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Metaverse for education – Virtual or real?

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Metaverse is considered an extension of the Internet that is expected to revolutionize our social and economic lives by offering seamless interactions in the virtual worlds. Some believe that the Metaverse is one of those technologies that are destined to fail while others envisage Metaverse as part and parcel of future life, same as the Internet in today's world. While the jury is still out on whether the Metaverse would eventually be materialized to its full potential, billions have been invested into the development of the Metaverse and its related technologies by the technology giants such as Meta, Microsoft, and Apple. The Metaverse promises to bring a step change in every walk of life and Education sector is no exception. A true realization of the Metaverse will make the geographical boundaries disappear making the education accessible to the least privileged communities. At the same time, the virtual worlds with immersive experiences of usually less accessible resources would provide at-scale resource sharing throughout the world. The Metaverse would enable seamless access of Stanford labs, for instance, to someone in Africa to do collaborative experiments in the virtual worlds. This Perspective presents the status of the Metaverse in Education. It describes the future of Education sector with the integration of the Metaverse. In the end it presents the author's perspective on the practicalities and challenges of the Metaverse in Education. The author believes that despite all the hype created around Metaverse, it will take a pandemic-like disruption for the academic world to truly embrace and integrate the Metaverse in Education sector.

KEYWORDS

Metaverse, augmented reality, virtual reality, education, learning, teaching

1. Introduction

Imagine you do not need to travel to a hospital to see your doctor, take a bus to attend your classes or catch a flight to participate in a friend's wedding, and still you manage to get your check-up done, take your classes or share the wedding celebrations as if you were physically present. This would all be possible in a Metaverse. In simple words, the Metaverse is an extension of the internet that transforms our 2D experience to an interactive 3D virtual world. This virtual world co-exists with the real world to support our daily activities such as healthcare, learning, businesses, etc. The Metaverse promises to bring people together, same as the internet did 2–3 decades ago, however only this time the experiences are expected to be more immersive and real-like.

The idea of Metaverse is not new, especially to those who might have read the novel *Snow Crash* (Stephenson, 1992), watched the movie *Ready Player One* (Cline, 2011), or played games like *Minecraft* or *Roblox*. Various authors have tried to define Metaverse in literal, technical and application terms, however, there is no unique and agreed definition of the Metaverse. Metaverse as defined in Oxford Dictionary is “a virtual reality space in which users can interact with an environment generated by computer and with other users.” Metaverse is supported through

elements of virtual reality (VR), augmented reality (AR), artificial intelligence (AI), robotics, blockchain based transactions, Internet of Things (IoT) and human-computer interface (HCI) (Dwivedi et al., 2022). Besides, high-speed connectivity is essential to a seamless Metaverse experience.

Gaming has been one of the earliest adopters of AR/VR technology. Gaming industry has benefited from the support of VR headsets like Oculus Rift, Sony's PlayStation VR. AR based games gained popularity through games like Pokémon Go. Most people, especially youth might have experienced the Metaverse within the gaming context, however, the applications of Metaverse are not limited to gaming only. As mentioned above, the Metaverse has the potential to transform healthcare, education, businesses, and remote operations.

Healthcare sector has been using AR/VR technology for training and surgery simulations. For instance, Medical Realities¹ is a platform used for medical training purposes. In businesses, AR has been adopted by many retailers to provide better shopping experience to their customers by visualizing the sale items overlaid on real home/office environment. IKEA's AR app is an example of the use of AR for shopping. Many museums, historical sites, and touristic attractions such as Louvre have embraced the power of AR/VR to allow the public to visit the site in the virtual world without the need of being physically present on site. As the advances are made toward the realization of Metaverse, all these use cases will have social interaction embedded with AR/VR experiences for the tourist group or a medical team to provide real-like interaction and experiences.

This perspective focuses on the Metaverse for Education. In today's post-pandemic academic sector, plenty of institutions are embracing online resource creation and consumption strategies. AR/VR based learning and teaching (L&T) activities are part of this adaptation. The objective of such developments is to provide student support of complex topics whereby the students could explore and understand these complex concepts with immersive experiences provided through AR/VR technology. For instance, Google has taken a huge step through Google Expeditions² to provide VR field trips. The impact of teaching and training in the Metaverse and its related technologies has already been very promising. For instance, as reported by an article (Likens and Mower, 2023), a VR based training for new managers in 12 locations in the US showed that the VR learners were 4 times faster to train than in classroom, felt 275% more confident to apply skills learned after training, 3.75 times more emotionally connected to the content than classroom learners and 4 times more focused than their e-learning peers. In the next section, detailed discussion will be provided on the Metaverse for Education. This will be followed by the challenges associated with the adaptation of Metaverse for Education and the author's perspectives on the future of Metaverse for Education will conclude the paper.

2. Metaverse for education

The Metaverse is anticipated to reshape all sectors of life. The way we socially interact, do the trade, run our businesses, or entertain

ourselves, everything will have an element of virtual and/or augmented reality. Similarly, there will be a big shift in the way the teaching and learning activities at all levels are conducted in a bid to create more engaging and interactive academic environments. It is suggested by Kye et al. (2021) that the Metaverse has the potential to form a new educational environment as it allows social communication supported through immersive learning experiences. Given that fact the gaming industry has already produced some excellent VR based games, the gamification of learning resources has a great potential to engage and motivate the learners (Park and Kim, 2022). While Tlili et al. (2022) debate about the Metaverse for Education being a blessing or a curse, there has been plenty of interest from related stakeholders in developing and delivering content in Metaverse. For instance, the frameworks like the ones proposed by Wang et al. (2022) are setting the guidelines for future education systems. The possibilities of learning and collaborating in a Metaverse are virtually endless. The future of Education will be transformed to support learners throughout the world irrespective of their gender, social and cultural background, and financial affordability of boarding and travel.

Below are some of the ways in which Education will be transformed:

- **Immersive learning through 3D/360° content:** Some complex concepts, especially in Engineering and Medicine, need 3D visualization. The use of 3D/360° content to teach and train students can help to improve their learning and increase engagement.
- **Virtual classrooms:** It will be a great step toward making education accessible while still being as engaging as real-life for learners who cannot afford to be physically present on campus. The interaction and group work would still be carried out through virtual spaces in the presence and supervision of instructors.
- **AI powered personalized learning:** The marriage of AI and Metaverse is such a powerful combination that will revolutionize the Education sector. We can imagine a personalized lesson plan and delivery, customized to the needs and abilities of each learner, being the future of AI powered Metaverse.
- **No cultural barriers and boundaries:** The Metaverse will enable the social interaction for the collaborative group work in a safe environment. With the representation through avatars, social barriers and boundaries that exist in various cultures regards to gender, age, color, etc., are expected to fade. As a result, it is anticipated that learners can interact in the Metaverse with confidence without the fear of breaking any social norms.
- **Skill transfer facilitation:** Hands-on skill transfer needs physical interactivity which at times is restricted by the availability of resources, human as well as space. The Metaverse is expected to facilitate the skill transfer with the support of advancements in AI and robotics, for instance, remote emergency nursing training or surgical procedures.
- **Driving the net-zero agenda:** During the COVID-19 pandemic, most of the academic activities had to be conducted online which meant that staff and students could not travel to the campuses. This contributed to lower carbon emissions, however, at the same time prompted the complaints from the students that they were deprived of the physical on-campus experience. The author is not

1 <https://www.medicalrealities.com/>

2 <https://artsandculture.google.com/project/expeditions>

of the view that the academia should go *all-online*, however, Metaverse can help to replace part of the physical experiences without losing much of the real-like feel and therefore, can drive the net-zero agenda by reducing the travel needs.

Here are some of the leading examples from academic world on the adaptation of Metaverse and its related technologies. The “Virtual Harvard”³ project is a project by Harvard University to create a virtual campus accessible by everyone through Metaverse. Stanford University has conducted “Virtual People”⁴ class for over 200 students in the Metaverse. Many universities such as the University of Western Australia, the University of South Florida are using “Second Life”⁵ for creating VR content. At the Western Michigan University, Virtual Reality Lab offers the students the opportunity to learn in the virtual world. University College London is involved in providing medical surgical training to its staff and students through immersive VR training sessions. These are some of the examples, however, many universities around the world have piloted various initiatives that use AR/VR and Metaverse to support the L&T activities.

3. Challenges to adopting Metaverse for education

While this all seems very promising, the road to a fully Metaverse enabled academic world is not so smooth. The possible speed breakers include:

1. **Buy-in from academics and policy makers:** It would be of utmost importance to have a buy-in from academics and policy makers before we could proceed with dream of Metaverse enabled Education. The Education sector would need to see the clear benefits for the student engagement, learning enhancement, and experience and be motivated to change the centuries old pedagogies.
2. **Technological advancements:** At the minute, the devices to support Metaverse functionality are heavy, bulky, inconvenient to use, and prone to motion sickness. The technological advancements would need to make the devices sleek, smart, and energy-efficient so the wide-scale adaptation of the Metaverse is made possible. It is more like the cell phones which were initially bulky, costly, and power hungry, however, the technological growth turned them into *smart* devices which resulted in widespread adaptation of broadband applications over the cell phones. The same will be true for AR/VR devices that will make the case for the application of ultra-high speed connectivity solutions like 6G and beyond.
3. **Availability of 3D resources:** There is a need for large scale availability of open-source 3D content, easy to use tools to

enable both academics and students to create and consume the virtual content seamlessly and effortlessly.

4. **Inclusiveness:** It is very important that the use of Metaverse for Education considers the inclusivity factor, particularly for the learners with disabilities.
5. **Cost-effective solutions:** The availability of devices and software at affordable prices to make it possible for institutes to roll-over Metaverse solutions to most students is a barrier that would need to be crossed before Education could truly benefit from the Metaverse.
6. **Safe and privacy aware Metaverse:** The Metaverse would need to carefully consider the aspects of security and privacy to enable each learner in the Metaverse to surf and socially interact without fear of identity theft or other security issues.
7. **High speed connectivity:** The Metaverse platforms are bandwidth hungry and, therefore, a seamless experience can only be provided over high speed connection. While there already exists a digital divide in terms of access to the Internet, high speed internet connectivity would need to be ensured for true widespread adaptation of Metaverse without further increasing the existing digital divide.
8. **Upgradation of existing learning management systems:** The existing learning management systems need to be upgraded to support the integration of Metaverse for routine learning activities. This upgradation must support the student learning in alignment with the intended learning outcomes of the existing programs.

4. Discussion

In view of the author the use of Metaverse in general, and for the Education in particular, promises an extremely exciting outlook. The Metaverse and its related technologies are in their infancy and there exist the research gaps that need to be filled. However, one can envisage the potential that Metaverse possesses to transform the centuries old educational systems to meet the demands of modern ‘digital native’ students. For a true and wide-scale realization of Metaverse for Education, the aforementioned challenges from technical, ethical, and social aspects must be addressed. The technological development would need to be paced at the post-pandemic learners’ expectations, and at the same time, excite the academics and policy makers to adapt the L&T pedagogies suitable for the virtual worlds. The Metaverse provides exciting opportunity for academic world to embrace a journey to the unexplored virtual worlds where the academic obligations on equality, diversity and inclusion are met. On one hand, AI will power the customized learning in the Metaverse where L&T activities and assessment approaches are tailored to each learner’s needs. On the other hand, gamification of learning in the Metaverse will result in engagement and motivation of future learners. The collaborative learning Metaverse paradigm encompasses the global scale and opens new educational horizons.

In author’s perspective, Education sector is traditionally sluggish to step changes and it was COVID-19 pandemic that proved catalyst

3 <https://www.thecrimson.com/article/2021/10/21/virtual-harvard-project/>

4 <https://news.stanford.edu/2021/11/05/new-class-among-first-taught-entirely-virtual-reality/>

5 <https://secondlife.com/>

in rethinking and reshaping of L&T practices. For now, with a minority of academics enthusiastic about the Metaverse prospects, the majority has still got their apprehensions and it might need another pandemic-like disruption to bridge the gap between the Metaverse and education.

With many of the high-street brands disappearing from city centers all around the world as shoppers preferring to shop online, who knows with the immersive experiences provided by the Metaverse, we might see campuses disappearing (or at least shrinking) in the next decade or so. As Amazon has transformed the shopping industry, will Google, Meta or some other tech giants have the same transformational impact on Education sector? We shall see.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

References

- Cline, E. (2011). *Ready Player One*. New York: Crown Publishing Group.
- Dwivedi, Y. K., Hughes, L., Baabdullah, A. M., Ribeiro-Navarrete, S., Giannakis, M., Al-Debei, M. M., et al. (2022). Metaverse beyond the hype: multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *Int. J. Inf. Manag.* 66:102542. doi: 10.1016/j.ijinfomgt.2022.102542
- Kye, B., Han, N., Kim, E., Park, Y., and Jo, S. (2021). Educational applications of metaverse: possibilities and limitations. *J. Educ. Eval. Profes.* 18. doi: 10.3352/jeehp.2021.18.32
- Likens, S., and Mower, A. (2023). What does virtual reality and the metaverse mean for training? Available at: <https://www.pwc.com/us/en/tech-effect/emerging-tech/virtual-reality-study.html> (Accessed February 26, 2023).
- Park, S., and Kim, S. (2022). Identifying world types to deliver gameful experiences for sustainable learning in the metaverse. *Sustainability* 14:1361. doi: 10.3390/su14031361
- Stephenson, N. (1992). *Snow Crash: A Novel*. New York: Spectra.
- Tlili, A., Huang, R., Shehata, B., Liu, D., Zhao, J., Metwally, A. H. S., et al. (2022). Is Metaverse in education a blessing or a curse: a combined content and bibliometric analysis. *Smart Learn. Environ.* 9, 1–31. doi: 10.1186/s40561-022-00205-x
- Wang, M., Yu, H., Bell, Z., and Chu, X. (2022). Constructing an Edu-metaverse ecosystem: a new and innovative framework. *IEEE Trans. Learn. Technol.* 15, 685–696. doi: 10.1109/TLT.2022.3210828

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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