

MIXED REALITY TOOLS FOR EDUCATION IN THE METAVERSE

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Abstract

Education needs to adapt to the constant changes of society and integrate modern technologies to enhance the process of teaching and learning. The recent Covid 19 pandemic has generated a shift towards digital education, as most educational institutions were forced to temporarily suspend all physical activities. The transfer and absorption of knowledge suffered greatly from this, especially in the underdeveloped countries where the infrastructure is limited. Nevertheless, the current crisis has paved the way for digital campuses, online classrooms and digital teaching platforms. In this article we briefly present several free tools that educators can adapt and use to create a virtual classroom based on mixed reality (XR) technologies, along with the main XR hardware (such as Oculus Quest, Hololens 2). We also share insights on how a virtual classroom can increase student participation and engagement, and how we envision the future of digital classrooms and their potential in the Metaverse.

Keywords: *Education, mixed reality, tools, Metaverse.*

1. Introduction

Metaverse is a digital world that aims to enhance our experience in the real world. The Metaverse can be defined as an imagined world with immersive digital spaces, ensuring the extension of synchronous communication for a significant number of users who can share different experiences (Akour, 2022). The integration of the physical and virtual worlds requires a synergy between different modalities to design the tridimensional spaces, the development of smart non-player characters (NPC), as well as customizable player characters (avatars) (Zhao, 2022).

As people enjoy their connection to the virtual world through the Metaverse, its potential as an educational tool for learning comes to light. Digital classrooms in the virtual world Metaverse have seen a dramatic increase over the past years in educational institutions and organizations around the world adopting this technology for classroom training or virtual conferences. The inclusion of extended realities, mainly virtual reality (VR), augmented reality (AR) and mixed reality (MR), in the learning process offers students opportunities and enhanced virtual experiences (Estrina, 2021). The learning activity of virtual classrooms is based on the collaboration of students, which takes advantage of its ability to allow easily bring together a relatively large number of people in a carefully designed environment in order to promote inclusiveness, openness and safety. Through virtual classrooms, students can learn about and practice some activities that are hard to conduct in a real-life classroom due to limitations in time, location, weather, and safety. For example, students can have access to simulations, conduct field experiments and tests, and perform virtual observations through virtual laboratories.

Also, the role of the educator will be transformed, it will become more complex in the sense that it must be up to date with new technologies and manage technological tools, to teach students how and when to use them (Scarlat, 2020), how to integrate them into the learning process, and how to adapt the existing teaching practices and teaching materials to these technological tools to enhance their learning process. The teacher becomes a facilitator of learning, an information broker to share knowledge, providing students with skills, methods, tools, and processes to deal with technology and enhance the interaction and learning.

In this paper, we briefly present several free tools that educators can adapt and use to create a virtual classroom based on mixed reality (XR) technologies, along with the main XR hardware. We also share insights on how a virtual classroom can increase student participation and engagement, and how we envision the future of digital classrooms and their potential in the Metaverse.

2. Mixed reality platforms for collaboration

The ability to communicate and collaborate in real-time has allowed our society to minimize the impact of the travelling restrictions imposed by COVID-19. The main platforms which were used for 2D virtual meetings are Zoom, Teams, Cisco Webex, Google Meet. However, these are limited and greatly affect the process of teaching and learning. Therefore, we propose the use of 3D virtual platforms that educators can adapt and use to create custom environments that can be explored with a variety of devices, from smartphones and tablets to virtual and augmented reality glasses. In Table 1 we present a list of free collaboration platforms that allow users to meet in the same virtual space and participate in training or educational activities (Diaz, 2020). For each tool, we highlight the main features, such as: device compatibility, the number of people who can connect at the same time to the same virtual space, and two other features that affect the feeling of immersion: 3D spatialized audio and customizable avatars.

Table 1. Mixed reality tools for education in the Metaverse (VR collaboration platforms).

Name	Device availability	No. of users	Spatialized audio	Customizable avatar
Alcove	Oculus Go, Quest 1, Meta Quest 2	up to 4	N/A	N/A
AltSpaceVR	Vive HTC, Oculus, Windows Mixed Reality, Desktop mode	up to 50 avatars per space	yes	yes
Horizon Venues	Oculus Quest 2	N/A	yes	yes
Horizon Worlds	Oculus Rift S, Oculus Quest 2	N/A	N/A	yes
Microsoft Mesh	HoloLens 2, VR Headsets, PCs and mobiles	max 8 concurrent users	yes	yes
Mozilla Hubs	all major VR platforms, as well as non-VR devices	a maximum capacity of 25 people in-room	yes	yes
NeosVR	Oculus Rift, Oculus Rift S, Oculus Quest with Oculus Link, Oculus Go, Pimax headsets, HTC Vive, Valve Index, and Windows Mixed Reality headsets	as many avatars as the local pc or cloud storage	yes	yes
Rec Room	Microsoft Windows, PlayStation 4/5, Oculus Quest 1/2, iOS 12.0 and up, Android 7.1 and up	up to 40 per room	yes	yes
Spatial	Oculus Quest, Oculus Quest 2, Mobile (iOS+Android)	up to 50 users in a room	yes	yes
VRChat	Oculus Rift, Oculus Quest, HTC Vive, Windows Mixed Reality, desktop mode	up to 16 players in a hub	yes	yes
vTime XR	Oculus Go, Google Daydream, Samsung Gear VR, Google Cardboard, Oculus Rift, Windows Mixed Reality, iOS, Android	N/A	yes	yes
OpenSimulator	Multi-platform	over 60 simultaneous users	N/A	yes

There are several XR headsets on the market that can be used in the classroom, however the Meta Quest 2 is the most promising and most popular. Its key points are the accessible cost and reasonable quality, but also the fact that it is standalone, which eliminates cables and the need for a VR-ready computer. The immersion is enhanced by the hand tracking function, thus students can interact with the virtual elements without the need for a dedicated controller. Other popular VR headsets are: HP Reverb G2, HTC Vive Cosmos, HTC Vive Pro 2, Samsung Odyssey+, Sony Playstation VR, and the Valve Index. Although a completely virtual scene can offer more flexibility and visual effects, in some situations a see-through headset (or augmented reality headset) is more suited. First of all, the risk of motion sickness is greatly reduced, as well as the risk for injuries caused by sudden, uncontrolled reactions of the user. The most promising devices are the HoloLens 2, Magic Leap 1 and Nreal Light HoloLens 2, Magic Leap 1, Nreal Light, Snapchat Spectacles, and Vuzix Smart Glasses.

3. The future of digital classrooms

In the context of a modern and transformative society, it is obvious that education needs to adapt and integrate new tools that will allow teachers to create rich, interactive, inclusive, and engaging educational environments. The COVID-19 pandemic has forced a change from the physical to the digital

classroom for which many educators and students were not prepared and did not have the necessary knowledge and infrastructure. Although there were many negative effects of the imposed digitalization (Tadesse & Muluye, 2020), the lessons learned after almost 2 years of online education can be used to create a roadmap to virtual classrooms that are better designed to accommodate teachers and students alike. The Metaverse is considered to become an important aspect of Education 4.0, a concept that illustrates the shift to education in the Industry 4.0 era (Salmon, 2019).

It has already been shown that virtual worlds have the potential to improve learning, collaboration, motivation, and overall performance of students (González, 2013). In this sense, a new concept has emerged that revolutionizes the world of higher education, offering new teaching and learning methods: the virtual campus (Neoma). These 3D immersive environment platforms allow teachers and students the possibility to connect with each other, to socialize and to participate in different conferences, trainings, and interactive meetings. Also, students become active participants and acquire a certain amount of independence since they can be anywhere at any time. Moreover, they can be part of different events or locations without the need to attend all of them and all the materials and devices required to access the virtual classroom are at the user's disposal. Thus, the educational experience is completely individualized, and students acquire and improve skills and knowledge in their own time.

4. Conclusions

In the perspective of new technologies, the virtual participation in a classroom will be as effective as the physical presence or will even exceed it in some respects: deeper and lasting knowledge, telepresence, no geographical restrictions, and so on (Mystakidis, 2022). Thus, teaching and learning is taking another step forward and this is the scenario where the interaction between students, teachers and other learning-facilitating entities are all connected. In this scenario, students acquire and learn by interacting with each other, while teachers learn to better manage their work.

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