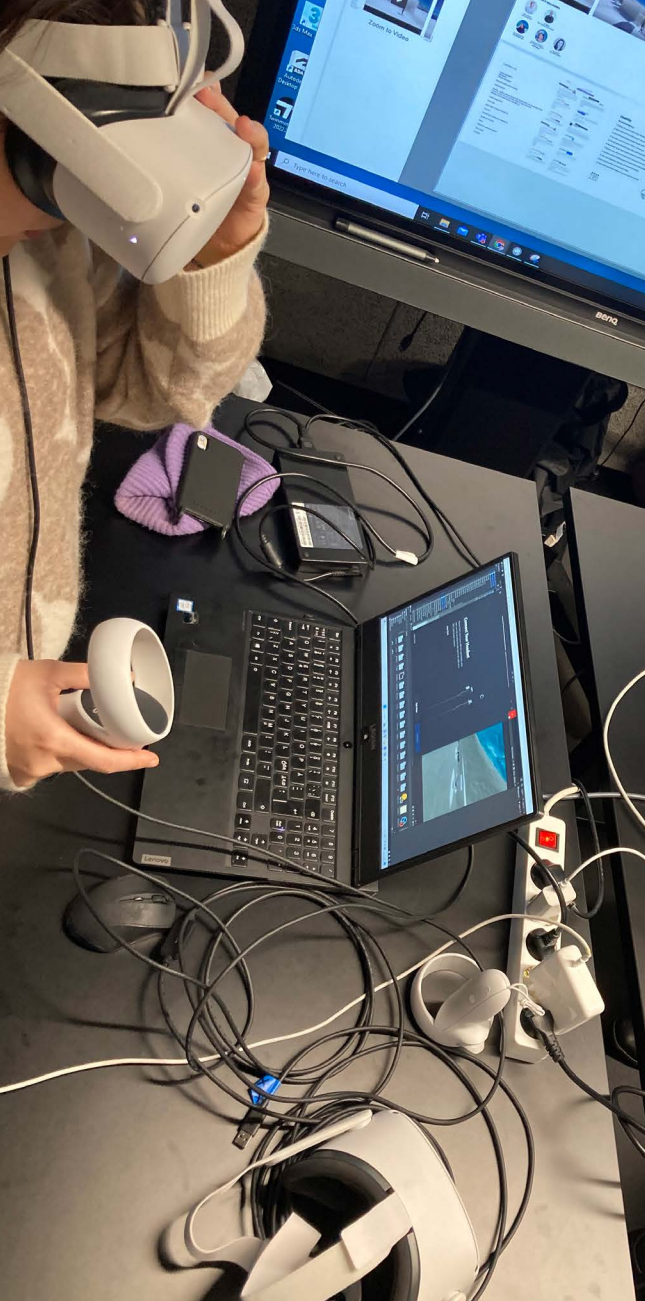


Image 7. Parinaz Mohammadi's Dana's mind World in Spatial.

Part 2. Guides on setting up and using your devices

Part 2 offers step-by-step guides on how to use VR devices, setting up your headset and how to install software for use. It gives information on how to use the Spatial platform.



Hardware

VR headset

A VR headset allows users to have an immersive experience where user engagement is greater than using a desktop or mobile device. When using a headset, the user is not disturbed by other engaging elements in his or her surroundings.

The Agile XR project decided to purchase the same devices for all partners so that all material produced in the project could be equally compared. The criteria for choosing the headset was accessibility, price, performance, and ability to cooperate with different software. Oculus Quest 2 known as Meta Quest 2 now was selected.

Here are some of the qualities that led us to purchase Oculus Quest 2: Oculus Quest 2 was wireless, it had a USB-C cable, was adjustable to your head size and lightweight, it was reasonably priced and the quality of display resolution and processor were good.

VR devices are easier to use when personalised. Most software recognises the user headset and device as a pair. The Oculus headset requires a Facebook account to operate. When devices have multiple users or groups of students, it is easiest to create accounts and emails for the project. We created several Google accounts for multiple users.

How to get started with our VR headset

You can use the Oculus Quest 2 Unboxing, Setup and Review YouTube video when setting up your headset.

Setting up the Meta Quest 2 (formerly known as the Oculus Quest 2) involves several steps to get your VR headset ready for use. Here's a step-by-step guide on how to set up the Meta Quest 2.

Note! Before starting the setup process, make sure you have a smartphone or tablet and a stable Wi-Fi connection.

Steps for setup

1. Charge the Headset

- ▶ Connect the included USB-C cable to the charging port on the Meta Quest 2 headset.
- ▶ Plug the other end into a USB power source, such as a computer USB port or a USB wall adapter.
- ▶ Let the headset charge until it's at least partially charged to ensure a smooth setup process.

2. Download the Meta Quest App

- ▶ On your smartphone or tablet, go to the App Store (iOS) or Google Play Store (Android).
- ▶ Search for and download the "Meta Quest" app (formerly Oculus app).

3. Turn On the Meta Quest 2

- ▶ Press and hold the power button on the right side of the Meta Quest 2 headset until you see the Oculus logo.

4. Pair the Headset with the App

- ▶ Open the Meta Quest app on your smartphone or tablet.
- ▶ Follow the on-screen instructions to pair the headset with the app. Make sure your phone's Bluetooth is enabled.

5. Connect to Wi-Fi

- ▶ In the Meta Quest app, you will be prompted to connect your headset to Wi-Fi. Choose your Wi-Fi network and enter the password if required.

6. Set Up Your Guardian Boundary

- ▶ The Guardian system helps you define a safe play area. Follow the on-screen instructions in the app to draw your Guardian boundary by pointing the headset controller at the ground.

7. Adjust Your View

- ▶ Put on the headset and adjust the straps to fit comfortably.
- ▶ Follow the on-screen instructions to adjust your view by moving the headset up and down, left and right, until it's comfortable and clear.

8. Complete the Tutorial

- ▶ The Meta Quest 2 will guide you through a tutorial to help you get familiar with the controllers and basic interactions.

9. Download VR Content

- ▶ Using the Meta Quest app on your smartphone or directly on the headset, browse and download VR content, games, and apps from the Oculus Store.

10. Link or Enable Facebook Account (Optional)

- ▶ If prompted, you can link your Meta Quest 2 with your Facebook account or create a new one. This step is usually optional but might be required for certain features.

11. Explore VR

- ▶ Once you've completed the setup and downloaded some VR content, you can start exploring and enjoying the virtual reality experiences on your Meta Quest 2.

12. Optional: Set Up a Virtual Desktop (PC Connection)

- ▶ If you want to connect your Meta Quest 2 to a PC for access to PC VR content, you can follow the instructions in the Oculus PC app to set up Oculus Link or use Air Link if your PC and headset support it.

Factory reset Oculus Quest 2

You might need to reset your device if you need to change the user profile or if the device is loaded with unwanted material for example. Once you successfully factory reset your Quest 2, it will be in the same state when you first took it out of the box. All of your previous data will be deleted.


Start you reset: Turn your headset off and put the headset on. Hold the power and volume-down button down until you see the boot screen. Please note that these are representations of the boot screen by Oculus. It may look a little different in your Quest, but the principle is the same.

Use the volume buttons to highlight "Factory Reset" and press the power button to select it.

Wait for the reset to complete.



Image 8. Picture of Oculus 2 Quest headset showing the location of the buttons.

A man in a dark blue shirt is wearing a VR headset and gesturing with his hands towards a large screen. The screen displays a virtual car dashboard with a glowing green steering wheel and various controls. The background is a bright, modern interior.

THE CRITERIA FOR
CHOOSING
THE META QUEST 2
HEADSET WAS
ACCESSIBILITY, PRICE,
PERFORMANCE, AND
ABILITY TO COOPERATE
WITH DIFFERENT
SOFTWARE.

Software

Horizon Workroom

One of the first platforms we tested was Horizon Workroom. It is a virtual reality (VR) collaboration software developed by Meta Platforms, Inc. (formerly Facebook). It was designed to facilitate remote work and collaboration in a virtual environment.

Horizon Workroom creates a virtual office environment in VR. Users can join the workspace using Oculus VR headsets, such as the Oculus Quest 2, to meet and collaborate with others as avatars in a virtual room.

The platform employs spatial audio technology, which means that the sound of voices and other audio sources comes from the direction of the avatar, making conversations feel more natural.

Users can engage in real-time discussions, share screens, documents, and whiteboards, making it suitable for a range of collaborative activities, from business meetings to brainstorming sessions.

Horizon Workroom allows users to customise their virtual workspaces, including room layouts, furniture, and decorations. This customization can help create a personalised and comfortable atmosphere.

While Horizon Workroom primarily targets VR users, it also offers a desktop mode for participants who do not have VR headsets. This ensures that non-VR users can still participate in meetings.

They offer a workroom which is a space to chat, share files and meet with coworkers. Workrooms exist in both 2D and VR — so you can shift between the two environments without missing a beat. This feature is available on Meta Quest 2 and web.

To sign in you need to create a Meta account.

A host creates the workroom and sends out invitations on PC.

Guests create a workroom account from invitation and pair it with their headset.

Workroom account setup requires a computer only.

Any email works. No signing in with a Facebook or Google account.

Available features

- ▶ avatar setup
- ▶ desk setup, no locomotion or teleport
- ▶ whiteboard
- ▶ image import
- ▶ screen sharing
- ▶ chat with virtual replicas of office tools
- ▶ integrations with calendar apps

Glue

Glue is a virtual collaboration platform designed for remote meetings and teamwork.

In 2023 Glue has developed more tools to customise avatars, making them more interactive, head and hand movements of VR users are tracked and perceived by other users. Glue offers spatial audio and each user's voice realistically emanates from their avatar's position. Glue has a library of ready and customisable spaces for different kinds of meetings and collaboration. Tools like sticky notes and whiteboards are available. They offer the ability to work with imported 3D models.

Glue allows free test use for up to 10 users.

Glue has VR and web signup.

Users have to create an account, install Glue and log in.

Sign up using invitation via email.

Available features

- ▶ cloud file for users
- ▶ speech-to-text capabilities
- ▶ 3D drawing - pen to draw, colour selection, moveable assets, unable to erase or save
- ▶ laser pointer
- ▶ camera, screenshot
- ▶ clock
- ▶ whiteboard - brush/colour selection, realistic eraser
- ▶ sticky notes
- ▶ visible username on top of avatars
- ▶ desktop view
- ▶ locations
- ▶ team files, i.e. images, 3D drawing, import/export through Glue web
- ▶ time duration, max 30 minutes, 10 users max in the free version

Other comments

- ▶ The Glue app cannot be found on Oculus store (desktop).
- ▶ The Glue app did not show up in the Oculus store at the beginning from the headset.

Links

- ▶ [Setup Quest \(Glue\)](#)
- ▶ [Glue on Desktop](#)
- ▶ [Glue on PC VR](#)
- ▶ [Glue 2.0 – VR tool for collaboration \(Immersive Learning News\)](#)

Spatial platform for customised spaces

Towards the end of this project, we tested Spatial.io and found it useful for several reasons. It did not have many distractions and it was easy to access and register an account.

The main reason we chose Spatial for further testing and VR environment development platform was its Creator Toolkit (published during our testing phase) which enabled us to build custom environments and functionality using the Unity game engine. So the customization possibilities were far better than with other platforms.

Spatial is a collaboration and communication platform that leverages augmented reality (AR) and virtual reality (VR) technologies to create immersive and interactive virtual workspaces. It allows users to meet, collaborate, and interact as avatars in a shared 3D space. Spatial is designed to enhance remote work, meetings, and collaboration by providing a more immersive and engaging experience.

Spatial provides virtual environments or workspaces where users can gather for meetings, presentations, discussions, and collaborative activities.

Users are represented as avatars within the virtual environment, enabling realistic interactions, movements, and expressions.

The platform supports real-time collaboration with features such as interactive whiteboards, document sharing, 3D object manipulation, and spatial audio for realistic sound positioning.

Spatial may integrate with various software and tools, making it possible to import content, access documents, and collaborate seamlessly within the virtual workspace.

While designed for immersive AR and VR experiences, Spatial may offer desktop and mobile versions, allowing users to join meetings and interact with the virtual environment without VR hardware.

Users may have the option to customise virtual environments, creating unique meeting spaces and layouts.

Spatial aims to bridge the gap between remote team members, enabling more engaging and effective collaboration regardless of geographical location.

Spatial gives several options for registration. For creating an account, profile and avatar you need to choose your preference of signing in. You can do this with any device: tablet, desktop computer, VR headset or mobile phone. Once you access the platform you will get a variety of worlds to explore. You are also able to create your own spaces.

Links

- ▶ [New to Spatial? Start here!](#)
- ▶ [How to Create or Join a Spatial Space](#)
- ▶ [2D image to Virtual Reality: A step-by-step guide to using Alpha3D with Spatial \(Alpha3D\)](#)

Spatial account setup (desktop)

That this manual is for a quick set up. Take a note, that this requires you to have a Google account.

1. Open the browser and go to <https://www.spatial.io>, but make sure you have signed in to your Google account before setting up the Spatial account.
2. Once you reach the landing page, select “**Log In**” on the top right corner of the page.
3. This will open a pop-up window. Select “**Google**”.
4. A second pop-up window will open. Select the Google account you have signed in with. Remember that you need to have signed in before this step.
5. After selecting the Google account you are taken into a new page. Agree to the terms to activate the account and finalise the Spatial account setup.
6. Type in the name you want to have in Spatial. This can be changed later.
7. After confirming the name, you will

be taken into your personal space where you can set up your avatar.

Avatar setup

1. First, you’ll need to create an account on the Ready Player Me website. Go to <https://readyplayer.me> and click the “Sign up” button at the top right corner of the page.
2. Next, you’ll be prompted to enter your email address and create a password. Fill in the required fields and click the “Create Account” button.
3. Once you’ve created your account, you’ll be directed to the Ready Player Me dashboard. From here, you can start creating your avatar by clicking the “Create Avatar” button.
4. You’ll then be prompted to choose a base model for your avatar. There are several options to choose from, including male, female, and non-binary models. Select the one that best represents you and click “Next”.
5. Next, you’ll be taken to the customization screen where you can choose various features for your

avatar, such as hairstyle, facial hair, eye colour, skin tone, and clothing. You can use the sliders and colour pickers to adjust the different features until you’re happy with how your avatar looks.

6. Once you have customised your avatar click the “Finish” button to save your changes.
7. You can then download your avatar as an image file, which you can use on various platforms such as social media, gaming, and at virtual events.

Spatial desktop

- ▶ Manage functions such as mike, emotes and screenshare in the toolbar.
- ▶ The chat function can be found on the desktop.
- ▶ Forgot the controls? The “?” icon in the left corner opens a tips tab.
- ▶ The “**Leave**”-button lets you exit the space.

SketchFab integration

To easily create a SketchFab account it is recommended to have a Google account.

1. To access the Sketchfab tab, press the **Add content** icon. You can find the icon at the bottom of the screen.
2. Select the **SketchFab** tab.
3. Click the **Connect your SketchFab account** button.
4. Select to log in with **Google**.
5. Select the account of your choice.
6. Choose the username and agree to the Terms of use and Privacy policy. Select **Create Account**.
7. Connect the accounts by selecting **Accept**.

Meta account setup

1. Navigate to Meta's site and select **Set up an account with email**.
2. Enter your email address and select **Next**.
3. Enter your name and select **Next**.
4. Enter your birthday and select **Next**.
5. Create a password and select **Next**.

6. Verify the information you've entered, and select **Create account**.
7. Retrieve the verification code from your email, and select **Continue**.
8. Your account is now ready. You can use it to log into your Quest and the Meta Quest app.

Install Oculus app on phone

1. Open the app store on your phone. If you're using an iPhone, it's the [App Store](#). If you're using an Android device, it's [Google Play Store](#).
2. In the search bar, type "Oculus" and search for the Oculus app.
3. Once you find the Oculus app, tap on it to open its page.
4. On the Oculus app page, tap the "Install" or "Get" button to download and install the app on your phone.
5. Depending on your phone's settings, you may be prompted to enter your password or use Touch ID or Face ID to confirm the download.
6. Wait for the app to download and install on your phone. This may take

a few minutes depending on your internet connection speed.

7. Once the Oculus app is installed, you can open it and sign in to your Oculus account to access your VR games and apps.

VR Headset setup (First time setup)

1. Turn on the VR headset. You will see a 5-digit pairing code show up in the headset.
2. If the code does not show up, open the Toolbar by pressing the Oculus button on your right touch controller.
3. Select the quick launch menu (time, battery, Wi-Fi) or app library then Setting > System > About > Pairing Code.
4. Turn on Meta Quest app. Log in with your Meta account or account of your choice.
5. To connect the device. Go to Menu > Devices > Pair new headset or Connect new device.
6. Tap Quest 2 and add the 5-digit code. Your Quest 2 will be paired with your phone.

VR Headset setup (Reconnect headset with Meta account)

1. Turn on the VR headset.
2. On the home screen it might ask you to reconnect with your headset using the code provided.
3. Connect your headset using the provided code by going to www.meta.com/device on mobile or desktop.
4. Update to the latest version if it requires. The headset will be restarted after that.
5. Go to App Library > Store > in the search bar type "Spatial" > Click Spatial app > Install.

Spatial VR setup

1. First time in Spatial app, you will be prompted with the tutorial on how to work with controllers and basic interaction with UI and objects in the space.
2. To complete your account, pair the code by visiting www.spatial.io/pair or click on your profile picture from Spatial website on desktop > Pair headset and add the code.

3. You are now ready to explore the spaces on Spatial.
4. To join AgileXR spaces, go to Team and select the space of your choice.

Spatial mobile setup

1. Download Spatial app from App Store or Google Play
2. To log in to your existing Spatial account, click on account button.
3. Log in to Spatial account the same email using on desktop version. You will be brought to Spatial homepage.
4. To access the space via the invitation link, open an invitation on email and click "JOIN SPACE"
5. Open the invitation with your choice of browser and click "open in app". You will be brought to invited space.
6. Navigation tutorial will pop up the first time you access the app. But you can also find it from The Kebab menu >Tutorials

A detailed manual for setting up a Spatial account including screenshots can be found as a Google Slide presentation:

[Manuals for Spatial account setup \(Google Slides\)](#)

Conclusions

The assumption at the beginning of the project was that existing VR learning applications do not support communality, but that the solution must be sought in social and collaborative Metaverse platforms.

Metaverse platforms are changing and evolving rapidly. During the evaluation and testing phase, the most potential platform changed and instead we started to use the Spatial platform.

The setup and onboarding phases have proven to be more challenging and time consuming than expected. For example, getting your Oculus Quest 2 headset ready for use requires skills you wouldn't expect from a casual user. VR headsets should be understood more as personal devices that you have had time to familiarise yourself with beforehand.

The onboarding phase of Metaverse platforms has also proven challenging. Installing applications, creating user accounts, customising avatars and learning the functionality of the platform take time and are not successful for a casual user. Even if the use seems troublesome we

encourage teachers and new users to try VR since it develops one's digital skills.


The user's first experiences on the Metaverse platform have also been surprising. Time is spent exploring places, trying out functions and general wandering. Organised pedagogical activities can be organised later, when they have first explored freely. Students also use the platforms more adequately when it becomes more established and routined.

A new, interesting opportunity has been found to work with 3D models. Teachers and students can bring 3D models to the Metaverse platform to enable collaborative action e.g. create entities from 3D models, move and scale models.

3D models gave us an opportunity to test our own spaces to gain knowledge. Our goal was to create a functional space for distance learning that offers a visually interesting space with qualities that support learning. Design elements consist of the size of the spaces, landing area and spaces for different purposes, like lecture space and spaces for group work or one to one

discussions when the space audio can be controlled.

This study gave us a belief that we still have not seen the potential of VR but technology can make learning more engaging and motivating for students.

A woman with dark hair is wearing a black VR headset and adjusting it with both hands. She is looking upwards and to the right. In the background, a computer monitor displays a grid of colorful icons. The scene is set in a well-lit room with a light-colored wall.

TIME IS SPENT
EXPLORING PLACES,
TRYING OUT FUNCTIONS
AND GENERAL
WANDERING. ORGANISED
PEDAGOGICAL ACTIVITIES
CAN BE ORGANISED
LATER, WHEN STUDENTS
HAVE FIRST EXPLORED
FREELY.

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Who we are

This guidebook has been made in the project Augmented Agile teamwork for hybrid learning at Schools (Agile XR) that was executed in 2022–2023.

Project partners

Metropolia UAS is Finland's largest University of Applied Sciences.

As recent technologies emerge to educational environments Metropolia UAS is among the first University of Applied Sciences who offer a degree program (XR Design) XR technologies and content creation.

RHIZO Lyceum, the coordinator, OLV Vlaanderen is a secondary school from the city Kortrijk, located in Flanders, Belgium. It is one active creator of the RHIZO school community, a partnership between eleven secondary schools.

CollectiveUP is a social enterprise that does research to create methods and technologies that benefit individuals and collectives.

Universidad Francisco de Vitoria (UFV) is a private independent non-profit university, based in Madrid, Spain. Teacher-researchers (in the field of education) and the university's Institute for Teaching Innovation are involved.

Metropolia Agile XR project group

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Appendix 1. Results of benchmarking

Name	Purpose of VR Platform	Key features	Headset support	Platform requirement	Max users	Pricing/ subscription	Avatars Default/ customizable	Game Engine	Design
AltspaceVR	General	Key features	Oculus Rift, Oculus Quest, Oculus Go, HTC Vive, Valve Index, Windows MR, Gear VR, Google Daydream	Steam, Oculus, Window Mixed Reality, Desktop mode	Official 50 avatars FrontRow enabling 50 avatars each room	Free	customizable	Unity	Cartoonic, low poly
Spatial.io	Spatial is dedicated to helping creators and brands build their own spaces in the metaverse to share culture together.	Key features	Quest, Quest2, Microsoft Hololens	Oculus, Microsoft Store	Up to ten Windows 10 devices	Free	customizable		
Glue	Brings remote teams together	for teams who need remote meetings to be as great as face-to-face meetings.	Call major standalone VRsets: Oculus Quest 1 & 2, Pico Neo 2 & 3 and HTC Vive Focus 3	With PCVR: SteamVR enabled headsets including the Windows Mixed Reality devices. You can also join in with PC/MAC in desk top mode without any VR devices.	max 40 users in one team space simultaneously for best performance. Max 10 users for free	Free for up to 10 users	customizable, highly expressive	Unity	Realistic
hubs mozilla	Meet, share and collaborate together in private 3D virtual spaces	Open source and customizable. Upload personalized avatars or create unique environments using Spoke.	o downloads or VR headset necessary. People use Hubs on all sorts of headsets.	Hubs works on most modern browsers	limit the room with 25 user max per room to avoid performance drop and to spilt the users into different room instead, in the case of large events	ee for now. For a custom deployment, Hubs Cloud is available on AWS	cartoonic	Unity	Low poly

Name	Purpose of VR Platform	Key features	Headset support	Platform requirement	Max users	Pricing/ subscription	Avatars Default/ customizable	Game Engine	Design
Meetivr	Meeting & collaboration platform Discussion users, Brain storms, Agile/Scrum, lecture hall	Pre-built virtual spaces, Powerful collaboration capabilities, A naturalised user interface,	Standalone headsets: Oculus Quest, Oculus Quest 2, Pico Neo 2 & Pico Neo 2 Eye, Pico Neo 3 Pro & Pico Neo 3 Pro Eye Tethered headsets: Oculus Rift, Oculus Rift S, HTC Vive, HTC Vive Pro, Windows MR, Valve Index Varjo	Advanced PC Desktop version (Windows and MacOS) WMR	For Highly Focused Conversations 6 available seats, For Brainstorming and Co-Creation Up to 20 simultaneous users		Customised, photo-realistic avatars		Realistic
3D Bears	Immersive learning platform	D-modelling integration, Augmented Reality (AR) and 3D printing. Pedagogical modules for effective learning.	All VR headsets, Mixed Reality headset	demo request, Desktop mode, IOS, Android			no		Cartoonic, realistic
Virtual dawn	Education, business, training, medical & entertainment	Customizable VR simulations and All-in-one Virtual Reality creation house	culus Rift, Oculus Quest, Oculus Go, HTC Vive, Valve Index, Windows MR, Gear VR	demo request	fixed or unlimited	REW Corporate: €1000/ y and €1400/ y with headset VREW free version	yes/ customizable	Unity	low poly

Name	Purpose of VR Platform	Key features	Headset support	Platform requirement	Max users	Pricing/ subscription	Avatars Default/ customizable	Game Engine	Design
TeachVR	Education	Online platform that can find, create and share VR a lesson and synchronized to the entire class. TeachVR education kit. Custom VR & AR development solutions for schools & companies	Pico G2, 360 camera, Oculus Go, Google cardboard, GearVR	demo request, iOS, Android	unlimited	Teacher license School license Free	no		cartoonic, lowpoly
Eonreality	Education & Training	Self-service AR&VR, Cloud based, asset import, data powered, interaction recording, cross-device publishing, user management, content management	Oculus Quest, HTC Vive, MagicLeap, Microsoft Hololens	Oculus Quest, Window 10, Magic Leap, Google Play, AppStore.			no		realistic
Unimersiv	Education & Training	Immersive VR education & Game based learning	GearVR, Oculus Rifts, Oculus Go, Google Daydream, Google Cardboard, HTC Vive	Oculus Quest, Steam		\$3.49-\$5.00	no	no	cartoonic, lowpoly



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