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Unlocking the Metaverse: Revolutionizing Resource Learning for Future Students

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Abstract

Recently, the metaverse has emerged as a global focal point, drawing extensive attention thanks to rapid technological advancements. The forthcoming metaverse promises amplified direct physical interactions, diminishing the significance of traditional constructs such as race, gender, and physical disabilities, ultimately offering profound societal advantages. This study is a qualitative descriptive literature review to show how metaverse in the live Nonetheless, the metaverse's development remains nascent, brimming with untapped potential. Despite proactive industry preparations and substantial investments, there's a pressing need for expanded scholarly discourse on the metaverse to provide the scientific guidance necessary for its maturation. Metaverse-based learning has been presented as a blockchain-driven prototype, emphasizing its infrastructure, interaction features, and ecosystem elements. The metaverse aims to enrich university students' and faculty's campus life, aligning with the principles of accessibility, diversity, equality, and humanity. The study findings are developing an ecosystem for the metaverse, a journey through the evolution of the metaverse, and conducting a virtual campus.

Keywords: ecosystem, metaverse, metaverse-based learning, remote learning

I. Introduction

"Metaverse" is defined as a decentralized futuristic space that connects virtual/augmented reality and blockchain. Others claim that they have already built it. And still, others note that the origins of the concept are pretty dystopian.

Meta is Greek, meaning beyond, and verse represents the totality of something. Thus, the Metaverse changes the human experience, using technology to transcend physical reality. The term was originally coined by science fiction writer Neal Stephenson in his 1992 novel "Snow Crash", where he described the Metaverse as a virtual world made up of unique environments, each with a specific purpose, to entertain, and socialize, educate, and entertain. Much more. Using head-mounted displays (HMD), smartphones, and other media technologies, people can enter a shared metaverse space and interact with one another regardless of location.

In simple terms, the Metaverse is the next iteration of the internet with a network of decentralized virtual spaces where users can socialize, learn and play. In addition, it leverages other new technologies (5G, blockchain, artificial intelligence). It moves from 2D graphics on flat screens to 3D graphics on HMD. And Metaverse will enable the creation of interactive and virtual equivalents of our physical world that we will be able to explore via the Extended platform. Reality (XR) [1].

The real-world need for the metaverse and its feasibility has spurred industry efforts, with numerous ventures underway. For instance, "The Sandbox" is a blockchain-based virtual sandbox game that secured over $2 million in funding in 2020. Similarly, "Roblox," an online game plat-

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form and creation system, achieved a peak valuation of over $40 billion. NVIDIA has introduced "Omniverse," a platform supporting real-time virtual collaboration in industrial design and visualization. Moreover, through the acquisition of Oculus, giants like Facebook are deeply invested in VR and augmented reality (AR) technologies. Epic Games raised $1 billion for metaverse development, while Sony invested $200 million to support Epic's vision. Industry giants like Tencent and Bytedance have also shown substantial interest in metaverse-related applications. [2]

A. Metaverse for Education

While the metaverse exists as a virtual realm, it profoundly impacts the real world, particularly regarding accessibility, diversity, equality, and humanity. This section highlights several representative applications that exemplify the metaverse's potential for social good.

Accessibility

In our increasingly globalized world, cross-border communication and collaboration have grown more frequent. However, geographical distance remains a substantial obstacle, increasing costs and complicating processes. Furthermore, the COVID-19 pandemic has led to the suspension of many events due to public health concerns [3]. The metaverse, however, offers remarkable accessibility solutions to cater to diverse social needs.

For instance, numerous events have transitioned to virtual formats facilitated by the metaverse. In 2020, many universities hosted its graduation ceremony within metaverse platform. As the real-life tour continues to be plagued by cancellations, Soulja Boy, Dillon Francis, and Ozzy Osbourne turn to the virtual world. The Metaverse Music Festival returns November 10-13 for its second year in Decentraland - an immersive digital world built using blockchain technology and owned by its users - with over 100 artists across 15 stages. This event is free to attend, and no crypto wallet is required to participate. Set in a cyberpunk city in the future, Dillon Francis opens the festival with a "mega club" experience projected across multiple screens, while Soulja Boy appears via a virtual avatar. Digital arrangements also allow for complex stage designs, as shown in Figure 1. [4].

These examples illustrate how the metaverse has seamlessly integrated into our daily lives, satisfying social requirements with reduced costs and heightened security.

Figure 1 Musical Concert in Decentraland

Diversity

The physical world's limitations, including factors such as geography and language, make it challenging to integrate diverse elements in one place to meet the varied needs of different individuals. However, the metaverse offers boundless expanses and seamless scene transitions, making it a potent tool for achieving diversity. Within the metaverse, a multitude of captivating scenarios can unfold. For instance, Animal Crossing hosted a presidential campaign for Joe Biden, while Stanford University students showcased their posters in Second Life. Beyond these examples, the metaverse hosts various activities encompassing education, shopping, political campaigns, artwork, pet ownership, haunted houses, and much more. Consequently, the diversity requirements of physical society find ample fulfillment within the metaverse.

Equality

Equality represents a noble aspiration for humanity, yet reality presents numerous factors influencing its attainment, including race, gender, disability, and wealth. Within the metaverse, however, everyone can control personalized avatars and wield their influence to foster a fair and sustainable society. For instance, the metaverse embodies democratic principles, allowing participants to maintain order and ensure normal op-

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erations. Decentraland features a Decentralized Autonomous Organization (DAO) where users propose and vote on policies governing the virtual world (e.g., regulations concerning wearable items). Similarly, in the Axie Infinity universe, inspired by Pokémon, users can earn tokens through skilled gameplay and contributions to the ecosystem. This ecosystem introduces a decentralized organizational mechanism, enabling Axie Infinity Shards (AXS) holders to stake their tokens through a designated platform and participate in governance decisions.

Humanity

Humanistic values encompass universal self-care for humanity, expressed through the preservation, pursuit, and concern for human dignity, weight, and destiny. Humanity treasures the various spiritual and cultural phenomena passed down by previous generations as a legacy for humankind. The metaverse provides an exceptional avenue for cultural communication and preservation. For example, the metaverse actively participates in the conservation of cultural relics. Physical world cultural relics, vulnerable to weathering, human interference, or natural disasters, face significant threats. When the Notre Dame de Paris suffered a devastating fire in 2019, causing substantial damage to its wooden structures, Ubisoft stepped in to digitally reconstruct the cathedral in 3D within the game Assassin's Creed Unity, to support its real-world reconstruction.

B. Features of the Metaverse in Education

Learning in a metaverse world will not feel the same as in a conventional classroom or screen-based video conferencing platform. A comparison of face-to-face learning, screen-based distance learning, and metaverse-based education is presented in Table 1. Metaverse-based learning is a combination of face-to-face and screen-based distance learning, and it is possible to compensate for both limitations. [5] Thus, each feature and its significance are interpreted in Table 1.

Infrastructure

The infrastructure layer constitutes the foundational backbone required to sustain the operation of a virtual world, encompassing computation, communication, blockchain, and storage.

Table 1. Comparison of face-to-face learning in class, screen-based distance learning, and metaverse-based learning

No	Factor	Classroom Learning	Remote Learning	Metaverse learning
	Time and location for students in class	A certain time according to the schedule	Available only when the teacher opens learning on the video conference platform	There are no time and location limitations
	Student identity	True identity	True identity	Digital identity (avatar)
	People who interact with students	Teachers and colleagues	Teachers and colleagues	Teachers and colleagues represented by avatars
	Learning scenes	Real learning scene	Real learning scene	Learning scene simulation
	Learning resources	Real learning scene Students cannot interact	Multimedia or online learning resources Students cannot interact	Visualization and decentralized learning resources Students can interact
	Learning activity	Mainly based on teaching materials from the teacher Allows students to follow learning in several series Allows students to collaborate	Mainly based on teaching materials from the teacher It is not easy for students to follow learning in several series It's not easy for students to collaborate	Mainly based on the decentralizati on of teaching materials Allows students to follow learning in several series Allows students to collaborate

Computation and Communication: Given the metaverse's vast scale as a multimedia system, its operation incurs substantial computational demands. Simultaneously, the metaverse's aspiration for universal accessibility necessitates robust communication technologies. However, it's vital to recognize that advancements in computation and communication extend beyond the metaverse alone; they are at the forefront of ongoing research. In this context, we focus on enhancing the metaverse user experience through these technological advancements. We present the following open research questions:

1. Designing Specialized Computational Devices: How can we create specific computational devices to meet the extensive computational requirements of the metaverse?
2. Coordinating Computational Resources: How can different computational resources, such as cloud computing or mobile de-

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vices, be effectively coordinated to enhance user experiences on various terminals?
3. Efficient Data Representation: What data structures or encoding methods can effectively represent and transmit the large-scale data of the metaverse?

Blockchain and Storage: The metaverse's vision of global connectivity generates an enormous volume of data, including maps, roles, and more, necessitating extensive storage infrastructure. Furthermore, the metaverse relies on blockchain technology for sustainability, decentralization, and fairness. Leading blockchain systems like Ethereum introduce smart contracts that extend the scope of blockchain applications, making it feasible for the metaverse to construct a decentralized social ecosystem. In this paper, we position blockchain as a fundamental infrastructure component of the metaverse. The following open research questions are integral to the metaverse's development:

1. Efficient Data Storage and Retrieval: How can we effectively store and retrieve the vast data generated within the metaverse?
2. Blockchain Consensus Models: What consensus model should the blockchain adopt to support the sustainable economics of the metaverse?
3. Data Allocation and Coordination: How can data allocation and coordination between mass storage and the blockchain be managed effectively?

Interaction

Within this subsection, we focus on aspects critical to the interaction layer that bridge the physical and virtual realms, including immersive user experiences, digital twins, and content creation.

Immersive User Experience: Achieving an immersive user experience hinges on two key components within interactions between users and the metaverse. Firstly, the metaverse must receive data from the physical world to enable users to control their avatars and undertake corresponding actions. This may involve technologies like those depicted in the film "Ready Player One," where users utilize specialized equipment, including treadmills, HMDs (Head-Mounted Displays), gloves, and suits to capture user actions. Secondly, real-time 3D rendering technologies like VR/AR represent the primary interaction interfaces. Additionally, haptic feedback, commonly integrated into game controllers like the Nintendo Switch, is essential. However, current technologies offer only partial support for specific areas, failing to provide a truly immersive user experience. This gives rise to the following research questions:

1. Enhancing User Experience: How can we understand user emotions and to improve their experience during interactions with the metaverse?
2. Integration of Input and Output Modalities: How can input and output modalities be seamlessly integrated to create a holistic user experience during interactions?

Digital Twins: Beyond metaverse users, physical world objects and entities can also interact with the metaverse, manifesting as digital twins within the virtual world. These digital twins mirror the states of their physical counterparts and can be influenced by and exert influence on them. This interdisciplinary area draws upon various fields, including material science, signal processing, IoT, and pattern recognition. However, the development of digital twins in the metaverse is still in its infancy, leading to the following research questions:

1. Mapping Physical Entities as Digital Twins: What physical world elements should be mapped as digital twins within the metaverse?
2. Leveraging Digital Twins for Real-World Benefits: How can digital twins within the metaverse be effectively employed to benefit the physical world?

Content Creation Interface

Content creation plays a pivotal role within the evolving metaverse, characterized by limitless scalability and interoperability. While operators establish the essential elements, innovative user-generated content (UGC) is the lifeblood that breathes vitality into this universe. Therefore, efficient content creation is a vital component of user-metaverse interactions.

For structures, objects, and environments that mirror their physical counterparts in the metaverse, 3D reconstruction methods are applied to create digital twins [14]. To generate these 3D models, users can employ 3D modeling

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software like 3ds Max, Blender, or Maya. However, these modeling systems typically require significant professional knowledge and experience, making them challenging for amateurs to replicate. This leads us to the following research questions:

1. Accurate Virtual Reconstruction: How can we precisely reconstruct existing physical objects and their attributes in the virtual world?
2. User-Friendly Content Creation: How can existing interaction modalities facilitate content creation to enhance the user experience?

II. Metaverse Ecosystem

By defining the Metaverse for Education (Eduverse) or Educational Metaverse (Edu-Metaverse) and building a new theoretical framework (an Ecosystem), to provide a clearer vision and understanding of the various metaverse worlds, to increase international social awareness of the Metaverse and its impact education. This new Edu-Metaverse Framework is groundbreaking and can serve as a foundation for rapidly growing research and development in education. [6]

Metaverse ecosystem of education from four main centers (centers): 1) Instructional Design and Performance Technology, 2) Center of Knowledge, 3) Center of Research and Technology, and 4) Center of Talent and Training. Common to the four centers are the factors in the three circles, as shown in Figure 2. [6]

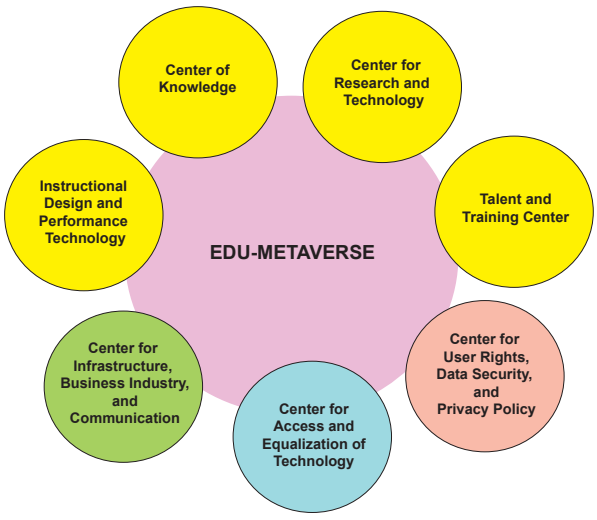

Figure 2 Metaverse ecosystem of education

III. Evolution of Metaverse

The metaverse will develop in three overlapping phases and will fully mature in 2030, and tech product leaders should start evaluating opportunities now. Its potential to change how individuals and organizations interact with each other and the world around them is so great that technology products and service providers already need a strategy. Gartner recommends evaluating opportunities in engagement, content (interoperability), and infrastructure starting now. [7]

Three overlapping metaverse phases are expected to be emerging, advanced, and mature. Therefore, in developing a strategy, technology product leaders need to evaluate the growth and trajectory of the technology and emerging trends that enable metaverse experiences at each stage, as shown in Figure 3.

IV. Metaverse Campus

Founded in 2012 by a team of behavioral psychologists, Virbela is an immersive technology company transforming the workplace for global business, launching a new virtual campus design, a more flexible avatar system, and native integration with Zoom. This innovation will give companies and their employees more fantastic choices and control over how they work, connecting people regardless of physical location while building a greater sense of community and culture. (GlobeNewswire, 2022)

Virbela helps address common workplace challenges facing today's remote and hybrid organizations. In the next five to 10 years, millions of individuals and thousands of organizations operate in virtual worlds. Virbela has designed a bottom-up platform to grow together and help organizations improve the employee experience, operate more efficiently, and build strong communities and cultures. Virbela empowers companies to make more human-centric workplaces that seamlessly blend physical and virtual work environments to connect them worldwide.

Virbela provides new ways to work, meet and learn that will unlock tremendous growth. Agility will lead to more productive and innovative companies and more accessible education. Exciting virtual spaces replicate real-world dynamics

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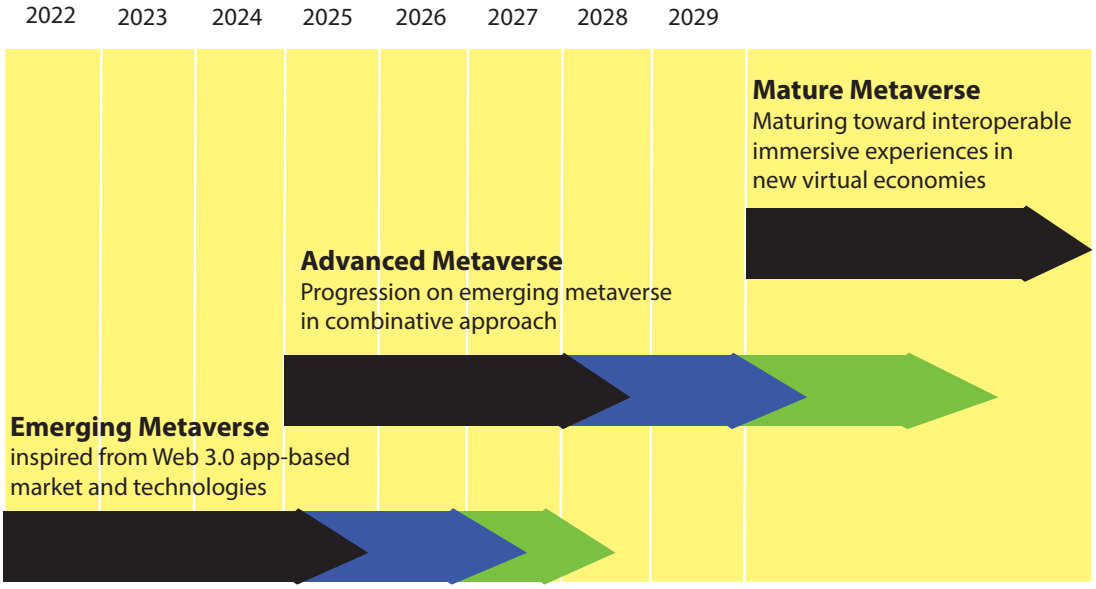

Figure 3 The evolutionary spectrum of the metaverse (Gartner)

and social interactions. With offices, events or universities can be recreated while maintaining a sense of community and culture in a way that video, chat, and email cannot.

1. Remote Learning

Increase Student Engagement and Retention. In a virtual classroom, students and teachers act as avatars, as shown in Figure 4, for one's first experiences.

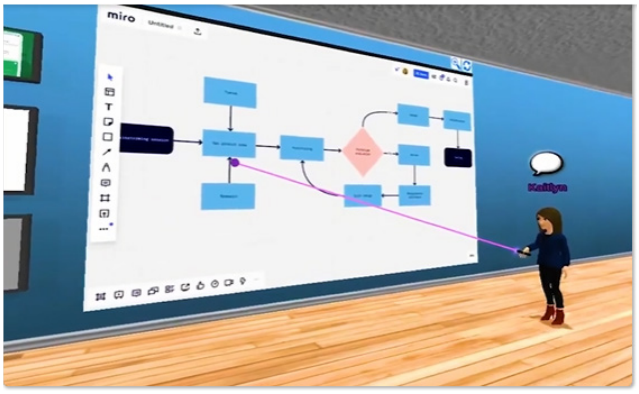

Figure 4 A teacher acts as avatars in virtual class room (Virbela)

- Helping Students Socialize and Build Relationships with Colleagues & Faculty. For students, meeting new people is one of the most rewarding parts.
- Building a Sense of Community and Culture in Online Programs. Existing online or hybrid classes get a boost from virtual spaces. Explore study areas and meeting places around campus or attend events.
- Instructors can show with PDFs, play videos, surf the web, unlink, or redecorate the room. Break free from the monotony of one-way videos in no time. [9]

2. Characteristics

Visual

- Modern and familiar - Inspiration is drawn from real cities, business centers, and nature.
- New grid layout - More flexibility and control are offered, making it perfect for companies looking to invest in building their virtual real estate.
- Dynamic architecture - This opens the door to creating digital counterparts of physical spaces and branded experiences.

Avatars

- Full control - Users have complete control over their appearance and experience.
- Style - Many customization options are available to ensure everyone is represented (e.g., gender, body type, style, mobility, etc.).

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Integration with Zoom

- Connect to Virbela meetings, wherever users are, and from any device.
- Employees can connect anywhere they want - across the metaverse, in the physical office, or calling from home.

3. Virtual Events

In a virtual event, it can be:

- Virtual event venues make attendees feel like they've gone somewhere. Stages, booths, and even beaches hold thousands of people with plenty to see and do.
- Partner with vendors and exhibitors to create attractive trade shows. Immersive booths feature interactive technology and allow natural conversation.
- Attendees from anywhere can enjoy conferences and trade shows without traveling. Intuitive navigation for easy access and interaction.
- Complete virtual environment with fireworks, stunning views, dances, speed boats, and more.

V. Conclusion

This paper has proposed an ecosystem for the Metaverse, delving into its infrastructure, interaction, and ecosystem components. It has outlined the critical elements within each layer, raising open research questions for further exploration. The paper has also provided a journey through the evolution of the Metaverse, showcasing pioneering works and modern prototypes.

Furthermore, the Virbela has been presented as a blockchain-driven prototype, emphasizing its infrastructure, interaction features, and ecosystem elements.

References

[1] D. Pimentel, G. Fauville, E. McGivney, S. Rosas, and E. Woolsey, "Learning in the Metaverse : A Guide for Practitioners," Meridian Treehouse, 2022. .

[2] J. Y. Lee, "A Study on Metaverse Hype for Sustainable Growth," Int. J. Adv. smart Converg., vol. 10, no. 3, pp. 72–80, 2021.

[3] Z. Yu, "The effects of gender , educational level , and personality on online learning outcomes during the COVID - 19 pandemic," Int. J. Educ. Technol. High. Educ., 2021, doi: 10.1186/s41239-021-00252-3.

[4] B. James, "Soulja Boy, Ozzy Osbourne and Dillon Francis to Play Metaverse Festival in Decentraland," Billboard, 2022. .

[5] X. Zhang, Y. Chen, L. Hu, and Y. Wang, "The metaverse in education: Definition, framework, features, potential applications, challenges, and future research topics," Sec. Educ. Psychol., 2022, doi: 10.3389/fpsyg.2022.1016300.

[6] M. Wang, H. Yu, Z. Bell, and X. Chu, "Constructing an Edu-Metaverse Ecosystem: A New and Innovative Framework," IEEE Transactions on Learning Technologies, 2022.

[7] Gartner, "Phases of the Metaverse Evolution : What it Means for Tech Product Strategy," Technology Fintech Digital Transformation, 2022. .

[8] GlobeNewswire, "Virbela Launches New Metaverse Campus to Better Connect Physical and Virtual Working Worlds," GlobeNewswire, 2022. https://www.globenewswire.com/en/news-release/2022/03/24/2409688/0/en/Virbela-Launches-New-Metaverse-Campus-to-Better-Connect-Physical-and-Virtual-Working-Worlds.html%0A (accessed Dec. 18, 2022).

[9] Virbela, "The Next Generation in Education," Virbela, 2021. https://www.virbela.com/solutions/remote-learning.