

## Interactive Pedagogical Approach to Teaching in Nigerian Universities: Using Metaverse as Enabling Technology

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### Abstract

*This paper explored metaverse literature and scholarly works to dissect the concept and potentials of metaverse, being a combination of three-dimensional virtual and real world inhabited by blockchain, artificial intelligence, digital twins, and other cutting-edge intelligent technologies. The study revealed that Metaverse offers a fully immersive educational experience like real-world classroom layouts in 3D form or constructed as partially or fully virtual scenes according to the learning content and the resources can be visualized, especially for the invisible or abstract concepts, items, or events in the physical world. The study further revealed the various challenges confronting the utilization of metaverse technologies in Nigerian Universities which range from inadequate infrastructural facilities, poor research activities, lack of stable electricity, lack of bandwidth and connectivity, inadequate ICT facilities and lack of technically experienced lecturers. The researchers recommended that government should allocate 26 percent of her total budget as recommended by UNESCO to educational sector to enhance the provision of necessary infrastructural facilities needed for the utilization of metaverse technologies in Nigerian Universities. The researchers further recommended that Federal, State government and Universities should undertake in-service training of lecturers through workshops, conferences, seminars and symposia on usage of metaverse, connect the Universities to stable electric grid, employ only competent and qualified lecturers as well as motivate them in terms of salary and other allowances so as to enable them discharged their duties effectively.*

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### Introduction

Education is the bed rock to social, economic, political and human developments. Globally, countries of the world continually sought to improve the quality of her education, particularly the developing countries. As a country colonized by British administration, formal education or Western education was introduced in Nigeria on 19th December 1842 to Badagry by Mr. and Mrs. William De Graft and Rev. Thomas Birch Freeman of the Wesleyan Methodist Church (Birabil & Ogeh, 2020). The formal education system includes primary/or elementary, secondary, and tertiary/or higher education. According to Castell (2016), Birabil and Ogeh (2020), the higher/or tertiary education is the highest of all the levels because it is that level of education that is above the secondary or high school cadre. Although the higher education includes the Universities, Polytechnics, and Colleges of

Education, however, the University which is the focus of this paper has been described by researchers as the apex of education because it covers all fields of human endeavor (Ekong & Onye, 2017; Birabil & Ogeh, 2020). The word University is derived from the latin words *universitas magistrorum et scholarium*, which roughly means community of teachers and scholars (Ekong & Onye, 2017). According to Amaele (2005), university education is more than the next level in the learning process; it is a critical component of human development worldwide. It provides not only the high-level skills necessary for every labor market but also the training essential for professional to develop the capacity and analytical skills that drive economies, support civil society, lead effective governments, and make important decisions which affect entire societies. The history of university education in Nigeria is traced to the Elliot Commission of 1943, which culminated in the establishment of University College Ibadan in 1948 (Birabil & Ogeh, 2020). The benefits derivable from a good and functional university education system cannot be overemphasized.

According to the National Policy on Education (FRN, 2013), the goals of tertiary education is to contribute to national development through high-level relevant manpower training; develop and inculcate proper values for the survival of the individual and society; develop the intellectual capability of individuals to understand and appreciate the environment; acquire both physical and intellectual skills for self-reliance; promote and encourage scholarship and community service; forge and cement national unity and promote national and international understanding and interaction. Over the years there has been a proliferation of universities including those established by Federal, State governments and privately owned. In Nigeria today, very few conventional universities take up academic activities through digital technologies. In the view of Adeoyeye, Afolabi and Ayo (2014), Wijaya and Utami (2021), educational system in Nigeria lack adequate digital technologies and hence do not adequately utilize them in learning and teaching. Nowadays, the teaching and learning environment has changed from talk and chalk in the classroom to a digital technological approach where all topics can be assessed through digital technological tools on devices (Abdullah, Saud & Mohd, 2021). Nzimande 2017, Amasi and Yellowe (2018), posited that the emergence of digital technologies has prompted researchers to predict the end of traditional pedagogical, didactic and philosophical approach to teaching. The universe is a place beyond imagination, where users in the form of avatars can interact with each other in a virtual space (Duan, et al., 2021). It is evident that digital reality technologies have the potential to revolutionize the domains of education, remote work, marketing and economics, as well as the entertainment business. In the view of Zhang, Chen, Hu and Wang (2022), the breakthrough of virtual reality (VR), augmented reality (AR), artificial intelligence (AI), blockchain, etc., the metaverse, a 3D digital space with collapsed virtual and real boundaries, has provoked increasing attention. Ning et al (2021), stated that metaverse is a new type of internet application that combines several modern technologies that possesses multi-technology, sociality, and hyper-spatiotemporal properties.

Metaverse has sparked a new technological trend across the globe with great potential in the education (Duan et al., 2021). A variety of technological fields have been utilized in Metaverse to build a healthy learning ecosystem. Today, various countries have explored specific forms and methods of promoting educational reform and innovation with the metaverse. According to Fitria, Simbolon and Afdaleni (2022), universities currently using metaverse for teaching are Aman Arab University, Brain STEM University, CEU University, Khon Kaen University, University of Nigeria, Muhammadiyah University, Malaysia and the University of Nicosia. In the course of time, it was observed that Nigerian Universities are fraught with lots of challenges that incapacitated their efficiency (Ojo, 2018; Ogunode, 2018; Osunikanmi, Adebukola & Foluke, 2018). As an emerging technology, the majority of educational researchers might be unaware of what the metaverse is, and its application in the education. It should be noted that introducing the metaverse into the educational

field may trigger several controversial issues such as challenges that deserve further discussion; otherwise, the “metaverse” will be a “metaworse” (Zhang, Chen, Hu & Wang, 2022). Therefore, this research paper aims to review scholarly works on metaverse to give a clear view of metaverse in education, concept, challenges, potential and recommendations towards invigorating metaverse in educational fields.

### **The Concept of Metaverse**

Metaverse originated from the science fiction novel *Snow Crash* published by Neil Stephenson in 1992 (Stephenson, 1992). In the science fiction novel *Snow Crash* according to Fitria, Simbolon and Afdaleni (2022), Suh and Ahn (2022), Stephenson describes Metaverse as a three-dimensional digital space, parallel to the real world, where people can interact and communicate through their respective Avatars with the help of devices such as Augmented Reality (AR), Virtual Reality (VR), magic gloves and controllers. According to Zhang, Chen, Hu and Wang (2022), Cheng et al., (2022), metaverse is a compound word combined with “meta-” (beyond; transcending) and “verse” (the root of universe, cosmos; the whole world), which denotes a new virtual universe created beyond the real world. Overtime, the metaverse concept was more vividly depicted in science fiction movies, such as *Ready Player One*, *Lucy*, and *The Matrix* (Zhao et al., 2022). Users created an avatar to represent who they are and to carry out activities in a virtual world by using technologies and devices such as AR and VR. In 2007, the Acceleration Studies Foundation, a metaverse research organization, took the first step to put forward the metaverse roadmap and propose the metaverse as a fusion of both virtually-enhanced physical reality and physical-persisted virtual space (Smart et al., 2007; Kye et al., 2021). According to Zhang, Chen, Hu and Wang (2022), four scenarios were categorized in the metaverse roadmap: augmented reality, lifelogging, virtual worlds, and mirror worlds. As the metaverse roadmap stated, the metaverse is a fusion of virtually-enhanced reality and physical-persisted virtual space (Smart et al., 2007; Kye et al., 2021), that is, the metaverse includes both the items mapped or augmented from the real world and the creations produced in the virtual world.

The gap between the virtual and the physical world will be narrowed or even eliminated in the metaverse, which enables the user’s experience in the metaverse more immersive, multi-sensory, and close to authentic. In March 2021, the sandbox game *Roblox* was listed in New York under the halo of “the first stock of the metaverse (Zhang, Chen, Hu & Wang, 2022). *Roblox* founder David Baszucki (Jeon, 2021), defined the metaverse as a place that combines high-fidelity communication with a new way to tell stories borrowing from mobile gaming and the entertainment industry. Metaverse quickly gained fame after Mark Zuckerberg proclaimed Facebook rebrand scheme and changed its name to “Meta” in October 2021. Since then, extensive efforts have gradually been carried out by countries across the world to make it a reality (Bobrowski, 2021; Fitria, Simbolon & Afdaleni, 2022). According to Mark Zuckerberg, Metaverse is a place where people who are on the internet cannot only see but also feel they are in it (Zuckerberg, 2021). Metaverse platforms offer advancements across the board as virtual reality systems become more user-friendly and networked. Hence, several researchers defined metaverse in various way to suit their understanding. According to Lee (2021), Putra and Wayoi (2022), the metaverse, refers to a combination of three-dimensional virtual and the real world inhabited by blockchain, artificial intelligence, digital twins, and other cutting-edge intelligent technologies. The metaverse is an immersive digital environment in which people can create their own avatar and engage and interact in activities with others (Suh & Ahn, 2022). Fitria, Simbolon and Afdaleni (2022), sees the Metaverse as an endless virtual world that is interconnected where people can work, meet, and play using virtual reality headsets, augmented reality glasses, smartphone apps, and/or other devices. Similarly, Mystakidis (2022), stated that

Metaverse is a post-reality world, a continuous and enduring multiuser environment that combines physical reality with digital virtuality. Almarzouqi et al. (2022), stated that Metaverse is created by fusing virtually upgraded physical and digital realities. The metaverse according to Hwang and Chien (2022) and Wang et al. (2022), is an evolving paradigm of the next-generation Internet, aims to build a fully immersive, hyper spatiotemporal, and self-sustaining virtual shared space for humans to play, work, and socialize. The creation of the Metaverse facilitate day-to-day human communication and interaction over the internet (Akour et al., 2022).

At present, all human activities have started using Metaverse technology such as school, college, shopping, work, socializing, and other jobs (Fitria, Simbolon & Afdaleni, 2022). In the Metaverse, the world of the internet feels like the real world through digital experiences (Fitria, Simbolon & Afdaleni, 2022). Underpinning technologies of the metaverse such as virtual reality, digital twin, artificial intelligence and cloud computing have already been applied in education with positive outcomes, indicating that the metaverse has great potential in education to some extent (Park & Kim, 2022; Shin, 2022). The metaverse has eight key features: Identity, Anywhere, Friends, Low Friction, Immersive, Civility, Variety, and Economy (VentureBeat, 2021). According to VentureBeat, (2021), the combination of the eight key features and education will create a three-dimensional digital education space known as education metaverse independent of the physical world, with fundamental characteristics such as interactivity, immersion, diversity, and breaking the limitations of time and space. The experiential and embodied teaching in the education metaverse align with the new future education model of “Education 4.0” (World Economic Forum, 2020), which promotes the digitalization, informatization and personalized transformation of education. Gartner (2022), predicted, nearly 30% of people will spend 2 h a day in the metaverse for work, entertainment, education, and socialization by 2027.

### **The Metaverse: A Perspective of Education**

According to Kye, Han, Kim, Park and Jo (2021), Srisawat and PiriyaSurawong (2022), pandemic or other natural disaster hinders effective school activities and causes monotonous making learning through zoom or video calls boring. The metaverse has impacted on various aspects of human life, including the world of education (Hwang & Chien, 2022; Park and Jeong, 2022; Park & Kim, 2022; Shin, 2022). As indicated by scholars, education is one of the most significant applications of the metaverse with great potential in the coming future (Zhang, Chen, Hu & Wang, 2022; Prieto et al., 2022). Education metaverse prefigures the future-tense of digital education as an advanced form of internet in education. Conventionally, teachers and learners attend classes by their real identities and meet each other in the physical classroom at a fixed time in accordance with the class schedule and school timetable, or learners attend classes when a teacher opens a meeting on the video-conferencing platform (Lee et al., 2022). In metaverse, by utilizing high-speed networks or computing technologies, learners are not constrained by time and location (Koo, 2021; Kye et al., 2021; Prieto et al., 2022; Zhang, Chen, Hu & Wang, 2022), learners can represent themselves in a totally different way by customizing their unique digital identity in the form of an avatar (Dionisio et al., 2013; Park & Kim, 2022). The construction of the digital identity is more user-defined and more advanced that it could edit the details of the avatar’s face (Wei et al., 2004), body (Kocur et al., 2020), and even facial expression (Murphy, 2017). In conventional learning environments, teachers often assess learners summatively by learning results (e.g., tests) due to the difficulty of recording learners’ performance and collecting their learning data. (Kye et al., 2021; Jovanović & Milosavljević, 2022; Taylor and Soneji, 2022).

In the metaverse, the learning analysis module utilize massive data to analyze and display learners’ learning performances and achievements by unit or in all. More significantly, it can make

assessing learners' performance easier, and provide teachers with reliable proof to conduct personalized services for learners (Kye et al., 2021 & Yamani, 2021). The education metaverse are impacted by network environment technologies, artificial intelligence, cloud-based data processing technologies, and blockchain-based systems based on AR, AR Cloud, Internet of Things, 5G technology, Artificial Intelligence (AI), spatial technology, robotics and brain-computer interfaces, and content production technologies on artificial intelligence and digital twin which allowed to interact with the created virtual items or the items projected from the real world through moving, manipulating, or clicking, thereby greatly motivating users' multiple senses (Koo, 2021; Jovanović & Milosavljević, 2022; Park & Kim, 2022; Srisawat & PiriyaSurawong, 2022; Prieto et al., 2022; Wang, Tang & Wang, 2023). In the metaverse, various realistic learning scenes can be simulated and created by modeling and rendering technologies (Duan et al., 2021; Lv et al., 2022 & Shin, 2022). The Metaverse offers a fully immersive educational experience like real-world classroom layouts in 3D form or constructed as partially or fully virtual scenes according to the learning content and the resources can be visualized in the metaverse, especially for the invisible or abstract concepts, items, or events in the physical world (Prieto et al., 2022; Myburgh, 2022; Taylor & Soneji, 2022). When studying planets, for instance, the Metaverse could show the entire galaxy with the ability to zoom in and out so that a learner can observe the texture and features of the cosmos and when studying old architecture, a learner can travel back in time and observe the architecture's intricate elements firsthand (Ning et al., 2021).

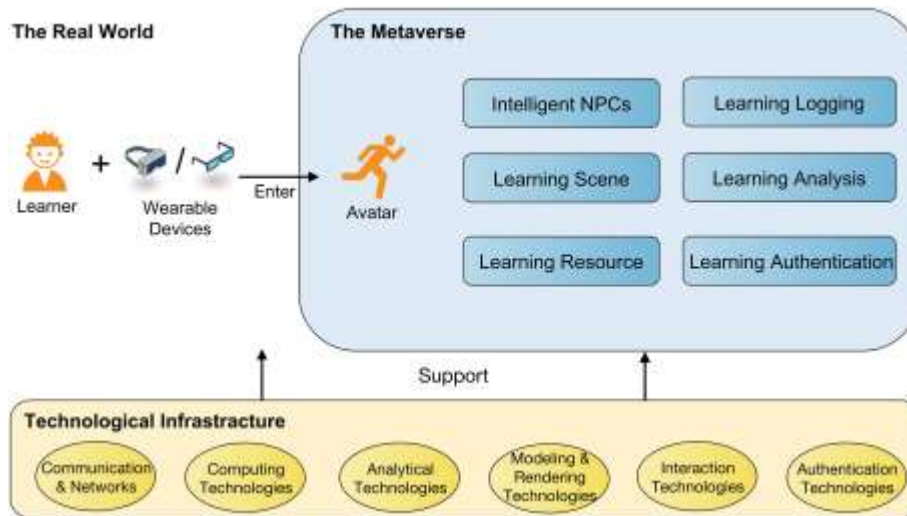
Education metaverse has several benefits such as increasing active engagement with learning materials (Hsu, 2017), increasing knowledge transfer (Radianti et al., 2020), enhancing learning outcomes (Lee, Wong, & Fung, 2010), and delivering better cognitive and affective outcomes (Calvert & Abadia, 2020; Shin, 2022; Zhao et al., 2022). In the metaverse, technologies like computing, databases, or AI play an important role in providing and analyzing huge amounts of data (Yang et al., 2022). In the metaverse-based learning environment, there are several special AI-driven roles such as intelligent teachers, intelligent learners, and intelligent peers (Huang et al., 2021; Jovanović & Milosavljević, 2022). As indicated by Hwang and Chien (2022), these intelligent agents can play an essential role in supporting arbitration, simulation, and decision-making for educational purposes. It implies that in the metaverse world, learners can get tutoring, seek help, have discussions, or practice skills with intelligent agents; meanwhile, teachers can also ask for help or simulate teaching with intelligent learners at any time (Zhang, Chen, Hu & Wang, 2022). In this sense, the provision of these intelligent agents can greatly meet personalized needs and enhance interaction for both learners and teachers.

Some educational institutions teach daily through online learning applications because the resources available to schools that require teachers and students to teach both in social media groups and in class are limited (Fitria, Simbolon & Afdaleni, 2022). The metaverse enables learners to engage in various types of learning activities (e.g., group work, creative learning, or inquiry-based learning) regardless of whether they are in classes or not, which help learners to apply, analyze, evaluate or create knowledge more easily throughout the learning process (Taylor & Soneji, 2022; Prieto et al., 2022; Shin, 2022; Mystakidis, 2022). More significantly, users can own and run their digital properties, and the security technologies, such as blockchain, can ensure their personal properties are safe and traceable (Min and Cai, 2022; Vidal-Tomás, 2022). According to Gamage et al., (2020), Myburgh (2022), the potentials of education metaverse are:

1. Creates a new learner-centered educational model that enhances students' motivation and autonomy in the classroom and facilitates tailored instruction.

2. Score management and evaluation system in the existing educational model can be remedied by blockchain, artificial intelligence, and other technologies of the education metaverse. In-class learning recordings of students can be stored by blockchain.
3. Artificial intelligence analyzes and assesses data from multiple dimensions to realize the diversification of student performance evaluation.
4. Assist the experiments that could be risky, irreversible, or toxic in the real world, e.g., an experiment with a potential risk of explosion.
5. Assist the experimental conditions and scientific phenomena that could not be possible in the real world, e.g. an experiment that needs to be carried out in a vacuum.
6. Assist the experiments that need relatively high costs and funds in the real world to procure equipment and materials.
7. Assist the experiments that react slowly or need long-term observations and records in the real world, e.g., learners can observe and record the whole growth stage of an insect.
8. Combining education and entertainment makes learning environments more appealing, encouraging students to participate more actively. As a result, the Metaverse is now being used as a 3D virtual environment in educational activities.

As a result of the potentials of education metaverse, learners feel as if they are in a real-world educational setting. From Figure 1, it can be seen that applying the metaverse in education can unlock a variety of fantastic learning experiences for learners (Zhang, Chen, Hu and Wang, 2022).



**Figure 1:** The Framework of the Metaverse in Education.

The development of Metaverse technology in education must also pay attention to its negative impacts. According to Zhang, Chen, Hu and Wang (2022), Dewantara et al. (2022), the disadvantages of Metaverse in education are:

1. Students are susceptible to developing virtual world addictions, confusing the boundaries between virtual and reality, and even developing thoughts of escapism from the real world.
2. Teachers face tremendous difficulties, including selecting instructional materials, designing a new educational system, and finding out how to integrate online metaverse teaching with traditional classroom instruction.

3. Practice becomes a problem in itself because it is difficult for students to access equipment and practical equipment in the laboratory.
4. It is hard for learners to gather and interact with peers and teachers face-to-face through the screen, which leads to some challenges, such as indifference, emotional deficiency, and desocialization (Almahasees et al., 2021; Koo, 2021).
5. It is considered to be an inevitable risk that young learners, who lack self-discipline and self-control, may fall into a state of addiction, which may lead to potential damage to their physical and mental health (Xi et al., 2022).
6. In addition, it is more easily for learners with little social experience to be exposed to criminal events (e.g., fraud, surveillance, leakage) due to a higher level of online anonymity in the metaverse. Once it happens, it will violate the learners' privacy, and even seriously affect their normal life.
7. Creating content costs more since it requires specific tools and abilities to produce the interactive virtual environments needed for efficient learning (Pimentel et al., 2022).

### **Metaverse in Nigerian University System**

According to Amadi and Urho (2015), the major dream of any university is to become a pace-setting institution in learning, character building and service to humanity with a duty to produce competent, reliable and creative graduates of high moral standards in society as well as championing a complete development of men and women in an enabling environment through appropriate teaching, research and service to humanity. Twenty-first century education is awash with seismic pedagogical shifts orchestrated by rapid advances in digital technology (Siemens, 2020). The benefits derived from integration of digital technologies in university education system can never be overemphasized. Due to rapid innovations in digital technology across the world, many universities integrate digital technologies for instructional delivery in their institutions to complement face-to-face interactions (Meskhi, Ponomareva & Ugnich, 2019; Oriji and Torunarigha, 2019; Owo & Udoka, 2021). The Nigerian Universities Commission (NUC), notes that Nigeria with an estimated population of about 200 million people has about 170 universities (NUC, 2019).

According to the National Policy on Education (FRN, 2013), the goals of tertiary education that is necessary for system performance include to contribute to national development through high-level relevant manpower training; develop and inculcate proper values for the survival of the individual and society; develop the intellectual capability of individuals to understand and appreciate the local and external environment; acquire both physical and intellectual skills for self-reliance; promote and encourage scholarship and community service. In the view of Bakare, Onah and Okereke (2018), the rate at which university students attain academic excellence therefore depends primarily on the mode of teaching, personality of lecturers and the teaching methods and strategies adopted by lecturers. According to Irvine (2021), the EON Reality and global leader in Augmented and Virtual Reality-based knowledge and skills transfer for industry and education, announces the first partnership with Nigerian University to establish a knowledge metaverse hub in the University of Nigeria, Nsukka. Irvine (2021), noted that the partnership aimed to educate students as well as upskilling and training the next generation of students and employers in metaverse. This has become an increasing feature of education occasioned by the fact that many of the younger generations of the 21st century were born as digital natives, who from birth speak the language of digitalization, computers, video games, and the internet.

Unfortunately, University education in Nigeria is confronted with several challenges (Ojo, 2018; Owo & Ajie, 2020). The many challenges integrating digital technologies in Nigeria include reluctance to embrace digital technologies, inadequate infrastructure facilities, poor research

activities, lack of electricity, lack of bandwidth and connectivity, inadequate ICT facilities, low level of computer literacy, and lack of technically experienced lecturers (Okoli, Ogbondah, & Ewor, 2016; Afolabi & Uhomoibhi, 2017; Osunyikanmi, Adebukola & Foluke, 2018; Owo & Ajie, 2020). The Nigerian government has not been able to meet-up with UNESCO 26% annual budget benchmark expected to spend on the educational sector which result in the problem of inadequate funding (Ukaigwe & Chima, 2019).

### **Conclusion**

With the help of digital technology, new instructional approaches can be developed. This provides the teachers and students with a different way to teach and learn while incorporating both learning models, hybrid and mobile. The use of visual imagery and active participation in the learning process has increased recently making it easier for teachers to employ pedagogies like inverted classes and collaborative learning, encouraging flexibility and positive class dynamics. Metaverse is based on the convergence of technologies which allow for multimodal interactions with virtual surroundings, digital objects, and people. As a result, education which was originally carried out face-to-face in class has been shifted to an online learning process. Metaverse has a positive impact on the world of education as well as an open challenge. With the availability of human resources and infrastructure, the Metaverse era in education will run smoothly and develop positively. Educators must adapt to the current situation so that even though the teaching and learning process in schools/institutions is less efficient, they still perform well. With the development of the Metaverse, the world of education in Nigeria inevitably has to prepare itself to welcome this technology.

### **Way Forward to Enhance Metaverse Usage in Nigerian University System**

From the findings of study, the following recommendations were made:

1. Federal, State government and universities should undertake in-service training of Lecturers through workshops, conferences, seminars and symposia on usage of metaverse.
2. Federal and State government should connect the Universities to stable electric grid to enhance effective interactive pedagogy using metaverse.
3. In the metaverse, learners' performance can be recorded and analyzed accurately during teaching/learning. Hence, teachers should employ the metaverse as an assessment approach.
4. Only competent and qualified lecturers as well as Computer engineers should be employed to teach and maintain metaverse technology facilities in the universities.
5. Universities should establish partnership with institutions already using metaverse in teaching/learning as this will promote cross-fertilization of ideas and enhance technology transfer.
6. Government should allocate 26 percent of her total budget as recommended by UNESCO to educational sector for effective integration of metaverse realities.
7. Lecturers should be well motivated in terms of adequate salary and other allowances so as to enable them discharged their duties effectively.



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