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PAPER

The Importance of Using Metaverse Technology in Education from the Point of View of University Teachers

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ABSTRACT

The study aims to demonstrate the significance of metaverse technology across various disciplines, academic degrees, scientific fields, and academic titles. It also aims to assess the level of knowledge and understanding of university teachers (research sample) regarding metaverse technology. Hence, the descriptive research methodology was based on the method of statistical survey in the sample. It involved a set of organized scientific steps to deduce data from the reality of the statistical sample and its nature in order to achieve the objectives of the study. In this study, a questionnaire was used as a tool to collect data from a random sample of approximately 121 teachers and instructors from the University of Baghdad. This approach helped the study draw important conclusions and make recommendations. Specifically, the study found the following: there is a need for a clear understanding of the importance of implementing metaverse technology in university education; teachers in scientific colleges are more aware of its importance compared to their counterparts in humanitarian colleges; there is a strong call for all universities, colleges, and academic institutions to prioritize the application of metaverse technology in university education; there should be the availability of all necessary supplies and devices; and there should be the creation of an appropriate environment for teachers to effectively use metaverse technology when teaching students.

KEYWORDS

platforms, metaverses, technologies, universities, environment, education

1 INTRODUCTION

Modern science has extensively studied the most crucial scientific methods in education, particularly in university academic institutions. The aim is to attain the utmost level of knowledge, technology, and skills in both theoretical and applied aspects. These methods play a significant role in enhancing the abilities of university

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teachers, refining their skills, and benefiting from their experiences. Additionally, they contribute to the development of university students' skills and enable them to effectively utilize their energies. Ultimately, this prepares them to fulfill their active roles in the labor market. Due to the importance of utilizing metaverse technology and its necessity, which has been evident in all disciplines during the integration of e-learning in universities, its use has become essential in order to keep up with the advancements observed in neighboring countries and around the world. This should be done in accordance with the available resources and the capabilities of both the university teachers and students, who should be prepared to engage in this crucial experience and benefit from the information it provides in various fields. As a result of the emergence of the Internet, the need for e-learning became apparent, and in recent years, the Internet has witnessed significant development. At the inception of the Internet, e-learning was primarily limited to text-based resources. However, with significant advancements in Internet technologies, e-learning tools have undergone a remarkable transformation, now offering comprehensive and dynamic learning environments. By the same token, communication technologies have developed, and the penetration of high-speed Internet access service through digital subscriber lines (DSL) has positively affected the change in the concept of e-learning, methods of presentation, and compatibility with it to include more interactive aspects [1]. Recently, this has led to the emergence of what is called "e-learning 2G," which focuses on incorporating social and other programs into the educational process. It also contributed to the rise of new e-learning environments known as virtual environments or virtual reality (VR). VR is a technology that uses images and three-dimensional digital videos to create immersive visual experiences for users. This can be achieved through the use of computers, glasses, stereo headphones, high-resolution specifications, game controllers, mobile phones, or other technologies that incorporate three-dimensional graphics. This allows the learner to experience a sense of presence and complete immersion when the real world and the virtual metaverse world come together harmoniously [2–5]. The metaverse represents an integrated current and future set of the physical and virtual worlds that connect the Internet of things (IoT) and other aspects of human life. It encompasses a wide range of applications for computer networks, mobile devices, and various forms of reality (augmented, virtual, alternative, mixed, and extended), as well as artificial intelligence (AI) and robotics. So far, the metaverse has been able to provide a wide range of opportunities for human imagination and potential job prospects. It has given rise to new patterns of e-business, digital currencies, e-learning, and various immersive social and virtual activities. These activities include expertise in science, technology, engineering, and mathematics (STEM) teaching and education through gaming-based learning (GBL). The term "metaverse" refers to the integration of the IoT and STEM applications into everyday life, encompassing both he physical and virtual worlds [6–8]. The problem of the study focuses on the following question:

What is the importance of utilizing metaverse technology in education for university teachers?

2 SIGNIFICANCE OF THE STUDY

The significance of the study is reflected in the need to incorporate modern methods and e-learning into university teaching. Many foreign and Arab universities have already started utilizing different technological tools and techniques in their teaching practices, particularly metaverse technology. The study focuses on defining

metaverse technology, its origins, characteristics, and applications in education. It aims to assess the level of understanding and importance of metaverse technology among university teachers, as well as present some examples of Arab experiences in using this technology in educational and academic institutions.

2.1 Aims of the study

1. Learn about the metaverse technique.
2. Determine the level of understanding of metaverse technology among university teachers (research sample).
3. Identify the importance of metaverse technology among university teachers (research sample) based on their humanitarian and scientific specialization.
4. Identify the importance of metaverse technology among university teachers (research sample) based on their academic achievements in master's and doctoral programs.
5. Identify the importance of metaverse technology among university teachers (research sample) based on their academic titles (assistant instructor, instructor, assistant professor, and professor).

3 LIMITS OF THE STUDY

Objective limits: Metaverse technique

Time limits: The questionnaire was distributed between January 17th to February 17th, 2023.

Spatial limits: Teachers of University of Baghdad

3.1 Population and sample

Like the community, the teachers affiliated with the University of Baghdad were randomly selected for the sample, which included approximately 121 teachers from the University of Baghdad.

4 LITERATURE REVIEW

Several studies have been published that address metaverse technology. In 2010, Dana M. Barry et al. carried out a notable study. This study focuses on the topic of problem-based learning (PBL), which is recognized as a powerful tool for science and engineering education in the real world. In this vein, a group of Japanese researchers, assisted by an American teacher, conducted an experimental study to assess the effectiveness of project-based learning activities in the metaverse. The project involved independent student teams from the United States of America and Japan. In light of this successful experimental study, it has been shown that there are several benefits to conducting such an activity in a virtual world without limiting students to a specific time or geographical location. The study [9], entitled "Bibliometric Mapping of Metaverse in Education," aimed to create a bibliometric map using statistical and computational methods to analyze data related to books, periodicals, authors, publishers, etc. The purpose was to study the use of

metaverse technology in education from an international perspective and evaluate the research trends published in the *Journal of Computer and Education*. The study aimed to reveal factors such as author, publisher, keyword, journal, country, and citation. The results showed that the book "Definition, Roles, and Potential Research Issues of the Metaverse in Education: An Artificial Intelligence Perspective" by Hwang G.J. is the most relevant. National Taiwan Normal University and National Taiwan University of Science and Technology are among the universities most interested in this topic. The United States of America has the largest number of publications and studies quoted by the researcher, while China ranks highest in the number of publications quoted from other countries. The study of Mistretta [10] "The Metaverse-an Alternative Education Space," showed that the metaverse is a three-dimensional virtual environment already inhabited by students, in the form of embodiments whose unique characters happily collaborate in spaces such as "roblox," a video game designed for children and teenagers, and "minecraft," which has been admired by many around the world. The metaverse is an alternative learning space that addresses the challenges posed by the theory of contagion and mitigates the disruption of the traditional classroom environment caused by the corona pandemic (COVID-19), transitioning instead to a diverse range of interconnected contexts. Thus, the metaverse has become an alternative educational space that promotes the comprehensive design of university education.

Dahan's et al. [11] "Metaverse Framework: A Case Study on E-Learning Environment (ELEM)," confirmed that electronics is a broad term that could contain everything digital in the future, so the use of its systems must be redirected in several areas such as teaching and learning; however, the framework of the metaverse itself is still unclear, as its exact components cannot be determined. The study concluded that the proposed framework would make virtual learning environments run smoothly based on metaverses, and e-learning would be a more interactive and enjoyable process.

The current study is distinguished from its predecessors in that it addressed the importance of employing metaverse technology in education from the point of view of teachers in Iraqi universities and the extent to which metaverse technology is used in raising the efficiency and skills of the teacher, as well as introducing metaverse technology, showing its characteristics and applications in education, and offering promising Arab experiences for the use of metaverse in educational institutions.

5 THEORETICAL BACKGROUND

5.1 The concept of metaverse

The term "metaverse" consists of two parts. The first part is "meta," which is a word of Greek origin meaning "beyond" or "after." "Meta" is a verbal prefix used in the formation of derivations and signifies going beyond or transitioning to something else. It is referred to as some contemporary scientific theories, such as post-theoretical, post-logic, and post-mathematics. The second section (verse) is derived from the word "universe" in reference to the world. The term "metaverse" addresses a metaphysical world, which is commonly used to describe the concept of future versions of the Internet consisting of a fixed 3D space linked to a perceived virtual world [12–15]. The metaverse is defined as a three-dimensional digital world and environment that exist beyond the limitations of physical reality. It is a space

where fragmented virtual worlds come together in a shared and continuous digital realm. It represents a futuristic set of virtual reality experiences and augmented reality, as well as interactions between virtual spaces and the real world through the IoT, AI, and machine learning [3]. Thus, it is a combination of virtual and augmented reality technologies that enhance the user's perception and incorporate virtual elements into the real world and their visual experience. This is achieved by adding images, sounds, videos, and various other virtual details, allowing users to immerse themselves in a digital world that offers communication spaces for work, play, parties, conferences, meetings, and more [16]. Diverse industries can benefit from remote work by enabling employees to work remotely, continue their work, engage in marketing activities, practice economic, cultural, and recreational activities, and connect people in a virtual world realistically [17–20]. The metaverse relies on technologies that enable multisensory interactions with virtual environments, digital objects, and people. This is made possible through the use of XR systems, which are designed to detect where humans tend to focus more. These systems utilize stereoscopic screens capable of transmitting deep visualizations. Consequently, researchers define the metaverse as a technology that relies on advanced software and hardware to transport users to a digital, virtual world. This virtual world simulates the mind outside the boundaries of reality and allows users to interact through virtual avatars [21, 22]. The concept of metaverse technology has gained significant recognition in the world of non-traditional projects. It holds great importance for decision-makers, investors, digital technology experts, and management strategists. However, the term "metaverse" does not have a specific origin. It has evolved through various stages of technical discoveries over the past two decades, ultimately forming an approximation of a non-traditional world. The term "metaverse" was first mentioned in the science fiction novel "Snow Crash (1992)" by American writer Neal Town Stephenson (1959), which described the characters as interacting with each other in a three-dimensional futuristic virtual world that is very similar to the real world in which we live, and this is what the metaverse is based on, as humans interact as characters (Avatar) with each other and with software in a three-dimensional virtual space that simulates the real world. Over time, the term "metaverse" evolved and started being used on virtual world platforms such as Second Life. This term gained popularity after the authors of DC Comics began using it in 2019. They used "metaverse" to describe a centralized version of reality that has an impact on alternative timelines in other versions [23–26]. In this vein, Microsoft, a specialized company in computer technologies, included Altspace VR, a social platform for virtual reality, in 2017. They then started utilizing the features of metaverse technologies by holding meetings in the virtual world through Microsoft Teams, an application that facilitates teamwork and communication in one place. It is evident that companies of this magnitude would not have embraced this technology. Facebook, in particular, even goes so far as to name its suite of applications with this name without taking into account the future implications. This is done in an attempt to gain an advantage in shaping a portion of the world, ensuring its ongoing success and profitability. The social media giant in California also launched Facebook in 2021, a video game that embodied a virtual world called "Horizon World." The owner of the company, the American businessman and programmer Mark Elliot Zuckerberg (1984), officially announced the change of the company's name to "Meta Platforms," which is one of the largest American information technology companies, stressing its commitment to developing virtual world technologies. Frances Haugen (born in 1984), an American data scientist and software engineer, criticized the company's operations as violations that threaten user privacy [2, 27–33].

5.2 Metaverse Properties

The metaverse has several properties as shown in Figure 1, in particular:

1. Interoperability: It is reflected in the ability of social, political, economic, and operational systems and institutions, with their diversity of disciplines, to collaborate and work together effectively in a world that seeks truth and reality. Accordingly, participants, including companies, will be able to provide goods and services in exchange for value that is recognized by others. This value can take the form of fiat currency exchanged for virtual gold, crypto currencies, or electronic money. These forms of value are similar to traditional fiat currencies and offer new opportunities for innovation and entrepreneurship.
2. Decentralization: It refers to the transfer of control from a single entity or central authority to multiple smaller organizations. This process involves planning and decision-making that prioritize mutual benefit and transparency. By distributing power to individuals rather than large technology companies or governments, decentralized platforms aim to prevent exploitation and control over people.
3. Persistence: By persistently continuing the effort and maintaining the service, making it available online to anyone who wants it, regardless of time and place, as there is no definitive space for the metaverse. People will be able to enter and exit at any time without any limit on the number of participants, just like in real life.
4. Spatiality: It is a concept that refers to the relationship between people and things and the resulting data, standards, and fixed management rules that enable people to access them and experience them in a way that is closer to the real world.
5. Community interaction: The interaction, movement, activity, orientation, cooperation, and consensus among people on any topic is indicative of their community affiliation, which is vital for the well-being of individuals. Metaverse participants will be able to interact with each other in the virtual, digital, and physical worlds.
6. Self-sovereignty: The individual's control of their identity and data on the Internet is a moral and natural right, as is the right to be the exclusive observer of their own being and life and to have the authority to install and enforce restrictions on others [2, 34].

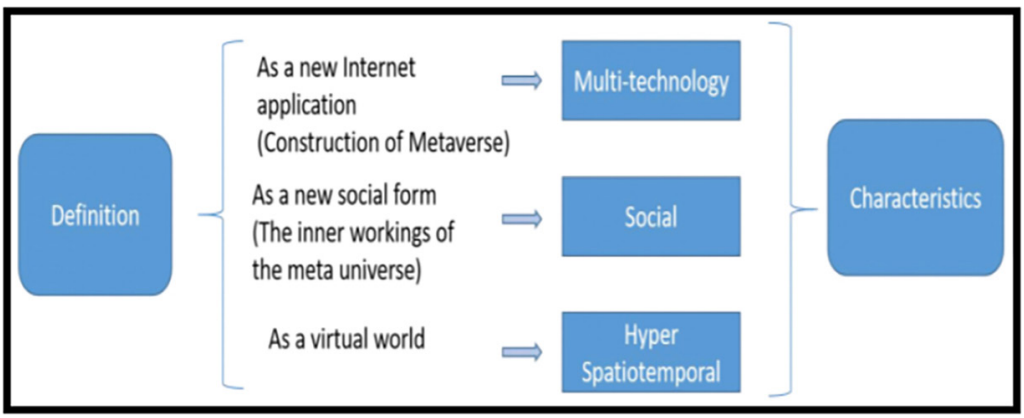

Fig. 1. The block diagram of metaverse

5.3 Metaverse applications in education

According to the above, the metaverse can provide students with a suitable learning environment, particularly through the opportunity for cooperative learning. This represents a successful teaching strategy that facilitates interaction between students as shown in Figure 2. The metaverse can be utilized in various areas to explain its usage, enhance student learning, and assist teachers in designing their own teaching methods. Teachers can provide students with learning topics and access teaching resources in the metaverse. On the one hand, this allows students to search for resources using virtual devices connected to the Internet and interact with their peers. On the other hand, students can share academic information through social networks [35, 36]. Metaverse, for example, can teach the English language. It digitally creates the identities of teachers and students and opens up teaching spaces in both formal and informal virtual worlds [37].

There are numerous potential applications of metaverse technology in education, including medicine, nursing, healthcare, language instruction, science teaching, and military and manufacturing training. The metaverse provides learners with increased opportunities to experiment, explore, and engage in activities such as work, social interaction, and real-world experiences. This will provide the metaverse with opportunities to serve in the field of management, experiment, and learn in the practice of piloting aircraft [38, 39].

Fig. 2. Status of the development of distance learning according to the medium for delivering contents

Several reasons support the adoption of the metaverse for educational purposes, including:

1. Place learners in a potentially risky real-world environment to consistently practice their knowledge or skills.
2. Keep learners constantly engaged in real-world contexts and provide opportunities for those who have not had the chance to experience it.
3. Enable learners to achieve or acquire something that necessitates long-term engagement and practice.
4. Encourage learners to attempt creating or exploring something that they may not be able to afford in the real world due to factors such as high cost or limited availability of materials.
5. Enable learners to explore alternative ideas and approaches in relation to their careers or personal lives.

6. Enable learners to perceive, experience, or observe things from different perspectives or roles.
7. Enable learners to learn how to interact and collaborate with individuals they may not have the opportunity to work with in the real world.
8. Explore the higher-order thinking abilities of learners by engaging them in complex, diverse, and real-world tasks [38].

5.4 Criticisms of the use of metaverse

Despite the great interest that the metaverse receive and its potential to bring about a major transformation in the virtual world and its characteristics, there are some fears and criticisms surrounding its use as shown in Figure 3. It can be summarized as follows:

1. Information privacy: This is because participating companies will likely collect users' personal data through wearable devices and engage with them.
2. Advertising: Social media companies are constantly strategizing to target ads within the metaverse, given the intense competition in the metaverse realm and the anticipation that major corporations will dominate it.
3. Growing concerns related to the spread of false information, like in any virtual environment.
4. Consumer addiction: Continued usage is another concern for the growth of the metaverse, as it can have long-term psychological and physical effects, including depression, anxiety, and obesity.
5. Social alienation: Spending extended periods of time in the virtual world can result in a disconnection from actual reality.
6. Biased content: This is what some people may face as a result of exposure to content that favors one thing over another [21].

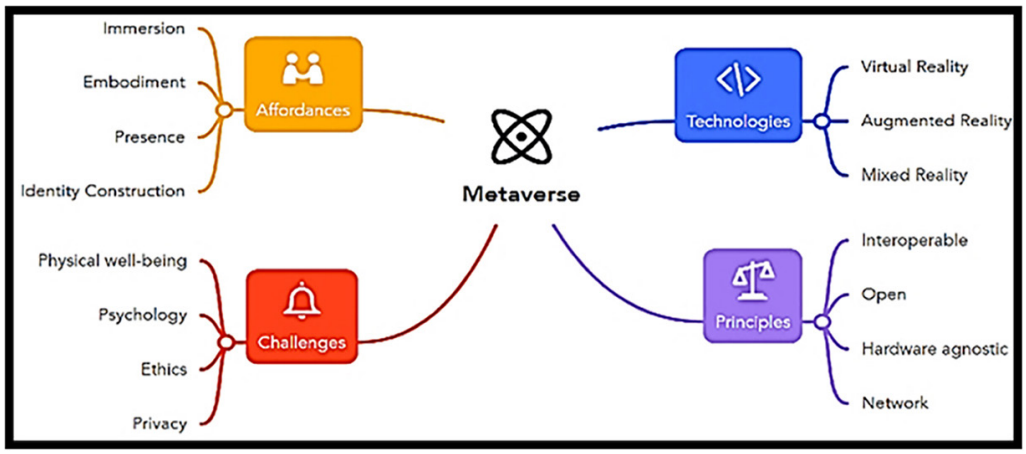

Fig. 3. Technologies, principles, affordances, and challenges

6 RESULTS AND DISCUSSION

The results of the current study are in accordance with its aims. They are discussed and interpreted in the light of previous studies and the approved theoretical framework. Finally, conclusions and recommendations were drawn. Revised 2: In order to achieve the second aim of the study, which is to identify the extent of understanding

of metaverse technology among university teachers (the research sample), the average scores and standard deviation of all members of the sample, consisting of approximately three hundred teachers, were calculated. The arithmetic average of their scores was 184.025, with a standard deviation of 23.144. Additionally, the hypothetical average of the scores on the importance of the metaverse technique was calculated to be forty-six. The differences were then tested using a one-sample T-test, as shown in Table 1. Reason 2: Improved clarity and readability by rephrasing and organizing the information in a more coherent manner.

Table 1. It displays arithmetic means, standard deviation, and calculated T-values

Sample	Arithmetic Mean	Standard Deviation	Purposeful Mean	T-value		Degree of Freedom	Level of Significance
				Calculated	Tabular		
300	184.025	23.144	46	22.39	1096	299	0.05

It is evident from the table above that the calculated T value of 22.39 exceeds the tabular value of 1096 at a significance level of 0.05, with 299 degrees of freedom. There are statistically significant differences among the sample members. This is because the average scores of the sample are higher than the theoretical average, indicating that the university teachers in the research sample have an understanding of the metaverse technique. In order to achieve the third aim of the research, which emphasized identifying the importance of metaverse technology among teachers at the University of Baghdad in both humanitarian and scientific disciplines. The researchers applied the scale to a sample of 300 teachers, consisting of 150 from humanitarian colleges and 150 from scientific colleges. The average score on the scale for humanitarian colleges was 99.5 degrees, with a standard deviation of 8.14 degrees. The average score of scientific colleges on the scale was 103.16 degrees, with a standard deviation of 6.85 degrees. To analyze the data, the researchers utilized the T test for two independent samples, as presented in Table 2.

Table 2. The T-value calculated for the metaverse technology scale among university teachers varies according to the specialization variable (humanitarian and scientific)

Variable	Number	Arithmetic Average	Standard Deviation	T-Value		Significance Level
				Calculated	Tabular	
Humanitarian	150	99.5	8.14	26.93	1.96	Function
Scientific	150	103.16	6.85			Function

Based on the table above, it can be observed that the calculated T-value of (26.93) degrees is higher than the tabular T-value of (1.98) at a significance level of (0.05) and with (298) degrees of freedom. This indicates that the influence of metaverse technology on teachers in scientific colleges is greater than its impact on teachers in humanitarian colleges. This can be attributed to the fact that scientific colleges have a higher level of interest and enthusiasm for metaverse technology. To achieve the fourth aim of the research, which emphasized identifying the importance of metaverse technology among university teachers based on their master's and doctoral academic achievement. The researchers applied the scale to a sample of 300 teachers, consisting of 175 Ph.D. holders and 125 Master's degree holders. The average academic achievement score for the doctorate degree on the scale was 88.24 degrees, with a standard deviation of 4.88 degrees. The average score of academic achievement for the master's degree on the scale was 74.66 degrees, with

a standard deviation of 3.54 degrees. To achieve this, the researchers utilized the T-test for two independent samples, as shown in Table 3.

Table 3. The T-value calculated for the scale of the importance of metaverse technology among university teachers and according to the variable of the type of academic achievement (master's and doctorate)

Variable	Number	Arithmetic Average	Standard Deviation	T-Value		Significance Level
				Calculated	Tabular	
Ph.D.	155	88.24	4.88	2.00	1.96	Function
Master	125	76.66	3.54			Function

It is evident from the table above that the calculated T-value of 2.00 degrees is higher than the tabular T-value of 1.96 at a significance level of 0.05 and with 298 degrees of freedom. This result favors average sample holders with a doctorate degree, indicating that metaverse technology has a greater impact on them compared to holders of a master's degree. This is because they are more eye-catching with metaverse technology. In order to achieve the fifth aim of the research, which is to identify the importance of metaverse technology among university teachers based on their scientific titles (assistant instructor, instructor, assistant professor, professor). The researchers extracted the arithmetic averages and standard deviations of the metaverse scale scores according to the scientific title, as shown in Table 4.

Table 4. Arithmetic averages and standard deviations of the metaverse scale scores among teachers according to the scientific title variable

Scientific Title	Number	Arithmetic Average	Standard Deviation
Assistant Instructor	95	4.35	0.60
Instructor	80	3.80	0.75
Assistant Professor	65	2.68	0.68
Professor	60	5.66	0.70

In light of the arithmetic averages on the degrees of the metaverse technique scale, there are apparent differences based on scientific titles. Therefore, the researchers adopted the analysis of single variance to indicate these differences, as shown in Table 5.

Table 5. Analysis of the single variance of the averages of the metaverse technique scale according to the scientific title

Contrast Source	Sum of Squares	Degrees of Freedom	Average Squares	Calculated Q-Value	Tabular Q-Value
Between groups	0.12	3	0.04	0.410	0.86
Inside groups	28.85	296	0.379		
Total	28.97	299			

Considering the results of the analysis of variance, it appears that there are no statistically significant differences at the significance level of 0.05. This is due to the scientific title having the highest arithmetic average on the metaverse technology scale compared to the professor's title variable.

7 CONCLUSION

1. The study proved that there is a clear understanding of the importance of metaverse technology among teachers at the University of Baghdad (research sample).
2. Scientific faculty teachers are more aspiring to the importance of applying metaverse technology in education than humanities faculty teachers.
3. Ph.D. teachers are more aspiring to the importance of applying technology than their master's degree counterparts, and there are no statistical differences in its importance according to their scientific title.

8 REFERENCES

[1] A. Abdul-Jawad, "Integrating virtual reality tools with open-source digital learning management software tools and its impact on developing e-course management skills," *Journal of the Faculty of Specific Education for Educational and Qualitative Studies,* no. 1, 2018.

[2] A. M. I. Brik, "Metaverse applications and their relationship with the future of the digital journalism industry," *The Egyptian Journal of Media Research,* vol. 2022, no. 78, pp. 45–76, 2022.

[3] أ. د. خ. محمد, "تكنولوجيا المجلة الدولية للتعليم الإلكتروني" and أ. د. خ. م. فرجون, vol. 5, no. 3, pp. 43–85, 2022. https://doi.org/10.21608/ijel.2022.231371

[4] H. T. Hazim, "Secure Chaos of 5G wireless communication system based on IOT applications," *International Journal of Online & Biomedical Engineering,* vol. 18, no. 12, pp. 89–105, 2022. https://doi.org/10.3991/ijoe.v18i12.33817

[5] D. K. Abdul-Rahman Al-Malah, S. Ibrahim Hamed, and H. T. Alrikabi, "The interactive role using the Mozabook digital education application and its effect on enhancing the performance of eLearning," *International Journal of Emerging Technologies in Learning (iJET),* vol. 15, no. 20, pp. 21–41, 2020. https://doi.org/10.3991/ijet.v15i20.17101

[6] P. L.-Y. Kwok, J. K.-N. Chen, and J. T.-C. Fung, "A curriculum package of social and ethical concerns in metaverse ecosystem in school education based on Bloom's taxonomy," in *The 30th International Conference on Computers in Education (ICCE 2022)*, 2022.

[7] B. H. Majeed, "The impact of teaching by using STEM approach in the development of creative thinking and mathematical achievement among the students of the fourth scientific class," *International Journal of Interactive Mobile Technologies (iJIM),* vol. 15, no. 13, pp. 172–188, 2021. https://doi.org/10.3991/ijim.v15i13.24185

[8] I. A. Aljazaery and H. T. Salim AL Rikabi, "Enhancement of online education in engineering college based on mobile wireless communication networks and IOT," *International Journal of Emerging Technologies in Learning,* vol. 18, no. 1, pp. 176–200, 2023. https://doi.org/10.3991/ijet.v18i01.35987

[9] N. Tas and Y. İ. Bolat, "Bibliometric mapping of metaverse in education," *International Journal of Technology in Education,* vol. 5, no. 3, pp. 440–458, 2022. https://doi.org/10.46328/ijte.323

[10] S. Mistretta, "The metaverse—An alternative education space," *AI, Computer Science and Robotics Technology,* vol. 22, pp. 1–23, 2022. https://doi.org/10.5772/acrt.05

[11] N. A. Dahan, M. Al-Razgan, A. Al-Laith, M. A. Alsoufi, M. S. Al-Asaly, and T. Alfakih, "Metaverse framework: A case study on E-learning environment (ELEM)," *Electronics,* vol. 11, no. 10, p. 1616, 2022. https://doi.org/10.3390/electronics11101616

[12] B. Kye, "Educational applications of metaverse: Possibilities and limitations," *Journal of Educational Evaluation for Health Professions,* vol. 18, no. 32, 2021. https://doi.org/10.3352/jeehp.2021.18.32

[13] W. Suh and S. Ahn, "Utilizing the metaverse for learner-centered constructivist education in the post-pandemic era: An analysis of elementary school students," *Journal of Intelligence,* vol. 10, no. 1, p. 17, 2022. https://doi.org/10.3390/jintelligence10010017

[14] A. GÖÇEN, "EĞİTİM BAĞLAMINDA METAVERSE," *Uluslararası Batı Karadeniz Sosyal ve Beşeri Bilimler Dergisi,* vol. 6, no. 1, pp. 98–122, 2022. https://doi.org/10.46452/baksoder.1124844

[15] O. Dulgaroglu, "Metaverse Teknolojisi ve Turizm (Metaverse Technology and Tourism)," *Review of Tourism Administration Journal,* vol. 3, no. 1, pp. 82–93, 2022.

[16] E. Davis, *Metaverse Explained: Understanding Metaverse Meaning, Advantages and Disadvantages*. Independently published, N.P., 2022.

[17] A. Siyaev and G. Jo, "Neuro-symbolic speech understanding in aircraft maintenance metaverse," *IEEE Access,* vol. 9, pp. 154484–154499, 2021. https://doi.org/10.1109/ACCESS.2021.3128616

[18] G. A. Al-Rubaye and H. T. Hazim, "Optimization of capacity in non-Gaussian noise models with and without fading channels for sustainable communication systems," *Heritage and Sustainable Development,* vol. 5, no. 2, pp. 239–252, 2023.

[19] A. M. Mohammed, H. A. K. Al-Saadi, and S. H. H. Al-Taai, "Information sources and their role in E-learning from Iraqi college students' viewpoint," *Webology,* vol. 19, no. 1, pp. 1128–1150, 2022. https://doi.org/10.14704/WEB/V19I1/WEB19077

[20] A. H. M. Alaidi, O. H. Yahya, and H. T. S. AlRikabi, "Using modern education technique in Wasit university," *International Journal of Interactive Mobile Technologies,* vol. 14, no. 6, pp. 82–94, 2020. https://doi.org/10.3991/ijim.v14i06.11539

[21] S. M. Mystakidis, "Metaverse," *Encyclopedia*, vol. 2, no. 1, pp. 486–497, 2022. https://doi.org/10.3390/encyclopedia2010031

[22] S. H. Hassan Al-Taai, H. A. Kanber, and W. A. Mohammed al-Dulaimi, "The importance of using the Internet of Things in education," *International Journal of Emerging Technologies in Learning,* vol. 18, no. 1, pp. 19–39, 2023. https://doi.org/10.3991/ijet.v18i01.35999

[23] G. S. Contreras, A. H. González, M. I. S. Fernández, C. B. Martínez, J. Cepa, and Z. Escobar, "The importance of the application of the metaverse in education," *Modern Applied Science,* vol. 16, no. 3, pp. 1–34, 2022. https://doi.org/10.5539/mas.v16n3p34

[24] S. Taylor and S. Soneji, "Bioinformatics and the metaverse: Are we ready?" *Frontiers in Bioinformatics,* vol. 2, p. 50, 2022. https://doi.org/10.3389/fbinf.2022.863676

[25] J. Xu *et al.*, "Metaverse: The vision for the future," in *CHI Conference on Human Factors in Computing Systems Extended Abstracts*, no. 167, 2022, pp. 1–3. https://doi.org/10.1145/3491101.3516399

[26] L. B. Rosenberg, "Regulating the metaverse, a blueprint for the future," in *International Conference on Extended Reality*, Springer, 2022, pp. 263–272. https://doi.org/10.1007/978-3-031-15546-8_23

[27] A. A.-S. Zeidan, *The World Beyond Tradition 'Metaverse'*. Ed. 1st, Istanbul: Scientific Platform Publications and Scientific Institute for Advanced Training and Studies, 2022.

[28] M. K. A. Al Gnbri, "Internal auditing in metaverse world: Between the prospects of virtual reality and the possibilities of augmented reality," *Indones. Account. Rev,* vol. 12, no. 2, pp. 125–134, 2022. https://doi.org/10.14414/tiar.v12i2.2848

[29] R. a. M. Al_Airaji, I. A. Aljazaery, and H. T. ALRikabi, "Watermark hiding in HDR image based on visual saliency and tucker decomposition," *Karbala International Journal of Modern Science,* vol. 9, no. 3, p. 6, 2023. https://doi.org/10.33640/2405-609X.3307

[30] H. A. Kanber and M. E. Alkhalidy, "Google scholar and the scientific originality of the professor," *Iraqi Journal of Information Technology,* vol. 8, no. 2, pp. 22–45, 2018. (in Arabic).

[31] M. S. K. Wahib, Z. A. A. Alamiry, and B. H. Majeed, "Digital citizenship for faculty of Iraqi universities," *Periodicals of Engineering and Natural Sciences,* vol. 11, no. 2, pp. 262–274, 2023. https://doi.org/10.21533/pen.v11i2.3525

[32] B. K. Mohammed, S. A. A. A. Alsaidi, R. F. Chisab, and H. T. S. AlRikabi, "Efficient RTS and CTS mechanism which save time," *International Journal of Interactive Mobile Technologies,* vol. 14, no. 4, pp. 204–211, 2020. https://doi.org/10.3991/ijim.v14i04.13243

[33] B. H. Majeed and L. F. Jawad, "Computational Thinking (CT) among university students," *International Journal of Interactive Mobile Technologies,* vol. 16, no. 10, pp. 244–252, 2022. https://doi.org/10.3991/ijim.v16i10.30043

[34] G. K. Sriram, "A comprehensive survey on metaverse," *International Research Journal of Modernization in Engineering Technology,* vol. 4, no. 2, pp. 772–775, 2022.

[35] A. Tlili *et al.*, "Is Metaverse in education a blessing or a curse: A combined content and bibliometric analysis," *Smart Learning Environments,* vol. 9, no. 1, pp. 1–31, 2022. https://doi.org/10.1186/s40561-022-00205-x

[36] H. A. Kanber, S. H. H. Al-Taai, and W. A. M. Al-Dulaimi, "Recruitment of teachers for cooperative education in educational institutions," *International Journal of Emerging Technologies in Learning,* vol. 18, no. 3, pp. 110–127, 2023. https://doi.org/10.3991/ijet.v18i03.36815

[37] S. Mystakidis and A. Christopoulos, "Teacher perceptions on virtual reality escape rooms for stem education," *Information,* vol. 13, no. 3, p. 136, 2022. https://doi.org/10.3390/info13030136

[38] G.-J. Hwang and S.-Y. Chien, "Definition, roles, and potential research issues of the metaverse in education: An artificial intelligence perspective," *Computers and Education: Artificial Intelligence,* vol. 3, p. 100082, 2022. https://doi.org/10.1016/j.caeai.2022.100082

[39] J. H. Jeon, "A study on education utilizing metaverse for effective communication in a convergence subject," *International Journal of Internet, Broadcasting and Communication,* vol. 13, no. 4, pp. 129–134, 2021.

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