

EDUCATIONAL TECHNOLOGY AND ICT

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Lecture-35

Module-35: Emerging Technologies in Education different Reality-AR, VR, MR and XR

Hello dear learners, welcome to the SWAYAM-NPTEL course on educational technology and ICT. I am your course coordinator Dr. Sarita Anand from Department of Education, Vinaya Bhavana, Visva-Bharati, Santiniketan, West Bengal, India and today we will talk about module 35 on emerging technologies in education, different realities like AR, VR, MR and XR. Augmented Reality, Virtual Reality, Mixed Reality and eXtended Reality. So, this is the lecture 35 and before going to the lecture we will see the concept covered in previous lecture. We had covered the assessment and educational technology part 2, where we had discussed about the e-portfolios, type of e-portfolios, tools for creating e-portfolios, different quizzes and tools for creating quizzes and technology for self and peer assessment.

Now, we will talk about the different technologies like the technology which we are these days using is rapidly changing and providing the innovative ways to enhance our teaching learning process. Different realities like AR-Augmented Reality, VR- Virtual Reality, Mixed Realities and eXtended Realities are changing how students engage with the content. These technologies create immersive and interactive learning experiences making education more engaging, effective and accessible.

So, let us start with the augmented reality in education. What is augmented reality? First, we have to understand that AR is a technology that overlays the digital content such as images, videos and 3D models onto the real environment using devices like smartphones, tablets and AR headsets. Unlike VR, which creates a completely virtual environment, AR enhances the real-world experiences by adding interactive digital elements.

The application of AR, and before applying AR, we should understand that VR has an immersive nature, while AR is non-immersive, as it only creates overlays on the real world. So, AR is increasingly being integrated into educational settings to enhance teaching and learning experiences. There are many AR applications; we will go through them one by one. The first one is interactive textbooks and learning materials. These days, AR-enabled textbooks allow students to scan pages with a mobile device to view 3D models, animations, and videos related to the content.

For example, AR-based science textbooks can show the molecular structure of compounds, human anatomy, or planetary motion on a smartphone. So, the second one is virtual laboratories and experiments. When discussing the application of AR in education, virtual laboratories and experiments are important. AR allows students to conduct virtual science experiments in a safe, controlled, and cost-effective manner. For example, using AR apps like Google Expeditions and Merge Cubes,

students can explore chemical reactions, physical simulations, and biological processes on their smartphones without facing the hazards of real chemical reactions. The next one is AR in medical and healthcare education. Medical students can visualize human anatomy in 3D and interact with AR-based models for deeper understanding. For example, Microsoft HoloLens is used for medical training to visualize human organs and perform simulated surgeries.

The next one is gamified learning and interactive storytelling. AR (Augmented Reality) makes learning more engaging by integrating gamification elements into the curriculum. For example, Pokémon Go-style AR games can be used to teach geography. History and problem-solving skills. The next one is AR for skill-based and vocational training.

AR (Augmented Reality) can provide hands-on learning experiences in vocational training programs such as mechanical engineering, architecture, and automotive repair. For example, AR training simulations allow students to practice real-world tasks before engaging in physical execution.

Next, AR for special education and inclusive learning. Augmented reality technology helps students with disabilities by providing interactive learning support. For example, AR-based sign language apps assist hearing-impaired students in learning through visual cues.

Tools and platforms for AR in education: some popular AR tools and applications are available for education, like Google Lens. It recognizes objects and provides related

educational content. Merge Cube, a handheld cube that allows students to interact with 3D augmented reality objects. Quiver transforms 2D drawings into 3D animated AR. Visuals.

Anatomy 4D allow the students to explore detailed human anatomy in augmented reality AR. HP Reveal formerly Aurasma used create AR experiences by overlay digital content onto printed material and before going to Virtual Reality remember the PM eVidya AR which is now known as So, this this is made by the government of India at CIET and CRT and for the CBSE students ah 9th class and 10th class and now we will talk about the Virtual Reality in education.

First, we will go through the definition of the virtual reality. It refers to a completely digital environment that immerses users in a simulated world. I have already told that augmented reality is not as much immersive as the VR. It separates their physical surrounding learners surrounding from the real world. This immersion is typically achieved through the VR headsets or similar device devices.

Mostly VR headsets are utilized. VR environments can be developed using real world video footage such as 360-degree immersive computer-generated graphics like interactive 3D simulations. For example, Google tilt brush or a blend of both approaches. VR requires head mounted displays, HMDs such as Oculus Rift and HTC Vive and the Google Cardboard to experience virtual worlds.

So, what are the applications of VR in education? The first one is virtual field trips. Students can explore historical sites, outer space, and underwater environments through VR simulations. They do not need to go into the ocean, but they can experience that environment. Medical training: medical students can perform virtual surgeries and diagnose conditions in a risk-free environment.

Next is engineering and design. Architecture students can build and explore 3D models of structures in a virtual space and learn about architecture. Language learning: VR-based language apps enable students to interact in virtual conversations to learn new languages. History and culture learning: students can experience ancient civilizations and historical events through VR reenactments.

The third one is mixed reality in education, and we will see the definition of mixed reality. It integrates elements of both augmented reality and virtual reality by allowing virtual objects to interact with the real environment. So, it is a crucial feature of MREs' occlusion.

Digital objects can be obscured by physical ones if they are placed in the foreground. So, one of the most well-known MR devices is the Microsoft HoloLens.

While Apple has been developing a more lightweight alternative, MR uses the holograms and spatial mapping to create the interactive learning experiences. and Microsoft HoloLens is one of the leading MR devices. So, immersive video and 360 streaming is there it is also known as the immersive video or 360 video streaming in a type of VR experiences that allow users to explore content in different direction using a VR headset. So, however, when viewed on a smartphone or a computer screen 360 video is no longer considered true virtual reality as it lacks the full immersion. So, it is coming under the MR in education.

Now, what is a hologram? Hologram are three dimensional digital projections placed within the real world. They exist across various XR eXtended realities technology and when used in the MR ah mixed reality they can dynamically interact with their physical surroundings creating a seamless blend between the digital and the real-world elements.

Now, the application of MR in education we have already discussed that the we can utilize these in the medical and science education students can manipulate 3D biological structures in real time engineering and robotics mixed reality ah helps the students in designing and testing the machine prototypes ah it also has the collaborative learning approach where the multiple users can interact with the same MR environment for the group project.

Now, the fourth one is eXtended Reality in education. This eXtended Reality is an umbrella term that encompasses the previously discussed three terms AR, VR and MR technologies. XR enables students to engage in fully immersive and interactive learning experiences.

The future of XR in education These days we are reaching to the AR and VR and hopefully in future classes we will be adopting these XR in education. AI powered adaptive learning, personalized learning environment based on the individual need, haptic feedback integration allowing the student to feel the virtual objects for hands on experiences like if they are seeing the polar region they will feel the cold.

So, cloud based XR making immersive learning more accessible through the cloud computing. So, this is the structured ah this is generated by the IBM institute where they have tried to explain the ah AR, VR, MR and XR combination.

You can see the picture and try to understand that the MR is the combination of AR and VR and all the three are coming under the XR when we are accommodating all the three

concept AR, MR and VR together this is becoming the XR for the learners and in the education and I have given the link of this picture which I have taken from the internet and the benefits of the AR, VR, MR and XR in education.

So, overall, the all four terms are benefiting the whole education system like giving the engagement improving the retention of the learners by providing the chances for the hands-on experiences, providing the experiential learning they are not going to the polar region, but they are getting the experience of those regions. So, increasing accessibility, high quality education and immersive technology are promoting the accessibility of the content, fostering the collaboration, it is motivating the learners to exchange their virtual spaces for their group projects and tasks.

Now, the conceptual model of the four realities- that the eXtended Reality is overarching category that includes the AR, VR, MR and AR and VR a distinct, but interconnected technologies and MR is the Mixed Reality; it is the mix of or blend of AR and VR which is allowing the interaction between the real time and the virtual elements. Now, we will see the relationship among the AR, VR MR and XR. So, I have already prepared the that picture that will be fitted here also that these XR eXtended Reality source as an umbrella term and this is mixing the AR, VR and ah MR together.

So, each of these technologies represents different levels of immersion and interaction between the real time and digital. But their relationship can be understood by analyzing their similarities, differences, and overlapping functionalities. So, this graphical representation, which I have mentioned, was also showing the relationship, and here also I have tried to explain in a simpler way that this Venn diagram is showing that XR is the area where this incorporates AR, VR, and MR. MR is basically the hybrid one, which integrates AR and VR together in the digital world interaction. So, a table of comparison I have made for your better understanding.

This is the comparison among AR, VR, MR, and XR based on their features like definition, reality level, interaction, and devices used for these realities. There are benefits, but definitely every aspect has its challenges, and these realities also have challenges like high cost. AR and VR headsets and software can be expensive for schools and colleges. The technological infrastructure requires high-speed internet and compatible devices, which is a challenge. Teacher training is the biggest challenge because educators need to be trained to integrate these emerging technologies into their curriculum effectively.

The health concern: prolonged VR use may cause motion sickness, eye strain, etcetera. Let us visit the example of each reality; this I have given for your further understanding. So, we can go one by one for the example; I will show you how we can use AR in daily life. The internet will take some time, and this is the platform, and I have seen here a very good video.

So, I can show you I had taken this picture from for your reference and this is the video I can show that how they are using the AR ok. Yes, you can see that these days how AR is being utilized in daily life also this is navigating and ah showing that road is ok or not. I think there was an audio, but is it not showing here no problem you can go through the given reality ok. This is called augmented reality navigation and these days high tech cars are using this reality and a as a teacher in the teaching learning process we can use the AR apps like e-partial AR on our Smartphones. So, we reach the destination ok.

Now, we will see the another one which we have seen the next one is that was YouTube video ah if you will not see not go through these facilities definitely will not be able to understand. So, every time advertisement is coming yes, we this is VR headset how they are using.

Audio is not coming I think, but no problem you can see I have given the link and you can go through it. look how they are designing this is immersive you can see this is the use of vr and she is wearing the vr headset using the device creating some artwork with the help of technology there was sound this is not showing This is was tilt brush which I have mentioned in the lecture. Now, I will show you another one the MR mixed reality example ok. Now, mixed reality you can see they are using the VR headset and mixed reality at their home. Watching the TV on any screen any wall they can see the television.

Now, using in the Hologram, HoloLens in the medical field this is the benefit educational benefit of these realities. Now, in architecture they are designing, they are trying to understand you can understand this is a high tech we as a teacher's we are not using these kinds of mixed realities, but definitely ah future is for them only and many of you may be acquainted with these technologies uses and you can understand that they are using it in at their home.

So, the next I will show you this one is about the XR. So, I can show you the XR I had given two examples. So, his voice was there, but it is not showing that how XR is working. MR was explaining that how it can be used. Yes, now came. So, he is explaining the eXtended Reality in his small video with actually this is the long video. So, you can go

through it 9 minutes video I cannot show you, but definitely this video is showing that how eXtended Reality is working and Mr. Mar was expert in this field. So, I will show you the smaller one. because when we are talking about theoretically about these four realities it will not.

So, there is some link problem, but no issues. I have given the link. Some homework will be there for you all, and there is a website. Oh, I think there is an internet issue. So, no problem. There are challenges of technology. I have given these examples as a learner. Please go through these links and try to. Understand the four concepts. So, these emerging technologies like AR, VR, and MR can be concluded to be shaping or reshaping the educational landscape scenario by making learning more interactive, immersive, engaging, and personalized. As AR is enhancing the real-world learning experiences and overlaying the digital content, while VR is creating a fully immersive environment for.

Experiential learning- whereas, Mixed Reality is merging both worlds, offering interactive learning opportunities by combining AR and VR. The future of education will definitely be increasingly driven by AI-powered XR (eXtended Reality) solutions, creating limitless possibilities for interactive, personalized, and skill-based learning.

Educational policymakers and educators must embrace these innovations to prepare students for the future, ensuring they acquire 21st-century skills through technology-driven learning experiences. So, I have given here a few references. You can go through them. Also, I had given the link in the course content. So, you can go through it, check the four realities, and thank you. Keep learning.