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Metaverse and Education: A Future Without Boundaries

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Abstract

In the era of vast cognitive progress and accelerated scientific advancement, the necessity of digital transformation in education has become paramount. Engaging in digital technology is essential to keep pace with this advanced scientific progress. Consequently, many modern technologies have emerged, such as artificial intelligence, chatbots, blockchain, and other technologies used across various sectors and fields including education, health, industry, and economics. Education, being the vital arena benefiting from digital transformation in its various facets—teachers, learners, content, and learning environments—has aimed primarily in this study to shed light on the use of Metaverse technology in education. It clarifies the benefits and areas enabled by Metaverse for education, highlighting some foreign and Arab experiences that have implemented Metaverse in education. The study also elucidates the added value of outputs resulting from the use of Metaverse in education, transitioning education to diverse worlds through digital electronic platforms available via subscriptions. These platforms allow selection of branches and educational materials that align with students' qualifications, intelligence levels, and their ability to interact with virtual, augmented, and real realities, as well as artificial intelligence strategies. Results of the Study: The results indicate that Metaverse technology can bring about a qualitative leap in education and initiate a real revolution across its various domains. From creating excitement and engagement in lessons, fosters an active learning environment where all educational paths interact, spanning virtual, augmented, and real realities, culminating in an extended reality. Metaverse technology enables teachers and learners to innovate, think creatively, and solve problems, thus making education more effective and responsive to learners' needs and fostering an enthusiastic desire for learning. It creates an engaging environment for learners and facilitates the creation of experiential and practice-based educational content. Moreover, it supports continuous high-quality development of educational content. Education is an industry, and investing in it is economically and socially essential, aligning with the priorities of sustainable development.

Keywords: Digital Technology - Metaverse - Virtual Reality (VR) - Augmented Reality (Educational Environment.)

Introduction

In this context, I wish to rewind a bit into history to clarify humanity's perpetual pursuit of self-improvement and the development of everything around them, always searching for the better. Human beings are resilient and persistent, adapting to their surroundings to survive and striving for continuity and secure, tranquil living. Anyone who delves into history and contemplates human stories realizes immediately that evolution is a fundamental trait of humanity, inherent in its instincts and nature. This evolution has varied across historical epochs and diversified with human environments.

In our present age, technology has become an inevitable necessity in all aspects of life—educational, health-related, social, economic, and more. Technology has emerged as the defining feature of the 21st-century human, leaving its mark notably in the educational field, both within and outside classrooms. Administrative work in educational institutions has become significantly dependent on technology, particularly evident during crises and rapid changes, as

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exemplified by the COVID-19 pandemic.

Metaverse technology has emerged as an inevitable result of this technological evolution, representing a product of digitization and communication advancements. These developments have permeated all facets of our lives, becoming integral to our activities and engagements. This study will delve into Metaverse technology, its applications in education, and its effectiveness for teachers, learners, and the educational process (1)

This leads us to pose many questions to ourselves and others, the most important being:

Study Questions:

1. What is meant by Metaverse technology and what are its prominent fields and characteristics?
2. What are the benefits resulting from the use of Metaverse in education for students, teachers, and the educational process?
3. How can Metaverse technology be effectively utilized in education?
4. What are the challenges facing the implementation of Metaverse technology in educational institutions?

Study Objectives:

1. Understanding Metaverse technology, its prominent fields, and its characteristics.
2. Understanding the benefits of Metaverse technology and its effectiveness on teachers, learners, and curricula.
3. Analyzing the impact of Metaverse technology effectiveness on the academic achievement of learners through the three-dimensional learning experience, allowing students to explore the educational space in more detail and realism.
4. Providing Insights and Recommendations to Address Challenges and Enhance the Use of Metaverse Technology in Improving Education and Reviewing Some Foreign and Arab Experiences in Applying Metaverse in Education.

Research Methodology:

The study employed a descriptive-analytical methodology, which described the study phenomenon and analyzed its data among its components, opinions expressed about it, and the effects. Previous studies related to digital technology, Metaverse technology, and its effectiveness on the educational process were reviewed. The study analyzed the negatives and positives encountered in applying Metaverse technology in education. Finally, the study will present a set of recommendations aimed at enhancing the use of Metaverse technology in education, along with proposals to address difficulties and amplify the positives.

Digital Technology Concept

Digital technologies are electronic tools, systems, devices, and resources that create, store, or process data. They encompass well-known examples such as social media, online games, multimedia, and mobile phones. (2)

The World of Metaverse:

Metaverse technology emerged with the advancement of telecommunications and information

technology. Its importance increased following crises and disasters that necessitated social distancing worldwide. Although Metaverse technology offers several advantages and benefits in the education sector, it has not yet evolved sufficiently to meet all the sector's needs, such as those of people with disabilities, in addition to its excessive cost, which may not be feasible for most countries. Nevertheless, this does not prevent it from spreading and becoming fundamental to educational systems worldwide. Metaverse gained prominence during the COVID-19 pandemic, supporting distance learning and rapidly integrating into educational frameworks on a large scale. (3)

The term "Metaverse" is composed of two parts: "Meta," which means "beyond" in Greek, and "verse," which refers to the universe or world. Therefore, the term signifies what comes after reality if we are to use the expression correctly. It represents the latest technological advancements achieved through gradual evolution in the realm of the internet and the web.

It has also been described as the integration of the virtual world with the real world, driven by technology, where people interact digitally through digital representations and avatars. It is a post-reality world where physical life is integrated with virtual environments via a network that includes a mix of Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), and three-dimensional (3D) environments, in addition to Artificial Intelligence (AI) technologies. Interaction within this environment occurs in real-time, effectively, and continuously.

This platform enables an unlimited number of people around the world to participate, providing a truly immersive environment for users, a genuine sense of presence, and real virtual communication in environments that closely mimic real-life settings. Users are represented by avatars, allowing for genuine interaction and sensory experiences, and these avatars are known as "Avatars." This interaction facilitates engagement in various activities like those in the real world, such as collaborating with colleagues, celebrating events with friends, and participating in festivities. (4)

Concept of the Metaverse: It is a modern technological concept that emerged and evolved in 2021 due to the efforts of technology scientists and their statements, along with the entry of major companies such as Microsoft, Epic Games, and Nvidia, into the world of Metaverse with massive projects. Research discussing Metaverse has indicated that there is still ambiguity and difficulty in finding a clear definition and understanding of Metaverse and its nature.

Definition: The Merriam-Webster dictionary defines the Metaverse as: "The natural evolution of the internet where it represents a stable virtual environment allowing access to numerous individual virtual realities and their interoperability



" Figure (1) illustrates that Metaverse is a technology that combines augmented reality, virtual reality, and three-dimensional environments.

Virtual worlds in three dimensions where people interact as groups with software agents, borrowing from the real world but without physical constraints, represent the Metaverse technology as follows (5)

In short, we can say that Metaverse technology is a modern technology that enables users to communicate and work in a virtual environment that combines virtual reality, augmented reality, and three-dimensional environments. It also provides engaging and enjoyable interaction in lifelike environments, adding happiness, attractiveness, and fun to users' interactions.

Tools of the Metaverse:

- Glasses and their types, lenses.
- Auxiliary devices: such as phones, large screens, computers, and speakers.

Metaverse and Education:

The researcher defines Metaverse technology in the educational process as an online communication technology between teachers and students, where the classroom is virtual. Teachers and students appear in three-dimensional forms, and the teacher explains and discusses with students using their sensations and awareness in a virtual environment that provides them with all educational possibilities and environmental views, in addition to artificial intelligence applications. This is achieved by wearing augmented reality glasses in three dimensions.

Education has greatly benefited from the extensive application and use of Information and Communication Technology (ICT) in both classroom and administrative settings within educational institutions. According to Ali Amin-Hussein (2022), emergency conditions such as the COVID-19 pandemic, wars, and disasters have contributed to creating a suitable educational environment. This forced governments, official educational institutions, teachers, parents, and students to utilize the available assistive technology in the educational field and distance learning.

As a result, Metaverse has significantly entered the education sector and spread widely. Metaverse technology provides Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), and three-dimensional (3D) environments, in addition to Artificial Intelligence (AI) technologies. Interaction with these technologies occurs in real-time, effectively, and continuously, involving an unlimited number of people worldwide. It offers users a truly immersive environment and a realistic sense, with genuine virtual interaction in environments that closely resemble real-world settings (7)

Metaverse has emerged as a natural outcome of the remarkable advancement in digitalization and communications witnessed in the modern age. Particularly, Metaverse has been heavily used in media and has extended to other areas and activities of life. Its use has expanded extensively in social media platforms, becoming a reality rather than mere imagination, as initially speculated.

The uses of the metaverse in the educational field are advancing rapidly, owing to the innovative technology it employs, which attracts learners and assists educators in providing distinctive learning opportunities and capabilities. The following figure illustrates the potential uses of the metaverse in education, where learners are brought together in a virtual and augmented reality world using telecommunications technology and artificial intelligence applications:

"8" Zhang X, Chen Y, Hu L and Wang Y (2022)

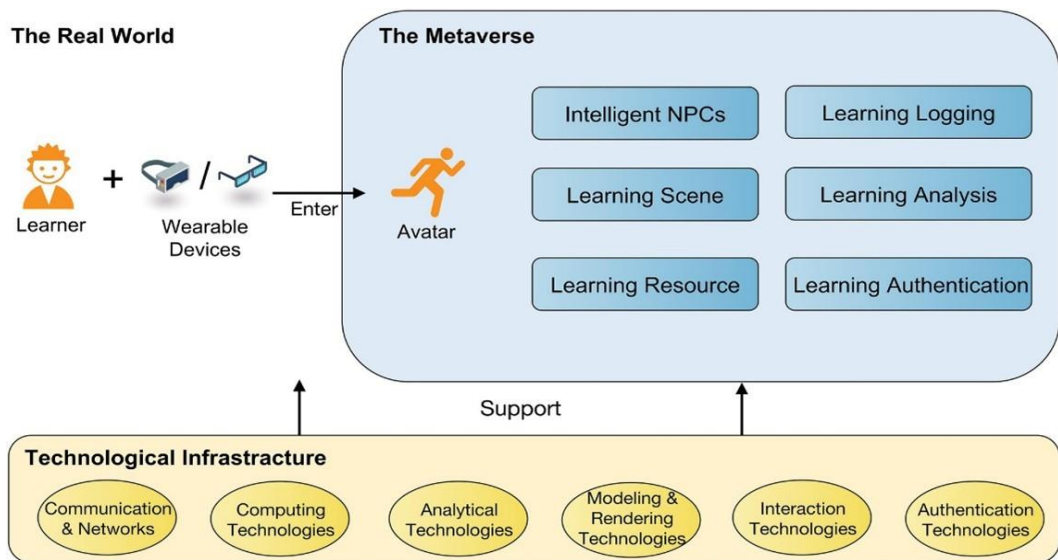


Figure (2):

Illustrates the features available in metaverse technology.

- Enhanced Reality.
- Virtual Reality.
- Artificial Intelligence.
- Semi-real Reality.

- Reflection and feelings related to the learning process.
- Interaction between teacher and learners and each other.
- Three-dimensional imaging technology.

I will talk in some detail about the benefits and advantages of using Metaverse technology in education with the following points:

Firstly, around teacher preparations to create a suitable classroom environment for educational materials:

A. **Metaverse technology allows teachers to set up a classroom environment that suits their subject matter.** It also enables them to choose an engaging educational environment for their students through the available models provided by this technology.

B. Metaverse technology facilitates easy access to and communication with students by bypassing barriers through the virtual world, overcoming the challenges of remote learning. It enables remote learning with direct interaction with students that simulates the natural educational environment.

C. It also helps overcome obstacles posed by crises and emergencies that enforce social distancing, such as the COVID-19 pandemic, epidemics, wars, and natural disasters. (9)

Secondly, in the field of scientific subjects:

A. Metaverse technology contributes to presenting any scientific subject engagingly and attractively for students, thereby enhancing their intellectual capabilities.

B. Additionally, Metaverse technology allows for the presentation of scientific materials, and difficult and hazardous samples in a safe environment that does not harm students during preparation.

C. Metaverse technology achieves the transition of students into a virtual world that rivals the real world for displaying natural environments such as mountains, plains, and seas. This provides a technological and scientific environment where students can observe and explore educational materials or study topics realistically (10)

Thirdly, in the realm of increasing students' motivation and attractiveness to learning:

A. Metaverse technology enhances students' motivation and attracts them to the educational process through augmented reality used by teachers. This increases their engagement and interaction with scientific subjects, fostering their learning capability and acquisition of knowledge.

B. Metaverse technology enables the clarification and elaboration of complex scientific material by explaining its details through high-quality graphics, images, and videos.

C. Metaverse technology appeals to students due to their affinity for modern technology and its applications, coupled with the entertainment factor present in the virtual classroom environment. (11)

Studies utilizing Metaverse technology in education have confirmed that students who learn and train using virtual reality achieve outstanding results across multiple domains. This underscores the importance of applying Metaverse technology in various educational fields.

These studies have shown a significant increase in students' confidence, up to 75%, in using what they have learned after training. Furthermore, the studies indicate that using Metaverse technology in education has led to improvements of up to 40% in learning outcomes compared to traditional methods. Results also demonstrate a preference of 35% for Metaverse over traditional e-learning methods.

These findings highlight the transformative impact of Metaverse technology on educational outcomes and student engagement.

We conclude from the above that Metaverse is of immense importance in the field of education because:

- It contributes to simplifying the complexities of sciences.
- It expands the geographic and temporal boundaries of learning, allowing students and teachers to interact and learn across geographical borders, thereby making learning accessible to learners worldwide.
- It enhances interaction between learners, teachers, and educational material.
- It diversifies teaching strategies and methods such as active learning to improve focus and understanding of complex concepts. It also promotes cooperative and social learning through interactive activities and collaborative projects that students can participate in within these virtual environments.
- Learning within a three-dimensional virtual learning environment allows for exploration, observation, and immersion, resembling real-world experiences.
- It provides rich, realistic field educational experiences, enabling learners to interact with educational materials and content in ways that simulate and match real-world situations.
- It provides entertainment for students through electronic games, and access to educational resources including e-books, interactive study clips, and educational games, thereby enhancing diversity and comprehensive learning.
- It offers environments for continuous learning and professional development for teachers and professionals in various fields, promoting continuous updating and development of skills and knowledge.
- It provides security precautions when conducting experiments in laboratories to avoid real-world risks, while also increasing interaction rates among learners.

Comparison between Education using Metaverse Technology and Traditional Education:

education in the traditional way	Education using metaverse technology	comparison
This often happens inside actual classrooms in schools or universities, where students and teachers are physically present in the same location.	In a three-dimensional virtual environment, students and teachers interact in ways like real life, but within a virtual setting.	-1the learning environment
In traditional education, interaction typically occurs	In the metaverse, interaction becomes more dynamic and interactive, with the ability to	-2ways of interaction

face-to-face between the teacher and students, with the direct exchange of questions, answers, and discussions.	interact with virtual objects and individuals in ways that are not possible, such as interactive scientific experiments or virtual educational trips.	
Traditional education relies on using conventional educational materials such as books, whiteboards, paper-based books, and diagrams.	In the metaverse, advanced technologies like virtual reality and virtual visits to historical or scientific locations can be used, providing rich and engaging learning experiences.	3 the educational experience
Traditional education may lead to deeper learning of conventional concepts that require greater focus on handwritten work, real discussions, and critical analysis.	It is expected that education in the metaverse will enhance social interaction and collaboration skills among students, due to its interactive nature and strong participation in this environment.	4 anticipated results
Traditional education faces challenges such as obtaining financial resources to meet its needs and dealing with the variables of real and realistic educational environments.	Education in the metaverse faces challenges such as prohibitive costs for developing and maintaining virtual environments, as well as security and privacy risks.	-5 challenges and risks

The main educational applications of the metaverse include:

1. Virtual laboratories: Virtual reality in libraries, virtual educational games, virtual tours, and virtual museums (12). Virtual laboratories provide a simulation experience of real laboratories and achieve results like those obtained in actual labs. They have contributed to enhancing students' understanding of abstract concepts and making them more tangible through a sensory experience closer to reality. Additionally, they have helped overcome risks and problems that students may encounter during experiments in real laboratories. Their usage has spread across various fields such as sciences, pharmacy, engineering, school labs, and others.

2. Virtual tours, also known by several names all referring to the same concept, such as 360-degree tours and QuickTime tours, are an effective online method to virtually visit archaeological, tourist sites, and museums. These tours enhance learners' understanding of lessons that are difficult to access or explain through symbols and words alone. For example, a historical tour may include past historical events or a space tour to explore galaxies and planets.) (13- from the Internet)

3. Virtual museums: technology does not necessarily require physical presence in the real world. They are created online to introduce the public to several types of museums and aim to preserve cultural heritage such as paintings, pottery, photographs, and sculptures. They provide research on their history and offer valuable information about them." 14 "From Internet

4. Virtual theaters: These contribute to creating a virtual environment that embodies real or imaginary settings for the audience. They enable the audience to navigate in real-time or pre-recorded virtual space. These presentations rely on simulation processes conducted via

computers, utilizing screens, video cameras, and other media in the virtual theater stage. Audiences typically view these performances by wearing virtual reality glasses. (15)

5. Virtual educational games: These games aim to provide and transform virtual reality into educational games and applications, boasting significant potential. They create an interactive environment among learners, allowing them to directly explore their imagination. This maximizes the potential that supports learning communities, providing essential tools to support educational and creative activities.

6. Virtual reality technology in libraries: Libraries are transforming into educational and experiential community centers. Libraries are striving to convert physical materials into digital formats and provide them online, making them capable of using virtual reality technologies as a primary source for presenting historical events in the future. Additionally, virtual books can be accessed without the need to visit the physical library in many instances.

Negatives and drawbacks of Metaverse:

Despite the benefits of the Metaverse in the field of education, it carries some drawbacks among its technologies. One of the most important ones is:

- Difficulty of use, as it requires training for teachers and learners on how to use and employ it correctly.
- Full interaction with metaverse technology can lead to cases of fear, negatively impacting health and safety, such as visual impairment, dizziness, and nausea.
- It also requires time to learn how to use these devices.
- Excessive cost of acquisition and production of virtual programs.
- Metaverse technology requires expensive equipment such as gloves for interacting with virtual elements and immersive glasses for virtual world immersion.
- Converting schools and universities to virtual reality via metaverse technology requires training teachers to gain experience and expertise.
- Designing educational curricula that rely on virtual technology, providing necessary devices and tools for applying virtual technology, and establishing rules and guidelines for metaverses use in education.
- Conducting continuous studies to assess the effectiveness of virtual technology in education.

Scientific studies that examined the outcomes of using metaverses technology in the educational process

Foreign Studies:

1- After the COVID-19 pandemic, a study conducted in South Korea aimed to analyze experiences and perspectives on MetaVerse for education focusing on learner-centered approaches to assess the extent to which this virtual environment relates to the lives of elementary school students. The study also examined how students became the focal point for new educational technologies. Following a literature review on the topic, a survey study was conducted with 336 elementary school students in Korea using eighteen items to measure each aspect of MetaVerse. Statistical analyses, including mean differences and an independent samples t-test, showed that on average, 97.9% of elementary school students had experiences

with MetaVerse, with 95.5% of them believing it was intricately linked to their daily lives. (16)

2-Study : Contreras et al. 2022 Contreras, G. S., González, A. H., Fernández (17)

The study examined the evolutionary stages of MetaVerse applications and their uses in American universities, starting in the 1990s. It highlighted numerous achievements in communication, simulation, modeling, and the development of three-dimensional virtual classrooms. These advancements led to the concept of MetaVerse, an environment where humans interact socially as avatars, significantly enhancing the effectiveness of MetaVerse technology in higher education in the United States.

3-Study Tlili et al. 2022 Tlili, A., Huang, R., Shehata, (18)

The study discussed the uses of MetaVerse in the education sector and whether it is a boon or a ban. The study conducted a systematic review of the literature on MetaVerse in education. Content analysis and bibliometric analysis were applied to uncover research trends, focuses, and limitations related to MetaVerse in education. The results highlighted a significant gap in real-life applications of educational MetaVerse. Additionally, the results showed that the design of MetaVerse in education has evolved across generations, with Generation Z being targeted more with artificial intelligence technologies compared to Generation X or Y.

Regarding learning scenarios, very few studies focused on mobile learning, blended learning, and partial learning. Furthermore, no study focused on using MetaVerse in educating students with disabilities. These findings provide a roadmap for future research directions that should be considered and investigated to enhance the adoption of MetaVerse in education globally and enrich learning and teaching experiences in MetaVerse.

4-Study: Inceoglu, M. M., & Ciloglulil (19)

The study discussed MetaVerse technology in the education sector, pointing out its increasing use daily. This study explored the factors influencing the historical development of MetaVerse, its architectural engineering, and its use in education. Strengths and weaknesses in the use of MetaVerse in education were emphasized, examining the opportunities it could offer as well as the problems and threats it might face. Given that MetaVerse is a new concept, attempts were made to propose resources for its use in education based on a limited number of sources currently available in literature. The study highlighted that MetaVerse could add a new dimension to educational technology. However, it is crucial to consider that the necessary technologies and infrastructures in this field are not yet sufficiently mature. Therefore, it is essential to identify appropriate strategies for using MetaVerse in the educational field and to begin assessing its broad impact until MetaVerse infrastructures mature.

Experiments with MetaVerse in Arab Universities:

1- Al-Azhar University Experience - MetaVerse Technology and the Future of Home Economics Education in the Digital Learning Era: A Foresight Study "20" by Judge Mahmoud Mohamed Lamia (2023) -

The research aimed to monitor the perceptions and trends of experts and specialists in the field of educational technology and home economics in educational institutions regarding the employment of MetaVerse technology in education in general and specifically in home economics education in the context of digital learning. To achieve this goal, the study utilized the foresight approach using the Delphi method to forecast the future and understand expert

opinions. The research methodology also

included a descriptive survey-analytical method. The research tools consisted of two instruments:

A - In-depth Interview Tool with Research Sample.

B - Survey Tool to Gauge Experts' Opinions on the Feasibility of Employing MetaVerse Technology in Home Economics Education in the Future, with the research sample consisting of:

- Experts in educational technology and home economics, faculty members totaling sixty individuals, in addition to supervisors and teachers. The survey was conducted in the first semester of the academic year 2023/2022. Key findings of the study:

- There is a critical need to raise awareness about MetaVerse technology and its application areas, enhance the positives of the technology, and mitigate its negatives and resulting impacts.

- Full institutional integration of MetaVerse technology is recommended, along with the preparation of qualified human resources capable of managing this technology. Additionally, it is crucial to have initiative-taking management that emphasize strategic planning for its implementation.

Some of the key challenges facing the deployment of MetaVerse technology include:

- Insufficient infrastructure required to operate the technology in education, necessitating continuous updates and development.

- Limited qualified human resources capable of effectively utilizing the technology.

- Future insights derived from the study highlight the need for concerted efforts from management and staff to deploy the technology. Additionally, the study concluded that it is still premature to implement MetaVerse technology in home economics education due to the lack of a robust electronic environment equipped with suitable classrooms. The research recommended the necessity to provide the requirements, overcome obstacles, and address challenges that may hinder the deployment of MetaVerse technology in education in general, and specifically in home economics education.

The "MetaVerse" market in the United Arab Emirates has achieved advanced growth, with a compounded annual growth rate reaching 28% from 2023 to 2028, according to a report by MarkNtel Advisors, a research and study institution. The report indicated that the Abu Dhabi government launched the "AD Gaming" platform in 2022, and in the same year, the Dubai government organized the Dubai eSports Festival, bringing together players, industry specialists, and enthusiasts to celebrate the latest trends and developments in the gaming sector. It is expected that the popularity of esports, including virtual reality, augmented reality, immersive sound, and social interaction platforms, will continue to rise alongside these initiatives. "19" Union News Center

The vision of the United Arab Emirates to become a global hub for the "MetaVerse" community and one of the world's largest economies in the growth of the "Metaverse" market is intricately linked to initiatives in artificial intelligence and robotics. These technologies provide the technological infrastructure for creating and simulating virtual environments. Additionally, governmental support for artificial intelligence and robotics

has attracted talented professionals and entrepreneurs to the country, contributing to the growth of its market.

The UAE's National Artificial Intelligence Strategy 2031 aims to establish the United Arab Emirates as a global leader in the field of artificial intelligence by the year 2031, supporting the market throughout the forecast period.

The UAE has become a global center for NFTs due to the significant rise in their buying, selling, and creation. They are increasingly used to establish ownership and generate income from digital creations. In 2022, several NFT markets emerged in the country, driven by the entry of startups, cryptocurrency exchanges, and more. Consequently, this market is currently experiencing substantial investment growth, expected to continue expanding, particularly in diverse applications ranging from virtual real estate to unique virtual assets."20" Al-Ittihad News Center op.cit.

Digital Transformation in Education in the UAE:

The UAE prioritizes and emphasizes the importance of enhancing digital transformation in education through:

- A. Adopting a clear visionary outlook for an innovative educational future centered around advanced technology and digital solutions,
- B. Launching several initiatives announced by the UAE government in this field, which have played a tangible role in achieving the goals of digital transformation in the education sector.

Key Initiatives:

1. Digital School: This is the first integrated digital school of its kind in the UAE and the Arab world.

Objectives of the Digital School:

- A. Empower students with digital learning options in areas lacking suitable conditions or resources for their education.
- B. Provide a qualitative option for blended learning and distance learning smartly and flexibly.

It is essential to note:

1. The convening of the World Government Summit 2024, during which the report "Status of Computer Science, Information Technology, and Telecommunications Education in the United Arab Emirates" was launched. This report highlights significant advancements in foundational digital education.
2. The UAE allocated a substantial educational budget of \$2.7 billion in 2023 and \$2.8 billion in 2024.

These points underscore the UAE's commitment and substantial investment in advancing digital education and technology integration within its educational framework.

3- Support for Digital Transformation:

The future industry has become a legacy and a steadfast approach for the UAE. Recognizing the significance of this approach, the visionary leadership spared no effort in supporting digital transformation in education. Adequate financial allocations were earmarked to meet the needs

of this transformation, alongside the formulation of best practices to enhance the quality of this crucial sector. These efforts align with national transformation plans aimed at developing a knowledge-based economy.

Moreover, the state has focused on employing innovative solutions and generative artificial intelligence tools across various fields. This indicates that the focus is not limited solely to distance education and learning. Advanced technologies such as Metaverse, virtual reality, and augmented reality have contributed to creating interactive learning environments within and beyond educational settings. This adaptation is crucial amidst the rapid changes observed in the digital space.

Factors that may lead to the delay of Arab universities in implementing modern technologies such as the Metaverse in education.

Arab universities are still taking slow steps toward implementing the Metaverse in higher education, for several reasons including:

The challenges are:

-Technological Challenges: Universities may face difficulty in implementing modern technologies due to limited capacity to update technological infrastructure and inadequate resources.

-Traditional Educational Culture: There may be resistance to changing traditional teaching methods and transitioning to more advanced and effective educational models.

- Lack of Technical Expertise: There might be a shortage of technical expertise among faculty members and administrative staff, making it difficult to implement technological changes.

-Financial Challenges: Universities may struggle to secure the necessary funding to implement modern technologies in education, resulting in delays in this regard.

-Policies and Legislation: Legal or political obstacles may prevent the application of modern technologies in education, such as copyright laws or restrictions on technology use in educational institutions.

Conclusion:

Based on the comprehensive study and analysis of Metaverse technology and its effectiveness in education, we can conclude that it is an innovative and intriguing technology promising a profound transformation across several sectors, including education, training, industry, and the economy. By providing interactive experiences and a virtual reality akin to the real world, Metaverse is considered an inspiring opportunity to foster innovation and enhance human experiences in diverse contexts.

Based on the analysis of data and results, we propose several points regarding the future.

Research Directions and Applications of Metaverse:

- Continuing Studies and Scientific Research: Continuously improving Metaverse technology and expanding its applications through ongoing studies and scientific research.

- Conducting More Scientific and Field Experiments: Further exploring the impact of Metaverse on society, economy, and culture through scientific and field experiments.

- **Developing Educational Tools and Resources:** Creating educational tools and resources that leverage Metaverse technology to enhance learning processes and motivate students.

- **Focusing on Specific Applications:** Concentrating on Metaverse applications in specific fields such as skills training, medical education, and engineering design.

These points suggest avenues for advancing Metaverse technology and maximizing its potential across various domains, fostering innovation, and enriching human experiences.

In conclusion: it is crucial to understand that virtual technologies like the Metaverse are not just technological tools; they are instruments for enhancing communication, fostering learning, and driving human development. By using them effectively and sustainably, Metaverse technology can catalyze positive transformation in our knowledge-based societies and economies. It is expected that by 2030, Metaverse's contribution to the global economy could reach approximately \$5 trillion, with the expected market value of non-fungible tokens (NFTs) reaching around \$80 billion. Additionally, consumer spending on in-game purchases is projected to reach \$75 billion by 2025. These figures highlight the potential economic impact and the growing significance of Metaverse in shaping future digital experiences and economic landscapes.

Recommendations:

- 1- Support research and development in the field of Metaverse through funding and investment in technological and educational infrastructure.
- 2- Encourage international cooperation and exchange of knowledge and expertise in the field of Metaverse.
- 3- Provide training and qualifications for teachers and staff to effectively manage Metaverse technologies.
- 4- Establish policies and legislation that support positive applications and protect users' rights in the field of Metaverse.
- 5- Create platforms for Metaverse related to both private and public institutions.
- 6- Set guidelines for the use of Metaverse in the education sector among teachers, students, and parents according to societal customs and traditions.
- 7- Utilize Metaverse technology in education according to educational content requirements and process conditions.
- 8- Harness Metaverse technology for practical explanations of hazardous materials or practical experiments when necessary.
- 9- Utilize Metaverse technology for distance learning during crises and disasters facing the community.

By implementing these recommendations and committing to continuous research and innovation, we can achieve progress and prosperity using Metaverse technology. Education is the foundation and catalyst for comprehensive and sustainable development sought and provided by global communities for their people.

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