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The Power of AR and VR: Igniting Passion for Learning Through Innovative Technologies

2024-1-PL01- KA220-VET-000243150

AR AND VR VOCATIONAL TEACHER TRAINING PROGRAM

2025

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INTRODUCTION

The AR and VR Vocational Teacher Training Program (IO1) is designed to equip educators with the knowledge and practical skills needed to integrate Augmented Reality (AR) and Virtual Reality (VR) into their classrooms. This program provides teachers in AR and VR environments with experiential learning methods by allowing them to gain hands-on experience with the tools and technologies they'll later use with their students. This approach builds confidence and familiarity, making it easier for teachers to incorporate these technologies effectively.

This innovative training is tailored for educators across various disciplines, including technical fields like IT, Electronics, and Automation, as well as subjects like Geography, Mathematics, and Biology. The goal is to empower teachers with innovative tools that go beyond traditional methods, helping to create more engaging and meaningful learning environments. By transitioning from traditional to experiential learning, teachers can make education more interactive and impactful for their students.

The program is structured into six comprehensive modules:

Module 1: Introduction to AR and VR Technologies in Education, where teachers will learn the foundational concepts and explore the potential of these technologies to enhance learning.

Module 2: Creating Engaging AR and VR Learning Experiences, which focuses on designing interactive and immersive content that captivates and educates students.

Module 3: Designing Curriculum-Integrated AR and VR Activities, where teachers will learn how to align AR and VR activities with their curriculum objectives.

Module 4: Hands-On AR and VR Content Creation, providing practical experience in creating AR and VR content for the classroom.

Module 5: Effective Integration of AR and VR into Teaching, offering strategies for incorporating AR and VR into lessons to improve student engagement.

Module 6: Assessment and Evaluation of AR and VR Learning, where teachers will explore how to assess student learning outcomes in AR/VR-enhanced educational settings.

The training is delivered over 36 hours across 6 weeks, with each module designed to build teachers' capacity to effectively use AR and VR in vocational education, making lessons more engaging, interactive, and compatible with modern educational practices.

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Summary of The Power of AR and VR: Igniting Passion for Learning Through Innovative Technologies Project

The Power of AR and VR project is aimed at equipping VET teachers with the skills and confidence to integrate Augmented Reality (AR) and Virtual Reality (VR) into their teaching methods, enhancing both teacher competence and student engagement. By introducing immersive technologies, the project seeks to transform learning environments, promote cross-disciplinary learning, and improve overall learning outcomes while ensuring inclusiveness for all students.

Project Objectives:

a. Equip VET teachers with the skills to effectively use AR and VR in their teaching practices.
b. Empower teachers to create cross-disciplinary learning experiences.
c. Enhance student engagement and improve learning outcomes through innovative teaching methods.
d. Promote inclusiveness by making AR and VR tools accessible and adaptable for diverse learners.

Key Activities:

a. Kick-off Meeting: Project initiation and strategy setting.
b. Webinars: A series of webinars introducing and exploring AR and VR applications in education, such as "Unlocking Learning Potentials: Integrating AR and VR in Education" and "Journey into Immersive Education."
c. LTTs (Learning, Teaching, Training Events): Piloting of the AR and VR training programs and toolkits with teachers.
d. Local Events: Piloting the AR and VR modules with local VET teachers.
e. Multiplier Events: Dissemination of project results and sharing best practices.
f. Final Meeting: Review of project outcomes and future strategies.

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Intellectual Outputs:

1. IO1: AR and VR Vocational Teacher Training Program: A comprehensive training program designed to empower teachers with the knowledge and skills needed for digital learning.
2. IO2: AR and VR Toolkit for Cross-Disciplinary Learning: A resource toolkit providing teachers with practical tools for integrating AR and VR into various subjects.
3. IO3: E-Learning Pills Platform: An interactive platform offering bite-sized learning modules, enhancing teacher training with flexible, online resources.

Expected Outcomes:

1. Enhanced Teacher Competence: Teachers will develop the skills and confidence to use AR and VR technologies in their lessons.

2. Engaging Learning Environments: By incorporating AR and VR, teachers will create more dynamic and interactive classroom experiences.

3. Wider Digital Adoption: The project aims to foster a culture of digital learning, encouraging broader adoption of immersive technologies in education.

4. Cross-Disciplinary Integration: AR and VR will be used to create learning experiences that span multiple subjects, enriching the learning process.

5. Increased Awareness: The project will raise awareness of the benefits of AR and VR in education, demonstrating how these technologies can transform teaching and learning.

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Roadmap Of The Training Program

Module 1: Introduction to AR and VR Technologies in Education

Teachers will explore the potential uses of AR and VR technologies in various educational settings.

Outcome: Teachers will gain a strong foundational understanding of how AR and VR can enhance learning experiences in different subjects.

Module 2: Creating Engaging AR and VR Learning Experiences

Teachers will learn techniques and best practices for creating captivating AR/VR lessons that boost student engagement.

Outcome: Participants will develop the ability to design AR and VR learning activities that foster deeper student involvement and understanding.

Module 3: Designing Curriculum-Integrated AR and VR Activities

Teachers will learn how to integrate AR and VR tools into existing curricula while ensuring alignment with educational goals.

Outcome: Teachers will be equipped to create curriculum-based AR and VR lessons that complement their subjects and enhance traditional teaching methods.

Module 4: Hands-On AR and VR Content Creation

Teachers will work with AR/VR tools to create interactive content, such as virtual simulations and 3D objects, that can be used in lessons.

Outcome: Teachers will have hands-on experience in designing their own AR and VR content for classroom use.

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Module 5: Effective Integration of AR and VR into Teaching

Teachers will learn effective classroom management techniques and pedagogical strategies for using AR and VR during lessons.

Outcome: Participants will be able to implement AR and VR technologies into their daily teaching practice, leading to more interactive and student-centered learning environments.

Module 6: Assessment and Evaluation of AR and VR Learning

Teachers will explore methods for assessing student learning outcomes and engagement through AR and VR activities.

Outcome: Participants will develop assessment rubrics and evaluation methods tailored to AR/VR-based learning, ensuring they can measure the effectiveness of their lessons.

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Module 1

Introduction to AR and VR Technologies in Education

Objective:

- To familiarize teachers with the fundamental concepts of Augmented Reality (AR) and Virtual Reality (VR) technologies
- To explain the key differences between AR and VR
- To demonstrate the potential of AR and VR technologies to enhance student engagement
- To encourage teachers to explore examples of AR and VR in education
- To build confidence in teachers by introducing them to the basic tools and platforms used for AR and VR content creation

Learning Outcomes:

- Define AR and VR and explain their key features and differences.
- Identify the benefits and challenges of incorporating AR and VR into vocational education.
- Recognize examples of AR and VR applications in education, especially in vocational training contexts.
- Describe how AR and VR can enhance learning experiences and student engagement.
- Navigate entry-level tools and platforms for AR and VR content exploration and development.

6 Hours

Key Concepts: Augmented Reality (AR), Virtual Reality (VR), Vocational Education Applications,

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Theoretical Component

Virtual reality (VR) and augmented reality (AR) are two technologies that are changing how teachers interact with students due to technology's transformation of education. AR uses devices like smartphones or tablets to superimpose digital content, such as text or images, onto the real world. On the other hand, virtual reality (VR) uses headsets to immerse people in a simulated world. Both technologies create opportunities for innovative teaching methods by enabling students to engage with the material in new ways and visualize concepts.

AR and VR can help close the knowledge gap between theory and practice in vocational education. Consider allowing students to use augmented reality (AR) to follow detailed instructions in real-time or to explore the internal workings of a machine digitally. These resources facilitate interactive, interesting learning and make it simpler to relate to practical uses. Teachers must, however, be aware of the distinctions between AR and VR to select the best strategy for their teaching goals.

However, AR and VR have drawbacks just like any other instrument. Cost, technical proficiency, and device accessibility can all be obstacles. To demonstrate how AR and VR technologies can improve learning without depleting resources, this module will concentrate on introducing teachers to useful and approachable tools. Understanding the technology's ability to produce engaging and unforgettable learning experiences is more important than quickly becoming an expert in it.

In the end, this module highlights that AR and VR are more than merely glitzy devices. They want to prepare students for a digital future by revolutionizing the way they engage with knowledge. Teachers will investigate how to successfully incorporate these resources into their lessons to attract students' interest and enhance results.

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Module Structure

Topic 1: Understanding AR and VR – Key Concepts and Differences

Topic 2: Exploring the Educational Potential of AR and VR

Topic 3: Introduction to AR and VR Tools for Vocational Training

Topic 4: Real-World Applications in Vocational Education

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ACTIVITY 1: Understanding AR and VR in Education

Objective:

- To help teachers differentiate between AR and VR
- To introduce real-life scenarios where AR and VR are applied in vocational education
- To build a foundational understanding of how these technologies enhance learning experiences

Description:

In this interactive and captivating activity, teachers will be introduced to the basic concepts of virtual reality (VR) and augmented reality (AR). Understanding these technologies by demonstrating their functions and differences from one another is the aim. Teachers will first view a brief demonstration video that shows how AR and VR work together, such as superimposing instructions on actual objects and immersing users in a completely virtual world.

After the demonstration, participants will discuss the technologies in a group setting, exchanging opinions and coming up with ideas for potential applications in vocational education.

Materials Needed:

- Projector
- Laptop or tablet
- Video (Link)

Instructions:

Step 1:

- Play a short video that demonstrates AR and VR in action.
- After the video, invite participants to share their first impressions
- After the video, ask participants:
  a. What caught your attention during the demonstration?
  b. Can you think of examples where AR or VR might enhance learning in your subject area?

Step 2:

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- Divide participants into groups
- Each group will explore a different AR app
- Introduce the apps:

a. Merge EDU (for interactive 3D learning).
b. QuiverVision (for creative and artistic lessons).
c. Google Lens (for research and exploration).
d. JigSpace (for step-by-step 3D demonstrations).

Group 1: Merge EDU (Content with Merge Cube)

- Focus: Interactive 3D models for STEM or vocational lessons.
- Use a Merge Cube
- Open the Merge EDU app and explore 3D models like planets or machinery.
- Rotate the cube to view models from all angles.
- Task:

a. Discuss how 3D models could help students visualize concepts in your subject.

- Example: Teaching how a car engine works by showing its parts in 3D.

Group 2: QuiverVision (AR Coloring Pages)

- Focus: Creative lessons for arts, science, or storytelling.
- Download and print free coloring pages from QuiverVision.
- Color the page and scan it using the app.
- Watch as the drawing turns into an animated 3D object.
- Task:

a. Discuss how this tool can engage younger students or support creative projects.

- Example: Explaining the water cycle through an animated diagram.

Group 3: Google Lens (Research Tool)

- Focus: Real-world exploration for research and identification.
- Open the Google Lens app (available on most smartphones).
- Scan real objects, like plants or books, to get instant information.
- Test the app by identifying a plant or exploring a map.
- Task:

a. Discuss how Google Lens can enrich lessons with real-time research.

- Example: Identifying plant species during a biology field trip.

Group 4: JigSpace (3D Learning App)

- Focus: Step-by-step AR demonstrations for STEM and vocational education.
- Open the JigSpace app and explore preloaded 3D "Jigs" (e.g., how a lock works).
- Interact with the model and follow the step-by-step breakdown.

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- Task:

a. Discuss how to use step-by-step AR for teaching complex processes.

- Example: Showing how a bicycle chain mechanism functions.

Assessment

- **Reflection on Video**

a. What was the most striking feature of AR or VR in the video demonstration?

b. How do you think AR and VR can address challenges in teaching specific concepts in your subject area? Provide one example.

c. What limitations or challenges do you foresee in implementing AR or VR in your lessons**?**

- **Final Reflection and Individual Feedback**

a. Which AR app did you find most useful for your teaching practice and why?

b. What is one concrete way you plan to implement AR or VR in your classroom within the next month?

c. What challenges might you face, and how will you overcome them?

60 mins

ACTIVITY 2: Blending Realities

Objective:

- To gain a clear understanding of Augmented Reality (AR) and Virtual Reality (VR)
- To explore AR and VR-like simulation apps to directly experience their educational potential
- To analyze and articulate the key differences between AR and VR

Description:

This activity aims to give participants a practical, group-based understanding of the main distinctions between virtual reality (VR) and augmented reality (AR). Participants will investigate how AR superimposes digital features onto the physical world and how VR produces completely realistic environments—even without the need for specialist headsets—

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using freely available apps. Making these technologies relatable and useful for instructional strategies is the primary objective.

By the end of the session, teachers will have a clear understanding of AR and VR, practical ideas for integrating these tools into their classrooms, and a deeper appreciation for how technology can transform teaching and learning. This activity fosters collaboration, creativity, and a practical approach to using innovative tools in education.

Materials Needed:

- Reality Composer (iOS) or AR Makr (iOS) for AR exploration.
- ExpeditionsPro (iOS/Android) or CoSpaces Edu (iOS/Android) for VR-like simulation.

Instructions:

Step 1:

- Start with a relatable question:

a. How do you think AR and VR differ in how they engage users and enhance learning?

Step 2:

- Divide participants into Two Groups:
- Group A: Explore AR.
- Group B: Explore VR (via a simulation-style app on smartphones or tablets).

Group A: AR Exploration

- App: Reality Composer (iOS) or AR Makr (iOS)

a. Open the app on your device.
b. Use it to place virtual objects into the real world (e.g., place a 3D model of a car on a table or a planet in the room).
c. Move around and observe how the virtual object stays anchored in the real world.
d. Experiment by resizing or interacting with the object.

- Guiding Questions:

a. How does this app help visualize concepts in real-world settings?
b. How could this tool enhance understanding of physical environments, like classrooms or workshops?

Group B: VR-Like Simulation Without Headsets

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- App: ExpeditionsPro (iOS/Android) or CoSpaces Edu (iOS/Android)

a. Open the app and select a virtual environment (e.g., an underwater world or a factory floor).
b. Navigate through the environment by swiping or tilting the device.
c. Explore specific features of the environment, such as zooming in on objects or switching perspectives.

- Guiding Questions:

a. What makes this experience immersive, even without physical surroundings?
b. How could this tool simulate environments that students might not otherwise access?

Step 3:

- Ask each group to summarize their experience with their app.

a. What was unique about your app?
b. How did the app's functionality align with AR or VR characteristics?

Assessment

- **Feedback and Reflection**

a. What is one new thing you learned about AR or VR that you didn't know before?
b. Which tools (AR or VR) do you see as more applicable to your teaching context, and why?
c. What challenges might you face in implementing these technologies, and how could you overcome them?
d. Provide one specific example of how you could use this app in your classroom.

60 mins

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ACTIVITY 3: Discovering AR and VR in Education

Objective:

- To explore and identify the educational potential of AR and VR by interacting with engaging and practical applications that demonstrate these technologies' capabilities in various teaching contexts.

Description:

Teachers explore the educational potential of AR and VR through hands-on interaction with innovative and accessible apps. Using EyeJack, they bring artwork to life with AR animations, enhancing storytelling and creative projects. At the same time, Panoform allows them to create VR-like simulations by transforming panoramic images into immersive virtual environments, with no headsets required. Through group collaboration, participants analyze the unique features of each tool, brainstorm lesson ideas tailored to their subjects, and discuss practical applications for enhancing student engagement. The activity concludes with reflection and takeaway strategies, equipping participants with actionable insights to integrate AR and VR into their teaching practices effectively.

Materials Needed:

- EyeJack

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All this Junk – Kerry Youde

- Panoform

Instructions:

Step 1:

- Open with a Question:

- What if your students could step into a virtual rainforest or interact with a 3D molecule on their desks? How might that change the way they learn?

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- Provide a Brief Overview:

"Augmented Reality (AR) overlays digital content in the real world, enhancing the learning environment. Virtual Reality (VR), on the other hand, immerses users in fully virtual experiences. Today, we'll explore their potential for education using creative tools.

Step 2:

- Divide Participants into Groups:

- Group A: Explore AR.

- Group B: Explore VR-like tools.

- Group A: AR Exploration App: EyeJack (iOS/Android)

a. Focus: Using AR to enhance storytelling and creative projects.
b. Open the EyeJack app and scan the provided AR-enabled artwork
c. Watch as the artwork comes to life with animations and interactive elements.
d. Experiment with how the app changes the storytelling experience.
e. Discuss how AR can be used to create interactive stories, teach visual arts, or explain complex topics through animation.
f. Example: Creating animated timelines for history lessons.

- Group B: VR-Like Simulation Without Headsets

a. App: Panoform (iOS/Desktop)
b. Focus: Turning panoramic photos into immersive VR-like experiences.
c. Take or upload a 360° panoramic image (e.g., a local museum, school lab, or cultural site).
d. Use the Panoform app to convert the image into a virtual environment.
e. Explore the environment on your device by swiping and tilting the screen.
f. Discuss how VR-like simulations can help students explore environments they can't visit in person.
g. Example: Conducting a virtual field trip to an archaeological site or industrial plant.

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Step 3:

- Each group presents their app experience.
- Guiding questions:

a. What features stood out most in your app?

b. How could this tool support teaching and learning in your subject?

- Ask each group to create a list of at least three specific lesson ideas for their tool.

- Example Ideas:

a. AR: Creating interactive visual guides for biology or literature.

b. VR-like: Hosting a virtual science fair with student-created environments.

Assessment

- **Individual Reflection Questions**

a. What was the most interesting feature of the AR or VR tool you explored, and why did it stand out to you?

b. How do you think this tool could enhance student engagement in your subject area?

c. Provide one specific lesson idea where you could use the tool you explored today.

d. What challenges might you face when integrating AR or VR into your teaching, and how could you overcome them?

e. Which do you find more applicable to your teaching—AR or VR? Why?

- **Group Discussion Questions**

a. What were the unique features of the app your group explored?

b. How does the app align with the characteristics of AR or VR?

c. In what ways could this tool transform traditional teaching methods in your subject?

d. Discuss at least two creative lesson ideas for using the app in a classroom setting.

e. How do you think students would respond to using this technology in their learning?

60 mins

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ACTIVITY 4: Exploring AR and VR Tools for Vocational Training

Objective:

- To equip teachers with hands-on experience using AR and VR tools designed for vocational training.
- To explore practical applications of AR and VR in enhancing skill development and engagement in technical education.

Description:

Teachers will explore innovative AR and VR tools specifically designed for vocational training, enabling skill development and increased engagement. Using apps like AR Ruler 3D for spatial planning and measurements, and Interplay Learning's SkillMill for virtual trade simulations, participants will interact with real-world scenarios tailored to vocational contexts. Through group collaboration, teachers will analyze the tools' features, brainstorm lesson ideas, and reflect on how these technologies can enhance technical education by bridging the gap between theoretical knowledge and practical application.

Materials Needed:

- AR Ruler 3D
- Interplay Learning

Instructions:

Step 1:

- Open with a Contextual Question:

- Ask participants:

a. What challenges do students face in developing hands-on vocational skills, and how could technology help?

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- Provide a Brief Overview:

AR and VR tools allow us to simulate hands-on learning experiences, enabling students to practice technical skills in a risk-free environment. Today, we'll explore tools that can transform vocational training."

Step 2:

- Divide Participants into Two Groups:

- Group A: Explore an AR tool.

- Group B: Explore a VR-like simulation tool.

- Group A: AR Exploration with AR Ruler 3D (iOS/Android)

a. Focus: Measuring and planning in vocational contexts like plumbing, carpentry, or construction.
b. Open the AR Ruler 3D app.
c. Use the app to measure real-world objects or spaces (e.g., measure the length of a table or room dimensions).
d. Experiment with different tools, such as angle measurements or 3D floor plans.
e. Discuss how this tool can be used to teach planning and measurement in vocational subjects.

- Example: Students can use AR Ruler 3D to create accurate measurements for installing fixtures or equipment.

- Group B: VR-Like Simulation with Interplay Learning (Web-Based)

a. Focus: Virtual simulations for trades like electrical work, plumbing, and HVAC systems.
b. Access the Interplay Learning platform via a browser.
c. Choose a trade simulation (e.g., fixing an electrical panel or repairing a plumbing system).
d. Navigate the simulation, following the step-by-step guidance to complete the task.
e. Discuss how virtual simulations can provide hands-on practice in a safe and controlled environment.

- Example: Simulating electrical repairs to teach safety protocols and procedures.

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Step 3:

- Facilitate Group Sharing:

- Each group presents their app experience.

- Questions

a. What did you learn about the tools?"
b. How could these tools support vocational training?

- Group Brainstorm:

- Ask groups to create a list of at least two lesson ideas using their assigned app.

Assessment

Individual Reflection Questions:

1. What was the most engaging feature of the AR or VR tool you explored, and why?

2. How do you see this tool enhancing student learning in vocational training?

3. What specific lesson idea could you implement using this tool?

4. What challenges might you face when using AR or VR in your teaching, and how will you overcome them?

Group Presentation Questions:

1. What unique features of the tool stood out during your exploration?

2. How does this tool address challenges commonly faced in vocational training?

3. Share a lesson idea your group brainstormed using this tool**.**

60 mins

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ACTIVITY 5: Real-World Applications of AR and VR in Vocational Education

Objective:

- To explore and evaluate real-world applications of AR and VR tools in vocational education.
- To equip teachers with practical strategies for integrating AR and VR into their vocational training programs

Description:

Teachers will explore free AR and VR tools designed for vocational training. Using Assemblr Studio to create AR-enhanced visuals and Google Earth VR (via the desktop version) to explore immersive environments, participants will engage with practical tools that replicate real-world tasks. The activity will highlight how these technologies can enhance learning by simulating environments and tasks relevant to vocational education.

Materials Needed:

- Assemblr Studio
- Google Earth Web VR

Instructions:

Step 1:

- Ask participants:

a. "What real-world tasks could benefit from enhanced visual tools or immersive virtual environments in vocational training?"

Step 2:

- Divide Participants into Two Groups:
- Group A: Explore an AR tool.
- Group B: Explore a VR-like tool.

- Group A: AR Exploration with Assemblr Studio (iOS/Android)

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a. Focus: Designing AR content to enhance vocational training.
b. Open the Assemblr Studio app
c. Create an AR-enhanced visual for a vocational task (e.g., a labeled engine or a step-by-step guide for equipment maintenance).
d. Experiment by adding 3D models, text, and animations to your design.
e. Scan your creation to view it in AR and adjust the settings for clarity.
f. Discuss how AR-enhanced visuals can make technical concepts more accessible to students.
g. Example: Creating a labeled 3D diagram of a machine to teach its components and functions.

- Group B: VR-Like Exploration with Google Earth Web VR (Desktop/Browser)

a. Focus: Exploring immersive environments for vocational tasks.
b. Open Google Earth on a desktop or browser.
c. Navigate to a vocationally relevant location (e.g., a construction site, industrial area, or manufacturing plant).
d. Use street view and 3D navigation to explore the environment.
e. Discuss the features and how they replicate real-world conditions.
f. Discuss how immersive environments can provide context for vocational lessons.
g. Example: Taking students on a virtual site tour to understand workplace layout and safety protocols.

Step 3:

- Each group presents their app experience:

a. "What did you learn about the tool?"
b. "How could this tool support vocational training?"

- Ask groups to create a list of at least two lesson ideas using their assigned app.
- Examples:

a. Assemblr Studio: Creating AR visuals for a plumbing or carpentry guide.
b. Google Earth Web VR: Exploring industrial layouts for workplace safety training.

Assessment

- Individual Reflection Questions:

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a. What was the most useful feature of the AR or VR tool you explored, and why?
b. How do you see this tool helping students prepare for real-world vocational tasks?
c. What specific lesson idea could you implement using this tool?
d. What challenges might you face when using AR or VR in vocational training, and how can you address them?

60 mins

ACTIVITY 6: Simulating Real-World Vocational Skills with AR and VR

Objective:

- To explore free AR and VR tools that simulate real-world tasks for vocational training.
- To empower teachers to integrate AR and VR into their classrooms to create engaging, practical learning experiences.

Description:

This activity introduces teachers to free AR and VR tools that simulate real-world skills in vocational education. Using Houzz for AR-based design and ThingLink (Web-Based) for interactive VR-like storytelling, participants will explore how these tools can enhance teaching by making complex tasks more accessible and engaging. Through hands-on exploration, collaborative brainstorming, and reflective discussions, teachers will discover innovative methods to integrate these tools into their vocational training programs.

Materials Needed:

- Houzz
- ThingLink

Instructions:

Step 1:

- Ask participants:

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a. "Imagine teaching students to design a room layout or visualize a factory process before physically executing it. How could AR and VR help with this?"
- Explain: "Today, we'll explore free AR and VR tools that let students simulate real-world tasks, providing hands-on learning experiences in a virtual environment."

Step 2:

- Divide Participants into Two Groups:
- Group A: Explore an AR tool.
- Group B: Explore a VR-like tool.
- Group A: AR Exploration with Houzz (iOS/Android)

a. Focus: Visualizing design concepts and layouts for vocational tasks like interior design or construction.
b. Open the Houzz app and select a sample room or project.
c. Use the AR feature to place furniture, fixtures, or decorations in a real-world space.
d. Experiment with different designs by changing objects and their arrangements.
e. Discuss how AR can enhance design and planning in vocational training.

- Example: Teaching students how to plan room layouts or visualize construction projects.

- Group B: VR Exploration with ThingLink (Web-Based)

a. Focus: Creating interactive VR-like environments for technical training and storytelling.
b. Open ThingLink in a web browser.
c. Choose or create an interactive 360° image (e.g., a virtual workshop or classroom).
d. Add hotspots with text, images, or videos to explain processes or provide instructions.
e. Discuss how VR-like storytelling can be used to simulate real-world processes.

- Example: Creating a virtual tour of a manufacturing plant to teach safety protocols.

Step 3:

- Facilitate Group Sharing:
- Each group presents their app experience:

a. "What did you learn about the tool?"
b. "How could this tool support vocational training?"
   - Ask groups to create a list of at least two lesson ideas using their assigned app.
   - Examples:

a. Houzz: Planning an interior design project for a client.
b. ThingLink: Developing an interactive safety walkthrough for a workshop.

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Assessment

- Individual Reflection:

a. What was the most engaging feature of the AR or VR tool you explored, and why?
b. How do you see this tool helping students prepare for real-world vocational tasks?
c. What specific lesson idea could you implement using this tool?
d. What challenges might you face when using AR or VR in vocational training, and how can you address them?

60 mins

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Module 2

Creating Engaging AR and VR Learning Experiences

Objective: This module aims to introduce educators to the best experience of applying augmented reality (AR) and virtual reality (VR) technologies in the teaching process, to present the most convenient platforms and software.

Learning Outcomes:

- Educators will get to know the most convenient AR and VR platforms;
- Educators will get to know the most convenient AR and VR software;
- Educators will learn how to make the teaching process interesting by applying AR and VR;
- Educators will become familiar with the best practices in the application of AR and VR in the teaching process.

6 Hours

Key Concepts: Best practices, most convenient platforms, most convenient software.

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Theoretical Component

Learning is a complex process and all involved parties must have a vested interest in achieving better results. It is difficult for students to concentrate for a variety of reasons, but a key factor is information noise. For students' social lives are particularly intense and important, so they spend a lot of time on social networks, often using smart devices. Various studies have shown that time spent on social networks harms pupils, making them more irritable, more distracted and less able to concentrate on tasks. In fact, the use of smart devices exacerbates the same problems. Screen time harms rest time and sleep quality, which affects their overall well-being and ability to concentrate. Most students do not move enough and eat a lot of highly processed food, which also contributes to poorer psychophysical development (Keles et al., 2019; Chen et al., 2024).

Today's students are hard to impress, with all kinds of content easily accessible online. A large amount of negative and forbidden content, such as violent or sexual content, is easily accessible. Such content arouses strong emotions and increases the need for more strong emotions, which undermines tolerance for non-emotional but useful content (Mathewson et al., 2020).

Another issue is the wide range of useful content on the internet, relevant to students' interests. These include various experiments, tests and challenges. Often this content is created by opinion leaders or simply charismatic individuals. It is clear to compare such content with educational institutions. It is clear that the content of the educational process in educational institutions is less attractive to students and that teachers are not comparable to their favorite Internet content creators.

Parents lack the skills and knowledge to control their children's 'screen time' and the content they consume. It is difficult to exert positive influence, but not everyone has the time and resources to help children learn (Huber et al., 2018).

Teachers need to keep students interested in the curriculum, despite all the difficulties. Fortunately, in many countries, educators have a choice of teaching methods.
The use of augmented or virtual reality is a great way to engage and master specific topics. This is an immersive and impactful method of presenting a variety of topics in an engaging way.

In the backdrop of information noise, AR and VR have significant advantages in the teaching process for improving student learning and the teaching experience of educators.

Key benefits of AR/VR in education:

- **Higher learning outcomes:** AR and VR technologies improve learning outcomes by providing an immersive environment, making it easier for students to understand and

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- retain complex material (Papanastasiou et al., 2018; Tene et al., 2024; Algerafi et al., 2023). These technologies are particularly effective when applied in science lessons (Tiwari et al., 2023; Tene et al., 2024).
- **Developing skills for the future:** these technologies enhance creative thinking, digital literacy, problem-solving and collaboration skills (Papanastasiou et al., 2018).
- **Increased engagement and motivation:** AR and VR captivate students and increase their interest in the lesson topic, engagement in the learning process and intrinsic motivation to learn (Tene et al., 2024; Poupard et al., 2024; Algerafi et al., 2023). The use of these technologies through simulations and interactive experiences promotes active learning and critical thinking (Algerafi et al., 2023).
- **Different teaching methods:** The use of AR and VR technologies often stimulates multiple senses simultaneously, increasing spatial perception and being engaging. This encourages the sharing of emotions and experiences, improves communication and collaboration skills, and satisfies the need to assimilate knowledge through different and inclusive learning methods, not only in the classroom but also independently (Papanastasiou et al., 2018; Bermejo et al., 2023).
- **Controlled learning load:** AR facilitates the perception and understanding of spatial perspectives by reducing unnecessary cognitive strain, which is particularly good for younger children (Poupard et al. 2024).
- **Suitable for homework and distance learning:** AR and VR are increasingly used in distance education, offering virtual classrooms, lessons, courses and online learning environments that can be both engaging and affordable. (Tiwari et al., 2023; Algerafi et al., 2023).

There is a wide range of hardware and software for AR and VR, but this module is based on the principle of accessibility, so priority is given to mobile devices and PCs in particular. Most smartphones released in recent years can be used to explore AR and VR in the classroom for learning content and tasks.

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Module Structure

Topic 1: Practical use of augmented reality (AR) in the classroom.

Topic 2: Practical use of virtual reality (VR) in the classroom.

Topic 3: Tips and tricks and best practices for using virtual and augmented reality in the classroom.

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ACTIVITY 1: Knowledge of nature and ecology with the help of AR

Objective:

- Demonstrate to teachers that augmented reality (AR) is ideal for integrated lessons.
- Demonstrate to teachers that augmented reality (AR) does not have to take up the whole lesson time.
- Discuss other cases and good practices of integrating AR into the classroom.

Description:

The activity is designed to demonstrate that a creative approach to a lesson topic, using modern technology, increases students' interest in the lesson topic and enhances their engagement in the lesson activities.

Materials Needed:

- T-shirt for the Virtual-tee app;
- Smartphone;
- Online collaboration and brainstorming platforms Padlet, Coggle, MindMeister, Canva, Lino Wall.

Instructions:

Step 1:

1. We start by asking: does anyone have experience of using augmented reality in the classroom?
2. We ask: what was the experience of using AR in the lesson briefly summarised?
3. Introducing the theme of this session – "Exploring the human anatomy through AR".

Step 2:

- Divide the group in two:
- Group A: will study the circulatory system;
- Group B: will study the digestive system.

Step 3:

1. We ask one representative from each group to wear a T-shirt.

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2. We ask one representative from each group to open the Padlet.
3. We ask the remaining members of both groups to download the Virtual-tee app.
4. Give both groups a task:
   - 4.1. Activate the Virtual-tee app, scan the T-shirt your group member is wearing and see what the internal organs look like.
   - 4.2. Capture for Padlet the emotions evoked by the image of a colleague wearing a T-shirt.
   - 4.3. Record each group member's opinion on how difficult it was to see the viscera on a scale of 1 to 5, with 1 being not difficult at all and 5 being very difficult and derive an overall group average.
   - 4.4. Identify the internal organ system assigned to your group in the app.
   - 4.5. Write down in a Padlet all the main organs in the system.
   - 4.6. Record each group member's opinion on how difficult it was to see the organs of the system on a scale from 1 to 5, with 1 being not difficult at all and 5 being very difficult and derive an overall group average.
   - 4.7. Capture an image of your group's internal organ system and insert it into Padlet.

Step 4:

1. Ask both groups to present which organs are involved in their system;
2. Ask both groups to present how difficult it was to see the internal organs and how difficult it was to see the organs belonging to their group's system.

Assessment

Please share your impressions:

- What emotions and thoughts are triggered by incorporating augmented reality into the classroom?
- Is this realistically applicable and how challenging was the task or would students find it more difficult?

Discuss with teachers what other tasks could be given to students.

Highlight the advantages and disadvantages of using AR.
In summary, the use of augmented reality requires advance preparation, but good planning makes it easier.
We find that although individuals differ in their acceptance of augmented reality training content, it is still an engaging, effective and memorable way to deliver the content of a lesson. Teachers need to ease students into the world of augmented reality.

60 mins

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ACTIVITY 2: Water cycle together AR using Quiver App

Objectives:

- Showing teachers how to easily integrate augmented reality (AR) into the classroom.
- Discuss with teachers the advantages and disadvantages of integrating augmented reality into the classroom.
- Discuss whether such lessons are in line with the principles of inclusive teaching?

Description:

The activity is designed to demonstrate that it is easy to follow the principles of immersive teaching through the use of augmented reality (AR) in teaching. To present best practices on how to integrate AR into lesson goals and objectives.

Materials:

- Smartphone;
- Quiver App;
- Printed Quiver Water LifeCycle AR sheets;
- Coloured pencils;
- Projector;
- Computer or tablet with Power Point or other alternative.

Instructions:

Step 1:

1. Introducing the lesson topic: “The water cycle together AR”.
2. Introducing how educators can introduce students to the topic.

Step 2:

1. Distribute crayons and sheets of Quiver Water LifeCycle drawings to the participants for colouring in (participants can be divided into pairs);
2. Explain the rules to follow when colouring a picture;
3. Ask to install the Quiver App on your phones.

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Step 3:

1. Please colour the drawing;
2. Preview the coloured drawing with the Quiver App;
3. Explain the whole cycle.

Step 4:

1. Ask the audience to answer questions related to ecology.
2. Please share your personal experience with aquatic ecology.

Assessment

Discussions with educators:

- How using AR helps to apply the principles of inclusive teaching;
- What difficulties you may encounter and how to overcome them;

We introduce the Quiver App platform in more detail and give you more examples of how to use it for integrated and engaging lessons.

60 mins

ACTIVITY 3: "My town square"

Objectives:

- Demonstrate to teachers how to use AR and VR to create engaging lessons.
- Giving teachers the opportunity to try out how to create a virtual reality environment based on best practices, which is suitable for both VR viewing and AR mode.

Description:

The session is designed to provide more specific knowledge in the application of augmented reality and virtual reality technologies through the CoSpaces Edu platform. Participants will practice the subtleties of creating virtual environments.

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Materials:

- Computer with internet connection;
- Projector;
- Smartphone;
- CoSpaces Edu app.

Instructions:

Step 1:

1. Please open CoSpaces Edu on your computer;
2. Please give us the address where you want to register on the platform;
3. When it opens, we choose to create a new CoSpace;
4. Select the 3D environment.

Step 2:

Introducing the task:

- A town square should be created with three attractions and useful information about them;
- There must be three students at each object;
- All students have to express an emotion.
- At least 3 objects must be animated.

Step 3:

Demonstrate to the class:

- How to build a city;
- How to zoom in and out of uploaded objects;
- How to rotate or tilt them;
- How to add an information table;
- How to insert students; how to animate objects.
- Wait for all participants to complete their 3D CoSpace.

Step 4:

1. Please install the CoSpaces Edu app on your smartphone and log in;

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2. We share a link to the CoSpaces we've created and show you how to do it;
3. We show how the CoSpace class is created;
4. We show you how to submit the created 3D CoSpace as a task;
5. Please open in VR mode (without glasses);
6. Please open in AR mode.

Step 5:

- We ask teachers if it was difficult to create their own CoSpace;
- We ask teachers which subjects were the most difficult;
- We are asking teachers to share their ideas on which lessons CoSpace 3D could be used for?

Assessment

At the end of the session, participants will have a deeper understanding of how to prepare for virtual environments in practice and how to apply these technologies to the teaching process.

Teachers will understand that we can view CoSpaces in VR and AR modes, and make them into activities for children.

Teachers will realise that even students can be given homework or project tasks to create CoSpaces.

60 mins

ACTIVITY 4: "My 360 town square"

Objectives:

- Demonstrate to teachers how to create a 360 environment using CoSpace.
- Allow teachers to try a second practical example of how to work with CoSpaces.
- Show other CoSpaces capabilities and demonstrate other practical examples.

Description:

The session is designed to provide more knowledge and practical skills when working with the CoSpaces Edu platform. To introduce other CoSpaces platform examples and capabilities.

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Materials:

- Computer with internet connection;
- Projector;
- Smartphone;
- CoSpaces Edu app.

Instructions:

Step 1:

1. Please reopen the platform we are choosing to create a new CoSpace.
2. Choose a 360 environment.

Step 2:

Introducing the task:

- You need to create a virtual tour with descriptions for 3-5 objects.

Step 3:

Demonstrate to the participants:

- How to upload 360 photos to CoSpaces;
- How to put info boards on objects;
- How to add other elements;
- We are waiting for all participants to finish their 360 CoSpace.

Step 4:

1. We share a link to the CoSpace we have created and show you how to do it;
2. Please open in VR mode (without glasses).

Step 5:

- We ask teachers which CoSpace was harder to create, 3D or 360?
- We ask teachers which type of CoSpace I see more opportunities for in the classroom and why;
- We are discussing with teachers whether they would see the possibility of teaching students how to create CoSpaces and assigning these tasks as homework or project activities.

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Step 6:

- Demonstrate other CoSpaces capabilities;
- Demonstrate other practical examples.

Assessment

At the end of the session, participants will know all the possibilities of CoSpaces and have tried the activities in practice.

Teachers will be able to easily prepare for various lessons with the help of CoSpaces.

60 mins

ACTIVITY 5: 360 video

Objectives:

- Demonstrate to teachers how to view 360 videos in VR.
- Show teachers how to use 360 VR video technology to explore different parts of the world and different classroom topics.
- Introduce teachers to 360 video content creation.
- Show teachers how to explore 3D objects with students in VR.

Description:

The session is designed to introduce teachers to 360 VR video technology and to show examples of how it can be used for lessons.

Materials:

- Computer with internet connection;
- Projector;
- Smartphone with internet connection;
- Padlet.

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Instructions:

Step 1:

1. Please open YouTube in your computer browser, go to 360 videos;
2. Watch a documentary in 360 environment;
3. You can watch a 360 video in VR mode on your phone.

Step 2:

1. Give examples for educators on how best to integrate 360 video viewing into the content of a lesson;
2. Give overview of how you can create your own 360 videos.

Step 3:

- Please open the 3D models on your phone;
- We put the 3D model in VR mode and assign a task to capture in Padlet 3 features of the object or space that you find interesting;
- Please explore the 3D model and record your observations in the Padlet.

Assessment

Teachers will have knowledge where to find 360 VR video content and what are the best practices for using it in the classroom.

Teachers will learn about the possibilities of 360 video content creation.

40 min.

ACTIVITY 6: places in 360

Objectives:

- Show teachers how to explore different parts of the world using VR an AR.

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- Discuss with teachers how 360 explorations of places can be applied in the classroom.

Description:

The session is designed to introduce teachers to 360 explorations of places and how it can be applied in lessons.

Materials:

- Computer with internet connection;
- Projector;
- Smartphone with internet connection;

Instructions:

Step 1:

- Please open the AirPano website in your computer browser;
- Please choose a location to explore;
- We are discussing with teachers how the site can be adapted for the classroom.

Step 2:

1. Please open the 360Cities website in your computer browser;
2. Please choose a location to explore;
3. Please choose another location and explore it in VR on your phone;
4. Please tell us which platform you prefer, AirPano or 360Cities.

Step 3:

1. Please open the VXRWeb website in your computer browser;
2. Please select a tour and open it;
3. We present the platform's capabilities and give examples of similar tours.

Assessment

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Teachers will have a clear idea of where to find 360 WebVR content and what are the best practices for using it in the classroom.
Teachers will learn how 360 explorations of places can be applied in lessons.

40 min.

ACTIVITY 7: VR games

Objectives:

- Introduce participants to the possibilities of VR gaming.
- Demonstrate to teachers how to use WebVR gaming technology in the classroom to create immersive lessons.
- Demonstrate how to adapt VR games to the teaching process.

Description:

Introduce teachers to VR games and show them how to play games with students on the VR game platform or how to play games in-game.

Materials:

- Computer with internet connection;
- Projector;
- Smartphone with internet connection;

Instructions:

Step 1:

1. Please download the RecRoom app to your phone;
2. Please register and complete the training in the app.

Step 2:

1. Demonstrate how to invite friends to the playrooms;
2. Demonstrate how to play games with students in VR.

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3. Introducing other game options for teachers.

Assessment

Teachers will learn how to adapt VR games to the teaching process.

Participants will learn how to play games in-game.

Discussion and sharing of ideas about how to apply VR games in the educational process.

40 min.

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Module 3
Designing Curriculum-Integrated AR and VR Activities

Objective:

The objective of this module is to equip teachers with the skills and knowledge to effectively integrate AR and VR tools into their existing curricula. Participants will learn to align AR/VR activities with educational standards, enhance traditional teaching methods, and design engaging, curriculum-based lesson plans. They will also explore pedagogical strategies, overcome common integration challenges, and assess the effectiveness of AR/VR experiences. By the end of the module, teachers will be prepared to create innovative, immersive learning activities that complement and elevate their classroom instruction.

Learning Outcomes:

- Understand Curriculum Integration Principles:
  - Explain the concept of integrating AR and VR technologies into educational curricula.
  - Identify the benefits of using AR and VR to enhance traditional teaching methods.
- Align AR/VR Activities with Educational Goals:
  - Analyze existing curriculum standards and learning objectives to identify areas suitable for AR/VR integration.
  - Demonstrate the ability to map AR/VR activities to specific learning outcomes across different subjects.
- Identify Opportunities for AR/VR in Various Subjects:
  - Recognize subject areas and topics where AR/VR can provide significant learning enhancements (e.g., science experiments, historical simulations).
  - Propose innovative AR/VR-based activities tailored to different age groups and educational levels.
- Design Effective AR/VR-Integrated Lesson Plans:
  - Develop lesson plans that incorporate AR/VR tools, clearly outlining objectives, activities, resources, and assessment methods.
  - Create engaging and interactive AR/VR experiences that are age-appropriate and align with curriculum goals.

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- Evaluate the Effectiveness of AR/VR Activities:
  - Implement methods for assessing student engagement and learning outcomes from AR/VR activities.
  - Reflect on the impact of AR/VR activities on student learning and identify areas for improvement.

6 Hours

Key Concepts:

1. Curriculum Integration
2. Educational Alignment
3. AR/VR Tools and Resources
4. Lesson Planning for AR/VR Integration
5. Student Engagement and Motivation
6. Assessment and Evaluation of AR/VR Activities
7. Overcoming Challenges in AR/VR Integration
8. Accessibility and Inclusivity in AR/VR Activities

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Theoretical Component

Integrating Augmented Reality (AR) and Virtual Reality (VR) into the educational curriculum offers a transformative approach to teaching, providing immersive, interactive learning experiences. Rather than using these technologies in isolation, they are embedded into lesson plans to enhance specific learning objectives. AR allows teachers to overlay digital content, such as 3D models and videos, onto the real world, while VR creates fully immersive virtual environments where students interact with content, such as exploring historical sites or the interior of a cell, scientific concepts or virtual laboratories

The benefits of AR and VR include increased student engagement, improved motivation, and better retention of information.For example, AR can be used to display and analyze 3D models of mechanical systems, such as engines or robotic systems, allowing students to interact with components and better understand how they function.VR can be used to create virtual first aid scenarios, where students practice procedures like cardiopulmonary resuscitation (CPR). Teachers need to identify specific learning objectives that AR/VR activities will support. For example if the goal in the agricultural science lesson is for students to understand the development of a plants they could use AR apps to observe the process of plant growth in 3D, seeing the various stages of its development, such as germination, leaf growth, and flowering

However, successful integration requires careful planning, choosing user-friendly tools, and ensuring accessibility for all students. Teachers may face challenges such as adapting to new technologies, but professional development and collaboration with peers can support this process.Teachers can further explore the impact of these technologies through resources like research articles and case studies.

In summary, the integration of AR and VR into the curriculum has the potential to revolutionize traditional teaching by providing immersive, interactive, and engaging learning experiences. When aligned effectively with educational goals, these technologies can enhance understanding, increase motivation, and support differentiated instruction, catering to various learning styles and needs. For further exploration, educators are encouraged to review articles and videos linked in the resource list, which provide additional examples and evidence-based insights into the benefits and best practices of AR/VR in education.

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    - Link: Educational Technology Research
2. **TED Talk: Virtual Reality in Education**
    - Speaker: Chris Milk
    - Title: *How Virtual Reality Can Create the Ultimate Empathy Machine*
    - Link: TED Talk Video
3. **Google for Education: AR & VR Resources**
    - Google provides comprehensive guides and tools for integrating AR/VR into classrooms, such as Google Expeditions and Google Lens.
4. **Research Paper: The Impact of AR on Student Learning**
    - Authors: Billinghurst, M., & Dünser, A.
    - Title: *Augmented Reality in the Classroom*
    - Summary: This paper discusses the positive impact of AR on student engagement and comprehension, particularly in science education.
    - Link: ResearchGate Article
5. **Book: Learning Transformed: 8 Keys to Designing Tomorrow's Schools Today**
    - Authors: Eric C. Sheninger and Thomas C. Murray
    - Description: This book includes chapters on the role of AR and VR in modern education, focusing on how immersive technologies can transform teaching and learning.
    - Link: Amazon Link

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Module Structure

Topic 1: Introduction to Curriculum Integration (1,5h)

ACTIVITY 1: AR/VR Integration Debate Game (45 mins)

ACTIVITY 2: Aligning AR/VR Activities with Curriculum Goals in Vocational Education (45 mins)

Topic 2: Identifying Opportunities for AR/VR Integration in VET (1,5h)

ACTIVITY 1: Identifying Challenges, Opportunities, and Pedagogical Strategies (45 mins)

ACTIVITY 2: Exploring Free AR/VR Tools (45 mins)

Topic3: Developing AR/VR Lesson Plans (1,5h)

Introduction and Objectives (5 mins)

Framework for AR/VR Lesson Design (20 mins)

Practical Workshop: Drafting an AR/VR Lesson Plan (40 mins)

ACTIVITY 1: Start with the Traditional Lesson Plan / Explore AR/VR Possibilities (12 mins)

ACTIVITY 2: Design the AR/VR Activity / Set AR/VR Objectives (13 mins)

ACTIVITY 3: Plan for Assessment and Outcomes / Reflect and Connect (15 mins)

Sharing and Feedback (20 mins)

ACTIVITY 4: Presentation of the Learning Plan and Discussion (20 mins)

Wrap-Up and Resources (5 mins)

Topic 4: Evaluating the Integration of AR / VR in VET School (1,5h)

THEORETICAL COMPONENT (20 mins)

ACTIVITY 1: Case Study Analysis (20 mins)

ACTIVITY 2: Evaluating AR/VR Tools (20 mins)

ACTIVITY 3: Designing an AR/VR Evaluation Plan (20 mins)

ACTIVITY 4: Evaluation Activity (10 mins)

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Topic 1: Introduction to Curriculum Integration

ACTIVITY 1: AR/VR Integration Debate Game

Objectives:

- Identify and articulate the benefits and potential concerns or challenges of integrating AR/VR into vocational education.
- Develop critical thinking and collaborative problem-solving skills.
- Propose practical solutions to address concerns while leveraging AR/VR benefits.

Description:

This team-based game encourages participants to weigh the benefits and challenges of AR/VR integration into educational curriculum. Teams present arguments for either the benefits or concerns. By debating and brainstorming solutions, participants gain a balanced perspective on implementing AR/VR in vocational education.

Materials Needed:

- Benefit Cards: Each lists a benefit of AR/VR (e.g., "Engages learners," "Provides safe simulation environments").
- Concern Cards: Each lists a concern (e.g., "Costly equipment," "Teacher training required").
- Timer or stopwatch
- Flip chart or whiteboard
- Markers

Instructions:

1. Introduction (5 minutes)

Explain the game's objective: to explore both the benefits and concerns of AR/VR integration and develop solutions collaboratively.

- Divide participants into two groups: **Pro-Team (Benefits)** and **Con-Team (Concerns)**.

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2. Debate Preparation (10 minutes)

- Each team receives a set of cards matching their assigned stance.
- Teams discuss and prepare arguments for their cards.
- Example for Pro-Team: "AR/VR boosts engagement by providing immersive learning experiences."
- Example for Con-Team: "AR/VR is expensive, making it inaccessible for many schools."

3. Debate Round (15 minutes)

- Teams take turns presenting their arguments (1-2 minute per card).
- After each argument, the opposing team has 12 minute to counter.

  Example:

  - Pro-Team: "AR/VR enables risk-free practice for hazardous tasks such as handling electrical systems"
  - Con-Team: "This could result in a gap between virtual practice and real- world execution."

4. Collaborative Solution Development (15 minutes)

- Both teams merge to brainstorm solutions for the concerns raised.
- Solutions should aim to maximize benefits while addressing challenges.

  Example:

  - Concern: "High cost of equipment."
  - Solution: "Request funding from public or other institutions and projects."

Assessment

- Strength and relevance of arguments of benefits and concerns presented during the debate.
- Creativity and feasibility of proposed solutions.
- Collaboration and engagement during the activity.
-

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45min

ACTIVITY 2: Aligning AR/VR Activities with Curriculum Goals in Vocational Education

Objectives:

- Understand how to align AR/VR activities with formal vocational education curriculum objectives and outcomes.
- Explore and select appropriate AR/VR tools and applications tailored to specific vocational fields
- Develop a plan to integrate AR/VR activities that meet curriculum standards and enhance learning outcomes.

Description:

This activity focuses on integrating AR/VR technologies into vocational education by aligning them with curriculum goals. Participants will explore relevant AR/VR tools, assess their suitability for specific vocational fields, and develop a plan to enhance learning outcomes through effective integration.

Materials Needed:

- Curriculum framework and learning objectives for vocational education programs/fields (printed or digital), e.g. (Mechanics, Food Technology, Healthcare) .
- Worksheets for analysing and mapping AR/VR activities to objectives and learning outcomes.
- Devices (tablets or laptops) with AR/VR apps installed, e.g., virtual car mechanic simulator, food processing simulations, or healthcare anatomy models.
- Flipcharts, sticky notes, and markers for brainstorming.
- Projector and screen for group presentations.

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1. Introduction (5 minutes)

Objective:

Align AR/VR activities with specific program objectives to enhance learning outcomes and prepare students for industry requirements.

Instructions:

- Begin with a brief discussion on the transformative potential of AR/VR in vocational education, using examples such as virtual simulations to enhance skill development. Clarify the session's focus: aligning AR/VR activities with curriculum goals.

- Share 2–3 examples of AR/VR activities and how they align with learning objectives.

  - **Example 1**: Using AR to visualize soil nutrient layers for agriculture students.
  - **Example 2**: VR simulation of an automotive workshop for mechanics training.

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2. Analyzing Objectives and Outcomes (10 minutes)

Instructions:

1. Form small groups: Divide participants into small groups based on their vocational fields (Mechanics, Food Technology,Agriculture field, Healthcare).

2. Analyze Curriculum Standards: Provide each group with:

   - A list of key learning objectives for their field based on curriculum documents
   - A worksheet with columns:

     - **Learning Objective**: What skill or knowledge (1-2) should students acquire?
     - **Outcome**: How will students demonstrate mastery?
     - **AR/VR Activity**: Which AR/VR tools can help achieve this objective?

3. Groups identify challenging objectives that could benefit from AR/VR integration and fill out the worksheet.

3. Aligning AR/VR with Objectives

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Step 1: Exploring AR/VR Tools (10 minutes)

- Groups explore the preloaded AR/VR applications provided.
- Ask them to select tools or simulations that align with their identified learning objectives.

Step 2: Mapping and Planning (10 minutes)

1. **Activity Design**:
    - Groups use the provided template to map AR/VR activities to the identified objectives.
    - Template Fields:
        - **Learning Objective**: What skill or knowledge should students acquire?
        - **AR/VR Activity**: What specific tool/activity will be used?
        - **Learning Outcome**: How will this activity help achieve the objective?
        - **Assessment Method**: How will you measure success?

Example Mapping (agriculture field):

- **Learning Objective**: Explain the process of pest management in crops.
- **AR/VR Activity**: Use an AR app to identify virtual pests on crops and practice control methods.
- **Learning Outcome**: Students will accurately identify pests and recommend control measures.
- **Assessment Method**: Quiz and class discussion.

4. Presentation and Feedback (10 minutes)

Instructions:

1. Each group presents their mappings and justifications (2-3 minutes per group).
2. Facilitate feedback and discussion on the feasibility and effectiveness of the selected AR/VR activities.

Assessment:

- Ensure active participation.
- Clarity and practicality of the AR/VR integration plan.
- Alignment with curriculum standards

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45 mins

Topic 2: Identifying Opportunities for AR/VR Integration in VET

Objective:

To equip teachers with the knowledge and skills to identify potential applications of AR/VR technologies in their specific VET fields, considering the challenges and limitations, and emphasizing the importance of pedagogical strategies.

ACTIVITY 1: Identifying Challenges, Opportunities, and Pedagogical Strategies (45 mins)

Objective:

To encourage participants to critically analyse their specific VET field and identify potential challenges, opportunities and appropriate pedagogical strategies for AR/VR integration.

Description:

A group discussion where participants discuss the specific challenges, opportunities and pedagogical strategies of integrating AR/VR into their field.

Materials Needed:

- Whiteboard or flip chart
- Markers
- Sticky notes

Instructions:

1. **Group Discussion:** Divide participants into groups based on their VET specialization.
2. **Challenge Identification:** Each group should discuss the potential challenges of implementing AR/VR in their field, such as technical difficulties, cost, and accessibility.
3. **Opportunity Identification:** Each group should identify specific learning outcomes or skills that could be enhanced through AR/VR.
4. **Pedagogical Strategy Selection:** Each group should discuss and select appropriate pedagogical strategies for their identified opportunities. Consider strategies such as:

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- **Inquiry-based learning:** Using VR to explore different ecosystems (e.g., virtual field trips to historical sites or natural environments).
- **Experiential learning:** Using AR for interactive math problems (e.g., visualizing 3D shapes or simulations).
- **Differentiated instruction:** Using VR to provide individualized learning experiences (e.g., tailored simulations or interactive tutorials).
- **Problem-based learning:** Present real-world problems and use AR/VR to simulate solutions (e.g., virtual workshops or case studies).
- **Collaborative learning:** Use VR to facilitate group discussions and collaborative problem-solving (e.g., virtual team meetings or brainstorming sessions).
- **Self-directed learning:** Provide students with AR/VR tools to explore topics independently (e.g., virtual labs or interactive textbooks).

5. **Group Presentation:** Each group presents their findings, including challenges, opportunities and selected pedagogical strategies, to the larger group.

Assessment:

- Active participation in the group discussion
- Ability to identify relevant challenges and opportunities
- Critical thinking and problem-solving skills
- Understanding of appropriate pedagogical strategies for AR/VR integration

By incorporating these pedagogical strategies and addressing the challenges and limitations, teachers can effectively leverage AR/VR to create engaging and effective learning experiences in VET.

45 mins

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ACTIVITY 2: Exploring Free AR/VR Tools (45 mins)

Objective:

To introduce participants to a variety of free AR/VR tools and their potential applications in VET education, focusing on real-world simulations and practical applications.

Description:

A hands-on activity where participants explore and experiment with free AR/VR tools relevant to their field.

Materials Needed:

- Computers or tablets
- Internet access
- List of free AR/VR tools:
  - **Mechanics:**
    - **Tilt Brush:** Create 3D models of engine parts.
    - **Engauge:** Simulate complex machinery and equipment.
  - **Economics:**
    - **Google Earth VR:** Explore global economies and trade routes.
    - **Virtually Better:** Simulate business scenarios and decision-making.
  - **IT:**
    - **CoSpaces Edu:** Create virtual reality experiences for coding and programming.
    - **Unity:** Develop interactive 3D simulations.
  - **Nutrition:**
    - **Anatomy 4D:** Explore the human body and understand nutrition.
    - **Quiver Vision:** Create interactive 3D models of food and nutrition concepts.
  - **Health:**
    - **Virtual Reality Therapy:** Simulate medical procedures and patient interactions.
    - **Google Expeditions:** Explore virtual hospitals and medical facilities.

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Instructions:

1. **Tool Demonstration:** Briefly demonstrate how to use a few selected AR/VR tools.
2. **Group Exploration:** Divide participants into groups and assign them specific AR/VR tools to explore.
3. **Hands-on Experimentation:** Each group should experiment with their assigned tools to create a simple AR/VR experience related to their field.
4. **Group Sharing:** Each group presents their created AR/VR experience to the larger group.

Assessment:

- Active participation in the tool exploration
- Creativity and relevance of the created AR/VR experience
- Ability to articulate the learning potential of the tool and address potential challenges

45 mins

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Topic 3: Developing AR/VR Lesson Plans (1.5 hours)

Introduction and Objectives (5 mins)

Objective:

Provide a clear understanding of the session's focus on creating structured, effective AR/VR lesson plans and its relevance to enhancing student learning.

Description:

Brief presentation on the purpose of the session and its connection to the broader module. Highlight the importance of lesson planning for successful AR/VR integration.

Materials Needed:

- Computer, classroom projector
- Internet access

Instructions:

A **presentation** will be developed and used for this part

Emphasis should be given to:

- Introduction of the session: *Developing AR/VR Lesson Plans.*
- Clarify the purpose of creating structured, curriculum-aligned lesson plans using AR/VR.
- Explain the session goal which is to equip participants to design and implement effective AR/VR lesson plans.
- Highlight the importance of lesson planning for successful AR/VR integration.
- Outline the session structure describing all steps as framework review, hands-on workshop, and feedback.
- Set the expectations of the Participants. At the end they will leave with actionable skills and confidence to create AR/VR lesson plans.
- Encourage engagement by asking participants to note questions for later discussion.

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Framework for AR/VR Lesson Design (20 mins)

Objective:

Equip participants with a clear framework to structure AR/VR lesson plans, emphasizing alignment with curriculum goals and pedagogical best practices.

Description:

Presenting the Framework. Walkthrough it. Explanations & Discussion, Illustrating using examples.

Materials Needed:

- Computer, classroom projector
- Internet access

Instructions:

In this section, the facilitator will guide participants through a **framework for designing AR/VR lesson plans**. This will focus on identifying key learning objectives in a traditional lesson plan and transforming them into specific AR/VR objectives. The goal is to align the immersive experience of AR/VR with the lesson's intended outcomes.

The Framework for AR/VR Lesson Design

Step	Action	Key Points to Emphasize
1. Identify Learning Objectives	Review the standard lesson plan's learning objectives. These are often written in terms of knowledge, skills, or concepts students need to learn.	- Start with clear, measurable learning objectives (e.g., "Students will understand the water cycle"). - Focus on objectives that can be enhanced by immersive AR/VR experiences (e.g., spatial learning, visualizing complex concepts).
2. Identify AR/VR Potential	Look for specific learning objectives that could benefit from an immersive experience, such as topics that are abstract, hard to visualize, or require interaction.	- Objective examples: "Explore the solar system" or "Understand the structure of a cell." - Consider learning objectives that can be more engaging with visual or interactive representation.

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3. Set AR/VR Learning Objectives	Convert general learning objectives into AR/VR-specific learning objectives. These should outline how AR/VR will be used to enhance learning experience.	- Example: From "Understand the water cycle" to "Use AR to visualize the water cycle process in 3D." - Example: From "Identify parts of a cell" to "Use VR to explore the inside of a plant cell."
4. Plan the AR/VR Activity	Design the AR/VR activity to meet the AR/VR-specific learning objectives. Plan the activity's flow, timing, and interactivity.	- Think about how students will interact with the AR/VR experience (e.g., using AR to manipulate 3D objects, VR to walk through simulations). - Include clear instructions on how to access and use the AR/VR tools.
5. Define Assessment and Outcomes	Determine how to assess students' understanding and engagement after the AR/VR activity. This can include quizzes, group discussions, or reflective activities.	- Examples of assessment: - Formative assessment: In-game quizzes or reflections after the VR experience. - Summative assessment: Group projects or presentations based on the AR/VR experience.
6. Post-Activity Reflection	Plan time for students to reflect on their AR/VR experience and connect it back to the lesson's overall objectives.	- Example: A class discussion or short reflective writing about what they learned in the AR/VR experience. - Encourage students to make connections between virtual experience and real-world applications.

How to Use This Framework

1. **Start with the Traditional Lesson Plan:**
    - Begin by reviewing the **learning objectives** of the existing lesson plan. These objectives are often based on concepts, knowledge, or skills to be acquired.
    - Example: "Students will understand the process of photosynthesis."
2. **Explore AR/VR Possibilities:**
    - Next, identify parts of the lesson where **AR/VR can enhance** the learning experience. This could involve visualizing abstract concepts (e.g., the structure of a molecule), providing interactive experiences (e.g., exploring the human body in 3D), or offering immersive environments (e.g., virtual field trips).

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3. **Set AR/VR Objectives:**
    - Convert the general objective into a specific **AR/VR learning objective**. This step helps bridge the gap between the traditional lesson plan and the AR/VR technology by specifying how the immersive tool will achieve the goal.
    - Example: From "Understand photosynthesis" to "Use AR to visualize the process of photosynthesis at the cellular level."
4. **Design the AR/VR Activity:**
    - Now, create the **AR/VR activity** that aligns with the AR/VR-specific objective. This should be clearly mapped out, including the activity's flow, time required, and specific interactive elements.
    - Example: "Students will use an AR app to explore a 3D model of the plant cell and interact with the chloroplasts to visualize photosynthesis."
5. **Plan for Assessment and Outcomes:**
    - Define how **students' learning** will be assessed post-activity. This could be through quizzes, group discussions, or written reflections, all designed to measure how well the AR/VR experience helped meet the learning objectives.
    - Example: "After the AR activity, students will complete a short quiz on the process of photosynthesis."
6. **Reflect and Connect:**
    - Finally, ensure that students have a chance to **reflect on the AR/VR experience** and relate it to their overall learning. This helps reinforce the content and allows for deeper understanding.
    - Example: "Students will discuss how the AR experience changed their understanding of photosynthesis and how it applies in real life."

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Practical Workshop: Drafting an AR/VR Lesson Plan (40 mins)

General Objective:

Empowering educators with the skills and confidence to design and implement an AR/VR-enhanced lesson plan. By the end of the workshop, participants will have created a draft lesson plan that incorporates AR/VR technologies, aligns with educational objectives, and includes meaningful assessments.

General Description:

This part of the session is a practical workshop. Trainees can work in groups. The number of members in each group will be determined based on the number of participants.

ACTIVITY 1: Start with the Traditional Lesson Plan / Explore AR/VR Possibilities

Objective:

To provide a foundational lesson plan that serves as the basis for integrating AR/VR technologies.

To familiarize participants with AR/VR tools and brainstorm how these technologies can enhance traditional lessons.

Description:

Participants will choose a traditional topic or lesson plan they are familiar with and outline the key components: objectives, activities, resources, and assessment methods.

Participants will explore AR/VR applications relevant to their subject area and brainstorm ways to incorporate these tools into their lessons.

Materials Needed:

1. Example traditional lesson plans
2. Template for outlining a lesson plan
3. Pens, paper, digital devices, Internet access

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4. List of pre-selected AR/VR applications or devices (e.g., Google Expeditions, Merge Cube, or Oculus Quest) categorized by subject

Instructions:

1. Begin with a brief explanation of the importance of having a solid traditional lesson plan as a foundation. / Distribute the lesson plan template.
2. Ask participants to select a topic they teach or are comfortable with.
3. Guide them to outline objectives, core activities, resources, and initial assessment ideas.
4. Facilitate a short discussion or Q&A to clarify doubts.
5. Provide a demonstration of a few AR/VR applications to inspire participants.
6. Share the list of apps and tools for their exploration & encourage participants to experiment with apps that align with their subject area.
7. Facilitate small group discussions to share ideas on how AR/VR could be integrated into their chosen lesson topics.

Assessment

1. Review participants' completed lesson plan templates to ensure objectives and activities are clearly defined.
2. Provide feedback on the completeness and clarity of their plans.
3. Monitor engagement during exploration and group discussions.
4. Ask participants to write down one or two AR/VR ideas they would like to pursue further.

12 mins

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ACTIVITY 2: Design the AR/VR Activity / Set AR/VR Objectives

Objective:

To create a detailed plan for incorporating AR/VR into the lesson plan.

To ensure AR/VR activities have clear, measurable learning objectives that align with the overall lesson goals.

Description:

Participants will design an AR/VR activity that aligns with their lesson objectives and enhances student learning.

Participants will define specific objectives for their AR/VR activities, focusing on measurable outcomes.

Materials Needed:

1. AR/VR Activity Design Template
2. Examples of AR/VR lesson activities
3. Bloom's Taxonomy reference sheet
4. Examples of AR/VR-specific learning objectives
5. Templates for writing objectives

Instructions:

1. Distribute the AR/VR Activity Design Template.
2. Explain the key elements of an AR/VR activity: purpose, tools, preparation, implementation, and follow-up.
3. Guide participants to create an activity that aligns with their lesson objectives.
4. Encourage peer reviews for feedback on initial drafts.
5. Review Bloom's Taxonomy and how it applies to AR/VR activities.
6. Share examples of well-written AR/VR objectives.
7. Ask participants to draft at least three objectives for their AR/VR activity.
8. Offer one-on-one support to refine objectives.

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Assessment

1. Evaluate the clarity, feasibility, and alignment of the AR/VR activity with lesson objectives.
2. Provide constructive feedback and suggestions for improvement.
3. Review drafted objectives for clarity, alignment, and measurability.
4. Provide individual feedback.

13 mins

ACTIVITY 3: Plan for Assessment and Outcomes / Reflect and Connect

Objective:

To develop a plan to assess student learning and evaluate the effectiveness of the AR/VR activity. To finalize the AR/VR lesson plan and connect it to real-world teaching practices

Description:

Participants will create assessment tools and criteria to measure learning outcomes from their AR/VR-enhanced lessons.

Participants will review their completed plans, reflect on their learning, and discuss strategies for integrating AR/VR into their classrooms.

Materials Needed:

1. Assessment planning templates
2. Examples of AR/VR assessments
3. Digital tools for creating quizzes or interactive assessments
4. Completed lesson plan drafts
5. Reflection prompts or checklist
6. Feedback forms

Instructions:

1. Explain the importance of assessment in evaluating the impact of AR/VR on learning.

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2. Share examples of formative and summative assessments suitable for AR/VR activities.
3. Guide participants to design assessment tools tailored to their objectives.
4. Allow participants to test and revise their assessments.
5. Ask participants to review their lesson plans and make final adjustments.
6. Facilitate a reflective discussion: What did they learn? What challenges do they anticipate?
7. Encourage participants to share their lesson plans in small groups for peer feedback.
8. Provide additional tips and resources for AR/VR integration.

Assessment

1. Review participants' assessment plans for alignment with objectives and lesson activities.
2. Provide feedback on the diversity and effectiveness of assessment methods.
3. Collect and review finalized lesson plans.
4. Use feedback forms to gauge participants' confidence and readiness to implement their plans.

15 mins

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Sharing and Feedback (20 minutes)

General Objective:

Encourage participants to present their lesson plans, gain constructive feedback, and refine their approach based on shared insights.

General Description:

Groups present their lesson plans to the class. Allocate presentation time according to the number of groups. Peers and the instructor provide constructive feedback. Discuss common challenges and solutions encountered during the drafting process.

ACTIVITY 4: Presentation of the Learning Plan and Discussion

Objective:

Encourage participants to present their lesson plans, gain constructive feedback, and refine their approach based on shared insights.

Description:

Participants will present their AR/VR-enhanced lesson plans in small groups or to the class. The session focuses on peer and instructor feedback, promoting collaborative problem-solving and the exchange of ideas.

Materials Needed:

1. Completed AR/VR lesson plans
2. Feedback forms or rubrics
3. Whiteboard or digital tool for summarizing common challenges and solutions
4. Timer or stopwatch

Instructions:

1. Assign 2-3 minutes for each participant to present their lesson plan.

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2. After each presentation, allow 1-2 minutes for peers and the instructor to provide constructive feedback.
3. Use a feedback form or rubric to guide the feedback process (e.g., clarity of objectives, feasibility of AR/VR activity, alignment with assessment).
4. Facilitate a brief group discussion at the end to identify common challenges and effective solutions.

Assessment

1. Monitor the quality of feedback shared by participants to ensure it is constructive and actionable.
2. Review feedback forms for thoroughness and relevance.
3. Observe how participants incorporate feedback into their lesson plans or verbal reflections during the session.

20 mins

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Wrap-Up (5 minutes)

Objective:

Summarize the key takeaways and share additional resources and templates to support participants in implementing AR/VR lesson plans independently.

Description:

Recap of the AR/VR lesson planning process. Open the floor for any final questions.

Instructions:

A **presentation** will be developed and used for this part

- Importance of a Solid Foundation: Ensure AR/VR activities are rooted in clear objectives and a well-structured traditional lesson plan.
- Alignment with Learning Goals: Always connect AR/VR activities to measurable and meaningful educational outcomes.
- Practical Feasibility: Consider resources, time, and student readiness when designing AR/VR experiences.
- Iterative Improvement: Use feedback and reflection to refine lesson plans for better effectiveness.
- Available Support: Highlight resources such as templates, tutorials, AR/VR app directories, and professional communities for ongoing guidance.
- Innovation and Flexibility: Encourage experimentation with AR/VR tools while remaining adaptable to different teaching contexts.

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Templates, Supplementary Material & Resources

A. A List of Learning Objectives and their description

Learning Objective	Description
1. Understand the basic principles of combustion	Explain how combustion works in an engine and the role of fuel, air, and spark in the combustion process.
2. Identify the main components of an internal combustion engine	Identify and describe the function of the pistons, crankshaft, cylinder, spark plugs, and exhaust system.
3. Explain the four-stroke cycle	Describe the intake, compression, power, and exhaust strokes in the operation of a combustion engine.
4. Understand how fuel is ignited and burned in an engine	Demonstrate the process of fuel combustion within an engine and how it powers the vehicle.
5. Examine the relationship between air-fuel mixture and engine performance	Investigate how variations in the air-fuel ratio affect engine power, efficiency, and emissions.
6. Analyze the importance of the exhaust system in controlling emissions	Explain how the exhaust system helps reduce harmful emissions and contributes to engine efficiency.
7. Understand the cooling system's role in engine performance	Describe the purpose and operation of the engine cooling system and its components like the radiator and thermostat.
8. Explore troubleshooting common engine problems	Identify and troubleshoot basic issues in combustion engines such as misfiring or overheating.
9. Discuss the environmental impact of internal combustion engines	Examine the environmental effects of combustion engines, including pollution, fuel consumption, and climate change.

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B. A List of Criteria to determine if AR/VR would be beneficial for a learning objective

Criteria	Yes/No
Enhances visualization of complex or abstract concepts	[ ] Yes / [ ] No
Provides interactive experience (e.g., manipulating parts)	[ ] Yes / [ ] No
Helps students better understand the relationships between components	[ ] Yes / [ ] No
Makes learning more engaging and memorable	[ ] Yes / [ ] No
Helps simplify difficult-to-understand processes (e.g., combustion cycle)	[ ] Yes / [ ] No
Provides real-world application through immersive experiences	[ ] Yes / [ ] No

C. Example of an AR/VR-Enhanced Lesson Plan Template

Section	Details
Lesson Title	Enter the title of your lesson here
Grade/Subject	Specify the grade level and subject area
Traditional Lesson Objectives	Objective 1: From traditional plan
	Objective 2: From traditional plan
	Objective 3: From traditional plan
AR/VR Integration Objectives	Objective 1: How AR/VR will enhance learning
	Objective 2: How AR/VR will help achieve the traditional goals
Traditional Activities	Activity 1: Describe activity without AR/VR
	Activity 2: Describe activity without AR/VR
AR/VR-Enhanced Activities	Activity 1: Describe the AR/VR-enhanced activity that aligns with the traditional activity
	Activity 2: Describe the AR/VR-enhanced activity that aligns with the traditional activity
Resources Needed	List traditional teaching materials
	List AR/VR tools or apps required

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Assessment Plan	Explain how learning will be assessed, including traditional and AR/VR-specific methods
	Detail tools like rubrics, quizzes, observations, or AR/VR activity outcomes
Reflection and Follow-Up	How will students reflect on what they learned?
	What follow-up activities or discussions will reinforce AR/VR integration?

D. AR/VR Learning Objective Template

Component	Details
Objective Title	Give a concise title for your AR/VR learning objective
Learning Goal	Specify what students will learn or achieve using AR/VR in relation to the traditional lesson plan
AR/VR Technology Used	List the specific AR/VR tools, apps, or platforms to be used for this objective
Connection to Traditional Objective	Describe how this AR/VR learning objective aligns with or enhances the traditional objective
Activity Description	Detail the AR/VR-enhanced activity that will help students achieve this objective
Expected Outcome	Describe the measurable learning outcome tied to this objective
Assessment Method	Explain how achievement of this objective will be evaluated, e.g., quiz, observation, project

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E. An Example of an AR/VR Activity Design Template

Category	Details
Activity Title	Provide a clear and engaging title for the activity.
Objective/Goal	Describe the educational, entertainment, or experiential goal (e.g., learning concepts, exploring environments, team-building, etc.).
Target Audience	Who is this activity designed for? (e.g., age group, experience level, educational background, etc.)
Duration	How long will the activity take? (e.g., 10 minutes, 1 hour, etc.)
Platform/Hardware Requirements	List the required devices and platforms (e.g., Oculus Rift, HTC Vive, mobile AR with smartphones, AR glasses, etc.).
Type of Experience	Choose the type of experience: VR, AR, Mixed Reality (MR)
Theme/Scenario	What is the narrative or theme? (e.g., historical exploration, virtual tour, scientific experiment, etc.)
Environment/Setting	Describe the virtual or augmented world (e.g., indoor, outdoor, natural, fantastical, etc.).
Interactivity	What actions can the user take? (e.g., navigating, picking up objects, solving puzzles, interacting with characters, etc.).
Objective/Tasks	What specific tasks or challenges will the user face? (e.g., find hidden objects, complete a puzzle, explore an environment).
Feedback/Rewards	What type of feedback will users receive? (e.g., visual/audio cues, progress tracking, virtual rewards).
Safety Considerations	List any safety instructions or precautions (e.g., space requirements for movement, time limits, or health recommendations).
User Interface (UI)	Describe the user interface elements (e.g., menus, buttons, HUD elements, controls).
Control Method	How will users interact with the system? (e.g., controllers, hand gestures, eye tracking, voice commands).
Narrative Flow/Sequence	What is the structure or sequence of events in the activity? (e.g., introduction, tasks, conclusion, narrative progression).
Multiplayer Option	Will the activity support multiplayer? If so, describe the interaction and features available.
Post-Activity Engagement	How will users engage after the activity? (e.g., sharing experiences, leaderboards, next steps in the activity, follow-up content).

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Testing/Usability	How will you test the activity for usability and engagement? (e.g., beta testing, user feedback, playtesting).
Performance Metrics	What metrics will be used to measure success? (e.g., user completion rates, time spent, user satisfaction).
Accessibility Features	List any features to ensure accessibility (e.g., subtitles, color-blind mode, adjustable controls).

F. An Example of a Reflection Checklist for AR/VR Integration in a Lesson Plan

Category	Reflection Prompt/Checklist	Completed (✓)
Objective Alignment	Did the AR/VR activity align with the learning objectives of the lesson?	
Student Engagement	Were students actively engaged in the AR/VR experience? Did they show interest and participation?	
Technology Integration	Was the AR/VR technology integrated smoothly into the lesson? Did students encounter any technical issues or challenges?	
Learning Outcomes	Did students achieve the desired learning outcomes? Were they able to grasp key concepts or skills as a result of the AR/VR experience?	
Interactivity	Were students able to interact with the AR/VR environment effectively? Did the interactivity enhance the learning experience?	
Teacher Support	Did the teacher provide adequate guidance and support throughout the AR/VR activity? Were there opportunities for assistance when needed?	
Student Collaboration	Did students collaborate or share insights during the AR/VR activity? Was teamwork promoted (if applicable)?	
Critical Thinking	Did the AR/VR experience encourage critical thinking or problem-solving among students?	
Real-World Relevance	Was the AR/VR content relevant to real-world applications or the students' lived experiences?	
Assessment of Learning	Did the AR/VR activity allow for effective assessment of student learning? Was there a method to track progress or understanding?	

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Feedback from Students	What feedback did students provide after the AR/VR lesson? Did they find the activity useful, enjoyable, or challenging?	
Inclusivity	Was the AR/VR experience accessible to all students, including those with disabilities or varied learning styles?	
Time Management	Did the lesson adhere to the planned time allocation? Was there enough time for students to complete tasks and reflect on their learning?	
Post-Lesson Reflection	After completing the lesson, did students have a chance to reflect on the experience and connect the AR/VR learning to other lessons or real-world applications?	
Technological Limitations	Were there any limitations in the AR/VR technology that affected the lesson's outcome? What could be improved for future sessions?	
Future Improvements	What changes or improvements would enhance the AR/VR lesson in the future? What additional resources or tools might improve the experience?	
Overall Experience	Did the AR/VR integration enhance the learning experience? Would you incorporate it again in future lessons?	

G. AR/VR Apps & Resources

- https://artsandculture.google.com/
- https://anatomylearning.com/webgl2024v2/browser.php
- https://play.google.com/store/apps/details?id=com.zoiclabs.stpn2.sib&hl=en
- https://play.google.com/store/apps/details?id=com.miragestudio.nuclearplants&hl=en

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H. Bloom's Taxonomy and its Application to AR/VR Activities (a short description)

Bloom's Taxonomy is a hierarchical model used to classify learning objectives into levels of complexity and specificity. The original taxonomy was created in 1956 by Benjamin Bloom and later revised in 2001. It categorizes cognitive skills into six levels, from lower-order thinking to higher-order thinking. These levels are:

1. Remembering (Knowledge)
2. Understanding (Comprehension)
3. Applying (Application)
4. Analyzing (Analysis)
5. Evaluating (Evaluation)
6. Creating (Synthesis)

AR/VR technologies are highly immersive and interactive, which provides opportunities for educators to target each level of Bloom's Taxonomy through engaging experiences. Below is an explanation of how each level can be applied to AR/VR activities:

Bloom's Taxonomy Level	Description	AR/VR Application Example
1. Remembering (Knowledge)	The ability to recall facts, terms, and basic concepts.	**AR**: A student points their device at an object (e.g., a plant) and AR provides information like its name, species, and facts. **VR**: A student explores a virtual museum where they identify historical artifacts and recall relevant facts about each item.
2. Understanding (Comprehension)	The ability to explain ideas or concepts.	**AR**: An AR app could allow students to see the layers of the Earth and understand geological processes through interactive visuals. **VR**: Students can enter a virtual environment to learn about ancient civilizations and explain how certain tools or structures were used.
3. Applying (Application)	The ability to use information in new situations.	**AR**: In a math class, students use AR to measure and manipulate real-world objects, like finding the area of irregular shapes using an AR app. **VR**: In a virtual cooking class, students can apply recipes by virtually interacting with ingredients and cooking tools to prepare dishes.

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4. Analyzing (Analysis)	The ability to break information into parts and understand its structure.	**AR**: Students could use AR to deconstruct and analyze a historical event by overlaying different perspectives on an event (e.g., political, economic, social). **VR**: Students analyze a virtual crime scene, examining evidence and figuring out how the pieces fit together to solve the mystery.
5. Evaluating (Evaluation)	The ability to make judgments based on criteria.	**AR**: Students could evaluate virtual scientific data presented through AR overlays, such as weather patterns, and compare them to real-world data. **VR**: In a virtual courtroom simulation, students evaluate the arguments and evidence, providing critiques and forming judgments based on logical reasoning.
6. Creating (Synthesis)	The ability to build new structures or models using knowledge.	**AR**: Students design a 3D model of a building or structure using AR, then view and manipulate it in real space. **VR**: Students participate in a VR creative writing exercise where they create and explore their own virtual worlds, scripting events or stories that unfold as they interact with the environment.

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Topic 4: Evaluating the Integration of AR / VR in VET School

Objective:

1. To analyze the potential benefits and challenges of integrating AR and VR technologies in VET school curricula.
2. To explore practical strategies for integrating AR and VR VET.
3. To develop skills to evaluate AR/VR tools based on their relevance and effectiveness in VET education.
4. To evaluate the effectiveness of AR and VR in enhancing student learning outcomes and skills development.

Description / Learning Outcomes:

At the end of the module, teachers will be able to:

1. Identify criteria for evaluating AR and VR technologies in educational settings.
2. Gain practical skills and competences in conducting evaluations and analyzing data related to AR and VR use in education.
3. Plan activities using AR/VR technologies in VET schools.
4. Assess the impact of AR and VR implementation on student engagement and learning outcomes.

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Theoretical Component (20 mins)

Topic: Criteria for Evaluating AR/VR Integration in VET

Key Points to Cover:

- **Relevance to usual VET Subjects**: Evaluating whether AR/VR content aligns with curriculum needs.
- **Ease of Use**: Comfortable usability for both instructors and students.
- **Cost-Benefit Analysis**: Weighing the expense of technology against its educational impact.
- **Accessibility**: Ensuring technologies are inclusive and accommodate diverse learners.
- **Learning Outcomes**: How effectively the technology enhances skill development and practical understanding.
- **Sustainability and Scalability**: Long-term feasibility and potential for broader application within the school.

Examples of Good Practices (will be focused in activities):

- Case study: Use of AR in automotive mechanic training to simulate engine repairs.
- Case study: VR applications for healthcare training, such as practicing surgical procedures.

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ACTIVITY 1: Case Study Analysis (20 mins)

Objective:

To analyze real-world examples of AR and VR integration in VET schools and identify key lessons learned.

Description:

A case study of a vocational school that uses VR to simulate real-world work environments for automotive technicians

Materials & Resources Needed:

- Access to a preselected AR/VR example.
- Flip charts or whiteboards.
- Markers or interactive digital collaboration tools like mentimeter, miro etc

Instructions:

1. Divide participants into small groups.
2. Assign each group a case study of a VET school that has successfully implemented AR or VR technology.
3. Ask groups to analyze the case study, focusing on the following questions:
    - What specific learning objectives were targeted with AR or VR?
    - How were AR or VR technologies used to enhance the learning experience?
    - What were the outcomes of the implementation, in terms of student engagement, learning outcomes, and skills development?
    - What challenges were encountered, and how were they addressed?
4. Facilitate a group discussion to share insights and identify common themes.

20 mins

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ACTIVITY 2: Evaluating AR/VR Tools (20 mins)

Objective:

To apply theoretical evaluation criteria to a real AR/VR tool and assess the suitability of different AR and VR tools for specific VET learning objectives..

Description:

Participants will review an AR or VR application relevant to their VET specialization and assess its effectiveness.

Materials & Resources Needed:

- Access to a preselected AR/VR demo or video.
- Printed or digital evaluation checklist (based on theoretical criteria).
- Flip charts or whiteboards.
- Markers or interactive digital collaboration tools like mentimeter, miro etc

Instructions:

1. Provide participants with a list of AR and VR tools commonly used in education.
2. Divide participants into small groups and assign each group a specific VET subject area (e.g., automotive, healthcare, construction).
3. Ask groups to evaluate the AR and VR tools based on the following criteria:
    - Alignment with learning objectives
    - Ease of use and technical requirements
    - Cost-effectiveness
    - Potential for student engagement and motivation
    - Quality of educational content
4. Facilitate a group discussion to compare and contrast the findings and identify the most promising tools for each subject area.

Assessment:

- Quality of completed checklists.
- Contributions to group discussions.

20 mins

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ACTIVITY 3: Designing an AR/VR Evaluation Plan (20 mins)

Objective:

To develop a comprehensive evaluation plan for an AR or VR project in a VET school.

Description:

Participants will collaborate in small groups to design an evaluation plan for their specific VET area, incorporating AR/VR technologies.

Materials & Resources Needed:

- Templates for evaluation plans.
- Examples of AR/VR use in education.
- Flip charts or whiteboards.
- Markers or interactive digital collaboration tools like mentimeter, miro etc

Instructions:

1. Divide participants into small groups and assign each group a specific AR or VR project idea.
2. Ask groups to develop an evaluation plan that includes the following components:
    - Clear research questions and hypotheses
    - Data collection methods (e.g., surveys, interviews, observations, performance assessments)
    - Data analysis techniques
    - Ethical considerations
    - Timeline and budget
3. Facilitate a group discussion to share and critique the evaluation plans.

Assessment:

- **Formative Evaluation:**
    - Observation of participant engagement and participation in activities
    - Informal feedback from participants
- **Summative Evaluation:**
    - Written assignments or reports on case study analysis, tool evaluation, and evaluation plan development
    - Post-training survey to assess participant satisfaction and learning outcomes

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ACTIVITY 4: Evaluation: Individual Reflection and Feedback (10 mins)

Description:

- **Prompt:** "Reflect on how AR/VR technologies could transform teaching and learning in your vocational area. What would be the biggest benefit? What challenges do you foresee?"
- Participants write short responses, followed by a brief open-floor discussion.

Materials & Resources Needed:

- Flip charts or whiteboards.
- Markers or interactive digital collaboration tools like mentimeter, miro etc

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Sources Used

1. **Online Articles / Case Studies:**
   - “Case Studies on VR in Education” (Education Next)
   - AR for automotive repairs from industry-specific reports.
   - VR in healthcare training: examples from simulation labs worldwide.

2. **Research Paper:**
   - Augmented Reality and Virtual Reality in Education by M. Billinghurst et al.

3. **Online Tools and Platforms:**
   - Unity Learn (AR/VR development examples)
   - Oculus Education Resources

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Module 4

Hands-On AR and VR Content Creation

Objectives:

- To familiarize teachers with the basics of AR and VR content creation.
- To explain and equip teachers with hand-on experience in creating and manipulating 3d models specifically designed for AR and VR applications.
- To provide teachers with the knowledge and skills to export 3D models for use in VR environments using Blender and related tools, enhancing their technical expertise.
- To explore the key principles of interaction design for AR/VR.
- To equip teachers with a clear understanding of the process of integrating objects into AR and VR environments, enabling them to create fully immersive and interactive experiences.

Learning Outcomes:

- **Create 3D models**: Understand the basic principles of 3D modelling and apply them to create objects for AR and VR using Blender.
- **Export 3D models**: Export models from Blender to file formats compatible with AR/VR environments, such as FBX, STL, GLB, OBJ, and others.
- **Set up an AR or VR environment**: Use simple tools or game engines to import and manipulate their 3D models within an AR or VR environment.
- **Implement interaction**: Understand how to design basic interactive experiences within VR, such as user-controlled navigation or object manipulation.
- **Problem-solving**: Learn how to troubleshoot issues that arise in the 3D modelling and AR/VR integration process.

 6 Hours

Key concepts: 3D Modelling: Blender, Common formats such as FBX, STL, OBJ, GLB, Augmented Reality (AR), Virtual Reality (VR), An immersive digital environment, Interaction Design, MakeHuman,

Theoretical Component

Creating VR and AR content for vocational IT education presents a significant opportunity to enhance the learning experience for participants. These technologies allow teachers to develop immersive and interactive environments that go beyond traditional classroom settings, providing students with real-world simulations and hands-on experiences. For example, IT teachers can create virtual networks or software development environments where students can actively engage with the content, experiment with different tools, and troubleshoot issues in real-time. These virtual spaces make it possible for students to practice their skills without the risks associated with physical systems, creating a dynamic and safe learning environment.

One of the key benefits of VR and AR in vocational IT education is their ability to make complex concepts tangible. For example, teachers can use VR simulations to visualize abstract programming concepts, such as algorithms or data structures, in a 3D environment. This immersion helps them better understand how these concepts work in practice. Similarly, AR can be used to overlay critical information onto physical objects, such as hardware components or network diagrams. This approach bridges the gap between theoretical learning and practical application, which is crucial in vocational education.

While there is still a limited amount of resources dedicated to the creation of VR and AR content for IT teaching, the need is growing. Teachers are increasingly recognizing the value of these technologies and are taking steps to develop and integrate them into their curricula. Tools such as Blender and MakeHuman can be used to generate 3D models and characters for use in these immersive environments.

Ultimately, the creation of VR and AR content for vocational IT teaching has the potential to revolutionize how IT concepts are taught. By creating realistic, interactive simulations, teachers can provide students with invaluable hands-on experience, preparing them for success in the ever-evolving tech industry. As the demand for these technologies continues to grow, Vet teachers have a unique opportunity to pioneer the future of digital education and equip students

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with the skills needed for the modern workforce. In the end, this module emphasizes that AR and VR are not just flashy gadgets; they are powerful tools designed to revolutionize learning and prepare students for a digital future. By transforming how students interact with knowledge, these technologies increase engagement and improve learning outcomes.

This module underscores that AR and VR are more than just eye-catching technologies. They are transformative tools that reshape the way students engage with knowledge, preparing them for a digital future. By integrating these technologies into education, teachers can enhance students' engagement, improve learning outcomes, and create dynamic, immersive experiences.

The implementation process begins with setting up specialized classrooms, followed by introductory work in the Blender programme to develop 3D models. Teachers then explore virtual environments using VR headsets and gradually advance to creating interactive scenes with UPBGE, refining their skills in digital design. The journey culminates in a fully immersive experience, where teachers apply VR to interact with their own creations.

This structured approach not only introduces innovative teaching methods but also fosters creativity and technological proficiency, making learning an exciting and interactive adventure.

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Module Structure

Topic 1: Preparing the Computer Lab for AR and VR 3D Modelling.

Topic 2: Introduction to Blender Basics.

Topic 3: Blender – Selection Techniques.

Topic 4: Using VR Glasses in Education.

Topic 5: Creating Scenes Using UPBGE.

Topic 6: Hubs Navigation – Creating Interaction in VR Glasses.

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ACTIVITY 1: Preparing the Computer Lab for AR and VR 3D Modelling

Objective:

- To equip teachers with the knowledge and skills of creating 3D models for AR and VR.
- To set up software tools.
- To configure a teacher-student control system.

Description:

In this activity, teachers will focus on preparing a classroom environment optimized for integrating Augmented Reality (AR) and Virtual Reality (VR) technologies. Throughout the session, teachers will learn how to set up essential software tools, including configuring a teacher-student control system for remote classroom management. This will involve installing and configuring Veyon and adding students' IP addresses to the teacher's computer to enable seamless monitoring and interaction. They will also explore key AR and VR file formats, such as FBX, STL, GLB, and OBJ, ensuring compatibility across different platforms.

By the end of this exercise, the classroom will be fully set up for working with AR and VR, and teachers will have practical experience in implementing these technologies, making their lessons more interactive, engaging, and technologically advanced.

Materials Needed:

- Laptop
- Projector
- Access to the Internet

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Click on the image to download the PDF file.

https://power-ar-vr-edu.2lo.pl/MODULES/4/ENG_zip/01_ENG.pdf

To download the programs necessary for this exercise, hover your cursor over 'ALL PROGRAMS' and download the large, compressed file. After extraction, proceed to install all the programs on your computer. These programs are designed for the Windows operating system. ALL PROGRAMS

Instructions:

Step 1:

Understanding AR, VR, and 3D Modelling

- Play a short video that demonstrates AR and VR.
  Visualization of the ruined City in the KOŁOBRZEG 3D project.

  Visualization using virtual reality in the KOŁOBRZEG 3D project.
- After the video, invite participants to share their first impressions.
- Brief discussion, ask participants:

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a. What do you know about VR and AR technology? What is your experience with it?
b. Have you ever used VR/AR in teaching? If so, how?
c. What concerns or doubts do you have about using VR/AR in education?
d. In which subjects and topics could VR/AR be applied?
e. What benefits do you think students can gain from learning in a VR/AR environment?
f. What potential challenges do you foresee in implementing this technology in schools?

- Overview of file formats: FBX, STL, GLB, OBJ – when and why to use them.
- Introduce some tools: Blender, MakeHuman, Ultimaker Cura. These are links to the official websites where you can download the versions for Apple computers.

Step 2:

Setting Up the Classroom Control System – Installing and Configuring Veyon.

- Divide participants into small groups. They will perform the same task simultaneously.
- Install Veyon (teacher's computer) https://veyon.io./en/download These links are for the official websites where you can download the Windows versions.
- Configure Veyon Master.

a. Select key-based authentication.
b. In the Service tab, choose the built-in VNC server.
c. In the Access Control tab, set user groups to default.
d. Generate a key pair on the teacher's computer (save both public and private keys).

- Configure student computers:
  a. Import the public key.
  b. Accept the name.

- Add students' IP addresses to the teacher's computer.
- Save the configuration for future use.

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Step 3:

Installing and Configuring Blender for 3D Modelling.

- Download Blender 3.0 Here is the link to the website where you can download Blender 3.0, which will be used in the upcoming activities.
- Install Blender and explore the interface.
- Install the Hubs Blender Exporter (a link to the official website where you can download the Blender 3.0 add-on, Hubs version 1.6.0.), for VR interactions:

  a. Download from GitHub – it is the link to the official website where you can download it.
  b. Copy moveable.py script to the appropriate directory- a detailed description of how to do this can be found in PowerPoint presentation 1.
  c. Enter the system account name.
  d. Activate the add-on in Blender.

Step 4:

Additional Tools for AR and 3D Printing.

  a. Install MakeHuman for character generation. This is the link to the official websites where you can download the versions for Apple computers.
  b. Download and install.
  c. Generate a basic 3D character.

- Preparing models for 3D printing:
  a. Install Ultimaker Cura. This is the link to the official websites where you can download the versions for Apple computers.
  b. Import a 3D model into Cura and adjust print settings.

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Assessment

- **Feedback and reflection**
  a. What was the most surprising aspect of this training for you?
  b. Has your perspective on VR/AR in education changed after this session? If so, how?
  c. Do you feel ready to start implementing VR/AR in your lessons? If not, what additional support do you need?
  d. What challenges do you anticipate when introducing VR/AR in your school?
  e. Do you see differences between VR and AR in terms of educational applications?
  f. What first steps will you take to integrate VR/AR into your teaching practice?

Additional Notes

- **Best Practices:**
  a. Keep training sessions interactive—let participants try each step.
  b. Encourage collaboration between teachers for troubleshooting.
  c. Assignment (if applicable): Practice setting up software at home and create a simple 3D model in Blender. This is the link to the official websites where you can download the versions for Apple computers.

60 mins

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ACTIVITY 2: Introduction to Blender Basics

Objectives:

- To equip teachers with the key components of Blender, including the 3D view, menu, Outliner, Properties, Tools, Timeline, and Camera.
- To familiarize teachers with the knowledge how to add, delete, and manipulate objects like cubes and meshes.
- To explain how to navigate the 3D space and adjust the view using the Gizmo.
- To master basic object manipulation techniques, such as moving, rotating, scaling, and modifying object properties.
- To provide the teachers with the knowledge of Blender's material system and explain how to apply colours to objects.

Description:

The aim of this activity is to ensure that participants gain a solid understanding of Blender's interface and its key components, including the 3D view, menu, Outliner, Properties panel, Tools, Timeline, and Camera. By the end of the session, participants will be able toad and remove objects within the software, as well as manipulate them using basic operations such as moving, rotating, and scaling. They will also learn how to apply materials and colours to objects, giving them a foundational understanding of Blender's material system. Also, participants will be taught how to configure the program, save personal preferences, and reset to factory settings if needed, ensuring they can efficiently navigate and customize the software to suit their needs.

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Materials Needed:

- Blender software installed on all computers
- Mouse with scroll wheel or Apple mouse with gesture support
- Projector or screen for instructor demonstration

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Instructions:

Step 1:

- **Start with some questions:**

a. How can you add material to an object and change its color in Blender?

b. Is it important to understand Blender's interface?

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c. Do you know what are the main differences between wireframe, solid, material, and render views in Blender?

Step 2:

Introduction to Blender Interface

- Divide participants into small groups. They will perform the same tasks simultaneously.
- Run Blender and explain the basic interface components: **3D View**, **Outliner**, **Properties Panel**, **Tools**, and **Timeline**.
- Briefly describe the **Camera** and **Light** objects.
- Explain how to identify each component and how they interact.

Step 3:

Navigating the 3D View

- Show how to click on objects to select them using the left mouse button.
- Demonstrate how to use **Shift + A** to add new objects (e.g., mesh objects like cubes).
- Explain the different views available (wireframe, solid, material, render) and how to toggle them using the **Z key**.
- Walk through how to move, rotate, and scale objects using the **G**, **R**, and **S** keys, respectively.

Step 4:

Basic Object Manipulation

- Demonstrate how to move an object in 3D space by pressing **G** and moving the mouse.
- Show how to rotate objects using the **R** key and scale objects with **S**.

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- Explain and show how to constrain transformations to specific axes (e.g., pressing **X**, **Y**, or **Z** after pressing **G**, **R**, or **S**).

Step 5:

Working with Materials

- Show how to apply colors to objects using the **Materials** tab in the **Properties Panel**.
- Explain how to create a new material, change the base color, and apply it to an object.
- Explain the Material Surface settings and how they affect the appearance of objects.

Step 6:

Navigating the Program Configuration

- Demonstrate how to configure Blender settings (e.g., interface, preferences).
- Show how to save and reset preferences to factory settings when necessary.

Step 7:

Installing and Using Add-ons

- Guide participants through downloading and installing **Screencast Keys** add-on to display their keyboard shortcuts while working in Blender.
- Explain how to activate the add-on and adjust its settings.
- Practical Exercise:
  a. Ask students to create a new object (e.g., cube or mesh) and apply materials or colours.
  b. Encourage them to move, rotate, and scale their object, then experiment with different views and materials.

Assessment

- Feedback and reflection

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a. How do you manipulate an object's position, rotation, and scale in Blender?

b. What key shortcuts can you use to speed up your work in Blender?

c. Describe how you can add a material to an object and change its colour in Blender.

d. Why is it important to understand Blender's interface, and how does it improve your workflow?

60 mins

ACTIVITY 3: Blender – Selection Techniques

Objectives:

- To provide teachers with practical experience in using Blender's interface and navigation through it effectively.
- To demonstrate how to seamlessly switch between various selection modes (vertex, edge, face).
- To equip teachers with the knowledge of how to use different selection tools, including the brush selection (C key) and rectangular selection (B key).
- To offer teachers hands-on practice in manipulating the 3D view, including rotating, zooming, and panning using mouse controls and shortcut keys.

Description:

In this lesson, participants will gain a solid understanding of the basic Blender interface and how to navigate it efficiently. They will learn how to perform essential selection operations, including selecting vertices, edges, and faces, and switching seamlessly between different

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selection modes (vertex, edge, face). The lesson will cover various selection tools, such as the brush selection tool (activated by the C key) and the rectangular selection tool (activated by the B key), enabling participants to select objects quickly and efficiently. Participants will be introduced to techniques for manipulating the 3D view, including rotating, zooming, and panning using mouse controls and shortcut keys. These skills are fundamental for creating and editing 3D models in Blender, laying the groundwork for more advanced techniques.

Materials Needed:

- Blender software installed on all computers
- Mouse with a scroll wheel
- Projector or screen for instructor demonstration

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Instructions:

Step 1:

Introduction to Blender

- Start with some questions:
    a. What do you know about Blender and 3D modelling software?
    b. Have you used any 3D software before, and if so, what did you find challenging?
    c. How do you think selecting and manipulating objects in a 3D space differs from working in 2D software?
- Briefly introduce Blender and explain its importance in 3D modelling.
- Explain the basic interface and what the participants will learn today: selection techniques.

Step 2:

Setting Up the Environment

- Open Blender, remove the default object by pressing **X** to delete it.
- Add a UV sphere by pressing **Shift + A** and selecting **UV Sphere**.
- Confirm that participants are in **Object Mode** by default.

Step 3:

Navigating Between Modes

- Demonstrate how to switch between **Object Mode** and **Edit Mode** using the **Tab** key.
- Explain what each mode is used for and why switching between modes is essential in modelling.

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Step 4:

Basic Selection Techniques

- Press **A** to select all vertices in the object. Discuss how the selected vertices turn orange.
- Use **Alt + A** to deselect all.
- Select individual vertices by clicking on them.
- Demonstrate how to use **Shift + Click** to select multiple vertices.
- Explain and demonstrate the three selection modes: Vertex, Edge, and Face. Switch between them using the **Ctrl + Tab** or the dropdown menu.

Step 5:

Advanced Selection Tools

- Show how to use the **C key** to activate the brush selection tool.
- Demonstrate how to adjust the brush size using the mouse wheel.
- Explain how to use the **B key** to activate rectangular selection.
- Draw a selection box around the object and discuss how it highlights the selected area.
- Highlight that pressing **Z** will toggle the wireframe view to see elements that might be hidden from the camera view.

Step 6:

Practical Exercise

- Give participants a task where they need to select specific elements (vertices, edges, and faces) of the UV sphere using the various selection techniques demonstrated.
- Monitor participants as they perform the tasks, providing individual help if needed.
- Introduce participants with PowerPoint presentations according to the topic.

Click on the images to download the PDF files.

Links for Designing in Blender: (4-38)

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Assessment

- **Feedback and reflection**

a. What is the difference between Object Mode and Edit Mode in Blender, and why is it important to switch between them? (Test participants' understanding of Blender's core functionality and the importance of modes in 3D modeling).
b. How do you select all vertices in a 3D object, and how do you deselect them? (Assess participants' knowledge of the basic selection methods and key shortcuts.)
c. How do you activate the brush selection tool (C key) and adjust its size? (Evaluate the participants' ability to use advanced selection tools and adjust settings like brush size).
d. Using the selection tools you've learned, select the vertices, edges, and faces of a UV Sphere. Which selection mode did you use for each type? (Assess the hands-on application of the various selection techniques taught during the activity).
e. How does switching to wireframe view (using the Z key) help with selection, and when would you use it in practice? (Test the understanding of the wireframe view and its utility in 3D modeling).

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This assessment will help gauge the participants' understanding of the Blender interface and their ability to apply the selection techniques covered in the activity. You can also assess their practical skills during the class through direct observation.

60 mins

Objectives:

1. To explain the safety rules when using 3D glasses.

ACTIVITY 4: Using VR Glasses in Education

2. To explore the use of 3D glasses in two systems: HTC and Class VR.
3. To familiarize teachers with how to integrate 3D glasses into lessons effectively.
4. To discover best practices for uploading and using 3D models.
5. To provide participants with the knowledge how to combine 3D glasses with 3D printing for enhanced learning.
6. To explain how to export models in the **.glb** format for use in VR systems.

Description:

This activity focuses on the integration of 3D glasses in educational settings, specifically comparing the HTC VR and Class VR systems. Participants will be introduced to essential safety guidelines for using 3D glasses, ensuring both comfort and well-being during VR experiences. The lesson will also provide an in-depth exploration of how to effectively integrate VR into lessons, offering teachers strategies for enhancing student engagement and fostering interactive learning experiences using virtual environments.

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Materials Needed:

- **HTC VR headset** or **Class VR headsets**
- **Computer with Unity installed (for HTC VR users)**
- **Blender software** (for creating and exporting 3D models)

- **Ultimaker Cura** (for 3D printing preparation)
- **360° camera or drone** (for capturing VR content)
- **Preloaded 3D models** for VR glasses
- **3D printer and printed models** (for hands-on activities)
- **Internet access** (for downloading and managing VR content)

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Instructions:

Step 1:

Introduction to 3D Glasses and Safety Rules

- Explain the importance of following **safety guidelines** when using 3D glasses.
- Discuss the **time limit** for using VR devices (**max 15 minutes per session**).
- Highlight scenarios where 3D glasses are **not appropriate** for learning.

Step 2:

Implementation of VR in Two Systems

- Divide participants into small groups. They will perform the same tasks simultaneously.
- Compare **HTC VR** and **Class VR** systems:

a. **HTC VR**: Works with **Unity**, but supports only **one user at a time**.

b. **Class VR**: Allows **multiple students** to participate simultaneously.

- Discuss alternative solutions, such as:

a. **Creating websites or apps** to present 3D content on computers and smartphones.

b. **Using large screens** for group learning.

- Explain how animations created in **Blender** can be used in both systems.
- Show an example: **Protein Biosynthesis Animation** (link).

Step 3:

Best Practices for Using 3D Glasses

- Discuss gradual **implementation** of VR tools in lessons.

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- Explore the use of **360° photos and videos** in education (easily captured with drones or 360 cameras).
- Demonstrate the importance of **preloading models into the glasses** to avoid connectivity issues.
- Explain the two ways to use **Class VR**:
  a. **Online** (connected to the internet).
  b. **Offline** (models must be uploaded in advance).
- Highlight the importance of **checking models before use**, including:

a. Scene layout and **3D model positioning**.
b. **Texture files** (avoid excessive file size).
c. Using a **normal map** to enhance the 3D effect with a simple mesh.

Step 4:

Combining 3D Glasses with 3D Printing

- Show how **3D printing** enhances lessons by allowing students to interact with physical models.
- Demonstrate an example:

a. First, show a short animation using **3D glasses or a screen**.
b. Then, provide **printed models** for students to assemble.

- Explain correct **3D printing settings**:

a. Check **wall orientation** in **Ultimaker Cura** (red color indicates errors).
b. Verify model **accuracy before printing**.

- Use the previously learned **magnetic cubes** exercise in this lesson.
- Discuss real-world applications, such as **biological models** (over 600 blocks printed for students).

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Step 5:

Exporting 3D Models for VR Systems

- Show how to **export 3D models** in **.glb format**, which is compatible with VR systems.
- Ensure that participants understand how to **upload models into Class VR**.
- Discuss potential applications for **custom-made 3D models** in education.

Assessment

- **Feedback and reflection**

a. What are the **safety rules** when using 3D glasses?
b. What is the main difference between **HTC VR** and **Class VR**?
c. Why should **3D models be preloaded** before a lesson?
d. How can **360° photos and videos** enhance VR lessons?
e. What are the **two ways** to use **Class VR**?
f. How can **3D printing** be combined with **3D glasses** for learning?
g. What format should 3D models be exported in for use with VR systems?

Additional Notes

- **Best Practices**

  Create a **simple 3D model** in Blender, export it in **.glb format**, and test how it can be used in a VR system or as part of a classroom projec

60 min

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ACTIVITY 5: Creating Scenes Using UPBGE

Objectives:

1. To familiarize teachers with the basic components of the UPBGE Logic Bricks editor: Sensors, Controllers, and Actuators.
2. To demonstrate how to create a simple interactive scene with a movable cube using keyboard input.
3. To explain how to apply logic bricks to control object motion and movement in a 3D space.
4. To equip the teachers with the knowledge of how to modify the behavior of objects using keyboard interactions.

Description:

This activity will guide participants through creating a simple interactive scene using the UPBGE (Uchronia-based Blender Game Engine) Logic Bricks editor. They will learn how to set up basic sensors, controllers, and actuators to make objects respond to keyboard input. The activity will culminate in the creation of a moving cube that reacts to keyboard arrows.

Materials needed:

- A computer with UPBGE installed (no installation required for UPBGE, as it's portable).
- A keyboard for testing inputs.
- A mouse for selecting and interacting with the editor.

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Instructions:

Step 1:

Introduction

- Explain what UPBGE is and how it allows users to create 3D interactive scenes and games.
- Discuss the role of Logic Bricks in creating interactions (Sensors, Controllers, and Actuators).
- Inform students about the lesson objectives and what they will achieve.

Step 2:

- Divide participants into small groups. They will perform the same tasks simultaneously.
- Go to the official UPBGE website and download the appropriate version of the program. UPBGE is a portable program, so there's no installation required.
- Open the program.
- Click on the button in the bottom left corner of the window to open the **Logic Bricks Editor**.
- Explain the three main sections of the window:

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a. **Sensors**
b. **Controllers**
c. **Actuators**

Step 3:

Setting Up the Cube

- Select the **Cube** object in the scene.
- In the Logic Bricks editor, add a **Sensor** by clicking the "Add Sensor" button.
- Choose **Keyboard** from the available sensor options.
- Click the mouse to activate a key press. Press the **left arrow key** on the keyboard to assign the action.

Step 4:

Configuring Controllers

- For the **Controller**, select **AND** from the available controller types.
- **Connect** the sensor to the controller by clicking and dragging between the Sensor and Controller boxes.

Step 5:

Adding Actuators

- For the **Actuator**, choose **Motion**.
- In the Motion actuator, input the displacement along the **X-Axis** as **0.2** to move the cube to the right when the left arrow key is pressed.

Step 6:

Running the Game

- Press **0** on the numeric keypad to switch to camera view.

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- Press **P** to start the game, then press the **left arrow** to make the cube move.
- Test the behavior and ensure the cube responds to the input.

Step 7:

Adding More Key Responses

- Use the same process to create additional movement for other arrow keys:

a. **Right Arrow:** Add another set of logic bricks for the right arrow key, adjusting the displacement for the X-axis (e.g., -0.2).

b. **Up Arrow:** Add a similar setup for the up arrow, modifying displacement for the Y-axis.

c. **Down Arrow:** Leave the down arrow without a controller, but ensure the system is still running with the correct logic.

Step 8:

Final Adjustments and Debugging

- Change names for clarity (e.g., "Move Left", "Move Right") in the Logic Bricks editor for better organization.
- Turn on the option to display the operation of the system for real-time feedback.

Assessment

- Feedback and reflection

a. What are the key components of the UPBGE Logic Bricks editor, and how do they contribute to creating interactive scenes?

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b. How do sensors, controllers, and actuators work together to enable object movement in a 3D space?
c. What role do keyboard inputs play in controlling the behaviour of objects in the interactive scene?
a. How can you modify the cube's movement to react to different keys or additional user inputs in the future?

- Ask participants to share any challenges they faced and provide troubleshooting tips.
- Encourage participants to experiment with other types of actuators, like rotating or scaling the object.

Encourage participants to continue experimenting with UPBGE and create more complex scenes using different sensors and actuators.

60min

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ACTIVITY 6: Hubs Navigation – Creating Interaction in VR Glasses

Objectives:

- To explain how to select and install the correct version of Blender and the Hubs add-on.
- To demonstrate the use of navigation meshes for controlling movement within a 3D environment.
- To create and connect navigation meshes to allow movement via joystick and teleportation.
- To explore the use of Blender and Hubs for creating interactive VR experiences.
- To gain hands-on experience in creating a virtual environment for educational or training purposes.

Description:

In this activity participants will equip the knowledge how to create interactive navigation in a 3D environment using Blender and the Hubs add-on, specifically focusing on creating navigation meshes and connecting them to allow for movement with either joystick control or teleportation in VR. The activity will also cover how to apply this concept to real-world applications, such as creating an interactive evacuation plan for a school. Participants will be equipped with the basic skills to create interactive VR experiences and navigate 3D environments using Blender and the Hubs add-on.

Materials needed:

- Computer with **Blender 3.0** installed.
- **Hubs add-on version 1.6.0** installed in Blender.
- VR glasses or VR-compatible hardware (optional, for testing and demonstration).

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- A model of a 3D environment (e.g., a park, evacuation plan).
- Blender's navigation tools and 3D modelling capabilities.
- Projector or screen for demonstrating the results.

Click on the images to download the PDF files.

https://power-ar-vr-edu.2lo.pl/MODULES/4/ENG_zip/41_ENG.pdf
https://power-ar-vr-edu.2lo.pl/MODULES/4/ENG_zip/42_ENG.pdf

https://power-ar-vr-edu.2lo.pl/MODULES/4/ENG_zip/43_ENG.pdf
https://power-ar-vr-edu.2lo.pl/MODULES/4/ENG_zip/44_ENG.pdf

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https://power-ar-vr-edu.2lo.pl/MODULES/4/ENG_zip/46_ENG.pdf

https://power-ar-vr-edu.2lo.pl/MODULES/4/ENG_zip/47_ENG.pdf

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Instructions:

Step 1:

Overview of Hubs and Navigation

- Briefly explain Hubs as a tool for creating immersive VR experiences and interactive 3D models.
- Discuss how navigation meshes are used in these environments to define areas where movement is allowed.
- Emphasize the relevance of creating interactive environments for VR and AR applications.

Step 2:

Installing Blender and Hubs

- Divide participants into small groups. They will perform the same tasks simultaneously.
- Ensure that participants have Blender 3.0 installed.
- Install the **Hubs add-on version 1.6.0** within Blender (show the installation process if necessary).
- **Access the Hubs add-on** via Blender's properties window.
- Highlight key features of the add-on and the navigation mesh component.

Step 3:

Introduction to Navigation Mesh

- Define the **Navigation Mesh**: a surface that enables movement within a 3D environment.

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- Show how to add a **Navigation Mesh** component to an object in Blender (e.g., a white mesh representing a walking path).
- Explain that only one navigation mesh can exist on a model.

Step 4:

Creating Paths with Curves

- Introduce how **Curves** in Blender are used to recreate paths (e.g., the park paths in Kolberg).
- Demonstrate how to create and adjust curves to represent paths.

Step 5:

Creating and Connecting Navigation Meshes

- Create a white mesh that will serve as the walking surface.
- Add a Navigation Mesh component to the mesh.
- Position the mesh on the ground, ensuring visibility is off.
- Show how to connect multiple meshes (e.g., white and blue meshes for different park areas).
- Use Ctrl + J to join the meshes together.

Step 6:

Movement with Joystick and Teleportation

- Joystick Movement:

a. Demonstrate how to create a plane by connecting meshes when using joystick movement.

- Teleportation Movement:

a. Show how to add an edge between meshes for teleportation-based movement, instead of creating a full plane.

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Step 7:

Adding Waypoints for Teleportation

- Create an **Empty Object** and position it on the path where teleportation should occur.
- Give it a **Waypoint** property, which will be visible as an avatar symbol.
- Explain the function of waypoints and how they can be used to guide user movement.

Step 8:

Project Example: Evacuation Plan in Blender

- Showcase an example where the navigation mesh was used to create an interactive evacuation model for a school.
- Explain how the model was adapted for 3D glasses and how it can be used for educational and safety training.
- Discuss the potential of using this system for various types of virtual training, simulations, and demonstrations

Assessment:

Feedback and reflection

a. How can you use the navigation mesh system in your own projects?
b. What challenges might arise when designing complex environments with multiple meshes and teleportation points?
c. In what other areas (besides evacuation plans) do you think navigation meshes and interactive VR can be useful?

- Encourage students to continue experimenting with Blender and the Hubs add-on.

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- Mention the potential for creating various types of virtual spaces and the interactive features they can implement

60 mins

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Module 5

Effective Integration of AR and VR into Teaching

Objective: This module aims to equip educators with the knowledge and skills to effectively integrate Augmented Reality (AR) and Virtual Reality (VR) technologies into their teaching practice. Teachers will learn how to enhance their lessons by leveraging immersive learning experiences, develop strategies for incorporating AR and VR into various subject areas, and create engaging, student-centered lessons that promote deeper understanding and engagement.

Learning Outcomes:

- identify key AR and VR tools and platforms that can be used in educational settings, especially vocational training, e.g., Google Earth, Google Lens, Google Expeditions
- explain the pedagogical benefits and challenges of integrating AR and VR into the classroom and vocational training
- design an interdisciplinary lesson plan that incorporates AR and VR to enhance learning experiences and subject-area understanding
- compare different AR and VR applications used in educational case studies and identify how they can be applied to your teaching context
- develop an immersive AR/VR lesson or project that integrates multimedia, interactivity, and student engagement strategies to foster experiential learning

6 Hours

Key Concepts:

immersive learning, interdisciplinary teaching, pedagogical strategies, student-centered learning, technological integration, vocational training, digital literacy, experiential learning, collaborative learning

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Theoretical Component

The use of augmented reality (AR) and virtual reality (VR) in education has transformed how teachers engage students as the word *experience* itself has changed and nowadays offers interactive and immersive learning experiences. Thus, these technologies allow learners to interact in ways that traditional methods could not, improving retention through hands-on, experiential learning. This proves to be of enormous significance in vocational training.

Students gain real-world perspectives that enhance their understanding by exploring historical events or scientific concepts virtually. AR and VR also support interdisciplinary teaching, helping students make connections between subjects for a more integrated learning experience. Pedagogical approaches such as gamification and scenario-based learning increase student engagement and foster active participation. This student-centered model encourages learners to take control of their education, exploring subjects at their own pace and interest. Integrating these technologies develops students' digital literacy, preparing them for a future where digital tools are essential.

Teachers must continuously reflect on the effectiveness of AR and VR, assessing their impact on learning outcomes and making adjustments as needed. In the end, AR and VR bridge the gap between theoretical knowledge and practical application, creating a more engaging and meaningful learning experience.

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Module Structure

Topic 1: Google Earth in AR & VR educational settings nowadays (3 hrs)

ACTIVITY 1: Google Earth is so much more than finding your house in street view (30 min)

ACTIVITY 2: Exploring urban landscapes with a virtual city comparison (60 min)

ACTIVITY 3: Collaborative journey with AR / VR (60 min)

ACTIVITY 4: Discussion circles on collaborative projects (30 min)

Topic 2: Bridging the experience gaps with AR and VR (1.5 hrs)

ACTIVITY 1: Redefining the (learning experience) with AR and VR (40 min)

ACTIVITY 2: Transforming learning experiences with AR & VR for the classroom (50 min)

Topic 3: Case studies of AR and VR in real life (1.5 hrs)

ACTIVITY 1: Case study exploration of AR and VR in education (90 min)

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Topic 1: Google Earth in AR & VR educational settings nowadays

ACTIVITY 1: Google Earth is so much more than finding your house in street view

Objective:

- exploring the integration of augmented reality (AR) and Virtual Reality (VR) in education using tools like Google Earth, with a focus on enhancing learning through immersive experiences
- identifying and discussing the educational applications of AR and VR in various subjects

Description:

In this activity, teachers will use AR and VR technologies to explore various locations and concepts more interactive and immersively. By visiting different places or historical events virtually, they can engage more deeply with the material, improving understanding and retention. They will also brainstorm the practical applications of these technologies in subjects and how they can create dynamic, hands-on learning experiences.

Materials Needed:

basic stationery (paper, pen…) and technology requirements (laptop, tablet, or smartphone with online access)

AI-based brainstorming tools like Padlet with AI insights, Coggle, MindMeister…

the collective result in Canva or Lino wall

Instructions:

Step 1:

Find your house in street view:

- How long ago do you think it was taken?
- Is there anything in the neighborhood that has changed?

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- What would you like to be different in the next street view of your house when it is uploaded?

Step 2:

What place is on your bucket list? Fly there with Google Earth, walk, explore, and take pictures. Can you be in the picture? Try to add your collective result in Canva or Lino wall.

Step 3:

What are the possible applications of Google Earth and such activities in educational settings? Brainstorm in your group using an AI-based brainstorming tool like Padlet with AI insights or Coggle, MindMeister…

Step 4:

Compare your ideas to other groups and add to your Padlet, Coggle, MindMeister…

Study other groups' ideas and discuss their:

- how innovative the presented ideas are
- if the suggested applications of Google Earth are practical
- if they are relevant to educational settings

Step 5:

Let's take part now in a group discussion.

- compare your group's applications of Google Earth to those of other groups and try to identify unique perspectives you came up with
- think of ways how these can the suggestions be implemented in an actual classroom setting
- identify at least two ways which AI tools could enhance these activities further

Step 6:

Use this self-reflection form:

- What was most interesting or surprising about using Google Earth for this activity?
- How effectively did you contribute to your group's discussions and outcomes?
- What challenges did you encounter during the activity, and how did you address them?
- If you had more time, what would you do differently?

Assessment

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Peer assessment: involves analyzing and discussing other groups' ideas by evaluating the innovation, practicality, and relevance of other groups' suggested applications of Google Earth in educational settings, fostering critical thinking and collaborative feedback skills

Guided group discussion: This assessment focuses on engaging in a group discussion to compare ideas, identify unique perspectives, explore practical classroom implementations, and brainstorm at least two ways AI tools could further enhance the proposed activities.

Self-reflection form: This assessment uses a self-reflection form to evaluate individual experiences, focusing on insights gained, personal contributions, challenges faced, and potential improvements for future activities.

30 mins

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ACTIVITY 2: Exploring urban landscapes with a virtual city comparison

Objective:

- comparing and contrasting the different landscapes, infrastructure, and environmental practices of Cape Town and Barcelona using Google Earth to understand the role of technology in urban planning and sustainability
- analyzing the integration of green spaces, eco-friendly practices, and technology in public spaces in both cities to explore their impact on daily life and sustainability efforts
- developing critical thinking and collaborative skills by using virtual tools (Google Earth, Padlet, Coggle, or MindMeister) to organize, share, and reflect on research findings related to urban environments

Description:

In this activity, teachers will explore two cities, Cape Town and Barcelona, using Google Earth to visit and compare key locations such as landmarks, buildings, and public spaces virtually. They will assess how each city's infrastructure, technology, and environmental sustainability practices reflect its culture and history. Through digital tools like Padlet, Coggle, or MindMeister, they will organize their findings and engage in group discussions to identify similarities and differences in their observations. This exercise will help teachers understand how urban planning, sustainability, and technology intersect in different parts of the world while fostering collaboration and critical thinking.

Materials Needed:

basic stationery (paper, pen…) and technology requirements (laptop, tablet, or smartphone with online access)

AI-based brainstorming tools like Padlet with AI insights, Coggle, MindMeister…

collective end result in Canva or Lino wall

Google Earth

Instructions:

Step 1:

You will explore, compare, and contrast two given locations.

Location 1: Cape Town, South Africa - Google Earth

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Location 2: Barcelona, Spain - Google Earth

- name 2-3 sights you can find there (landmarks or attractions, famous buildings, parks, or monuments)
- describe housing and infrastructure (types of homes or buildings, public transportation, bike lanes, sidewalks, accessibility…)
- technology (integration into public spaces)
- environment and sustainability (green spaces, visible signs of sustainability - eco-friendly buildings, recycling…)

Use Google Earth for virtual tours and street views; use Padlet, Coggle, or MindMeister… for organizing and comparing observations.

Step 2:

To reflect on the results of your research, focus on the following questions:

- How do the buildings and streets in each place show the culture and history of the area?
- How do people use technology in their daily lives? How is it part of the public spaces?
- What role does nature play in each neighborhood? How is green space (parks or trees) used in Cape Town and Barcelona? Any practices that show respect for nature and sustainability?
- Which place feels easier for walking, cycling, and using public transport? Why?

Add your thoughts to the Padlet , Coggle, or MindMeister you used in the previous task. Share the link of your observations on the collective end result in Canva or Lino wall.

Step 3:

Exchange your ideas and conclusions. Study all the groups' findings. Find at least 5 similarities and five differences in the findings of all groups.

Step 4:

Self-reflection 3-2-1 activity

- 3 things I learned
- 2 things I found challenging
- 1 thing I would like to know more about

Assessment

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Self-assessment (3-2-1 activity): This assessment uses a 3-2-1 self-reflection activity, encouraging teachers to identify three things they learned, two challenges they faced, and one topic they would like to explore further, fostering personal insight and growth.

Group discussion: This assessment involves exchanging ideas and analyzing all groups' findings to identify at least five similarities and five differences, promoting comparative analysis and collaborative learning.

60 mins

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ACTIVITY 3: Collaborative journey with AR / VR

Objective:

- developing collaboration skills by working in groups to create a shared Google Earth project, incorporating multimedia elements like photos, videos, and interactive features
- enhancing critical thinking and analysis by comparing and contrasting different locations virtually, exploring cultural, historical, and environmental aspects

Description:

In this activity, teachers will work in groups to create a collaborative Google Earth project that explores various locations through virtual tours. They will integrate multimedia, text, and interactive features to tell a compelling story about each location. Throughout the process, teachers will discuss the benefits of using virtual exploration tools, like Google Earth, to learn about cultural, environmental, and historical differences.

Materials Needed:

basic stationery (paper, pen…) and technology requirements (laptop, tablet, or smartphone with online access)

Google Earth (Youtube Tutorial)

Google Forms

Peer-assessment

Instructions:

Step 1:

Before creating your first story in Google Earth (Youtube Tutorial), watch the tutorial and put these in the correct order:

- intro
- creating a project
- adding a place

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- adding info
- sharing the project
- going on a journey

Step 2:

Stories/projects in Google Earth are usually created to preserve memories or share a story of a journey. You will now work in groups and create a collaborative Google Earth project, which will include:

- specified locations
- specified views
- outlines
- shapes
- photo/video albums
- rich-text…

This collaborative project will help you learn how to work together, explore new places, and creatively share information using Google Earth. Study the assessment criteria before starting.

You will submit the links to your Google Earth stories on Google Forms. It is easy to share analytics then, and all the links will be readily available to all groups.

Step 3:

Peer-assessment:

- clarity - easy to follow and well-organized: the story and understand the locations, views, and content presented in the Google Earth story
- creativity and visuals - how creative it is (views, shapes, outlines, photos, and videos); is the story visually engaging and well-designed
- content relevance - how relevant and accurate is the information provided, and does it contribute to the viewer's understanding
- multimedia use (photos/videos) - effective use of multimedia: images and videos clear and appropriate for the topic
- storytelling - how engaging is the story told
- explanation - effective text descriptions to explain the locations and highlight key details; the text is informative, clear, and easy to understand

Assessment

Peer assessment: This assessment evaluates the quality of the Google Earth story based on clarity, creativity, visuals, content relevance, effective multimedia use, engaging storytelling, and clear, informative text descriptions that enhance the viewer's understanding.

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60 mins

ACTIVITY 4: Discussion circles on collaborative projects

Objective:

- evaluating and improving communication by participating in peer assessments and group discussions
- fostering collaborative learning
- enhancing critical thinking

Description:

In this activity, teachers will participate in discussion circles by rotating through five different stations, each led by a mentor, where they will discuss various aspects of using Google Earth in educational and cultural exploration. Each group will focus on a specific question related to virtual travel, project engagement, and the impact of technology on our understanding of the world. After completing all stations, participants will share a key insight or challenge they feel more confident about when creating and presenting their own Google Earth projects. This activity encourages collaboration, critical thinking, and reflection on how digital tools can enhance learning experiences.

Materials Needed:

basic stationery (paper, pen…) and technology requirements (laptop, tablet, or smartphone with online access)

Instructions:

Let's get ready for the discussion circles. We will form small groups (around 4-5 people per circle). There will be 5 different stations: each station will have a mentor to guide the discussion. Each group will focus on a different aspect of the topic:

- What are the benefits of exploring new places virtually before traveling there in person?
- In what ways can exploring different locations like Cape Town and Barcelona on Google Earth teach us about cultural and environmental differences? (or any other locations)

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- How can Google Earth be used to help us understand the changes in a neighborhood over time?
- What makes a Google Earth project engaging and easy to follow for viewers?
- How does the use of technology in public spaces, like Google Earth, impact how we learn about different places and cultures?

You will sit at one station and discuss one of the questions related to the Google Earth project for 5 minutes. When you hear a bell, the whole group will move to the following table on their right to discuss the next aspect of the topic. Once all groups have participated in all four discussion circles, each teacher will share one new insight or challenge they feel more comfortable with when creating and presenting Google Earth projects - 10 minutes.

Assessment

Discussion circles: This assessment uses rotating discussion circles to help participants explore different aspects of using Google Earth. Small groups will discuss the benefits of exploring places virtually, learning about cultural and environmental differences, understanding neighborhood changes over time, what makes Google Earth projects engaging, and how technology like Google Earth influences how we learn about places and cultures. Each group will spend 5 minutes discussing a specific question at one station then move to the next station. After visiting all stations, participants will share one new insight or challenge they feel more confident about when creating and presenting Google Earth projects. This final sharing session will take 10 minutes.

30 mins

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Topic 2: Bridging the experience gaps with AR and VR

ACTIVITY 1: Redefining the (learning experience) with AR and VR

Objective:

- enhancing digital literacy and experiential learning
- applying AR and VR in subject-specific contexts

Description:

Teachers will start by unscrambling sentences hidden within a WordArt cloud to uncover insights about the impact of AR and VR on learning and perception. They will discuss how the concept of *experience* has evolved with the integration of AR and VR. Teachers will then research Google's AR/VR tools, including Google Lens, Google Maps, and Google Art and Culture, and discuss ways to incorporate them into their subject areas and vocational training. This will equip teachers with practical ideas for enhancing classroom engagement and experiential learning.

Materials Needed:

basic stationery (paper, pen…) and technology requirements (laptop, tablet, or smartphone with online access)

WordArt, word cloud

Google Ar & VR

Instructions:

Step 1: Try unscrambling two sentences from this WordArt cloud.

Step 2: The sentences hiding behind the word cloud were:

Augmented, virtual, and immersive reality expand how we experience the world and access knowledge. They allow you to take in information and content visually, like in the world.

They are to be found on the homepage of Google Ar & VR: *Experience the world in a whole new dimension*.

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- What does it mean?
- Explain how the word *experience* has changed and how important it is for learning skills.
- How can it be applied in educational settings?
- Provide examples of how AR and VR can create immersive environments, thus enabling students to experience concepts firsthand, for example, a virtual field trip to ancient Greece, a tour of the human body, or a visit to NASA's launching station.

Step 3: Research the following products and add more to the list:

- Google Search
- Lens
- Google Maps
- AR Glasses experiences
- Google Art and Culture
- Google Expeditions
- …

Discuss each in the group and provide examples of integrating these into your subject area.

Assessment

Discussion: This assessment involves engaging in group discussions to analyze the meaning of AR/VR technologies, their impact on learning, and how they can be applied in educational settings with specific examples.

Self-reflection: This assessment encourages teachers to reflect on what they learned about AR/VR technologies, how they can apply them in their teaching, and the challenges they faced during the activity.

40 mins

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ACTIVITY 2: Transforming learning experiences with AR & VR for the classroom

Objective:

- developing interdisciplinary AR & VR lesson plans
- evaluating and improving teaching practices
- enhancing collaboration and peer feedback skills

Description:

In this activity, teachers will work in groups to design an interdisciplinary lesson plan incorporating AR and VR technologies. They will identify the subject areas, key competencies, and pedagogical strategies using storytelling, scenario-based learning, or gamification to engage students. The lesson plan will also include assessment rubrics. They will engage in a group discussion and self-reflection to evaluate the learning experience.

Materials Needed:

basic stationery (paper, pen…) and technology requirements (laptop, tablet, or smartphone with online access)

RubiStar

Canva

lesson plan template

Instructions:

Step 1: In your group, choose a teaching unit to create a draft of an interdisciplinary lesson plan using AR & VR.

- define the subject areas to tackle and the key competencies
- think about pedagogical strategies that help teachers use AR & VR purposefully and integrate these tools into their subject areas
- focus on methodologies like storytelling, scenario-based learning, or gamification

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- design rubrics using RubiStar
- add your lesson plan to the Canva link (lesson plan template)

Step 2: Group presentations: present your interdisciplinary lesson plan and make sure you explain the following:

- subject areas and key competencies addressed
- the pedagogical strategies recommended
- used methodologies
- designed rubrics

Step 3: Revise the prepared lesson plans and provide feedback with a personal touch, focusing on addressed strategies and recommended methodologies. Pay special attention to the designed rubrics.

Step 3: Review the feedback you received and:

- improve your lesson plans using the suggestions provided
- discuss how effective peer feedback was in improving your work

Step 4: Group discussion and self-reflection.

Assessment

Peer assessment: This assessment involves reviewing and providing constructive feedback on other groups' interdisciplinary lesson plans, focusing on pedagogical strategies, methodologies, and rubrics designed.

Self-reflection: This assessment encourages teachers to reflect on their experience of creating an interdisciplinary lesson plan, the value of peer feedback, and how they can improve their work based on suggestions received.

Group discussion: This assessment involves participating in a group discussion to share insights and experiences on the effectiveness of the lesson planning process and peer feedback in enhancing the lesson plans.

50 mins

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Topic 3: Case studies of AR and VR in real-life

ACTIVITY 1: Case study exploration of AR and VR in education

Objective:

- enhancing technological literacy
- developing analytical skills

Description:

This teacher training activity involves analyzing a case study using AR and VR in real-world settings. Teachers will research and identify a case relevant to their subject area, examining the technology used, its benefits, and challenges. They will then synthesize their findings into a visual case study poster, focusing on how the technology can be transferred to their teaching environments. After presenting their cases, teachers will engage in discussions, reflecting on the practical application of these technologies in the classroom and preparing a virtual exhibition of their findings for broader sharing.

Materials Needed:

basic stationery (paper, pen…) and technology requirements (laptop, tablet, or smartphone with online access)

Canva

online case studies

Instructions:

Step 1: You will now take part in a case study analysis.

- find a case online showing how AR and VR are used in a field close to your subject area (history - virtual trips to ancient Greece; biology - 360º videos; foreign languages - experiencing cultural contexts of the language being learned…)
- research the case and find at least two sources reporting about it
- describe the technology used
- list the benefits
- identify the challenges
- explain how this can be transferred to your classroom

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Step 2: Write a short reflection about your findings. Create a Canva poster with the text and appropriate visuals.

- a brief overview of the case study, including location and date
- a clear identification and explanation of the technology used, benefits, and challenges
- ways of meeting the educational objectives
- evidence or examples from the case study to support their analysis

Step 3: Shortly present your case study. Other groups will fill in the peer assessment checklist.

Step 4: Reflect and discuss

- the open floor for questions and discussions
- ask clarifying questions and share their thoughts on the analysis

Possible prompts:

- What aspects of the case study stood out to you, and why?
- How could the technology used in the case study be improved or expanded for educational use?
- What challenges did the case study highlight, and how might these be addressed in a classroom setting?
- How can the benefits identified in the case study be applied to your subject area?
- What are some examples from your experience where AR/VR could enhance your teaching lesson?
- How might the integration of this technology influence students' engagement and motivation?
- Based on the case study, how can AR/VR address diverse learning styles?
- How can the challenges identified in the case study be overcome to make AR/VR more accessible for all students?

Step 5: Prepare a virtual exhibition of your case study posters.

Assessment

Peer assessment: The peer assessment involves evaluating the case study based on the depth of research, relevance to the subject area, clarity of the presentation, and the effectiveness of feedback provided, focusing on constructive critique and improvement.

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Group discussion: This assessment involves reflecting on the case study, engaging in a group discussion by asking clarifying questions, and sharing insights and thoughts on the analysis to deepen understanding.

90 mins

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Module 6

Assessment and Evaluation of AR and VR Learning

Objective: Equip educators with tools to evaluate the effectiveness of AR/VR-enhanced learning.

Equip educators with practical tools and theoretical frameworks to assess student learning outcomes and engagement in AR and VR-enhanced educational settings. The focus is designing reliable, inclusive, actionable assessment strategies tailored to immersive technologies.

Learning Outcomes:

- Develop rubrics and assessment strategies for AR/VR activities.
- Analyse student performance and engagement in immersive environments.
- Reflect on the impact of AR/VR tools on learning outcomes.

6 Hours

Key Concepts:

Types of Assessment, Evaluation Metrics, Tools for AR/VR Evaluation, Challenges in AR/VR Assessment, Feedback Mechanisms.

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Theoretical Component

This framework for assessment and evaluation in AR/VR immersive learning contexts underscores the transformative potential of these technologies. By leveraging Bloom's Revised Taxonomy and the SAMR model, educators can design meaningful, authentic assessments that measure cognitive growth, practical skills, and creativity. Addressing challenges and using best practices ensures that AR/VR-based assessments are effective and equitable.

1. Bloom's Revised Taxonomy

Bloom's Revised Taxonomy is a foundational guide for designing assessments that measure cognitive skills. It provides a structured approach for evaluating immersive learning experiences. At the level of remembering, learners can demonstrate their ability to recall knowledge through AR-enhanced quizzes or VR simulations. Understanding is assessed by tasks that require interpreting immersive content, ensuring that learners grasp the material at a deeper level. Applying involves measuring the ability to use learned concepts in virtual or augmented contexts, encouraging practical application. Critical thinking is assessed through analyzing, where learners must deconstruct immersive scenarios to explore their components. Evaluating focuses on judging decision-making and problem-solving capabilities within AR/VR environments, providing insights into their ability to weigh options and make informed choices. Finally, creating encourages learners to synthesize knowledge by designing unique projects or solutions within virtual worlds, fostering innovation and creativity.

2. SAMR Model

The SAMR (Substitution, Augmentation, Modification, and Redefinition) model offers a framework for evaluating the transformative potential of AR and VR in assessments. In the substitution phase, AR/VR tools replace traditional assessments without altering their functionality, maintaining familiarity for users. Augmentation enhances assessment functionality, as seen in interactive quizzes with AR overlays that add a new dimension to traditional tasks. Modification allows for significant task redesign, such as immersive VR-based role plays that offer more dynamic evaluation methods. At the redefinition stage, new

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evaluation forms are developed, such as real-time VR simulations assessing competency-based skills, enabling previously inconceivable tasks.

3. Immersive Learning Assessment with AR and VR

Virtual Reality (VR) allows for performance-based evaluations in scenarios such as simulated surgeries or crisis management exercises, where learners' responses to realistic challenges can be observed and measured. Augmented Reality (AR) facilitates interactive assessments by integrating digital elements into real-world problem-solving tasks, enabling learners to demonstrate their understanding and application in authentic contexts. AR and VR offer unique opportunities to align assessments with higher-order cognitive skills and redefine traditional evaluation methodologies, making learning more engaging and meaningful.

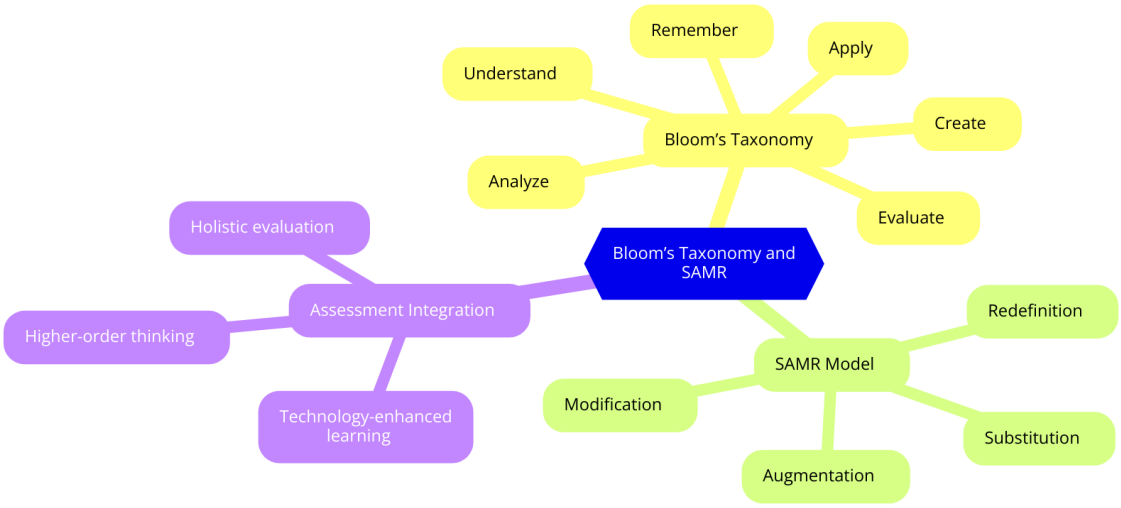

Figure 1 - Bloom's Taxonomy and SAMR for Assessment Strategies for Effective Assessment in AR/VR

Practical assessment in AR/VR begins with using engagement metrics to track learner interaction and engagement within immersive environments, providing valuable insights into their learning behavior. Authentic tasks that mirror real-world challenges are designed to leverage AR/VR for context, ensuring relevance and applicability. Formative feedback is integrated into immersive tasks, offering immediate and actionable insights to support the learning process and guide improvements. Detailed rubrics for immersive tasks are developed

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to evaluate creativity, problem-solving, and collaboration within VR/AR contexts, ensuring transparent and comprehensive assessment criteria.

Challenges and Considerations

Ensuring validity and reliability is crucial for assessments to measure intended outcomes consistently across immersive experiences. Issues of access and equity must be addressed to provide fair assessment opportunities, considering disparities in AR/VR technology access. Technical constraints, such as hardware limitations and varying user proficiency in immersive platforms, must also be considered to ensure the smooth implementation of AR/VR-based assessments.

4. Case Studies

Virtual reality (VR) and augmented reality (AR) technologies have shown remarkable potential in transforming education across various domains. Personalized learning environments using 3D VR platforms have demonstrated enhanced learning outcomes. A study by Horváth (2021) revealed how personalized VR classrooms could improve test performance and engagement by adapting educational experiences to individual cognitive styles. Students achieved higher test scores and faster response times when engaging with these customized VR spaces.

In STEM education, immersive technologies have shown particular promise in engaging students and improving their understanding of complex scientific concepts. A systematic review by Tene et al. (2024) highlighted the positive impact of AR/VR on collaboration and academic performance. Similarly, research by Arslan et al. (2021) found that AR tools significantly enhanced conceptual and cognitive learning outcomes in engineering drawing courses.

Mathematics learning has also benefited significantly from integrating AR/VR technologies. According to Cao (2023), a meta-analysis showed that AR and VR positively impacted mathematics education, helping students better understand and retain mathematical concepts. This research emphasizes how immersive experiences can support students in grasping challenging mathematical ideas, resulting in improved academic performance.

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Project-based learning environments have also embraced VR technology. A case study by Morales et al. (2013) demonstrated how high school students independently used VR tools to create educational applications. The study highlighted the potential of VR to support independent and peer-mentored learning, even with minimal teacher intervention.

In K-12 science education, AR and VR tools have been employed to make learning more engaging and effective. According to Zhang and Wang (2021), these technologies are particularly effective in inquiry-based learning environments. However, the research suggests that greater integration of AR/VR tools with curriculum content is necessary to maximize their impact on student learning.

Higher education has also seen significant advancements in AR and VR. Research by Familoni and Onyebuchi (2024) demonstrated that immersive technologies improve student engagement, knowledge retention, and skill acquisition in higher education settings.

Digital learning environments have increasingly integrated AR/VR, yielding positive results. For instance, Makransky et al. (2020) explored VR simulations in genetics education and found that gamified assessments and interactive elements significantly increased student motivation and understanding.

Finally, AR has been shown to significantly enhance cognitive development and knowledge acquisition. A study by Tuta and Luić (2024) demonstrated that students engaged in active learning through AR achieved higher knowledge retention and understanding levels.

These findings collectively highlight the transformative potential of AR/VR technologies in education, offering innovative ways to engage students, improve comprehension, and enhance performance across various disciplines and educational levels.

5. Inclusive Assessment:

Inclusive assessment in AR/VR platforms is essential for ensuring accessibility for students with diverse needs. Adopting universal design principles, such as adjustable text sizes, voice

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commands, and alternative input methods, enhances accessibility for students with visual, auditory, or motor impairments. Scaffolding, step-by-step instructions, and real-time AI feedback support learners with cognitive challenges, as highlighted by studies on Universal Design for Learning (UDL) in AR/VR education (Wehrmann & Zender, 2024).

Assessment strategies must include adaptive content and multimodal feedback. For instance, simulations can adjust difficulty levels for individual needs, and haptic or visual cues provide actionable insights for sensory-impaired students. Research shows that immersive technologies improve accessibility and engagement for learners with special needs (Badilla-Quintana et al., 2020). Practical applications, such as virtual ecosystems featuring narrated descriptions, sign language overlays, and simplified navigation, demonstrate the transformative potential of AR/VR in inclusive education (Algerafi et al., 2023).

Collaboration with accessibility experts and educators is critical to ensuring AR/VR platforms meet diverse needs effectively (Svendby, 2020). By prioritizing accessibility and inclusive assessment, AR/VR technologies create innovative, equitable, and supportive learning environments for all students.

6. Ethical Considerations:

Ethical Considerations, Privacy Concerns, and Data Usage in AR/VR Learning Analytics

As AR/VR technologies become increasingly integrated into education, they bring significant ethical considerations, particularly around privacy and data usage. These immersive tools collect vast amounts of learner data to personalize experiences and enhance outcomes, raising critical questions about managing this information (Steele et al., 2020).

Transparency is at the heart of ethical AR/VR use. Institutions must communicate what data is being collected, how it will be used, and who will have access. Learners and guardians should be informed and allowed to consent without facing academic disadvantages (Jilani Saudagar et al., 2024).

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Privacy concerns stem from the sensitive nature of the data collected, including biometric details, behavioral patterns, and engagement metrics. If inadequately secured, this information could be vulnerable to breaches, risking student identities and personal privacy (Yekollu et al., 2024). To mitigate these risks, robust cybersecurity measures and compliance with legal frameworks such as GDPR or FERPA are essential (Paneva & Alt, 2024).

While learning analytics can significantly enhance personalized education, institutions must limit data collection to what is strictly necessary. Anonymization and data encryption further protect learner identities, ensuring a balance between innovation and privacy (Shirazi et al., 2024).

By embracing transparency, prioritizing data security, and adhering to strict ethical guidelines, educators can harness the benefits of AR/VR while maintaining the trust and rights of learners (Pase, 2012).

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Module Structure

Topic 1: Introduction to AR and VR Assessment

- **Lecture:** Overview of AR/VR evaluation strategies.
- **Discussion:** Challenges in assessing immersive technologies.
- **Case study analysis:** Best practices in AR/VR evaluation.

Topic 2: Designing Effective Assessment Tools

- **Workshop:** Creating rubrics tailored to immersive activities (MagicSchool, ChatGPT, MS CoPilot).
- **Group exercise:** Designing diagnostic and summative assessments for an AR/VR lesson.

Topic 3: Implementing Technology-Driven Assessments

- **Hands-on session:** Using analytics dashboards in AR/VR tools.
- **Demonstration:** Real-time feedback systems for evaluating engagement and participation.

Topic 4: Reflection and Continuous Improvement

- **Reflective writing:** Analyzing the outcomes of AR/VR assessments.
- **Peer review:** Sharing and critiquing assessment plans developed during the module.

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ACTIVITY 1: Creating a Comprehensive AR/VR Assessment Plan

Objective:

- Design a complete assessment plan for a specific AR/VR lesson or activity.

Description:

Participants will work in groups to develop an assessment plan that includes diagnostic, formative, and summative components.

Materials Needed:

- Templates for rubrics and evaluation metrics.
- Access to AR/VR lesson plans and analytics tools.

Instructions:

- Select an AR/VR lesson plan or activity.
- Identify the learning objectives to assess.
- Design a rubric for formative and summative assessments (MagicSchool, ChatGPT, MS CoPilot).
- Include a feedback mechanism for students to reflect on their experiences.

Assessment

The quality and applicability of the designed plan will be evaluated using peer reviews and facilitator feedback.

60 mins

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ACTIVITY 2: Assessment and Evaluation of AR and VR Learning in Educational Settings - Introduction to AR and VR Technologies in Education.

Objective:

- Assessing and evaluating student learning outcomes in Augmented Reality (AR) and Virtual Reality (VR) educational settings requires a multi-dimensional approach considering cognitive, affective, social, and psychomotor learning domains. The following information provides a structured framework for assessing student learning in AR and VR-enhanced educational environments within **Module 1: Introduction to AR and VR Technologies in Education.**

Description:

a. Formative Assessment

Formative assessments will be conducted throughout the module to provide real-time feedback to students and instructors. Methods include:

- **Observation and Reflection**: Teachers will observe students engaging with AR and VR applications and document their interactions and challenges.
- **Quizzes and Polls**: Short quizzes after AR/VR activities to assess knowledge retention.
- **Peer Reviews**: Students will evaluate each other's experiences with AR and VR applications, fostering collaborative learning.
- **Think-Aloud Protocols**: Encourage students to verbalize their thought processes using AR and VR tools.

b. Summative Assessment

Summative assessments will measure the overall effectiveness of AR and VR learning at the end of the module:

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- **Project-Based Assessment**: Students will develop a mini-lesson or demonstration using an AR/VR tool.
- **Performance-Based Evaluation**: Hands-on activities where students apply AR and VR to real-world teaching scenarios.
- **Reflective Reports**: Students will write reflections on their experiences with AR/VR, discussing challenges, learning gains, and future applications.
- **Pre- and Post-Tests**: Comparisons between initial and final understanding of AR/VR concepts.

Materials Needed:

To systematically assess student learning outcomes, an evaluation instrument will be used:

Rubric for AR/VR Learning Assessment

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Engagement	Actively participates, explores tools fully	Engages well but with minor gaps	Partial engagement requires guidance	Minimal engagement avoids tasks
Understanding	Clearly explains AR/VR concepts and applications	Understands key points but lacks clarity	Basic understanding, some confusion	Limited comprehension
Application	Successfully integrates AR/VR into a teaching scenario	It uses AR/VR effectively but lacks depth	Applies tools with difficulty	Cannot apply AR/VR in practice
Creativity	Innovative and original use of AR/VR	Some creative elements included	Basic application with little innovation	No originality in the approach

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Reflection	Provides deep insights and self-evaluation	Reflects on learning but lacks depth	Limited reflection with minimal analysis	No meaningful reflection

Instructions:

Step 1: Pre-Assessment and Orientation

- Conduct an initial survey to assess prior knowledge of AR/VR.
- Provide an introduction to AR and VR tools.

Step 2: Activity-Based Engagement

- Use hands-on activities such as **Merge EDU, Google Lens, QuiverVision, JigSpace, and ExpeditionsPro**.
- Facilitate group discussions and encourage collaboration.

Step 3: Ongoing Formative Assessment

- Teachers monitor student interactions and collect qualitative data.
- Provide real-time feedback to enhance learning experiences.

Step 4: Summative Assessment

- Require students to complete a final project integrating AR/VR into an educational context.
- Conduct post-tests and reflective self-assessments.

Step 5: Evaluation and Feedback

- Teachers analyze student reflections and performance data.

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- Adjust future AR/VR integration based on assessment findings.

Assessment

This assessment framework ensures a holistic evaluation of student learning in AR and VR-enhanced educational settings. By implementing formative and summative assessments, teachers can effectively measure engagement, understanding, application, creativity, and reflection, improving AR and VR adoption in education.

60 mins

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ACTIVITY 3: Assessment and Evaluation of AR and VR Learning in Educational Settings - Creating Engaging AR and VR Learning Experiences.

Objective:

- Assessing student learning outcomes in AR and VR-enhanced educational settings is essential for understanding the impact of immersive technologies on engagement, comprehension, and skill development. The following information provides a structured framework for evaluating learning experiences in **Module 2: Creating Engaging AR and VR Learning Experiences**.

Description:

a. Formative Assessment

Formative assessments allow for real-time feedback and adaptation during learning activities. Key methods include:

- **Observation and Feedback**: Educators observe student interactions with AR/VR tools and provide feedback.
- **Quizzes and Knowledge Checks**: Short, interactive quizzes after AR/VR activities to assess understanding.
- **Group Discussions and Peer Reviews**: Students share insights, critique each other's projects, and offer suggestions for improvement.
- **Self-Reflection Logs**: Students document their learning experiences and challenges in journals.

b. Summative Assessment

Summative assessments measure the effectiveness of AR/VR instruction at the end of the module. Approaches include:

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- **Project-Based Evaluation**: Students create AR/VR lesson plans or simulations demonstrating their understanding.
- **Practical Application Tests**: Hands-on assessments where students must use AR/VR tools to solve real-world educational challenges.
- **Pre- and Post-Module Assessments**: A comparison of knowledge levels before and after AR/VR integration.

Materials Needed:

A standardized rubric will be used to evaluate students' performance in AR/VR learning experiences.

Rubric for AR/VR Learning Assessment

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Engagement	Fully engaged, explores all AR/VR features	Engaged but with minor gaps	Limited engagement requires guidance	Minimal interaction avoids tasks
Concept Understanding	Clearly explains AR/VR applications	Demonstrates understanding of some gaps	Basic comprehension with errors	Lacks knowledge of AR/VR concepts
Application of Tools	Effectively applies AR/VR in lesson plans	Uses AR/VR with minor challenges	Struggles with the application but makes an attempt	Cannot apply AR/VR in a meaningful way
Creativity and Innovation	Uses AR/VR in highly creative ways	Some originality in the use of AR/VR	Basic application, little innovation	No creative use of AR/VR tools

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Reflection and Adaptation	Thoughtful insights and clear plans for improvement	Some reflection, but it lacks depth	Limited reflection, minimal adaptation	No meaningful reflection

Instructions:

Step 1: Pre-Assessment and Orientation

- Conduct an initial survey to gauge educators' prior knowledge of AR/VR.
- Introduce AR/VR tools and applications.

Step 2: Activity-Based Engagement

- Facilitate hands-on sessions using AR/VR applications such as **Quiver App, Virtual-Tee, CoSpaces Edu, and AirPano**.
- Encourage collaborative exploration and experimentation.

Step 3: Ongoing Formative Assessment

- Use peer discussions, observations, and short quizzes to track learning progress.
- Provide immediate feedback and support.

Step 4: Summative Assessment

- Require participants to create and present an AR/VR-enhanced lesson plan.
- Conduct post-module tests and reflective discussions.

Step 5: Evaluation and Continuous Improvement

- Analyze assessment results and feedback.
- Make necessary modifications to future AR/VR modules based on findings.

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Assessment

This assessment framework ensures a structured and practical evaluation of AR and VR integration in educational settings. By implementing both formative and summative assessments, educators can enhance student engagement, comprehension, and application of AR/VR technologies in teaching and learning.

60 mins

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ACTIVITY 4: Assessment and Evaluation of AR and VR Learning in Educational Settings - Designing Curriculum-Integrated AR and VR Activities.

Objective:

- Assessing and evaluating student learning outcomes in Augmented Reality (AR) and Virtual Reality (VR)-enhanced educational settings ensure that these technologies are effectively integrated into teaching. We outline structured assessment methods for **Module 3: Designing Curriculum-Integrated AR and VR Activities.**

Description:

a. Formative Assessment

Formative assessment provides ongoing feedback to educators and students. Methods include:

- **Observational Analysis**: Teachers document student engagement and interaction with AR/VR tools.
- **Think-Pair-Share**: Students discuss and reflect on AR/VR experiences with peers.
- **Quick Knowledge Checks**: Short quizzes to assess immediate understanding.
- **Digital Portfolios**: Students compile AR/VR projects, screenshots, and reflections.

b. Summative Assessment

Summative assessments evaluate overall learning at the end of the module. Key approaches:

- **Project-Based Learning**: Students design and present an AR/VR-enhanced lesson.
- **Case Study Analysis**: Examination of AR/VR applications in educational settings.
- **Performance-Based Tasks**: Hands-on application of AR/VR tools in simulated teaching scenarios.

- **Pre- and Post-Assessments**: Comparing initial and final understanding of AR/VR.

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Materials Needed:

A structured rubric is used to evaluate AR/VR learning experiences.

Rubric for AR/VR Learning Assessment

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Engagement	Actively explores and engages with AR/VR tools	Uses AR/VR effectively but with some hesitation	Limited engagement, needs guidance	It avoids interaction, minimal participation
Understanding	Clearly explains AR/VR concepts and applications	Understands AR/VR but with minor gaps	Basic comprehension with confusion	Lacks knowledge of AR/VR concepts
Application	Integrates AR/VR effectively into lesson plans	Applies AR/VR but lacks depth	Struggles with application	Cannot apply AR/VR in lessons
Creativity	Highly innovative use of AR/VR	Some original elements	The basic application lacks innovation	No creativity in the use of AR/VR
Reflection	Provides deep insights and improvement plans	Reflects on learning with some detail	Limited reflection	No meaningful reflection

Instructions:

Step 1: Pre-Assessment and Orientation

- Conduct an initial knowledge survey.

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- Introduce key AR/VR tools and platforms (Google Expeditions, Google Lens, CoSpaces Edu).

Step 2: Activity-Based Engagement

- Hands-on activities using **Google Earth, virtual simulations, and collaborative VR projects**.
- Group discussions and brainstorming on AR/VR applications.

Step 3: Ongoing Formative Assessment

- Use peer reviews, observational analysis, and knowledge checks.
- Encourage students to document experiences in digital portfolios.

Step 4: Summative Assessment

- Require students to develop an **AR/VR-enhanced lesson plan**.
- Conduct **case study presentations on AR/VR in education**.
- Facilitate post-module reflections and final assessments.

Step 5: Evaluation and Continuous Improvement

- Analyze assessment data and reflections.
- Revise and improve future AR/VR integration strategies

Assessment

This assessment framework ensures the practical evaluation of AR and VR learning experiences, fostering engagement, comprehension, and practical application in education. Educators can optimize AR/VR use for enhanced learning outcomes by combining formative and summative assessments.

60 mins

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ACTIVITY 5: Assessment and Evaluation of AR and VR Learning in Educational Settings - Hands-On AR and VR Content Creation.

Objective:

- Assessing student learning outcomes in AR and VR-enhanced educational settings ensures the effective integration of these technologies into vocational and IT education. We provide structured assessment methods for **Module 4: Hands-On AR and VR Content Creation.**

Description:

a. Formative Assessment

Formative assessment provides ongoing feedback to students and instructors. Methods include:

- **Observational Analysis**: Teachers document student interactions with AR/VR tools.
- **Peer Collaboration and Feedback**: Students assess each other's progress and share learning experiences.
- **Knowledge Check Quizzes**: Short quizzes after AR/VR sessions to evaluate comprehension.
- **Digital Portfolios**: Students maintain a portfolio of 3D models, VR interactions, and reflections.

b. Summative Assessment

Summative assessment measures overall learning and skill development at the end of the module. Approaches include:

- **Project-Based Learning**: Students create and present AR/VR-enhanced 3D models and lesson plans.

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- **Performance-Based Evaluation**: Practical application of AR/VR tools in content creation.
- **Case Study Analysis**: Evaluating real-world applications of AR/VR in IT education.
- **Pre- and Post-Assessments**: Comparisons of initial and final competency levels.

Materials Needed:

A structured rubric evaluates AR/VR learning outcomes and application skills.

Rubric for AR/VR Learning Assessment

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Engagement	Fully explores AR/VR features with enthusiasm	Uses AR/VR effectively with minor gaps	Limited engagement requires support	It avoids interaction, minimal participation
Concept Understanding	Clearly explains AR/VR principles and applications	Understands AR/VR but with minor confusion	Basic comprehension with gaps	Lacks understanding of AR/VR concepts
Technical Application	Effectively integrates AR/VR tools into projects	It uses AR/VR adequately but with minor errors	Struggles with applying AR/VR	Cannot effectively apply AR/VR
Creativity & Innovation	Highly creative and original AR/VR applications	Some original elements present	The basic application lacks innovation	No creativity in approach
Problem-Solving	Identifies and resolves AR/VR issues effectively	Troubleshoots some issues with assistance	Needs guidance to solve AR/VR problems	Cannot troubleshoot AR/VR challenges

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Instructions:

Step 1: Pre-Assessment and Orientation

- Conduct an initial survey to assess students' prior knowledge of AR/VR.
- Introduce key tools such as **Blender, MakeHuman, UPBGE, ClassVR, and Ultimaker Cura**.

Step 2: Hands-On AR/VR Engagement

- Hands-on activities using **3D modeling software, AR/VR environments, and interactive applications**.
- Group discussions on integrating AR/VR into IT and vocational education.

Step 3: Ongoing Formative Assessment

- Regular observation, knowledge checks, and collaborative discussions.
- Digital portfolios documenting student progress in AR/VR applications.

Step 4: Summative Assessment

- Students develop an **AR/VR-enhanced project (e.g., interactive VR scene, 3D model for AR applications)**.
- Presentations and peer evaluations of completed projects.
- Reflection on challenges and learning experiences.

Step 5: Evaluation and Continuous Improvement

- Analyze assessment data and reflections.
- Modify future AR/VR instructional strategies based on assessment findings.

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Assessment

This structured assessment framework ensures comprehensive evaluation of student engagement, technical application, and problem-solving abilities in AR and VR-enhanced educational settings. The combination of formative and summative assessments helps educators optimize AR/VR integration for improved student learning outcomes.

60 mins

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ACTIVITY 6: Assessment and Evaluation of AR and VR Learning in Educational Settings - Effective Integration of AR and VR into Teaching.

Objective:

- Assessing and evaluating student learning outcomes in Augmented Reality (AR) and Virtual Reality (VR)-enhanced educational settings ensure that these technologies are effectively integrated into teaching. We outline structured assessment methods for **Module 5: Effective Integration of AR and VR into Teaching.**

Description:

a. Formative Assessment

Formative assessment provides ongoing feedback to educators and students. Methods include:

- **Observational Analysis**: Teachers document student engagement and interaction with AR/VR tools.
- **Think-Pair-Share**: Students discuss and reflect on AR/VR experiences with peers.
- **Quick Knowledge Checks**: Short quizzes to assess immediate understanding.
- **Digital Portfolios**: Students compile AR/VR projects, screenshots, and reflections.

b. Summative Assessment

Summative assessments evaluate overall learning at the end of the module. Key approaches:

- **Project-Based Learning**: Students design and present an AR/VR-enhanced lesson.
- **Case Study Analysis**: Examination of AR/VR applications in educational settings.
- **Performance-Based Tasks**: Hands-on application of AR/VR tools in simulated teaching scenarios.

- **Pre- and Post-Assessments**: Comparing initial and final understanding of AR/VR.

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Materials Needed:

A structured rubric is used to evaluate AR/VR learning experiences.

Rubric for AR/VR Learning Assessment

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Engagement	Actively explores and engages with AR/VR tools	Uses AR/VR effectively but with some hesitation	Limited engagement, needs guidance	It avoids interaction, minimal participation
Understanding	Clearly explains AR/VR concepts and applications	Understands AR/VR but with minor gaps	Basic comprehension with confusion	Lacks knowledge of AR/VR concepts
Application	Integrates AR/VR effectively into lesson plans	Applies AR/VR but lacks depth	Struggles with application	Cannot apply AR/VR in lessons
Creativity	Highly innovative use of AR/VR	Some original elements	The basic application lacks innovation	No creativity in the use of AR/VR
Reflection	Provides deep insights and improvement plans	Reflects on learning with some detail	Limited reflection	No meaningful reflection

Instructions:

Step 1: Pre-Assessment and Orientation

- Conduct an initial knowledge survey.

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- Introduce key AR/VR tools and platforms (Google Earth, Google Lens, Google Expeditions).

Step 2: Activity-Based Engagement

- Hands-on activities using **Google Earth, VR city comparisons, and collaborative virtual projects**.
- Group discussions and brainstorming on AR/VR applications.

Step 3: Ongoing Formative Assessment

- Use peer reviews, observational analysis, and knowledge checks.
- Encourage students to document experiences in digital portfolios.

Step 4: Summative Assessment

- Require students to develop an **AR/VR-enhanced lesson plan**.
- Conduct **case study presentations on AR/VR in education**.
- Facilitate post-module reflections and final assessments.

Step 5: Evaluation and Continuous Improvement

- Analyze assessment data and reflections.
- Revise and improve future AR/VR integration strategies.

Assessment

This assessment framework ensures the practical evaluation of AR and VR learning experiences, fostering engagement, comprehension, and practical application in education. Educators can optimize AR/VR use for enhanced learning outcomes by combining formative and summative assessments.

60 mins

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