

# ROLE OF METAVERSE IN E-LEARNING AND ITS CONTRIBUTION TO IMPROVING THE QUALITY OF EDUCATION

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## ABSTRACT

Metaverse is a virtual world where an immersive experience through the use of an avatar takes place within it, which is in many cases accessible by a VR headset. This research is about the use and benefits of metaverse for e-learning. Metaverse helps e-learning by being an attractive medium where 3d models and virtual presentations with the help of AI are possible to improve the current state of education. In this research first, we introduced the metaverse and stated that there are two approaches for its role in the metaverse, first the facilitating role where it exactly mirrors the real-world classrooms, and second the accommodating role where there are extra functionalities compared to the real world. Then we explored how metaverse improves the quality of education, under two major categories. First, one being attractiveness, discussed those characteristics that are originating from the external world, like how entertaining the metaverse is to an external agent. The second one was about assistive approaches, which discussed those characteristics that originated from within the metaverse. Next, there were challenges, and finally the conclusion. The conclusion contains a brief mention of all the characteristics of the metaverse that result in improving the quality of education.

## KEYWORDS

Metaverse, Education, E-learning, Improving, Learning

## 1. INTRODUCTION

The term "metaverse" was coined in 1992 for science fiction purposes (Benrimoh, Chheda, & Margolese, 2022), however, it emerged in the early 2000s as a part of experiences in the gaming industry (Hwang & Lee, 2022). Metaverse can be defined generically in its present usage as "a three-dimensional virtual shared space (sometimes called a virtual world), where users can have immersive experiences by entering it as digital avatars and interacting with other users, while its emphasis is on artificial reality and augmented reality, and where creatively pushes the boundaries of technology" (Tesoro, 2022; Jacob, 2022; Cannes lions, 2022; Hwang & Lee, 2022). As of today, there are many "metaverse platforms" available to access virtual worlds which are provided by different companies. Among them, Horizon Worlds (by Meta), Altspace VR (by Microsoft), BlueJeans (by Verizon), Decentraland, Roblox, Sandbox, and Second Life are some examples (Shein, 2022).

Concerning education-specific metaverses, currently, there are some specialised metaverse platforms available for education, which streamline VR and AR educational content based on the respective syllabus of the university ("Metaverse in a," 2022). Even Meta has a dedicated team for the creation of education applications within their metaverse (Horn, 2022), and it can be seen that as the metaverse unfolds rapidly, the arena for learning, training and upskilling gets wide open ("Metaverse meets," 2022).

Before covid, it was much more difficult to imagine that one-day e-learning technologies like metaverse can play their role in the field of education, but today it is much more feasible ("Metaverse meets," 2022). Just as the learning tools like laptops in the past resulted in the creation of online learning, today also metaverse is poised to be a dominant medium for education in the future (Horn, 2022). Metaverse can improve learning increasingly; Based on a PwC report, those who were trained using VR were up to 275% more confident to behave in real tasks than what they learned in virtual reality. They showed a 40% improvement compared to what they learned in the face-to-face classroom, and a 35% improvement compared to e-learning (Vikram, 2022). This article covers how, and by which approaches metaverse results in the improvement of education.

## **2. METAVERSE FOR E-LEARNING**

There are two choices while implementing metaverse for e-learning: first, we should expect that metaverse adapts to e-learning (where it "Facilitates"), and second, we should expect that e-learning should adapt to metaverse (where it "Accommodates").

### **2.1. Facilitate**

Here metaverse adapts to traditional learning and acts just as a medium. There are no extra tools of metaverse to be used in the process of education, only the teacher and students just as traditional learning have the basic interacting actions in a virtual classroom. No 3d models, no AI tools, and no such things that provide an additional characteristic to the metaverse, but it's absolute tutor-based learning. There are only lectures through virtual 3D classrooms, educating seminars, and virtual campus activities (Horn, 2022; "Metaverse meets," 2022).

### **2.2. Accommodate**

In this case, the e-learning gets adapted to the metaverse and its capabilities. Here in addition to tutor-based learning, there are additional tools like 3d models for better understanding of the topic, AI is in use to assist the learning process, or there are numerous varied landscapes for students to be present as a part of the learning process.

In other words, experts are expecting the metaverse to not only mirror the real world in a three-dimensional medium but also to extend it to allow us to do what previously could only be imagined. This makes it by far, more engaging and robust than the real world. (Needleman, 2021) There are co-working spaces, virtual reality environments, and learning applications. (Horn, 2022) The Brookings Institution states that "when education lags the digital leaps, the technology rather than educators defines what counts as an educational opportunity." (Horn, 2022).

## **3. IMPROVING THE QUALITY OF EDUCATION**

There are two main directions where the metaverse helps in improving the quality of education, first those aspects that act from outside of the metaverse and encourage students to be involved in the metaverse, like its "attractiveness", and second are those aspects that act from within the metaverse, like its unique tools and applications, which are "assistive".

### **3.1. Attractiveness**

Metaverse is attractive to many students when they see it from the outside world. That is because it is the same area where their entertainment including their games, virtual concerts and hangouts with friends have been conducted. So, the correlation between the fun time they had in the metaverse, and the e-learning that will be done through the metaverse, results in it being attractive. What matters here, is the perceptions that students have about their intention to use a metaverse learning environment (Yang & Ryu, 2022). We see that today; Generation Z is more willing to accept online education. For them, the digital world has the same importance as the real one. Based on these facts, the metaverse has to be an area of choice for them (Lin, Wan, Gan, Chen, & Han-Chieh Chao, 2022).

#### **3.1.1 Being Entertaining**

The current popular metaverse platforms, which are mainly in the gaming sector, have dominant populations of children and young adults. One reason that universities are using metaverse, is to attract children and young adults, due to the already proven attraction of them towards it (Kshetri, 2022a). As the children can create an avatar to represent themselves in a virtual classroom, they can have more fun compared to traditional education (Puncreobutr, Dhamacharoen, & Tapaneeyakorn, 2022). Metaverse makes education more entertaining and interactive ("Metaverse meets," 2022). Some companies even have called their education metaverse,

"edutainment", which combines the two words education and entertainment (Schorsch, 2023). Therefore, attracting students more towards education can increase the overall quality of education.

### **3.1.2 Gameful Experience**

The gaming industry with great experience in the development of games might adopt "serious games", where gaming technologies, experiences, and storytelling will be used for training and simulation ("Six trends," 2022). As in the metaverse, the education gets gamified, and the skills learned by students can stay for the lifelong with them (Agarwal, 2022). This is especially valid for those students with eidetic memory (Kumbhat, 2022). In general, gameful and practical ways of training have a greater effect on learning efficiency. For example, physics experiments, building automobile prototypes, chemistry experiments, running simulations, and visiting places of historical significance, are all examples of learning through a gameful experience and are more efficient than their non-practical and non-gameful counterparts (Agarwal, 2022). As an example, a pilot by Atlanta's Morehouse College showed that there was a 10% increase in students' GPAs for the world history class through virtual reality, compared to traditional e-learning via Zoom and face-to-face learning of its past year (Kshetri, 2022a). Also, immersion can increase engagement in learning (Kshetri, 2022). In addition, there is a meaningful relationship between a gameful experience in the metaverse, and the motivation for learning (Park & Kim, 2022).

### **3.1.3. Promoting Communication**

Compared to the online classes at the present, metaverse will provide more effective communication. Both tutors and learners can create their respective rooms for meetings, collaborations, study, or even just for socializing. They can see each other, share files easily, and play their favourite games. Under these circumstances, the friendship of classmates will be enhanced (Lin et al., 2022).

### **3.1.4. Lower Costs**

In general, metaverse causes lower costs for many aspects of learning, including instructor, travel, and in some cases facility costs (Gronstedt, 2022). For an institution as a whole, there might be an initial high expense there to create the metaverse software and implement it by using devices like headsets, but after the first installation, the upcoming costs will be reduced. For example, there will be no need to buy expensive laboratory instruments to do experiments, as all experiments can be done virtually in the metaverse.

### **3.1.5. No Bias and Zero Risk**

Biases either unconscious or conscious, whether about being disabled, dark-skinned or being a woman, all can be solved by the use of avatars under a metaverse (Cook, 2021). In addition, the use of avatars (instead of actual presence) in different sorts of virtual situations, results in zero risks if things go wrong. This advantage has already been tested in case of the flight simulations (Freifeld, 2022).

## **3.2. Assistive**

If we view the metaverse absolutely from within, we can discover its assistive capabilities, like 3d models, AI tools, and virtual applications.

### **3.2.1 Avatars and Population**

An avatar of a deceased individual or a historical figure can be represented by its respective avatar, and with the help of AI, it can talk, such that it feels it was brought back to life (Needleman, 2021). For example, as a part of the history class, bringing Herodotus to talk to students, can result in a better educational experience. It is even possible to swap out characters, their speaking languages, and other variables, to customize the respective training to match the demographics where they are being used (Freifeld, 2022).

Another positive aspect of the metaverse is that it is capable of handling an infinite number of users at the same time (Needleman, 2021). Even a normal-sized virtual class can be made a multi-story class to get more capacity, or the tutor can be mirrored in another class or on a large screen.

### **3.2.2 Space and Environment**

Teachers can arrange their lesson plans over a landscape, where for each topic students will travel to the next area, which is specific to that topic, and as such due to a more interactive and immersive manner, it will have

better results in overall learning of students (Agarwal, 2022). Also, every day they may attend the class in a different-looking class. Another possibility is that when viewing any event, instead of having to view it from a specific perspective, we have the freedom to be able to change the angle of view based on our choice (Needleman, 2021). Students can even be suspended or on the fly while attending the class.

One advantage of travelling in spaces in the metaverse is that, not only the space can be collapsed by the implementation of higher speeds in VR, but also to be more precise, time is also collapsed. As such, it reduces training time by 5 or 10 times (Gronstedt, 2022). It can be understood better when considering the time, we spend going to university or to pass through the corridors of our real universities. It is worth knowing that currently there are metaverse universities (For example the Invact Metaversity in India), that function like fully equipped real universities but under virtual reality. They can have a virtual reality library, cafeteria, hallways, and playground, and offer different courses to be accomplished using VR headsets (Vikram, 2022).

### **3.2.3 Hard/Impossible-To-Crete Phenomena**

Metaverse can make education more affordable. For example, instead of purchasing cadavers which cost a lot, they can use a 3d model of it in the metaverse, at a lower cost (a, 2022). Sometimes some experiments in the real world are risky, like those related to chemical reactions or flying aeroplanes. In such cases, virtual reality headsets and gloves can come into play to assist with such tasks (Kshetri, 2022a). Another example is about how to administer anaesthesia to a virtual patient a medical student in a simulated operating room (Vikram, 2022).

In addition to above mentioned hard-to-create phenomena, there are some impossible-to-create phenomena too. For example, historical monuments that are destroyed can be visited in their rebuilt forms, or the arrangement of atoms in a protein can be visualized (Kshetri, 2022a).

### **3.2.4 Hardware**

Conventional metaverses can only simulate two of the human senses, visual and auditory. But if in addition to that, they could synthesize touch (for example by use of haptic gears), taste, and smell, and could integrate all of these into a single model, that could be wonderful ("Tech I'd," 2022). It is even expected that shortly, the mainstream headsets provide possibilities like facial expression, eye tracking, biometrics, etc., which results in more realistic responses by the users (Freifeld, 2022).

### **3.2.5 Software**

Some researchers regard the most recent version of the internet to be the metaverse (Duan et al., 2021). Therefore it is expected that all well-known applications, especially in the field of education, create updated versions of their applications which operate on a metaverse basis and well-known metaverse platforms. Due to the evolving nature of metaverse platforms, these applications should regularly be checked and updated to cope with the changes and technological trends of these metaverses (Dohan et al., 2022).

In the metaverse, any virtual content can be mixed with a real-world video and after that, any sort of virtual interaction is possible (Needleman, 2021). Also, it is expected that the prevalence of metaverse results in the replacement of traditional 2D presentations like PowerPoint, with 3D and interactive presentations within metaverse. Sometimes metaverses for education, explain concepts on various levels, from a more difficult level to a lower difficulty one, and the user can choose between them. It helps in case the user wants to get a deeper understanding of that concept ("Metaverse in a," 2022). Another advantage of the metaverse is that in some cases, it is accessible in variable timings, as such providing on-demand learning (Gronstedt, 2022). Another advantage of the metaverse is that the educational content in the metaverse can be monetized. Content creators can use tokenized assets in the metaverse, as a new business model that is provided to them. Under the metaverse, most of the tokenized assets in use are non-fungible token technologies (NFTs). By the use of NFTs, content creators can retain most of the revenue resulting from the sale of their works. In addition to virtual products and services, acquiring real-world goods is also possible ("Six trends," 2022).

The use of Artificial Intelligence in the metaverse is such that to access the AI for our respective questions, any avatar of choice can be assigned to be powered by AI, and as the questions will be asked, it will reply to them based on its AI knowledge (Needleman, 2021). The same can be done for access to the web, while the use of a virtual laptop is also a possibility.

## 4. CHALLENGES

However, for specialized purposes and in long-term use, the costs of education through the metaverse are lower for institutions, but one of the challenges that are faced at present for implementation of the metaverse is its high costs. Other issues are data privacy and protection, adaptability to new technology, and lack of rural access to advanced infrastructure (Kshetri, 2022b). The availability of computing infrastructure for a full-fledged worldwide metaverse also needs to be assessed. Its regulatory compliance issues, besides the possibility of unethical behaviour and even addiction, are among the other facing issues the implementation of the metaverse (Singal, 2022).

One major drawback of the metaverse is that by long-term use of it, we get used to it, and any return to traditional forms of learning will be with some burden because the way users were engaged with the virtual world is different from the way they get engaged with the real world (Needleman, 2021).

One other challenge that is faced for use of metaverse in education, is the absence of relevant use cases as of now because as the metaverse gets developed more and more, more possibilities for its usage emerge, so the future gets more adequate for the use of metaverse in education, but not necessarily the present (Murray, 2022). At least once in the past, there had been a failed attempt for educators to cope with technology, and that was when their obsession and excitement with the Second Life metaverse platform, faded fast and it was set aside (Horn, 2022). Such failures should be deeply assessed and prevented for future attempts.

## 5. CONCLUSION

In this paper we have discussed how metaverse can help in improving the quality of education. First of all, as it is entertaining and provides a gameful experience it is attractive to an outside viewer. Besides that, the metaverse encourages socializing and more communication, while it lowers costs, and avoids social biases (like for gender or ethnicity) by use of an avatar. By use of virtual replicas and simulations, it also avoids the regular risks that are present in real-life experiences, for example, the possible accidents in a test flight. One example of the usefulness of metaverse in education is that the deceased individuals can appear as their avatars and by use of AI can talk for audiences.

An infinite number of users can be present in the metaverse at the same time, and a lesson can be taught by travelling through a landscape. A virtual university with all the accommodations of a fully functioning university can be there in the metaverse. One advantage of the metaverse is that hard-to-create phenomena and impossible-to-create phenomena, both can be performed in the metaverse. For example, flying an aero plane, administering anesthesia, or even visiting historical monuments that no longer exist. In addition to the implementation of visual and auditory senses at present, other features like touch, taste, smell, facial expression, eye tracking, biometrics, etc., all can be implemented. Software applications that are based in the metaverse can emerge, PowerPoint presentations can be replaced with 3D presentations within the metaverse, the level of difficulty of a concept can be chosen, on-demand learning at variable timings will be possible, the created educational content can be monetized, and questions from AI and the web can be asked from an avatar who was assigned solely for this purpose.

In general, the metaverse improves the quality of education substantially, through the approaches mentioned above. A report by KPMG suggests that around 92% of users expressed their belief that metaverse is capable of enhancing their learning opportunities, including all aspects of job training, school, and higher education (Colvin, 2022).

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