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Prospects And Challenges Of Educational Metaverse In Higher Education

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Abstract:

One of the modern technologies with the most promise is the metaverse, according to technologists but there aren't many discussions on opportunities and challenges of the metaverse for higher education. Metaverse is defined by many educationists as the next generation of internet-based education. Since its creation, the metaverse has been viewed as a shared virtual area where simulations may work together. Users may produce material and engage in interactive experiences in the fully immersive, permanent metaverse. Educational Metaverse performs with four distinctive classes i.e. avatars, AR/VR/MR. AI, & lifelogging. Higher Education Students may have the chance to practice different skills in the metaverse, be placed in an intellectual or competence-practicing environment, be encouraged to develop and learn things that they are unable to do in the real world, and be able to collaborate and communicate with other students in the virtual world. Immersive learning experiences, personalized learning, augmented collaboration and enhanced accessibility are some of the benefits of using metaverse in higher education. Whereas, the challenges of educational metaverse in higher education include regarding nature of immersive learning experiences, Quality of teaching-learning content, virtual immersive environment, interface and interaction, and challenges regarding security and privacy of users, data, hardware and software. Students can be provided with unique and valuable learning experiences that prepare them for the opportunities and challenges of the future by utilizing the cutting-edge technology of metaverse in higher education.

Keywords: Metaverse; higher education; artificial intelligence; avatars; lifelogging; AR/VR; educational metaverse; immersive; challenges;

Introduction:

we are progressively incarnated in a fabulously smart society which is described by the nearby connection among IoT (Internet of Things), Artificial Intelligence (AI), big data, and the humans. During COVID-19 pandemic, implementation of the digital aspect was boosted (Hutson, 2022; Mistretta, 2022; Kye et al. (2021; Ferreira & Serpa, 2018) in various life sectors of life. Suh & Ahn (2022) state that metaverse implies to immersive digital environments where one, in the virtual universe, may interrelate with avatars. Whereas Lee et al. (2022) narrate that metaverse refers to a virtual world which empowers socio-economic activities just as real world. Metaverse is explained by many professionals as the next generation of internet. The act of Facebook changing its name to Meta may be contemplated as an indicator metaverse getting in (Doko, 2021).

In the metaverse world, people communicate through avatars and bring their daily lives to the virtual world. Avatars have vital functionality regarding social presence on such metaverse platforms. Stephenson (1992), in his book, delineated avatars as bodies which are audio-visual in nature and which are used to communicate

and link with one another in a Metaverse environment. In the Metaverse environments which are 3D based, users can hence encounter each other, sell and buy different digital objects, create digital societies or groups (Lee et al., 2022; Upadhyay and Khandelwal, 2022).

The Concept of Metaverse

The idea of the Metaverse is not novel as this was perceived previously in sci-fi novels like Snow Crash (Stephenson, 1992) which envisages a virtual reality-oriented heir to Internet. This idea further gauged much attention while a movie version of this novel entitled "Ready Player One" was released (Cline, 2011). Linden Labs in 2003 developed first successful metaverse named "Second Life Platform" which was start of metaverse realm (Suh and Ahn, 2022). People used to communicate and interact with one another through Avatars by bringing their daily life processes and conduct on Second Life Platform.

Metaverse is considerably more than these technologies, despite the claims of some who claim it is simply a new name for old ones (such as online community platforms, virtual reality, augmented reality, and virtual systems). (Park & Kim, 2022). Since the metaverse offers additional features like "shared," "persistent," and "decentralized," it should be distinguished from conventional terms (Hwang & Chien, 2022). Simulation, AR and VR technologies could only provide the virtual content and environment, and not establish a shared social connection between users/learners. Multi-user interactive platforms like Second Life allow users to communicate with one another while assuming different identities, but they are unable to provide a persistent world or culture where users can live, work, learn, and create.

Users' private information and Metaverse logs can be safeguarded using decentralized technology (such as blockchains and non-fungible tokens) to secure the security of economic activity. Hence, properly speaking, determining if a technology is a part of the Metaverse should go beyond looking at whether it has applications in Second Life, VR, AR, or simulation. Instead, people should take these embodied features (i.e., "shared", "persistent" and "decentralized") into account to combine and implement these existing technologies into a brand-new perspective on educational technology so as to provide students with effective learning opportunities and contexts (Díaz et al., 2020; Rospigliosi, 2022).

After the emergence of Metaverse, massive endeavors and research studies were conducted to brand the metaverse a reality. Since its emergence, metaverse is considered as communal virtual space and the mirrored world, an omniverse: a space of collaboration of simulations (Lee et al., 2021), personified internet/3D Internet (Chayka, 2021), a novel form of internet exposition and social structure that combines diversified emerging technologies (Ning et al., 2021), post-reality universe, an enduring and obstinate multi-user space integrating digital virtuality and physical reality (Mystakidis et al., 2021), as well as lifelogging (Bruun, & Stentoft, 2019). Lee et al. (2022) narrated that with the transition to various phases like high-quality computers and high-speed internet networks, the development of 5G, and the worldwide epidemic speeding up the preliminary processes, the metaverse has now emerged as one of the most talked-about subjects of the modern period.

Definitions of Metaverse

The metaverse is actually 'virtual reality' beyond reality. This word comprises two concepts i.e. "Meta", denoting virtuality an otherworldliness, whereas "verse", means the universe or the world. So the term "Metaverse" refers to a digitized world as a novel sphere articulated via digital media like internet, smartphones etc. (Kim, 2020). Metaverse offers revolutionary new possibilities in a variety of fields (such as business, science, and education) to improve users' interactions with social activities including meetings, teamwork on projects, gaming, and learning in virtual settings. (Hwang & Chien, 2022; Siyaev & Jo, 2021).

Table 1: Definitions of Metaverse

Ball (2022)	"Metaverse is an extensive, interoperable network of 3D virtual worlds that can be experienced simultaneously and permanently by an immense number of users, offering a sense of presence, as well as continuity in data such as history, identity, objects, entitlements, payments, and communications."
Korean Government (2022)	Metaverse is a world where people and things interact in a seamlessly connected virtual environment; where the boundaries between virtual and real worlds blend together; and where new social, cultural, and economic values are created.
Duan et al. (2021)	The Metaverse has taken the Internet to the next level, allowing users to interact with each other and software applications through avatars in a virtual world.
Seok (2021)	Metaverse is a 3D virtual environment in which educational activities occur just like in the real world.
Kye et al., (2021)	Metaverse is a virtual reality prevailing outside reality.
Park & Kim (2021)	Metaverse is an interconnected, always-on network of shared virtual worlds in which people can utilize their avatars to interact in real-time with both other individuals and objects.
Kumar et al. (2013)	Metaverse is a fully immersive, persistent virtual environment in which users can create content and have an interactive experience.
Huggett (2020)	Metaverse is an advanced version of the internet, which envelops users in a social, virtual world that can be experienced via immersive virtual reality. It unifies virtual worlds, physical actors, objects, interfaces, and networks to replace the current version of the real world.

Educational Application of Metaverse

All spheres of existence are affected by the beginning of the new metaverse age. The integration of the metaverse with education to improve learning has been discussed by many computer scientists and educators. For instance, Kemp and Livingstone's (2006) study described how to improve learning process by combining LMS systems with Metaverse and virtual environment called "Second Life" (Kemp & Livingstone, 2006).

Collins (2008) predicts that the dependence of the virtual component of education on the metaverse in his research. He explains that the metaverse, where proactive and pro-social people would connect and interact to improve teaching and learning processes, would be the next learning environment for higher education. The essence of the 3D digital virtual world, the avatar, which interacts and communicates by simulating the presence of an individual with all of his feelings and thoughts, is a further topic of discussion (Schlemmer, & Backes, 2014).

The succeeding period is seen with a substantial growing interest in metaverse and its presence, that would lead to an increase in the digital aspect of not only social and economic life but putatively, in education as well (Abbate et al., 2022; Suh & Ahn, 2022; Cui, Xu & Yao, 2022). According to Zhang et al. (2022), the metaverse could open the door to achieve the UN Sustainable Development Goal 4: Quality Education. Despite this, there is still very limited research on metaverse environments as an effective teaching and learning tool. The metaverse has an elevating manifestation in contemporary educational patterns which embraces diverse experiences and activities being conducted in the virtual spaces. Metaverse is particularly valuable in the fields of engineering, health sciences, and architecture. In these fields, it

becomes essential to go for experiential learning and practice skills with ensured safety of environment prior to the application of the skills in the real world .((Braud, Fernández & Hui, 2022).

The metaverse, additionally assists in distance learning and cooperation among learners and educators from around the world. Virtual reality, enables learners to take classes and join in academic activities without their physical presence (Sarıtaş & Topraklıkoğlu, 2022). Exploring the means to optimize the prospective impact of metaverse on education is hot cake for researcher currently. The most crucial challenge right now is to figure out how it will affect education in the future (Ning et al., 2021). Four distinctive classes of metaverse are discussed below.

1- Avatars

One evident mode of influence of metaverse on education is utilization of avatars which are humans' digital identity in the virtual spaces (Ranjan, 2021; Cawood, 2022; Wasmuth, 2016). vatars are physical representations of humans in the metaverse that are identical to how they seem in the real world. (Sun et al., 2022; Guler & Savas, 2022). The benefit of using these avatars is that students will be able to participate in academic activities without physically being present (Park & Kim, 2022; Go et al., 2021; Zuckerberg, 2021; Genay et al., 2021).

2- AR/VR/MR

Two innovative aspects in metaverse are Augmented Reality (AR), Virtual Reality (VR) and Mixed Realty (MR) The fourth wave of computer innovation is now being driven by the spatial, immersive technologies of virtual reality (VR), augmented reality (AR) and mixed reality (MR) (Kamenov, 2017). The AR/VR/MR technology are the technical foundations for the creation of the Metaverse.

Through device recognition and evaluation, augmented reality (AR) overlays the virtual information at a position based on the detected object (two-dimensional, three-dimensional, GPS, somatosensory, facial, and other detected objects), displays it on the device's screen, and enables the virtual information to interact in real time (Ning et al, 2021). Augmented reality, as studied in the educational context, gave a variety of ways to help in enhancing teaching and learning. The implications of AR in educational context can be schematized in the following fashion (Koo, 2021; Jovanović and Milosavljević, 2022; Park and Kim, 2022).

Virtual reality (VR) gives instructors and students a wholly immersive experience that gives them the impression that they are in a real educational setting. It is a cutting-edge, perfect virtual reality system (Hirsh-Pasek et al., 2022; Dabas & Katiyar, 2022; Lege & Bonner, 2020). Mixed Reality (MR), a brand-new visual experience, mixes the actual and virtual worlds. Real-time interaction between physical and digital objects occurs in the new visualization environment (Voinea, Boboc & Antonya, 2022). The line separating VR, AR, and MR will eventually blend together to form a single product. The Metaverse currently uses it as its main interaction tool to build a highly interactive virtual world for educators and students.

3- AI

The Metaverse's central tenet is the analysis of complicated data for comprehension, control, and planning, and the advancement of AI (Artificial Intelligence) can be the basis for processing this data. In order for the metaverse to function according to the principles set out by its designers, artificial intelligence is a necessary technology. In educational context, according to Duan et al. (2021), Students break down educational content more efficiently when employing neuro-symbolic AI, convolutional neural networks, machine learning, and semantic database technologies.

AI like other educational technologies is important in this digital age according to metaverse requirements. The educational metaverse is undergoing significant change as a result of artificial intelligence since it supports students' individualized, personalized, and interactive learning. Contrarily, AI has made it possible for students to tailor their approach to educational programs in accordance with their personal

interests. (PM, 2023). As narrated by Hwang & Chien (2022), Tutors, peers, and learners are just a few of the intelligent non-player characters (NPCs) who might play new roles in metaverse as a result of AI. Additionally, the development of a variety of digital coworkers, data mining, and human-computer collaborative evaluation in education is made possible by artificial intelligence technology. (Zhiming et al., 2017). It can be claimed, according to Hua & Xiaoqing (2022), that the educational metaverse's multimodal interactivity, new immersive team collaboration models, and highly realistic teaching scenarios are bound to change the educational ecosystem and have significant theoretical and practical implications for advancing the transformation of smart education.

4. Lifelogging

The recording, storage, and dissemination of daily events and information for both things and people is known as "lifelogging," and it is a crucial metaverse scenario (Thawonmas & Fukumoto, 2011). In an educational metaverse, While learners' past experiences (such as virtual works, data, assignments, and learning tracks) may be recorded and preserved in the metaverse, learners' real-time status information can be presented and shared using storage, databases, or tracking technologies. Reviewing or observing the learning process and carrying out certain significant activities (such as interaction patterns and analyzing behaviors) based on personal experiences benefits both students and teachers (Prieto et al., 2022). According to Kye et al. (2021), lifelogging in an educational metaverse deals with the learning analytics of the students (e.g. dashboards), review and reflecting the daily learning patterns of students, critically explore and implement the information in an appropriate direction, and promoting and supporting learning in a customized direction by teachers in-line with the learning logs of students.

Educational Metaverse

The metaverse, being an emerging field is supposed to bring prospective change in education as well as in many other fields. Medicine, engineering, nursing healthcare education, science education, and manufacturing training seem the direct effected ones of this change. The characteristics of the metaverse, are making the expectations of educators much higher. It is expected that the metaverse centered education based on VR or AR will be potentially different from traditional education. (Hwang, G. J., & Chien, S. Y., 2022)

Audiovisual-based education is a chief Metaverse application in education which has significant potential for progression. The reason for this is that just reading about anything and experiencing something is a totally different learning. Experiential education is critical for concrete learning. For example, as radioactivity is too dangerous to experience, so the educational settings can't allow the actual experience of evaluating and experiencing radioactivity technically and scientifically yet this can be experienced through the Metaverse (Kanematsu, H., et al., 2014). Sung, B. et al., (2021) confirmed the efficacy of the metaverse educational practice by comparing marketing students' stages based on face electromyography and learning objectives (based on attitude, performance, and enjoyment).

Many scholars have explained the benefits of incorporating the Metaverse for educational objectives in their research (Zhang et al., 2022; Zonaphan, 2022; Kye et al., 2021). It circumvents a number of learning barriers, including time and space restrictions and possible dangers when learning (Wang et al., 2022). In addition, Metaverse could give students the opportunity to experience various capacities, set them in an intellectual or competence-practicing atmosphere, encourage them to develop and discover knowledge that they are incapable to do in the real world, and enable them to work together and communicate with other students in the virtual world (Hwang & Chien, 2022). It is projected that the Metaverse will be utilized in education more often in the near future and that research into its usage will rise significantly (Hwang & Chien, 2022). Therefore, people need to learn what this new term means and what challenges and opportunities the Metaverse presents to the fields of education.

Educational Metaverse in Higher Education

The Covid-19 epidemic has sparked significant transformations in the way of thinking and learning as well. A broad spectrum of possibilities for innovation and advancement in the education have emerged as a result of the extensive move to virtual learning. The advent of the metaverse as a platform for higher education is one such breakthrough.

The Metaverse is a young digital revolution in higher education, thus there are still a lot of unanswered questions as both academicians and students are curious about it. Even if it is a widely popular sector, educational metaverse still needs professional guidance and even specialized training in higher education (Anil and Alankuş, 2022). Therefore, higher education institutions have major responsibilities in addition to the technical faculties that develop systems. Higher education institutions will indiscriminately get the fast-presence zones of virtual campuses; such institutions must demonstrate their preparedness to quickly and fully integrate the metaverse.

In the educational metaverse, an ordinary educational setting likely would be a virtual space created to mimic a real classroom. It might incorporate interactive features for the learners, including whiteboards, seats, and desks that are all virtual. Students may raise their hands remotely to pose inquiries or engage part in class discussions as the teacher delivered lessons virtually. Students may also choose to represent themselves virtually using avatars that may have their complexion, hair, and clothes customized. To further improve the learning experiences in higher education, the metaverse classroom might include immersive and interactive components like interactive lessons, virtual simulations and virtual field excursions. The precise appearance and feel of a typical metaverse classroom in higher education is subjected to change as technology develops since metaverse classroom technology and design are still in their infancy.

Prospects of Metaverse in Higher Education

The technology's developers are certain that Metaverse will enable a more open and adaptable learning environment. Higher education students can engage in classes and lessons from anywhere in the world with an internet connection. By doing this, geographic and physical limitations are removed, allowing more higher education students to benefit from a top-notch education. Additionally, students in the metaverse may establish connections with classmates from all around the world, which broadens their viewpoints and offers valuable learning opportunities.

In higher education, the students' experiences regarding metaverse classrooms my entail the followings:

i) Immersive Learning Experiences:
Virtual simulations, virtual field excursions, and other interactive activities can be used in metaverse classrooms to provide immersive and participatory learning experiences in higher education.

ii) Personalized Learning Experiences:
As students may interact with virtual information at their own pace and delve deeper into subjects that interest them, the metaverse may offer a more individualized learning experience.

iii) Augmented Collaboration
In higher education, students might collaborate in real-time in metaverse classrooms regardless of where they are physically located, which could result in richer and more interesting debates.

iv) Enhanced Accessibility
By enabling students to engage in class activities and discussions from any location, virtual learning in the metaverse might boost accessibility for students with challenges or those who reside in remote places.

The effect of the metaverse on the on-campus environment is a further worry. The on-campus higher education experience is crucial to a student's education as it offers chances for improvement and development that are harder to promote in virtual settings. Even if the metaverse is still in its early phases, the advantages of virtual

learning there emphasize the fascinating prospects for the future of higher education.

Multi-dimensionality of Metaverse in Higher Education

The 4D-UX (four-dimensional user experience), also known as multidimensionality, is a broad field that combines architecture of information, usability, visual design, and human aspects into a digital-virtual experience. It turns the 2D environment into an engaging, adventurous setting that lets users lose themselves in stories while yet maintaining task-focused attention. It frequently incorporates segmented narrative, three-dimensional (3D) visualization, and augmented reality (AR) and virtual reality (VR). By integrating artificial intelligence and machine learning technologies with the design, 4D-UX is improved to be implemented in higher education.

Four types of Metaverse are found in literature (Smart, J., Paffendorf, J., & Cascio, J.; 2007) i.e. i) augmentation, ii) simulation, iii) internal and iv) external. The term "augmentation technology" refers to a type of technology that adds a new function to an existing real-world system. The additional information about the physical environment that we recognize in the metaverse is placed over it by augmentation technology. The opposite of augmented technology is simulation technology. It is a technology that creates a unique setting by displaying reality. In the metaverse, simulation entails a number of methods for understanding the virtual setting as a place for interaction. For instance, either in real life or in a virtual environment. Briefly, simulation and augmented technologies can be differentiated based on how the information will be used, such as in virtual reality or actual reality.

Metaverse constitute of an internal world and an external world. The aspects of individuality and character of a person/thing are highlighted in the internal world. to The employment of technology completes the metaverse's internal reality. Avatars, or digital twins, are individuals or entities that perform actions. In the virtual structure, where the operator is active there, they can even behave naturally. Contrarily, the external or outside world frequently emphasizes aspects of the metaverse's operator-adjusted outer reality. Thus, the metaverse is divided into two main components. The first is the technology for showing data about the user's immediate environment and the ways to manipulate it. These internal and external frameworks serve as another dimension for classifying programs according to whether they make use of metaverse technology to enhance the user's internal or external reality.

A few higher education solicitations have also endorsed Metaverse because to the introduction of immersive technologies like Mixed Reality (MR), Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (XR). One of the numerous benefits of metaverse in higher education is that it allows students to virtually attend their lessons and provides necessities for simulating the actual classroom. Using their unique digital personas, or avatars, students may collaborate with teachers and engage with classmates in Metaverse. As a result of motivation, this might provide an immersive learning opportunity and increase the learning drive.

Existing Frameworks of Metaverse in Higher Education

1- ASF Metaverse Roadmap (Kye et al., 2021)

Two axes are presented in the ASF's metaverse roadmap to explain the types of the metaverse in higher education. One is 'augmentation versus simulation', and the other is 'intimate versus external'

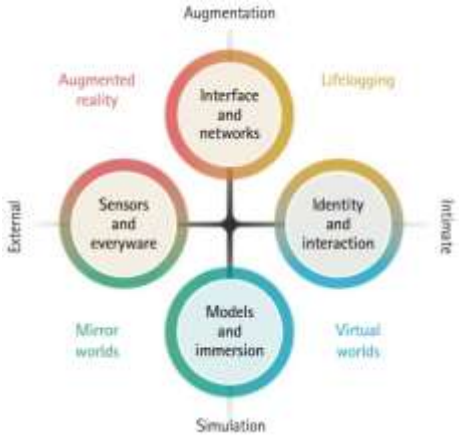

Figure 1: ASF Metaverse Roadmap by Kye et al. (2021)

Kye et al. have explained the four classes of educational metaverse within the two axes i.e., i) Augmented Reality (AR), ii) Lifelogging, iii) Virtual Worlds, and iv) Mirror Worlds. Fig 1 illustrates the ASF metaverse roadmap.

2- Higher Education Metaverse Framework (Zhang et al., 2022)

This framework explains that how technological infrastructure supports the utilization and existence of metaverse and how the real-world education and the education in metaverse interact with the help of wearable technologies. Fig 2 illustrates each element of the educational metaverse's technological infrastructure.

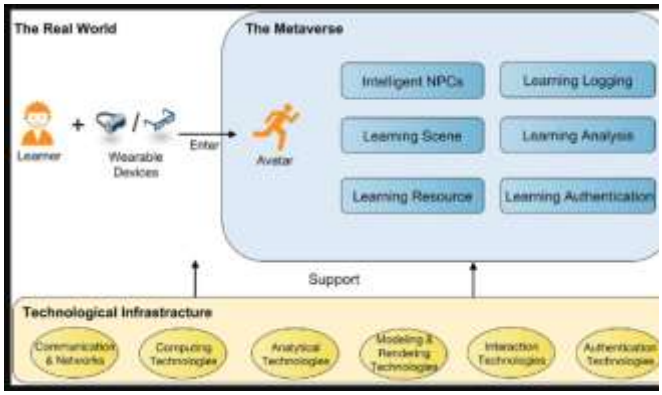

Figure 2: Educational Metaverse Framework by Zhang et al. (2021)

The realization of the metaverse in higher education heavily depends on modern technologies, which explains why it appears that the metaverse occurs exactly because of the maturity of technological advances (Kang, 2021; Yang et al., 2022). As a result, a variety of technologies may be used in higher education to build the metaverse's infrastructure, which is in charge of providing significant assistance for the elements both in the actual world and the metaverse. figure depicts blend of numerous technologies which develop a supportive technological infrastructure for metaverse in higher education.

3- The 6Cs Framework of Educational Metaverse in Higher Education

The educational metaverse mainly meets the standards for high-quality digital learning in the context of higher education. Metaverse advocates the growth of a learning society that promotes the acquisition of a wide variety of abilities both inside and outside the classroom in place of a narrow concentration on content. These skills include i) collaboration, ii) communication, iii) content, iv) critical thinking, v) creative innovation, and vi) confidence. Below is an elucidation of the six Cs of educational metaverse.

i) Collaboration:

Collaboration implies that "social interaction" is a trait that people possess. Metaverse provides students with the opportunity to work together while studying (Kim et al., 2022). Therefore, educational metaverse platforms hold great potential for involving independent, active learners in group learning. The students receive the best education possible, emphasizing their agency and involvement via cooperation and inquiry. The collaborative learning may be enhanced by the metaverse while also being more accessible and straightforward. There would be no need to wait for the ideal time or location to meet together, since virtual meet-ups would take the place of actual meetings and collaborative sessions. The metaverse's ability for cooperation, immersion, and participation fosters the development of social experience and enables the establishment of parallel universes. Experiential learning, cooperative learning, and self-regulated learning paradigms all support the theoretical foundation of collaborative learning.

ii) Communication

Substantial value of metaverse is established for Higher education institutions to offer online course materials and virtual classrooms. However, the metaverse is expected to contain even richer, more comprehensive digital experiences for higher education teachers and students. The creation of an online meeting place for students and professors is the most exciting use of the metaverse in the higher education. With the capacity to use an avatar to move around this virtual environment, they may

have more fulfilling communication interactions free from time and place limitations.

Figure 3: 6 C's Framework of Metaverse by Hirsh-Pasek et al. (2022)

iii) Content:

Digital content is integrated with the physical environment in educational metaverse. It seems as though the actual world is covered in layers of digital material. Content in metaverse is designed on the pillars of collaboration, communication integration of knowledge. The metaverse accentuates and provides immersive, simulated, gamified, and AR/VR-based learning content with high quality of presentation and visualization including the features for enhanced engagement and motivation for learning.

iv) Critical thinking

The capacity to assess the reliability of information is referred to as critical thinking skill. The learners ideally use these talents both inside and outside of the classroom. Students may think distinctively attributable to the metaverse, and this new style of thinking encourages them to think critically, which makes them more effective learners. The metaverse allows students many methods for analyzing and evaluating their knowledge and competencies in addition to opportunities for actual performance in virtual environment using avatars.

v) Creative innovation

Metaverse Learning delivers engaging and innovative learning experiences which employ virtual environments, virtual reality (VR) and augmented reality (AR). It seems like an inevitable innovative addition to a classroom setting for a metaverse to be compacted with avatars. However, an innovative 3D immersive metaverse environment can promote positive social interactions while lowering obstacles to learning. With so much educational environment innovation through metaverse, it's becoming more crucial than ever to modernize teaching methods with virtualization and digitalization. Beyond providing students with access to the metaverse classrooms and learning resources, we must provide the students with the knowledge, tools and information that will prepare them for these new and forthcoming learning patterns and immersive contents in prospective digital era. Creativity through metaverse enables the students and teachers of creating innovative learning experiences using the real life and virtual life associations.

vi) Confidence

Educational metaverse in higher education is considered as an entirely new reality that assures the students for their learning achievements and fulfilling their educational goals. Metaverse develops self-confidence in students which leads them to believe in their own abilities being persistent in learning tasks and interact with virtual and immersive learning environment. The utilization of AR/VR in metaverse supports the students for creating their own virtual learning experiences and experimentations aligned with their learning goals and objectives. Educational Metaverse also provides opportunities for the higher education students for more personalized, self-paced and individualized learning. Assertive students in educational metaverse may be empowered with the skills like critical thinking, communication, collaboration, content expertise and creative thinking for enhancing their learning.

The 6Cs offer a systemic checklist of what children acquire or what they can and should acquire while fun learning offers a checklist for how children learn. Once the formula is understood, it is simple to design the digital and real-world environments so that they adhere to the best learning principles. A metaverse can be created to provide a setting and experiences that facilitate and support

teamwork, communication, content mastery, creative thinking, creative invention, and self-assurance. If designers and educators apply this checklist with a well stated learning objective, they can decide whether the virtual environment they are developing in the metaverse is likely to be actually instructional or just for fun.

Challenges of Educational Metaverse in Higher Education

In general, the metaverse enables educational institutions and teachers to develop engaging and beneficial learning experiences that impart significant knowledge and information, which promotes discovery and experimentation. Despite its advantages, many challenges are faced by educational metaverse in higher education. These are:

i- Challenge of learning experiences
ii- Quality of teaching-learning content
iii- Environmental Challenges
iv- Interface Challenges
v- Interaction Challenges
vi- Challenges regarding security and privacy

i) Challenge of Learning Experiences

Artificial intelligence combined with immersive game-based learning and virtual reality can produce individualized learning experiences that are not experienced in real time but rather through the metaverse. Learning in the metaverse may become less regimented and more governed by automatic systems that adjust the curriculum and learning pace in accordance with the student's aptitude and interests. Due to these variations, exams and other forms of evaluation and monitoring must be significantly altered. Multiple choice tests and other conventional methods are not adequate for evaluating the individualized and unstructured learning experiences provided by the metaverse.

ii) Quality of Teaching-Learning Content

Students may be exposed to unsuitable material through the metaverse. To introduce 3D, interactive, virtual settings into traditional and online learning contexts, for instance, Roblox developed Roblox Education. Roblox claims to have robust security measures in place to keep users secure, but no security system is impenetrable, and Roblox's metaverse includes user-generated content and a chat function that might be compromised by predators or those uploading pornography or other unlawful materials.

iii) Environmental Challenge

Identifying the sensory experiences that make up the world is essential, as is creating environments that can reproduce them. To comprehend and visualize the scenes and objects is important for creating a visual educational environment. furthermore, to create a soundscape, it is vital to recognize and synthesize the sounds and voices. Moreover, it's crucial to have motion rendering for avatars to move naturally.

To develop a balanced educational metaverse environment and maintain its sustainability is a challenge. To incapacitate this challenge, numerous users are required for the metaverse to function, and even on relatively basic mobile devices, seamless services are presented (Nabity-Grover et al. (2020). Environmental design must take the scalability of the present limited environment into account for long-term service. It is essential to consistently create open-source platforms that enable cooperation between numerous developers and a top-tier expert group in order to extend the environment and make use of it.

iv) Interface Challenges

The physical interface improves the user's immersion in the metaverse. As typical devices, head-mounted displays and hand-based input devices are frequently employed. Additionally, non-hand-based and motion-based input devices are developing into input axes.

It is a challenge to create and maintain an interactive and easy-to-use interface of metaverse. Holograms and eye-attached glasses (lenses) are useful additions to augmented reality and virtual reality. A more sophisticated method (such as raising the rendering density for the targeted portion) is required to give the viewer a real-time, detailed image. Along with tracking eye movement, focus, blinking, winking, and direction, Head-mounted Displays (HMDs) also analyze and utilize user data. Additionally, some user interfaces shield young users from undesirable sounds by muffling and expressing them in the real world. The majority of interfaces in the metaverse consist of visual and supplemental audio forms. According to Park & Kim (2022), although some of the senses (such as taste, smell & touch) are taken into consideration, research on sensors is still in the experimental stage.

v) Interaction Challenges

To design and maintain the interactions in educational metaverse is a challenging task as the metaverse requires interactions to survive. Discussions between users and discussions with non-player characters (NPCs)/Avatars are two forms of interaction in metaverse. Through social networking, users typically communicate with one another in their native tongue and in English. However, a service that interprets and provides natural expressions through translation is necessary in order for consumers of different languages to use a metaverse.

Educational metaverse platforms are still outshone, particularly in higher education. This reality runs counter to the Metaverse's predicted future as the next ubiquitous computing paradigm, which has the potential to revolutionize many facets including online learning and e-Training (Mystakidis, 2022). The challenging notion that persona (such as preference or interest) is an element that enriches the metaverse, is an important aspect to remember while having interactions with avatars. It is defiant to have a continual conversation with different identities and beliefs. With a straightforward NPC model without multiple personas, it is challenging to retain the user's attention towards learning tasks. Avatars are required that evolve with users and react legitimately to unanticipated events. Based on discussion history, it must be feasible to respond logically using the user's lifelog activity.

vi) Challenges regarding Security and Privacy

The metaverse presents several unique challenges from security and privacy standpoints. Such challenges arise due to the newness and complexity of the metaverse and the multisensory environment, which can lead to more adverse impacts on users and victims in case of privacy violations and security breaches.

Regardless of extensive research on metaverse technologies, privacy and security in the metaverse have received relatively little attention. In the educational metaverse, security and privacy are major concerns, much like on social networking sites. In order to identify a user (student, teacher, managers or administrator), malicious users can track and gather real-time biometrics (such as voice modulations and facial expressions) and educational metaverse users' activity (such as their connections with other users). The educational metaverse is constructed in a cyber (or digital) environment, thus we must take cybersecurity and privacy concerns into account in order to offer educators and students with appropriate opportunities of teaching and learning more safely and effectively. To guarantee that people and systems are protected from a variety of risks and vulnerabilities, cybersecurity and privacy should offer a variety of measures, approaches, and

solutions (Zhang et al., 2022). Following security and privacy threats can be found in educational metaverse:

a) Data security:
It is possible to impersonate, forge and leak private data (video, messages, voices) and content kept in a virtual environment, service system or metaverse platform. Sensitive information should be encrypted before being kept securely to reduce the effects of unauthorized access.

b) Network security
Metaverse systems often don't provide encryption for network connections, such as those between Avatars or from the user's device to the platform. Attackers can thus use sniffer or spoofing attacks on the metaverse platform to intercept messages or get sensitive information. As suggested by Dwivedi et al. (2022), network connections must thus be encrypted using a safe and effective encryption technique, depending on the data and the circumstances in the metaverse.

c) Software and Hardware Security
There are several types of software security concerns, such as unsafe system architecture, malware, unpatched software, and ransomware, that might be exploited by hackers, much like in the current metaverse systems. Moreover, the usage of IoT devices, HMDs, and VR headsets, among other hardware-related concerns, for content authentication and access control, is common in metaverse systems. According to Dwivedi et al. (2022), early in the software development process, "security by design" architecture is required to safeguard the user against software dangers, whereas to avoid hardware threats, it is recommended to use a separate secure chip rather than the device's software module when security features are installed on a device.

d) Metaverse Privacy
Metaverse systems have much greater capacity for sensitive data collection than conventional systems, which poses a serious risk to user privacy. for metaverse, privacy concerns and their solutions were suggested by Falchuk et al. (2018), particularly for Avatars and the aspects that comprise the metaverse that never end. Sensitive data must be more rigorously safeguarded against privacy concerns using countermeasures for data security, such as fine-grained authentication, dynamic access control, pseudonymization, and encryption.

Discussion and Recommendations

However, it is safe to say that the metaverse has a great deal of potential to transform the way that people learn and teach in the future. We must assess the potential of the metaverse and its implications for higher education as it develops and gets better. The advantages of the metaverse for higher education cannot be disregarded, even while there are legitimate worries regarding the standard of instruction and the effect on the on-campus experience, security and privacy, learning environment. By utilizing this cutting-edge technology, we can provide students a special and worthwhile learning experience that gets them ready for the possibilities and challenges of the future.

REFERENCES

1. Abbate, S., Centobelli, P., Cerchione, R., Oropallo, E., & Riccio, E. (2022, April). A first bibliometric literature review on Metaverse. In 2022 IEEE Technology and Engineering

Management Conference (TEMSCON EUROPE) (pp. 254-260). IEEE.
2. Anıl, F. & Alankuş, Z. (2022). Metaverse Evreninde Pazarlama: 7P Pazarlama Karması Üzerinden Bir Değerlendirme. Uluslararası Halkla İlişkiler ve Reklam Çalışmaları Dergisi, 5(1), 134-168
3. Ball, M. (2022). The metaverse: and how it will revolutionize everything. Liveright Publishing.
4. Braud, T., Fernández, C. B., & Hui, P. (2022). Scaling-up ar: University campus as a physical-digital metaverse. In 2022 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW) (pp. 169-175). IEEE.
5. Bruun, A., & Stentoft, M. L. (2019). Lifelogging in the wild: Participant experiences of using lifelogging as a research tool. In Human-Computer Interaction–INTERACT 2019: 17th IFIP TC 13 International Conference, Paphos, Cyprus, September 2–6, 2019, Proceedings, Part III 17 (pp. 431-451). Springer International Publishing.
6. Cawood, R. (2022, July 17). Could students attend uni as avatars on a virtual campus? Financial Review.
7. Chayka, K. (2021). We already live in Facebook's metaverse. The New Yorker.
8. Cline, E. (2011). Ready player one. Ballantine Books.
9. Collins, C. (2008). Looking to the future: Higher education in the Metaverse. Educause Review, 43(5), 51–63.
10. Cui, H., Xu, Z., & Yao, C. (2022, June). Will the Metaverse Be the Future of the Internet? In 2022 8th International Conference on Humanities and Social Science Research (ICHSSR 2022) (pp. 2165-2170). Atlantis Press.
11. Dabas, R., & Katiyar, K. (2022). Virtual Reality and its Applications. Specialusis Ugdymas, 2(43), 1667-1674.
12. Díaz, J., Saldaña, C., & Avila, C. (2020). Virtual world as a resource for hybrid education. International Journal of Emerging Technologies in Learning (iJET), 15(15), 94-109.
13. Doko, E. (2021). Alternatif bir dünya arayışı: Metaverse, Lacivert, 85, 79-81.
14. Duan, H., Li, J., Fan, S., Lin, Z., Wu, X., & Cai, W. (2021, October). Metaverse for social good: A university campus prototype. In Proceedings of the 29th ACM international conference on multimedia (pp. 153-161).
15. 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.
16. Falchuk, B., Loeb, S., and Neff, R. (2018). The social metaverse: Battle for privacy. IEEE Technol. Soc. Mag. 37, 52–61.
17. Ferreira, C. M., & Serpa, S. (2018). Society 5.0 and social development: Contributions to a discussion. Management and Organizational Studies. 2018; 5 (4): 26-31. DOI: https://doi.org/10.5430/mos. v5n4p26.
18. Genay, A. C. S., Lecuyer, A., and Hachet, M. (2021). Being an avatar "for real": a survey on virtual embodiment in augmented reality. IEEE Trans. Vis. Comput. Graph. 1–2.
19. Go, S. Y., Jeong, H. G., Kim, J. I., & Sin, Y. T. (2021). Metaverse concept and development direction. Korea Information Processing Society Review, 28(1), 7-16.
20. Güler, O., & Savaş, S. (2022). All aspects of Metaverse studies, technologies and future. Gazi Journal of Engineerıng Sciences, 8(2), 292-319.
21. Hirsh-Pasek, K., Zosh, J., Hadani, H. S., Golinkoff, R. M., Clark, K., Donohue, C., & Wartella, E. (2022). A whole new world: Education meets the metaverse. Policy. Available at: https://www.accenture.com/gb-en/blogs/blogs-immersive-experience-wave-learning-ropes.
22. Hua, D.; & Xiaoqing, G. Knowledge prospect in the era of intelligence: Knowledge view reshaped by artificial intelligence. Mod. Distance Educ. Res. 2022, 4, 47–54.

23. Huggett, J. (2020). Virtually real or really virtual: Towards a heritage metaverse. Studies in digital heritage, 4(1), 1-15.
24. Hutson, J. (2022). Social Virtual Reality: Neurodivergence and inclusivity in the metaverse. Societies, 12(4), 102.
25. Hwang, G. J., & Chien, S. Y. (2022). Definition, roles, and potential research issues of the metaverse in education: An artificial intelligence perspective. Computers and Education: Artificial Intelligence, 3, 100082.
26. Irwin, P., Crepinsek, M., & Coutts, R. (2022). The use of avatars: challenging longstanding approaches for experiential learning in nursing. Interactive Learning Environments, 1-10.
27. Jovanović, A., & Milosavljević, A. (2022). VoRtex Metaverse platform for gamified collaborative learning. Electronics, 11(3), 317.
28. Kanematsu, H., Kobayashi, T., Barry, D. M., Fukumura, Y., Dharmawansa, A., & Ogawa, N. (2014). Virtual STEM class for nuclear safety education in metaverse. Procedia Computer Science, 35, 1255-1261.
29. Kang, Y. (2021). Metaverse framework and building block. J. Korea Inst. Inf. Commun. Eng. 25, 1263–1266.
30. Kamenov K. 2017. Immersive experience. The 4th Wave in Tech: Learning the Ropes. Accenture.com.
31. Kemp, J., & Livingstone, D. (2006). Putting a Second Life "metaverse" skin on learning management systems. In Proceedings of the Second Life education workshop at the Second Life community convention (Vol. 20). CA, San Francisco: The University of Paisley.
32. Kim, M. J., Lee, C.-K., & Jung, T. (2020). Exploring consumer behavior in virtual reality tourism using an extended stimulus-organism-response model. Journal of Travel Research, 59(1), 69–89.
33. Kim, S., Jungmin, S., Shin, B & Kim, J. (2022). Collaborative Learner-Centered Education and Training in Mobile Metaverse Platform. Mobile Information Systems. Hindawi. Special Issue.
34. Koo, H. (2021). Training in lung cancer surgery through the metaverse, including extended reality, in the smart operating room of Seoul National University Bundang hospital, Korea. J. Educ. Eval. Health Prof. 18:33. doi: 10.3352/jeehp.2021.18.33
35. Korean Government (2022). Joint Announcement by Relevant Ministries of the Korean Government: Metaverse Industrialization Policy. Available at: https://www.korea.kr/news/policyBriefingView.do?newsId=156492454
36. Kumar, S., Chhugani, J., Kim, C., Kim, D., Nguyen, A., Dubey, P., ... & Kim, Y. (2013). Second life and the new generation of virtual worlds. Computer, 41(9), 46-53.
37. Kye, B., Han, N., Kim, E., Park, Y., & Jo, S. (2021). Educational applications of metaverse: possibilities and limitations. Journal of educational evaluation for health professions, 18.
38. Lee, L. H., Braud, T., Zhou, P., Wang, L., Xu, D., Lin, Z., ... & Hui, P. (2021). All one needs to know about metaverse: A complete survey on technological singularity, virtual ecosystem, and research agenda. arXiv preprint arXiv:2110.05352.
39. Lee, L., Tlili, A., Huang, R., Shehata, B., Liu, D., Zhao, J., Metwally, A. H. S., & Burgos, D. (2022). Is Metaverse in education a blessing or a curse: a combined content and bibliometric analysis. Smart Learning Environments, 9(1), 1-31.
40. Lege, R. & Bonner, E. (2020). Virtual reality in education: The promise, progress, and challenge. Jalt Call Journal. 16, 167-180.
41. Mistretta, S. (2022). The metaverse—An alternative education space. AI, Computer Science and Robotics Technology.
42. Morais, G. M., Santos, V. F., & Gonçalves, C. A. (2020). Netnography: Origins, foundations, evolution and axiological and methodological developments and trends. The Qualitative Report, 25(2), 441-455.
43. Mystakidis, S., Berki, E., & Valtanen, J. P. (2021). Deep and meaningful elearning with social virtual reality environments in higher

education: A systematic literature review. Applied Sciences, 11, 2412.
44. Mystakidis, S., Christopoulos, A., & Pellas, N. (2022). A systematic mapping review of augmented reality applications to support STEM learning in higher education. Education and Information Technologies, 27(2), 1883-1927.
45. Nabity-Grover, T., Cheung, C. M., & Thatcher, J. B. (2020). Inside out and outside in: How the COVID-19 pandemic affects self-disclosure on social media. International Journal of Information Management, 55, 102188.
46. Ning, H., Wang, H., Lin, Y., Wang, W., Dhelim, S., Farha, F., & Daneshmand, M. (2021). A Survey on Metaverse: the State-of-the-art, Technologies, Applications, and Challenges. arXiv preprint arXiv:2111.09673.
47. Park, S. M., & Kim, Y. G. (2022). A metaverse: taxonomy, components, applications, and open challenges. IEEE access, 10, 4209-4251.
48. PM, A. (2023, March 6). How AI and Metaverse are Transforming the Educational Sector? Analytics Insight. Available at: https://www.analyticsinsight.net/how-ai-and-metaverse-are-transforming-the-educational-sector/
49. Prieto, J. F., Lacasa, P., and Martínez-Borda, R. (2022). Approaching metaverses: mixed reality interfaces in youth media platforms. New Techno Humanit.
50. Ranjan, S. (2021, September 9). Education's New Avatar. Higher Education Digest.
51. Rospigliosi, P. A. (2022). Metaverse or Simulacra? Roblox, Minecraft, Meta and the turn to virtual reality for education, socialisation and work. Interactive Learning Environments, 30(1), 1-3.
52. Sá, M. J., Santos, A. I., Serpa, S., & Ferreira, C. M. (2021). Digital Literacy in Digital Society 5.0. Academic Journal of Interdisciplinary Studies, 10(2), 1-9.
53. Saritas, M. T., & Topraklikoglu, K. (2022). Systematic Literature Review on the Use of Metaverse in Education. International Journal of Technology in Education, 5(4), 586-607.
54. Schlemmer, E. (Ed.). (2014). Learning in Metaverses: Co-Existing in Real Virtuality: Co-Existing in Real Virtuality. IGI Global.
55. Seok, W. H. (2021). Analysis of metaverse business model and ecosystem. Electronics and Telecommunications Trends, 36(4), 81-91.
56. Serpa, S., & Ferreira, C. M. (2020). Sustainability and digital as challenges of sociology. Journal of Educational and Social Research, 10(2), 15-23.
57. Siyaev, A., & Jo, G. S. (2021). Neuro-symbolic speech understanding in aircraft maintenance metaverse. IEEE Access, 9, 154484-154499.
58. Smart J, Cascio J, Paffendorf J. (2007). Metaverse roadmap: pathway to the 3D web [Internet]. Ann Arbor (MI): Acceleration Studies Foundation.
59. Stephenson N (1992). Snow crash (2011th edn). Penguin, London.
60. Suh, W., & Ahn, S. (2022). Utilizing the metaverse for learner-centered constructivist education in the post-pandemic era: an analysis of elementary school students. Journal of Intelligence, 10(1), 17.
61. Sun, J., Gan, W., Chao, H. C., & Yu, P. S. (2022). Metaverse: Survey, applications, security, and opportunities. arXiv preprint arXiv:2210.07990.
62. Sung, E. C., Bae, S., Han, D. I. D., & Kwon, O. (2021). Consumer engagement via interactive artificial intelligence and mixed reality. International journal of information management, 60, 102382.
63. Thawonmas, R., & Fukumoto, A. (2011). Frame extraction based on displacement amount for automatic comic generation from metaverse museum visit log. In Intelligent Interactive Multimedia Systems and Services: Proceedings of the 4th International Conference on Intelligent Interactive Multimedia Systems and Services (IIMSS 2011) (pp. 153-162). Springer Berlin Heidelberg.
64. Upadhyay, A. K., & Khandelwal, K. (2022). Metaverse: the future of immersive training. Strategic HR Review, 21(3), 83-86.
65. Voinea, G.D., Boboc, R. G. & Antonya, C. (2022). Mixed reality tools for education in

metaverse. Education and New Development. 12(4), 249-251.

66. Wang, F. Y., Qin, R., Wang, X., & Hu, B. (2022). Metasocieties in metaverse: Metaeconomics and metamanagement for metaenterprises and metacities. IEEE Transactions on Computational Social Systems, 9(1), 2-7.
67. Wasmuth, H. (2016). “Thinking as someone else” - Using avatars in teacher education and the challenge to think and act as someone else. Global Education Review, 3(4). 127-145
68. Yong, Y. J., Lee, J. H., & Kim, Y. S. (2022). A Study on the Possibility of a Change in Culture and Arts Education Curriculum by Shooting" METACLASSROOM" in the COVID19 Pandemic Era. Cypriot Journal of Educational Sciences, 17(5), 1603-1621.
69. Yang, Q., Zhao, Y., Huang, H., Xiong, Z., Kang, J., and Zheng, Z. (2022). Fusing blockchain and AI with metaverse: a survey. IEEE Open J. Comput. Soc. 3, 122–136.
70. Zhang, Z., Ning, H., Shi, F., Farha, F., Xu, Y., Xu, J., & Choo, K. K. R. (2022). Artificial intelligence in cyber security: research advances, challenges, and opportunities. Artificial Intelligence Review, 1-25.
71. Zhang, X., Chen, Y., Hu, L., & Wang, Y. (2022). The metaverse in education: Definition, framework, features, potential applications, challenges, and future research topics. Frontiers in Psychology, 13.
72. Zhiming, Y., Xiaxia, T., Xuan, Q., Fei, Z., & Yuanmei, D. (2017). The connotations, key technologies and application trends of educational artificial intelligence (EAI): Interpretation and analysis of the two reports entitled ‘preparing for the future of artificial intelligence’and ‘the National Artificial Intelligence Research and Development Strategic Plan’. Journal of Distance Education, 1, 26-35.
73. Zonaphan, L., Northus, K., Wijaya, J., Achmad, S., & Sutoyo, R. (2022, November). Metaverse as A Future of Education: A Systematic Review. In 2022 8th International HCI and UX Conference in Indonesia (CHIuXiD) (Vol. 1, pp. 77-81). IEEE.
74. Zuckerberg, M. (2021). Connect 2021 Keynote: Our Vision for the Metaverse. Facebook. Available at: https://tech.fb.com/ar-vr/2021/10/connect-2021-our-vision-for-the-metaverse/