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THE ROLE OF THE METAVERSE IN MANAGING THE QUALITY OF EDUCATIONAL SERVICES

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Abstract:

The main objective of this research paper is to examine the role of the Metaverse in managing the quality of educational services. The descriptive-analytical method is utilized in this research paper. The population of the research includes 881 university teachers who belong to universities in the southern region of Jordan. A total sample size of 385 participants is chosen.
The obtained results show that the role of the Metaverse in managing the quality of educational services was seen to be high in all the dimensions of the Metaverse, such as the interactive educational dimension, the technological and innovative dimension, and quality of educational services and satisfaction. The results further demonstrate that there exist no statistically significant differences between the means in relation to the role of the Metaverse and its dimensions in managing the quality of educational services according to the gender variable. Statistically significant differences were, however, found between the means of Metaverse dimensions in accordance with the knowledge of Metaverse technology, with those in the good category having higher means than those in the poor, moderate, and excellent categories.

Keywords: Metaverse, Interactive Educational Dimension, Technological and Innovative Dimension, Quality of Educational Services, Satisfaction

INTRODUCTION

One of the most significant trends discussed in recent times concerns the creation of the Metaverse, which is the future of the Internet in its newest version. Even though the idea behind the Metaverse came from a science fiction book written in 1992, it gained recognition only due to Facebook's decision made in 2021 to become a Metaverse platform (Huang et al., 2023). It is possible to define the Metaverse as a new reality combining virtual and real worlds with people communicating and interacting with each other via virtual avatars (Mystakidis, 2022).

The Metaverse is not used only for entertaining purposes or games because it was adopted for educational, commercial, and medical purposes. Thus, more and more funds are being invested in Metaverse projects due to the current situation connected with the COVID-19 pandemic (Tukur et al., 2023). The increased use of Metaverse-related technologies leads to new challenges that have to do with security and privacy protection issues. It is essential to understand that security services play a crucial role in successful implementation of the Metaverse.

As a rule, such services involve authentication, encryption, and monitoring technologies aimed at reducing digital risks. In light of the huge amount of data transmitted and stored by Metaverse platforms, one can state that the lack of effective security measures could make users skeptical about the system, which would decrease its usage significantly (Wang et al., 2023).

A quick growth of the Metaverse was followed by an increase in cybersecurity risks and even more serious problems connected with new threats like digital identity theft or phishing attacks. Research shows that there is a sharp rise in cyberattacks on Metaverse platforms after 2021 when Facebook decided to implement its idea of a virtual world, which makes it urgent to work on the problem (Almansoori et al., 2024).

Special security measures and solutions for Metaverse platforms were developed by researchers and professionals, who started thinking about the peculiarities of such systems. For instance, one can mention privacy-preserving communication and security of Metaverse digital identities as well as protecting digital assets and cryptocurrencies connected with the Metaverse (Ramolia et al., 2025).

It is obvious that the further successful development of the Metaverse depends on how efficiently security services manage to cope with challenges related to its rapid growth. It is vital to integrate cybersecurity and privacy protection features into the development process because the Metaverse should grow into a safe digital reality (Huang et al., 2023).

Metaverse technologies were already applied successfully by the police forces of the United Arab Emirates, such as Sharjah Police. It uses Metaverse-based applications to train employees efficiently and conduct virtual simulations of security situations. Thus, the professionalism of security services increases. Besides, the adoption of Metaverse technologies by Sharjah Police resulted in the establishment of virtual police centers where customers can easily contact law enforcement bodies, which positively affects customer satisfaction in line with the strategy of UAE's digitalization in governmental spheres (AlAli & Alshamsi, 2023).

Statement of the Problem

The higher education sector is undergoing tremendous changes because of advancements made in the technological aspect, especially with the rise of Metaverse technologies as one of the trends currently influencing educational practices, teaching techniques, and services' management. As a result of this trend, there has been a change in education environments due to the introduction of virtual learning spaces and increased opportunities for enhancing the quality of educational services.

With the current interest in incorporating digital technologies in Jordanian universities amid the rise of digital transformation, it is clear that there is a gap concerning the degree to which Metaverse technologies are used in managing the quality of educational services. Not only is there the issue concerning the extent to which they are utilized, but there is a clear disparity in the preparedness of educational institutions and their faculty members to adopt this type of innovative solution. Faculty members play an important role in this context owing to their active involvement in creating educational content, teaching, and assessing students.

Nevertheless, there are few local studies focusing on the role of the Metaverse in managing the quality of educational services from the viewpoint of Jordanian faculty members, especially within universities operating in the southern part of the country. There is a need to conduct further research in this field, considering the scarcity of information available. Consequently, the problem of the proposed research can be defined as the need for investigation into the role of the Metaverse in managing the quality of educational services from the viewpoint of faculty members at universities in the southern region of Jordan. Moreover, there is a necessity to identify the extent to which this technology is used and to examine its various dimensions associated with education, technology, and services. The results of the research will hopefully allow formulating scientific grounds for further improvement of educational policies and quality of education in general.

RESEARCH QUESTIONS

Therefore, the research questions formulated in accordance with the stated problem are as follows:

1. What is the role of the Metaverse in managing the quality of educational services from the perspective of faculty members in universities in the southern region of Jordan?
2. Is there any statistically significant difference at the significance level ($\alpha = 0.05$) in the role of the Metaverse dimensions in managing the quality of educational services, as perceived by faculty members in universities located in the southern region of Jordan, based on gender and the level of knowledge of Metaverse technologies?

Importance of the Study

The current research will strive to obtain theoretical and practical importance as follows:

Theoretical Importance

* The importance of the theoretical nature of this study is due to the importance of enriching the existing contemporary educational literature with new insights about the use of Metaverse in the field of higher education.
* This research will contribute to the creation of a contemporary conceptual framework about the role of the Metaverse in managing the quality of educational services.
* It will fill the gap in the number of studies conducted about the topic in question in the Arab countries, especially in Jordan. More specifically, the number of studies examining the Metaverse in Jordanian universities, located in the southern region of Jordan, will be increased.
* Scientific basis will be laid for the development of the following researches aimed at discussing topics related to digital transformations and the management of the quality of educational services.
* It will support emerging research trends related to technological innovation in the educational process.

Practical Importance

* The practical importance of this study consists in providing the decision-makers in Jordanian universities with scientific indications about the role of the Metaverse in their decision-making related to digital educational policies.
* This study will assist universities in improving the quality of the provided educational services thanks to the utilization of the Metaverse.
* Faculty members will be provided with recommendations concerning how to integrate the discussed technology into the instruction process.
* Training and professional development programs related to new educational technologies will be encouraged.
* Digital transformation and infrastructure will be strengthened.
* The experience of university-based education will be improved along with enhancing the level of students' satisfaction.

Conceptual and Operational Definitions of Variables

The following conceptual and operational definitions of variables are presented:
Metaverse :is understood as a three-dimensional virtual space where both virtual and real realities are integrated. People are able to communicate with each other through digital avatars (Mystakidis, 2022).
Quality of Educational Services : Quality of Educational Services is understood as the ability of an educational organization to deliver educational services that satisfy the requirements of its beneficiaries, especially students. The provision of an effective educational environment, curricula, qualified staff, and infrastructure contribute to distinguishing educational results and increasing students' satisfaction with their education.
Operational definition: The score received by the respondent on the instrument of this study.

Delimitations of the Study
The study was conducted under the following delimitations:
* **Spatial Delimitation:** The study was delimited to universities operating in the southern region of Jordan.
* **Temporal Delimitation:** The study was carried out in the academic year 2025/2026.
* **Human Delimitation:** The study was restricted to university faculty members employed in universities operating in the southern region of Jordan.
* **Thematic Delimitation:** The study was delimited to the Metaverse and the management of educational service quality.

LITERATURE REVIEW

Advancements in technology have revolutionized human interactions and virtual worlds. This has introduced some innovative concepts that have had a tremendous impact on different areas of human life. One of the notable innovations introduced by these advancements is the Metaverse. In recent years, the term Metaverse has garnered considerable recognition due to its game-changing nature. Metaverse, which is a three-dimensional digital world, refers to a virtual environment where people interact via avatars in simulated real-world environments. As such, the emergence of Metaverse marks a turning point regarding the evolution of human interactions with the internet (Kye et al., 2021).
The term Metaverse was originally coined by the author Neal Stephenson in his sci-fi book titled *Snow Crash* that he wrote in 1992. He created a virtual reality where individuals interacted using avatars inside a three-dimensional digital universe. However, this term remained purely fictional until the turn of the millennium when virtual worlds such as *Second Life* were introduced. Following 2020, however, the term Metaverse became more widespread in use, following the change in name from Facebook to Meta by Mark Zuckerberg (Mystakidis, 2022). In particular, Zuckerberg declared his company's commitment to developing an all-encompassing Metaverse ecosystem (Onu et al., 2024).

The Metaverse concept is often defined differently depending on its intended use. For instance, the Metaverse has been defined as a manifestation of the Internet comprising connected three-dimensional virtual spaces used for conducting comprehensive social and economic interactions (Duan et al., 2021). Metaverse has also been defined as a continuation of everyday life into a three-dimensional digital world where continuous activities such as education, commerce, and social life take place (Kye et al., 2021). Additionally, the Metaverse can also be described as a three-dimensional immersive digital world where users can interact with digital environments virtually, just like the physical world (Hwang & Chien, 2022).
Therefore, the Metaverse concept can be defined as an all-encompassing and interactive three-dimensional digital universe used for interacting with other users and digital environments through Virtual Reality (VR) and Augmented Reality (AR) technologies. Metaverse is considered the next big thing in the Internet evolution, allowing users to get involved using their avatars in social, educational, and economic engagements in simulated real-world environments.
Some of the technologies that make up the Metaverse include XR technologies such as VR, AR, and Mixed Reality (MR) besides AI, blockchain, digital twin, and fifth-generation (5G) cellular networks and cloud infrastructures. XR technology allows for real-time interaction of multiple individuals in a virtual environment using their avatars (Onu et al., 2024). Together, these technologies form an immersive and interactive digital environment where users can engage with each other and participate in digital economies with real-world values (Zhang et al., 2022).
Socially, the Metaverse represents a new dimension in human socialization. In particular, the Metaverse allows people to build and nurture friendships, engage in communities and cultural activities, and participate in virtual events in immersive three-dimensional virtual environments (Youssef et al., 2024). For instance, studies have shown that the use of Metaverses allows for building communities among Gen-Z users in the United Arab Emirates, enhancing their sense of belongingness to their virtual environment (Youssef et al., 2024). Also, Al-Qadi (2023) argues that the Metaverse creates numerous opportunities for forming cohesive digital communities in isolated environments.
From an economic perspective, the Metaverse allows for a new form of digital economy based on cryptocurrencies and NFTs. In these virtual spaces, users can conduct transactions, set up virtual shops, and engage in professional activities in immersive three-dimensional worlds (Chalmers et al., 2022). Metaverses provide an open space for innovation and creativity in designing and selling different types of digital assets such as clothes and buildings.
Concerning education, Metaverse provides an ideal environment for the development of education in the 21st century. Students can undertake classroom sessions virtually, do laboratory work, and attend academic conferences (Onu et al., 2024). Several studies have revealed that Metaverse learning is effective in increasing students' participation in lessons and encouraging them to develop collaboration and teamwork skills (Mystakidis, 2022). According to Al-Qarni (2024),

although Metaverse integration in the Arab educational system is still at the initial stage, there is enormous potential for improvement in curriculum design and teaching if the related technological and human issues are appropriately addressed.

METHODOLOGY

Research Method

In order to fulfill the purpose of this study, a descriptive-analytical methodology was used. Descriptive-analytical methodology is considered a research method through which current events, practices, and phenomena are observed as they take place without interference from the researcher.

Population and Sample of the Study

The population in this study includes all teachers who are working in the southern universities of Jordan such as Mutah University, Tafila Technical University, and Al Hussein Bin Talal University. According to the ministry of higher education statistics for the academic year 2025/2026, the total number of teachers is 881 teachers.

Also, a stratified random sampling method was utilized to obtain a sample of 385 teachers during the first semester of 2025/2026 academic year.

Research Instrument

A questionnaire is the main tool used in order to measure the variables in this study. The questionnaire included two parts as follows:

First Section: Demographic Variables

This section contains some demographic variables of the participants:

- Gender
- Level of knowledge about Metaverse technologies

Second Section: Dimensions of the Study

Second section included 24 items distributed among three dimensions as follows:

1. **Interactive Educational Dimension:** (1-8)
2. **Technological and Innovative Dimension:** (9-16)
3. **Educational Service Quality and Satisfaction Dimension:** (17-24)

Validity and Reliability

A pilot study was conducted for validity and reliability tests of the questionnaire based on 30 participants to test its reliability and validity.

Validity and reliability tests were performed as follows:

* Cronbach's alpha coefficient was calculated to examine the internal consistency of the questionnaire.
* Split-half reliability coefficient of questionnaire using the Spearman Brown formula.

The following table presents the results of validity and reliability tests of the questionnaire.

Table (1)
Reliability Results of the Study Instrument for the Three Metaverse Dimensions Using Cronbach's Alpha and Split-Half Reliability

Independent Variable	Dimension	Number of Items	Cronbach's Alpha	Split-Half Correlation	Spearman–Brown Corrected Coefficient
Metaverse	Interactive Educational Domain	8	0.871	0.820	0.901
	Technological and Innovative Domain	8	0.904	0.910	0.949
	Educational Service Quality and Satisfaction	8	0.894	0.791	0.885
All Items Combined		**24**	**0.956**	**0.904**	**0.949**

**** Statistically significant at α = 0.01.**

Interpretation of Table (1)

The results presented in Table (1) indicate the following:

- The values of Cronbach's Alpha demonstrate a high level of reliability for the questionnaire items. The reliability coefficients ranged from **0.871 to 0.904**, while the overall Cronbach's Alpha coefficient for all **24 items** reached **0.956**, which is considered very high. This reflects a strong degree of reliability of the instrument used to measure the dimensions of the Interactive Educational Domain, the Technological and Innovative Domain, and Educational Service Quality and Satisfaction.

- The split-half reliability coefficients were also high, indicating strong consistency between the odd- and even-numbered items within each dimension. The correlation coefficients ranged from **0.791 to 0.910**, while the Spearman–Brown corrected coefficients ranged from **0.885 to 0.949**. The overall correlation coefficient was **0.904**, and the overall corrected coefficient reached **0.949**. These findings confirm a strong internal consistency among the questionnaire items and provide substantial evidence of the instrument's validity and reliability.

Descriptive Statistics of the Study Variables

To answer the study questions, the levels of the Metaverse dimensions were measured using descriptive statistical techniques, including means, standard deviations, relative weights, and rankings of both dimensions and questionnaire items. Responses were evaluated using the **five-point Likert scale**, and the strength of responses was interpreted according to the criteria shown in Table (2).

Table (2)
Response Strength Indicators for the Five-Point Likert Scale

Weighted Mean	Relative Weight	Level of Agreement
1.00 – 1.80	20% – 36%	Very Low
1.81 – 2.60	>36% – 52%	Low
2.61 – 3.40	>52% – 68%	Moderate
3.41 – 4.20	>68% – 84%	High
4.21 – 5.00	>84% – 100%	Very High

To interpret the study findings and determine the level of agreement, the ranking of arithmetic means was used at both the overall instrument level and the individual item level according to the criteria adopted in the study.

Results and Discussion

Results Related to the First Research Question

To answer the first research question:

"What is the role of the Metaverse in managing the quality of educational services from the perspective of faculty members at universities in the southern region of Jordan?"

Descriptive statistics, including means, standard deviations, and relative weights, were calculated to determine the role of the Metaverse in managing educational service quality and to rank the dimensions according to their availability from the perspective of the study sample.

Table (3)
Overall Indicators for Measuring the Level of Metaverse Dimensions in Managing Educational Service Quality

No.	Dimension	Mean	Standard Deviation	Relative Weight (%)	Rank	Level of Agreement
1	Interactive Educational Domain	4.12	0.597	82.4%	3	High
2	Technological and Innovative Domain	4.21	0.620	84.2%	1	Very High
3	Educational Service Quality and Satisfaction	4.20	0.548	84.0%	2	High
Overall Metaverse Dimensions		**4.18**	**0.552**	**83.6%**		**High**

Interpretation of Table (3)

The results indicate that the overall mean score of the Metaverse dimensions was **4.18**, with a standard deviation of **0.552** and a relative weight of **83.6%**, reflecting a **high level of agreement** among the respondents regarding the availability and effectiveness of Metaverse dimensions in managing educational service quality.

The **Technological and Innovative Domain** ranked first, with a mean score of **4.21**, a standard deviation of **0.620**, and a relative weight of **84.2%**, indicating a **very high level of agreement**.

The **Educational Service Quality and Satisfaction Domain** ranked second, with a mean score of **4.20**, a standard deviation of **0.548**, and a relative weight of **84.0%**, indicating a **high level of agreement**.

The **Interactive Educational Domain** ranked third, with a mean score of **4.12**, a standard deviation of **0.597**, and a relative weight of **82.4%**, also indicating a **high level of agreement** regarding the role of the Metaverse in managing educational service quality.

Results Related to the Second Research Question

To answer the second research question:

"Are there statistically significant differences at the significance level (α = 0.05) in the levels of Metaverse dimensions in managing educational service quality from the perspective of faculty members at universities in the southern region of Jordan attributable to gender and level of knowledge of Metaverse technologies?"

The following statistical tests were employed:

- **Independent Samples t-test** to examine differences in respondents' mean scores according to the **gender** variable.
- **One-Way Analysis of Variance (One-Way ANOVA)** to examine differences in respondents' mean scores according to their **level of knowledge of Metaverse technologies**.

The results of these analyses are presented in **Tables (4), (5), and (6)**.

Table (4)
Results of the Independent Samples t-Test for Identifying Differences Between the Mean Scores of Metaverse Dimensions in Managing Educational Service Quality Attributable to Gender

Dimension	Gender	N	Mean	Std. Deviation	t-value	df	Sig.
Interactive Educational Domain	Male	312	4.15	0.602	2.028	383	0.466
	Female	73	4.00	0.563			
Technological and Innovative Domain	Male	312	4.24	0.628	1.782	383	0.188
	Female	73	4.10	0.571			
Educational Service Quality and Satisfaction	Male	312	4.23	0.547	1.579	383	0.351
	Female	73	4.11	0.546			

The results presented in Table (4) indicate that there are **no statistically significant differences** between the mean scores of the Metaverse dimensions (Interactive Educational Domain, Technological and Innovative Domain, and Educational Service Quality and Satisfaction) attributable to the variable of gender. This conclusion is based on the fact that the significance values (Sig.) for all dimensions were greater than 0.05.

Table (5)
Results of the One-Way ANOVA Test for Identifying Differences Between the Mean Scores of Metaverse Dimensions in Managing Educational Service Quality Attributable to the Level of Knowledge of Metaverse Technologies

Dimension	Knowledge of Metaverse Technologies	N	Mean	Std. Deviation	F-value	df	Sig.
Interactive Educational Domain	Weak	28	4.39	0.397	17.126	381	0.001
	Moderate	140	4.29	0.649			
	Good	179	3.91	0.515			
	Excellent	38	4.35	0.538			
Technological and Innovative Domain	Weak	28	4.63	0.329	12.256	381	0.001
	Moderate	140	4.29	0.687			
	Good	179	4.04	0.543			
	Excellent	38	4.43	0.577			
Educational Service Quality and Satisfaction	Weak	28	4.35	0.311	4.134	381	0.001
	Moderate	140	4.29	0.645			
	Good	179	4.10	0.487			
	Excellent	38	4.26	0.488			

The results in Table (5) reveal the existence of **statistically significant differences** between the mean scores of the Metaverse dimensions in managing educational service quality attributable to respondents' level of knowledge of Metaverse technologies. This conclusion is supported by significance values lower than 0.05 across all dimensions.
To further verify the significance of these differences, a One-Way Analysis of Variance (ANOVA) was conducted, as presented in Table (6).

Table (6)
One-Way ANOVA Results for Differences in Participants' Responses According to Their Level of Knowledge of Metaverse Technologies

Dimension	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Interactive Educational Domain	Between Groups	16.283	3	5.428	17.126	0.001
	Within Groups	120.747	381	0.317		
	Total	137.031	384			
Technological and Innovative Domain	Between Groups	12.978	3	4.326	12.256	0.001
	Within Groups	134.482	381	0.353		
	Total	147.460	384			

Educational Service Quality and Satisfaction	Between Groups	3.632	3	1.211	4.134	0.001
	Within Groups	111.570	381	0.293		
	Total	115.201	384			
Overall Score	Between Groups	9.762	3	3.254	11.576	0.001
	Within Groups	107.107	381	0.281		
	Total	116.869	384			

Table (6) demonstrates statistically significant differences in the responses of the study participants regarding all Metaverse dimensions and the overall score according to their level of knowledge of Metaverse technologies. The calculated F-values were **17.126**, **12.256**, **4.134**, and **11.576**, respectively, all at a significance level of **0.001**.
To determine the direction of these differences, the Scheffé post hoc test was employed, and the results are presented in Table (7).

Table (7)
Scheffé Post Hoc Test Results for Determining the Direction of Differences According to Knowledge of Metaverse Technologies

Dimension	Knowledge Level	Mean	Weak	Moderate	Good	Excellent
Interactive Educational Domain	Weak	4.39	—	0.099	0.483*	0.040
	Moderate	4.29	-0.099	—	0.384*	-0.059
	Good	3.91	-0.483*	-0.384*	—	-0.444*
	Excellent	4.35	-0.040	0.059	0.444*	—
Technological and Innovative Domain	Weak	4.63	—	0.337	0.590*	0.159
	Moderate	4.29	-0.337*	—	0.253*	-0.141
	Good	4.04	-0.590*	-0.253*	—	-0.394*
	Excellent	4.43	-0.159	0.141	0.394*	—
Educational Service Quality and Satisfaction	Weak	4.35	—	0.061	0.248	0.085
	Moderate	4.29	-0.061	—	0.188*	0.024
	Good	4.10	-0.248*	-0.188*	—	-0.163
	Excellent	4.26	-0.085	-0.024	0.163	—
Overall Score	Weak	4.46	—	0.165	0.440*	0.108
	Moderate	4.29	-0.165	—	0.275*	-0.058
	Good	4.01	-0.440*	-0.275*	—	-0.333*
	Excellent	4.35	-0.108	0.058	0.333*	—

* Significant at the 0.05 level.
The Scheffé post hoc comparisons indicate that the statistically significant differences were primarily in favor of respondents with weak, moderate, and excellent levels of knowledge of Metaverse technologies when compared with the "good" category, which consistently recorded lower mean scores across most dimensions and the overall score. These findings suggest that perceptions of the role of the Metaverse in managing educational service quality vary according to the respondents' level of familiarity with Metaverse technologies.

From the above results, the differences in the mean scores of the study participants' responses based on their level of knowledge of Metaverse technologies were in favor of the **"Good"** knowledge category as compared to the **Weak, Moderate, and Excellent** knowledge categories as perceived by faculty members at universities in the southern region of Jordan.

Based on the above results, the answer to the fourth research question can be summarized as follows:

1. No statistically significant differences existed between the mean scores of the Metaverse dimensions (Interactive Educational Domain, Technological and Innovative Domain, and Educational Service Quality and Satisfaction) in managing educational service quality attributable to the variable of gender as perceived by faculty members at universities in the southern region of Jordan.

2. Statistically significant differences existed between the mean scores of the Metaverse dimensions (Interactive Educational Domain, Technological and Innovative Domain, and Educational Service Quality and Satisfaction) in

managing educational service quality attributable to the level of knowledge of Metaverse technologies. The differences favored the **"Good"** knowledge category compared with the Weak, Moderate, and Excellent categories as perceived by faculty members at universities in the southern region of Jordan.

DISCUSSION OF THE RESULTS

According to the findings, there were no statistically significant differences between the mean scores of the Metaverse dimensions in managing educational service quality attributable to the variable of gender. This was because the values of significance (Sig.) were higher than 0.05 for all the dimensions as perceived by faculty members in universities in the southern region of Jordan.

These results could be justified through the fact that the use of the Metaverse applications has made it possible for both male and female faculty members to access these resources equally. Thus, they both have similar access to the virtual environment and are able to interact with it. Additionally, male and female faculty members in Jordanian universities follow a unified set of rules and guidelines on using these emerging technologies in teaching and education management. Finally, technological and digital competencies needed for operating with the Metaverse became an inherent element of the modern academic life.

However, the results have shown statistically significant differences between the mean scores of the Metaverse dimensions in managing educational service quality attributable to the level of knowledge of Metaverse technologies. The differences were in favor of the **"Good"** category of knowledge as the values of significance were less than 0.05.

In fact, users with a good level of knowledge about Metaverse applications possess the capability to perceive educational benefits offered by this technology and to understand their practical usage. Therefore, they know how to apply these technologies in order to promote interaction and to facilitate the process of providing better educational services. Besides, the knowledge about this technology is sufficient for utilizing all of its capabilities. Contrary to the users with low or average knowledge, users with the excellent knowledge of Metaverse are usually more critical about its implementation due to their awareness of difficulties involved in the process. Consequently, respondents with the good level of knowledge provided more positive evaluations of the impact of Metaverse on educational service quality than the other groups.

In particular, the finding about the lack of statistically significant differences in respect of gender is aligned with the overall trend seen in other studies focusing mainly on educational potential of Metaverse technologies. Specifically, Onu et al. (2024) have indicated that the Metaverse possesses a high potential for interaction and improving efficiency due to virtual reality technologies. Thus, its use provides users with a wide range of learning experiences. At the same time, the effective use of Metaverse is mainly determined by educational readiness, infrastructure and training rather than personal characteristics such as gender.

Additionally, the present findings are consistent with the results obtained by Youssef et al. (2024). According to the study, the Metaverse enhances social interaction and develops social skills in Gen Z users. In particular, the technology has been found to significantly improve digital interaction between people but there were no substantial gender differences. Therefore, the inclusiveness of virtual environments ensures equal access and opportunity for all users and thus explains the lack of differences among male and female faculty members with regard to Metaverse in managing educational service quality.

Regarding the finding about the presence of statistically significant differences attributable to the level of knowledge of Metaverse technologies, they are highly consistent with those made by Onu et al. (2024). In particular, the authors emphasize that in order to make Metaverse applications efficient, the adequate level of knowledge, technical skills, and constant training should be achieved. The higher is the level of users' knowledge about Metaverse technologies, the more they are able to appreciate its benefits and take advantage of its educational potential.

Moreover, the present findings are aligned with those made by AlAli and Alshamsi (2023). According to the research, the successful implementation of Metaverse technologies in the training program is largely determined by the readiness and preparedness of users for working with these emerging technologies. Thus, Metaverse-based training environments have been found to increase efficiency and effectiveness of training programs while stressing the importance of preparing trainee's staff and building their technical capacities. This explains the superiority of evaluations provided by participants with a good level of knowledge about the examined technology.

Finally, the findings should be viewed against the background of the results provided by Youssef et al. (2024). According to this study, the effective usage of the Metaverse technology is closely related to individual skills and capabilities of interaction with virtual environments. Thus, increased knowledge leads to better perception of benefits provided by Metaverse technology and helps users to achieve their objectives. On the contrary, users with low knowledge of this technology cannot efficiently interact with it. Thus, all the above results confirm the role of knowledge as the determinant of successful implementation of Metaverse.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proposed:

1. Allocate adequate resources for the continuous development and enhancement of Metaverse tools to keep pace with technological advancements, while strengthening analytical tools capable of identifying educational challenges and opportunities with greater accuracy and efficiency.

2. Establish strategic partnerships with universities, research centers, and technology providers to support the development of Metaverse-based educational systems and promote knowledge exchange and innovation.
3. Develop clear policies and guidelines governing the use of Metaverse technologies in higher education, accompanied by a comprehensive implementation and development plan to ensure effective integration into educational practices.
4. Conduct further studies on the Metaverse and examine its relationship with additional variables related to educational quality, digital transformation, student engagement, academic achievement, and institutional performance.

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