

Integrating E-learning in Metaverse for Sustainable Development of Higher Education and Training

Nguyễn Đức Sơn
Graphic Design Department
FPT - Greenwich Vietnam
Ho Chi Minh City, Vietnam
Email: sonnd24@fe.edu.vn

Abstract—Today, the development of information technology in the context of the industrial revolution 4.0 has changed the face of education rapidly and raised many new problems in this context. Along with that, the process of globalization has also given birth many non-traditional education methods. These types of education have transcended space, time, and types of boundaries. The article mentions the role and importance of metaverse in the global trend of higher education development through e-learning in the process of implementing cross-border education in universities all over the world. The article uses an interdisciplinary approach: education, science, and technology... to build a metaversity model in metaverse to develop training at universities in a sustainable way.

Index Terms—metaverse, metaversity, e-learning, borderless education.

I. INTRODUCTION

Entering the 21st century, in the context of the industrial revolution 4.0, higher education has been applying information and communication technology to serve higher education. This is reflected in the digital transformation taking place in training institutions around the world. According to Susan Grajek and Betsy Reinitz [13], transfer process at universities around the world by 2020 indicates that 13% of colleges and universities are engaged in digital transformation, 32% are developing a digital transformation strategy and 38% of other higher education institutions are exploring digital transformation, only 17% of educational institutions do not have time to enter the process.

Along with that, the process of globalization has given birth to many non-traditional educational methods. New generations demand different delivery methods and curricular content. Flexibility and personalized offerings have become a common denominator in all sectors [11]. These types of education have transcended space, time, and types of boundaries. Many non-traditional educational models, such as virtual education..., were born, have been making it possible for new education providers to carry out educational work more smoothly than ever before. The emergence of the market for higher education services in the globalization trend is increasing [4]. Many university programs cross borders from universities through the internet and other means of distance education to learners worldwide. One of the new trends is distance education through "virtual univer-

sities" that can form and develop. A form of transition from an real university to a Metaverse university is the Hybrid university (Augmentation model – replicates everything and enables access anytime and form anywhere – using IT to virtualize the real environment as a means of broadening access [5]). IT has become a driving force in the formation of a global academic environment, and it also contributes to the connection, dissemination, and exchange of all achievements between universities, research institutes, production facilities and corporate groups around the world. There are many types of universities that apply information technology in training. However, main form of deployment is via the internet with e-learning. Currently, some popular forms of training by e-learning are: Technology - Based Training; Computer - Based Training; Web-Based Training; Online Learning/Training; Distance Learning. Nowadays, training model in the Metaverse - Metaversity environment has been formed a in the world.

II. DEFINITION

A. Metaverse

Neal Stephenson coined the term “metaverse” for the first time in his popular novel “Snow Crash” in 1992; and then Facebook rebranded as Meta and declared the metaverse to be Silicon Valley's "next big thing" in 2021 [1].

The Metaverse is the post-reality universe, a perpetual and persistent multiuser environment merging physical reality with digital virtuality. It is based on the convergence of technologies that enable multisensory interactions with virtual environments, digital objects and people such as virtual reality (VR) and augmented reality (AR). Hence, the Metaverse is an interconnected web of social, networked immersive environments in persistent multiuser platforms. It enables seamless embodied user communication in real-time and dynamic interactions with digital artifacts. Its first iteration was a web of virtual worlds where avatars were able to teleport among them. The contemporary iteration of the Metaverse features social, immersive VR platforms compatible with massive multiplayer online video games, open game worlds and AR collaborative spaces [12].

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B. Metaversity

A university inside the Metaverse [4]. It is a concept based on combining Metaverse and University. It is a Metaverse community-based education platform focused on empowering individuals with the skills and knowledge needed to teach and learn, as well as activities related to education and training. In addition, metaversity also helps training institutions and educators... generate income on the web3 in the Metaverse environment. The application of Metaverse in training implementation has been forming a "market" for cross-border education and a sustainable creative industry. Multimedia and interactive display in Metaversity is a new display method that gives learners a variety of experiences, excitement, and fun besides receiving one-way information. They can actively interact with each other, collaborate, and expand to learn more information and knowledge in all relevant fields in the metaverse [1].

The Deputy Minister of Information and Communications affirmed during the conference "The future of the internet", over the past 20 years, Vietnam's internet has developed strongly with a usage rate of 70.3%, becoming an essential need, and the foundation for the development of the digital economy and digital society. This is a great potential when digital transformation in higher education and virtual university application in Metaversity. If metaverse is applied in Vietnamese education, it will be a huge change, bringing practical benefits to learners, lecturers, and administrators, helping to access necessary information for managing and teaching and learning anywhere, anytime with good experiences in metaversity. The university will be better managed, more transparent, more economical and the quality of education will be improved. For examples: Greenwich Vietnam, also recently launched a new campus on Metavert (<https://meta.horizonland.app/>) [4]. It was only integrated into Metavert at first for enrollment and communication purposes. However, this has made a worthwhile contribution to increasing its reputation with the Greenwich Vietnam into community and give learners a good experience in Metavert's ecosystem. The implementation of integrated teaching and learning on metaverse will be expanded and create a large educational ecosystem of Metaversity. With a virtual classroom supported by applications in Metaverse, participating learners can conduct learning and research at their own pace with mentor in the metaverse space; or even there is no mentor at all, simply learners participate in metaversity to experience, interact and create new content... There are virtual classrooms that contain a variety of ready-made learning materials that students can use. Students can follow up without the help of the instructor/ mentor. E-lecturer in this virtual classroom model replaces the lecturer to help learners based on pre-programmed situations and AI learned during e-learning operation.

Learners can have fun and experience with excitement in class instead of just passively studying in physics class. Integrating the interactive display of course content into the Metaverse environment is a new way of applying technology that changes the way a classroom is run. There are many ways to participate in learning on Metaverse. It can be combined

with a traditional classroom at a training facility with the metaverse. It can be combined with a traditional classroom at a training facility with the metaverse. Learners have the feeling that they are really in the classroom with the best experience for learning and developing the necessary skills. It provides the ability to visualize complex phenomena and gather information in the clearest and most complete way. In the metaversity environment, the learner themselves who will decide how and with whom to study... However, to maintain the quality of metaversity, it is necessary to apply the same process management and quality management philosophies to ensure a good training system, a good trainer system and a good digital content system. Metaversity creates an open higher education system with open input, open training, open assessment from many sides, and many perspectives.

III. METAVERSITY MODEL

Metaversity is a digitally built university using VR in the metaverse; a digital university campus is both in sync with and out of sync with the real world. Live Classes were taught by a qualified lecturer. And his lecture can be recorded and deployed to the content library in Metaversity for students to visit and experience for themselves later. Metaversity facilities make physical space "flat" (geographically), meaning that learners and teachers will interact in a virtual classroom environment in metaversity, even though they may be far apart. Smart devices are installed in the classroom to digitize the physical version of the classroom and exist in the Metaverse space as an extension and enhancement of the learner's experience [3]. In the near future, Metaverse as a large society, combined with many technology businesses, also creates conditions for students to participate in virtual reality experiences and have the opportunity to access high technology. On the basis of this research, the paper proposes the following Metaversity model:

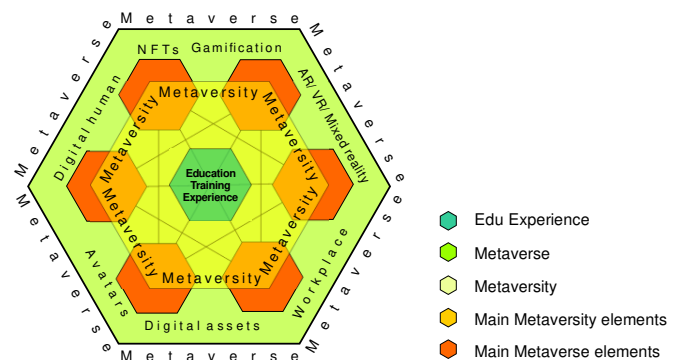


Fig.1. Metaversity model

Metaversity is the result of integrating an entire university into Metaverse: Human (lecturers, administrators, students...); curriculums and teaching, learning materials; teaching methods; assets, facilities... All elements in the real world are digitized and operated in the Metaversity environment to provide the best teaching and learning experience (administrators, lecturers, students...)

A. Learning and teaching ecosystem

Metaversity (learning and teaching ecosystem in the metaverse) emerges and creates a social space for people to learn and share experiences in productive ways: Well-designed immersive environment with interactive way of visualization makes learning sessions focused and engaging with stronger and more memorable visuals. They can be created in the metaverse, both passive learning (the teacher conveys knowledge) and comprehension through reading (the learner read) is replaced by truly experiential learning. Learners can grab, manipulate, and walk around learning objects; they can be immersed in historical events; among many other opportunities.

In education and training, the learning-by-doing process is the best way to learn to accumulate knowledge and form skills, even if it is a large and complex project. As a result, learners are “embedded” in an immersive metaverse while they also use external peripherals to further enhance the learning experience. Overall, the metaverse is a very safe place for learners to “just be themselves” so that they actively learn at their own pace, making mistakes and making mistakes again, until the learning goal is accomplished. Moreover, learning from mistakes is also a good way to master skills. If learners do this in the real world, it will often be very expensive or impossible to do.

B. Metaverse also removes spatial barriers

No matter where learners are, they can enter the immersive world for any learning purpose. Usually, they are spatially sustainable. The learners and teachers from all over the world can interact and work as a team in the metaverse based on a conceptual model just like the real world (both in space and time).

The most compelling feature of the metaverse is that learners can interact with each other and with the instructor, no matter where they are located. Immersive Metaverse enables social and community learning experiences. Today, according to the International Telecommunication Union, 369 million young people do not have access to the Internet, resulting in exclusion, fewer educational resources and limited opportunities for children and young people to access the Internet. UNESCO also reports that 260 million children between the ages of 5 and 16 are out of school. Metaverse will be a connected ecosystem that brings opportunities and access to quality education for all. It acts as an educational bridge in a very effective way. Universities need to work with customers, governments,... to bridge the digital divide in society, and promote educational programs like Connect To Learn, which help achieve the goals and Global Sustainable Development Goals at the same time. The transition from offline “classroom” to “Metaverse”, this is truly a journey to democratize education [1].

Due to the better interaction in the spatial and social structure of the metaverse, lecturer are also more likely to make requests to enhance work. A properly designed Metaversity environment will allow for the creation of entirely new ways of teaching and learning. Instructors can use role-

playing techniques with avatars to present real-life situations. Learners can perform assignments easily because the 3D environment in the metaverse allows to simulate reality accurately [8]. From there, metaversity will build a skill database of learners (collecting different skills and storing them in a standardized skills database).

Learners can chat interactively and lively. In addition to video lectures, hosting live chats can be a good way to engage the learning community and make the learning process a lot more dynamic. A good learning management system will provide ways to interact with students in a virtual classroom. Interactions can be made via video, audio systems or can be live chat based on text input in the interactive screen. Thereby, it is possible to connect everyone in the virtual classroom together to enhance the student's learning experience [9].

Incorporate instant feedback in Metaversity. Everyone feels encouraged to explore with instant feedback on how well they are doing. This can be done in virtual classrooms by taking advantage of one of the most popular features of a learning management system: automated assessment. These automated assessments will map to the e-lecturer's expressions and actions so that students can see the results of their activities in the virtual classroom.

Metaverse helps deploy e-learning training anytime, anywhere, imparting knowledge on demand, providing quick feedback [9]. Learners can access the courses anywhere such as at the office, at home, at public Internet spots, 24 hours a day, 7 days a week. Join their virtual classroom on metaverse to meet the e-lecturer anytime they log-in to the virtual classroom.

Metaverse makes Virtual Classrooms more accessible to learners. Learners will no longer have to wait until class time to ask their lecturer questions: in a virtual classroom, they can be easily contacted to solve any problems while they are practicing [3]. Virtual classrooms with ready-made databases, role-playing-like organization...

Metaverse makes e-learning deployment more flexible. Students can choose from online instructor or self-interactive courses, adjust their learning pace according to their ability, and can enhance their knowledge through online libraries and supporting of e-lecturer [2].

C. Applying Metaverse

Applying Metaverse can focus on two main contents: in educational management and in teaching, learning, testing and evaluation: (1) In educational management, including digitizing management information, creating new system of large interconnected databases, application of AI technologies, blockchain, data analysis,...) to manage, operate, forecast, support decision making quickly and accurately; (2) In teaching, learning, testing and evaluation, including digital materials (e-textbooks, electronic lectures, e-learning lecture warehouses, multiple-choice question banks), digital libraries, laboratories,... virtual experience, deploy online training system, build virtual universities (cyber universities).

To build e-learning in the Metaverse environment, it will be necessary to convert traditional classrooms to digitize – visual/audio digital exercises for 24/7 learning and interaction. Learners and their mentors will automatically rely on the digital data to design a training program that is suitable for their ability and level. Lectures will be based primarily on supportive interactions and intensive teaching based on digitized fundamentals. Metaverse supports content innovation, teaching and learning methods, testing, and evaluation. Support effective implementation of synchronous solutions (including digital data e-learning lectures, electronic lesson design software, simulation software and teaching software). IoT, big data, artificial intelligence and machine learning AV/VR, security, blockchain, chatbots, Increased Accessibility... build and form a unified training ecosystem to connect hardware with software into smart, energy-efficient products and easily expand the system and Metaverse space. Grasping this trend of new digital technologies, universities can convert lectures into videos, play and learn (Gamification) to virtual reality (VR) and AR applications.

The simplest way is to use AR to add explanatory information about the images in the real space of the classroom, or simply on each image section of the reference book or a part of the classroom space with virtual classroom space in Metaverse. The Integrated Hybrid Classroom (combine online and offline at the same time) can even use AR to render 3D (digital versions) of models. Universities will not need to build large classrooms / lecture halls with a capacity of thousands of students. Instead, the university just builds presentations that can be created and saved in a virtual environment using digital technology or can be uploaded to Metaverse, setting up an online classroom directly in Metaverse... Learners can easily enter the classroom, access the lecture content data, and can download each part to learn (based on compliance with copyright law).

A lecturer's workflow in Metaverse could be: (1) first creating original immersive content that can be hosted in metaversity; (2) then this content will be assigned to a blockchain such as NFT and ensure that the blockchain used by the NFT is the same as used by the metaverse; (3) publish content in metaversity, assign rights and avail of viewing, using, modification and possible resale of the content [1]. Metaverse allows content creators with blockchain technology to turn into assets (cryptocurrency). These digital assets can be used in the real world through rendering devices or traded under NFT as is the case with cryptocurrencies.

Even learners become content creators and can leverage their "property". A student might create a product as part of a project assignment. Once converted and become part of the blockchain, that "creative" product will allow students to monetize the creation of digital assets. Thereby, learners can use their metaverse to communicate, connect, play some games, exhibit important solutions, co-create business projects, etc. Metaverse has gradually improved in terms of platform, scale, security, and partnerships to achieve one result: a dramatically enhanced learning experience that improves learning outcomes and the teaching experience.

D. Disadvantages of e-learning on Metaverse

In addition to the outstanding potential of being applied in the future, e-learning on Metaverse also has some disadvantages. Some common problems such as: emotional and spatial issues that make an impression on learners; Direct interaction with learners is limited due to limitations of technology. Need to be connected to high-speed internet (5G) and connect to many network-connected devices to learn. If there is a problem with the equipment or the transmission network, learning will be interrupted; Haven't created a lively space like a traditional classroom.

Besides, Metaverse also requires computing power, and needs a large human resource of engineers, designers, and administrators to keep Metaverse up and working. Metaverse will need a large-scale technology infrastructure, from computing power to compute, 3D visualization to content for financial and trading systems. Going forward, Metaverse is still a technology built by many organizations. In addition, it is necessary to develop policies related to learning materials such as intellectual property, copyright; related to the quality of teaching in the network environment such as network information security [10]; related to personal information protection, information security in the network environment; and regulations related to the conditions for organization of online teaching and learning, quality accreditation, legality, and recognition of learning results...

IV. CONCLUSION

In short, the digital era has now created very favorable opportunities to improve training quality and develop sustainably. Metaverse and gamification is one of the new trends in the context of the industrial revolution 4.0, helping to enhance the learner's experience while improving the quality of training. It helps us a lot in training management, in all stages of the teaching and learning process: from preparing lesson outlines, designing programs, lectures, implementing subjects, exchanging and interacting with people learning, grading and exhibition, communication activities... can all be integrated with multimedia in metaverse. By integrating multimedia, technology in the teaching and learning process will enable rich and vivid content transmissions in real or virtual contexts. VR or AR can help to enhance the interpretation of complex ideas, explore human knowledge, increase interaction opportunities, provide user experiences... Vietnam is on the road of Industrialization, Modernization, deep international integration in all areas of life, including education and training... The research and deployment of e-learning applications in the metaverse environment will help Vietnamese education develop quickly and sustainably.

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