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THE OPTIMAL PERFORMANCE OF THE EDUCATIONAL PROCESS TOWARDS THE EFFECTIVE ROLE OF METAVERSE TECHNOLOGY IN SUPPORTING THE EDUCATIONAL PROCESS.

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Abstract
Distance learning has become the main teaching and learning method, and currently the metaverse is being proposed as a new alternative for accessing educational information. Henceforth, metaverse technology is considered a new alternative for accessing educational information. In fact, several countries such as Korea and Japan have started using this technology in education. Thus, and through this study, it can be assumed that it is important to collect the students' opinions to know their attitudes in relation to using the metaverse technology in their teaching and learning, as well as knowing how to better use the educational spaces. Such studies are necessary to determine the effectiveness of using metaverse for educational purposes. In addition, it would be worthwhile not only to get an understanding of the ways of using the educational environment more effectively, but also to highlight the need to educate students about metaverse technology and how it can be used to access information. The current study seeks to depict what students think about the ways of using metaverse applications in the classroom and obtain information. In this research, the descriptive analytical method was used. The research community was represented by the students of the Computer Engineering Department at King Abdulaziz University in Jeddah, where a random sample of 89 male and female students from the Computer Engineering Department was selected. The questionnaire was the study tool to collect the related information and data. The study results indicated that the degree of students' responses regarding the use of metaverse technology in education, and the benefits of using metaverse technology in the classroom, were with a high degree of agreement. The results also showed that the degree of students' responses about the disadvantages of using metaverse technology in the classroom was with a moderate degree of agreement. Moreover, there were no statistically significant differences between males and females, ages, the extent of using metaverse technology before, and the extent to which metaverse technology is available for permanent and effective learning in the classroom in the axes of the study tool as they were at a level of statistical significance (0.05).
On the other hand, the creation of digital learning and research environments for immersive experiences is not reflected in the prevalence of a large number of educational experiments conducted on metaverse technology. Consequently, the topic of this study is of great interest for further research and innovation to lay the theoretical foundations for expanding the field of study. Accordingly, it would be necessary to conduct a systematic review of the main scientific literature to contribute to the subject of study with a great potential to ensure the establishment of an optimum from its theoretical foundations leading to its subsequent adoption as a main

topic for the use of technology in the field of education, in addition to subsequently demonstrating the theoretical specificities that can be applied to teaching methodology.
Keywords: metaverse, blended learning, avatar, smart device, virtual reality.

1. Introduction:

With the use of the Internet in all fields, and the introduction of Internet-based technologies, major changes have occurred in our lives. As a result, the nature of the use of the available information on the network has changed. In addition, the use of the Internet and the related technologies has led to the emergence of many new technologies, and the metaverse technology is one of these emerging technologies. In fact, metaverse represents a development of the concept of the virtual world in our lives according to Dionisio and Gilbert (2013), and the interaction of individuals in a three-dimensional environment while allowing the effective use of body language through visual communication and video chat between avatars and gestures (Owens 2012). As an electronic social reality, the metaverse is the new reality in which different technologies are shared according to Kuş (2021), or the simulation of the natural world according to Narin and Aydın (2021).

Although the metaverse refers to an interactive 3D world, concepts regarding the nature and organization of the metaverse have changed over time. According to the general trend, a metaverse is a network of interconnected virtual worlds alternative to a single virtual world version (Dionisio and Gilbert 2013). Therefore, to better understand the metaverse, it is necessary to understand the concept of virtual worlds, which are environments containing three-dimensional graphical worlds that are viewed as a kind of simulation of tangible reality (Metcalf et al. 2011). According to Dickey (2005), the virtual worlds are online desktop applications in which users can interact and move in simulated 3D environments.

The use of the metaverse in education can be viewed as a learning environment enhanced with technologies associated with the metaverse that integrate with elements of the virtual and real educational environment. It enables learners to use wearable devices to enter the educational setting without being restricted by time and locations and allows them to use digital identities to conduct real-time interactions with different forms of elements (e.g., avatars, intelligent NPCs, or virtual learning resources) (Suzuki et al. 2020; Prieto, Lacasa, and Martínez-Borda 2022; Rospigliosi 2022). The researcher assumes that metaverse technology will create more jobs in ways we cannot imagine now, and that this technology has the potential to enrich the quality of life, especially for people who lack material resources. However, and like any new technology, its derived benefits depend on how the technology and its infrastructure are designed.

The researcher also believes that the metaverse technology is capable of creating attractive activities within the classroom. Using this technology for course content, online resources, and teacher input enables it to be a tool that can work in most classrooms. Recently, due to the Corona pandemic (COVID-19), lectures have become held online around the world, but without an interactive environment, and in higher education, especially the post-Corona era, distance learning has become the main teaching and learning method. Currently, the metaverse is being proposed as a new alternative for accessing educational information. The problem of

the study revolves around answering the question: What is the role and impact of using metaverse technology in supporting and activating the performance of the educational process? When a new technology is used in education, qualitative research is required to obtain detailed information. Qualitative research is also necessary to understand how students feel when learning using metaverse technology, and to know the challenges they face in this environment. Such study areas are required to determine the effectiveness of the results obtained using the metaverse for educational purposes. As well, it would be worthwhile to understand how to use the educational environment more effectively. This study is also necessary to educate students about the use of metaverse technology and how it can be used to access information.

The current study seeks to answer several questions, including: What is the role of metaverse technology in supporting education, what is the extent of students' knowledge of metaverse technology, how do they feel about using the metaverse in education and obtaining information, what is the impact of the metaverse on raising the efficiency of education, and what are the related challenges?

This study deals with knowing what students think about their teaching and learning using metaverse technology. By collecting attitudes, it will be possible to know how to better use the educational spaces. It is also important for students to learn about metaverse technology while studying. It is possible to make the metaverse a better place for learning by discovering the problems that students face while they are there, and in this case the goal of this study is to find out what students think about how to use metaverse applications in the classroom to obtain information.

2. Previous studies:

As there is plenty of research related to the metaverse in a variety of fields, there are many studies on education based on the use of metaverse technology. These studies allow us to better understand education and its qualifications in the metaverse environment.

Rahman et al.'s (2023) study, entitled "Using Metaverse Technology in Education", aimed at identifying metaverse applications and activities in the field of education, defining a hypothesis framework, and proposing a model for better quality and education available to everyone using the metaverse. Specifically, it focused on creating an interactive classroom and an environment for group discussion, presentation, theses, and meetings using the Mozilla Hubs platform, which is an open and free source. It is customizable and accessible from all over the world. The methodology of this research was based on the use of a qualitative method of analysis, in addition to a review of ten main techniques that depend on the quality of the metaverse in education. This research will impact the entire education sector through content visualization, virtual campuses, 3D simulations, and enabling a high-quality distance education process accessible to everyone everywhere. The study provided a comprehensive overview of the technical and educational roadmap for metaverse applications, specifically in the classroom context. However, the study also acknowledges the limitations and social implications of this technology. On the other hand, the study highlighted the need for further research to fully understand its potential and limitations. Even though the development of metaverse technology is still in its early stages, there are obstacles to it that must be overcome before it can be fully integrated into people's social activities. However, there is optimism for the future of the

metaverse towards its integration into our daily lives, especially in the education sector. Ultimately, the study stressed the importance of continuing to develop and refine the metaverse ecosystem to achieve its full impact in the education sector.

Chua and Yu's (2023) study, entitled "A Systematic Review of the Literature on the Acceptance of the Use of Metaverse in Education over a 16-Year Period," seeks to provide answers to the following questions: what is the tendency towards the use of metaverse in education? what is the distribution of types of platforms, software, and devices based on the type of metaverse in the different sectors of education? Is there a tangible benefit to using the metaverse in the different sectors of education? Is it easy to use the metaverse technology in the various sectors of education? The study applied a comprehensive search method through databases, and the results of this research concluded that there should be a change from a single platform or metaverse program to a more diverse set of programs and devices for metaverse technologies in education. This change is to determine the importance of the perceived usefulness and ease of use in acceptance and rejection of the use of the metaverse in education. The study suggested future research to explore the perceived usefulness and ease of use for a wider range of educational domains, as well as considering different types of platforms and metaverses in terms of design.

Zhou's (2022) study, entitled "Developing a Smart Learning Ecosystem from a Metaverse Perspective", stressed that the metaverse leads the future education trends and brings about profound changes in education based on analyzing the development trend of smart education and the connotation and working mechanisms of the metaverse in education. Thus, the study enriched the smart education ecosystem through core educational technologies including developing resource and interaction scenarios, combining virtual reality with spatial querying, and building three scenario-based modular smart learning spaces to form a new educational mode featuring virtual reality, coexistence with reality, spatial integration, and collaborative research. The application value of the mode is then verified using the analytical hierarchy process. Ultimately, the education system developed in this study creates a smart education ecosystem composed of four integrated environmental elements - resource environment, interaction environment, space environment, and collaboration environment, which accelerates the organic integration of transformative education and smart education and provides the theoretical foundation and reference for the new application for the future.

Rachmadtullah et al's (2023) study, entitled "Primary school teachers' perceptions of the potential of metaverse technology as a technology that transforms interactive learning methods in Indonesia", stressed that, currently, there are many technology-based learning methods that can be used in the effective teaching and learning process. This research aimed at identifying how primary school teachers in Indonesia perceive the potential of metaverse technology as a media transformation learning. The researchers used the descriptive method with a descriptive qualitative approach in order to describe the actual situation regarding the importance of metaverse for teachers in primary schools. The participants in this study were twenty primary school teachers with good technical skills. Data was collected through

observation and interviews. The results of this study showed that primary school teachers are interested in using the metaverse as a teaching tool for teachers, and that one of the options to improve learning performance is to use the metaverse as a tool or as a new method for learning and teaching. Using metaverse does not mean that the teacher has to change traditional teaching methods, but it rather helps the teacher to convey the material to the students effectively.

Kye et al.'s (2021) study, entitled "Educational Applications of the Metaverse: Potential and Limitations", aimed at identifying the four types of metaverse and explaining the potential and limitations of its educational applications. The Metaverse Roadmap is classified into four types: augmented reality, life log, mirror world, and virtual reality. An example of the application of augmented reality in medical education would be an augmented reality T-shirt that allows students to examine the inside of the human body as an anatomy laboratory. Furthermore, a research team at a Seoul hospital developed a platform for spine surgery that applied augmented reality technology. It is suggested that the potential of the metaverse as a new learning environment is as follows: a space for new sociability, a greater degree of freedom to create and participate, and providing new experiences and high immersion through virtual simulation. Some limitations would be weak social ties and the possibility of privacy being violated, committing various crimes due to the virtual space and anonymity in the metaverse, and poor adjustment to the real world for the students whose identity is not identified. The study proposed tasks for the educational use of the metaverse. First, teachers should carefully analyze how students understand the metaverse. Second, teachers must design classrooms for students to solve problems or undertake projects collaboratively and creatively. Third, educational metaverse platforms must be developed that prevent misuse of the students' data.
Rahman et al.'s (2023) study differed in the use of metaverse technology in education to propose an interactive classroom by involving students in the process of improving education. This is similar to the current study in collecting students' opinions in terms of using technology in education. The current study differed from the study of Rahman et al. in the methodology used, as qualitative analysis was used and a classroom model was proposed in the study of Rahman et al., while the descriptive analytical approach was followed in the current study. The study of Chua and Yu (2023) agreed with the current study in terms of the extent of acceptance of the use of metaverse technology, and differed in terms of the type of research, such as a review or an original research. Zhou's study (2022) agreed with the current study in terms of applying metaverse technology in education, and differed in terms of the study sample, as Zhou's study focused on building a smart learning system on interactive educational resources. The studies of Rahmatullah et al. (2023) and Kay et al. (2021) agreed with the current study in terms of the objectives, and differed in terms of the study community, as both studies relied on reviewing and narrating the teachers' point of view, while the current study tended to know the opinions of students. Table No. (1) shows the results of the SOWT analysis of previous studies in terms of strengths, weaknesses, opportunities, and challenges.
The current study is distinguished from the rest of the previous studies in that it was applied in a community that includes male and female engineering students at King Abdulaziz University to determine the extent of these male and female students' awareness and interest in metaverse

technology, and the effectiveness of its use in the field of education from the male and female students' point of view.

Table 1: SWOT analysis of previous studies on the use of metaverse technology in education (the researcher's work).

Strengths	**Weaknesses**
1. There is a high ability to adapt to changes and a potential to contribute to developments.	1. Inadequate research and development studies in the field of metaverse.
2. A smart learning system based on interactive educational resources.	2. Students in universities are not adequately prepared in the field of digital learning.
3. A new method for effective learning.	4. There are shortcomings in the field of cybersecurity.
4. Free, easy access, and customizability.	3. Deficiencies and delays in implementation.
5. The education system facilitates the transition of the educational system to metaverse.	5. Decrease in digital culture.
6. The presence of educational institutions that provide educational services with advanced technology.	6. Low access to Internet use in the community.
	7. An educational system in which educational services are important.
Opportunities	**Threats**
1. Providing important employment opportunities.	1. Many transformation-related developments and opportunities exist in foreign powers.
2. Providing investment opportunities for investors outside the educational sector.	2. A more diverse set of software and hardware for metaverse technologies in education.
3. Dissemination of personalized educational services.	3. Lack of research and development at the academic level.

4. Reducing the costs of educational services.	4. External dependency on the technical level.
5. Obtaining health data with increased use of wearable technologies.	5. Problems caused by lack of cyber security.
6. Understand the importance of research and development.	6. Potential issues related to ethics and privacy.
7. Incentives provided by the government to increase educational technologies.	7. Due to the frequent use of the metaverse by a certain audience, they become addicted and the resulting educational problems arise.
8. Providing great opportunities for technology education.	8. Society's inability to adapt to digital learning.
9. Reducing the risk level in educational services.	9. With the spread of metaverse technology, the sedentary pace of life and its associated educational problems increased.
10. Create a large global metaverse technology system.	10. Increased separation from real life and increased psychological problems associated with it.
11. Reducing physical and psychological violence against workers in the educational field.	11. Deepening inequality in access to educational services. Students with sufficient digital opportunities receive more service, while individuals in the opposite situation receive less service.

3. The used Methodology:

The current study used the descriptive analytical method, and the questionnaire was applied as a tool for this study to collect information and data related to it, given its nature in terms of the objectives, the method, and the community. The questionnaire instructions were formulated for the purpose of familiarizing the sample members with the purpose of the study tool, taking into account the clarity of the statements and their suitability to the level of the respondents, and emphasizing the writing of data related to the study variables. The questionnaire was presented to the supervising doctor for the purpose of reviewing it, making comments, and making appropriate amendments. The measurement areas for the research tool were represented in two sections that included demographic data, and the axes of the study tool, which were the extent of knowledge of the study community participants about metaverse technology, the participants' opinions about using metaverse technology in education, the participants'

opinions about the benefits of using metaverse technology in the classroom, and the participants' opinions about the disadvantages of using metaverse technology in the classroom. The research community is represented by male and female students of the Computer Engineering Department at King Abdulaziz University in Jeddah. A random sample of 89 male and female students from the Computer Engineering Department was taken.

The internal consistency of the research tool was checked by calculating the Pearson correlation coefficient between each statement and the degree of the axis to which it belongs. The results of the Pearson correlation coefficients and statistical significance showed that all correlation coefficients were high and positive, with values ranging between (0.507 - 0.900) and significant at the level of statistical significance (0.01).), which indicates that the questionnaire has good internal consistency and that its statements are closely related to the axes, and therefore the statements in each axis measure what they were designed to measure.

To verify the stability of the research tool, Cronbach's alpha coefficients were used, and the results showed that the Cronbach's alpha coefficients for the phrases ranged between (0.871 - 0.887), while the Cronbach's alpha value for the tool as a whole was (0.901). We note that all reliability coefficients were high.

The reliability results that were reached showed that the research tool is characterized by stability, which makes the researcher assured about the answers of the sample members to the questionnaire, and therefore the results that will be reached through the questionnaire will be reliable and dependable in reaching sound decisions.

The data of this study were analyzed using the Statistical Package for the Social Sciences (SPSS) program, and the Excel program was used to make graphs. Statistical treatments and tests were used, including the Pearson correlation coefficient to measure the internal consistency of the study tool, and the Cronbach alpha coefficient to find the reliability coefficient, and replications and percentages to describe the research sample according to the primary variables, the arithmetic mean, the one-way analysis of variance (ANOVA) test, and the (t) test for two independent samples.

4. Results and discussion:

This section includes a presentation of the results reached by the study, based on the statistical analysis of the data collected by the questionnaire, verifying the objectives of the study and answering the questions that were raised.

The results of proportions and replication for the distribution of sample members by gender showed that the majority of sample members were male (77.5%), while the percentage of females was (22.5%). In terms of age group, the majority are (20 years and under) with a rate of (42.7%), followed by the age group (from 22 and over) years with a rate of (29.2%), while the group (from 20 to 22 years) is at the bottom of the ranking with a rate of (28.1%).

As for the extent of the use of the metaverse technology by male and female students, the results of the percentages and replication for distributing the sample members according to their use of the metaverse technology showed that the majority used it at a rate of (69.7%), while the percentage of those who did not use it reached (30.3%). In terms of the extent of the desire to benefit from metaverse technology in the classroom, the results of the percentages and replication for distributing the sample members according to the desire to benefit from

metaverse technology in the classroom showed that the majority want to benefit from this technology at a rate of (84.3%), while the percentage of those who do not want to was (15.7%). On a related level, the results of the arithmetic means and standard deviations of the participants' opinions on the use of metaverse technology in education showed that the general average reached (3.66) and falls into the fourth category (3.4 - 4.2), which means that knowing the level of participants' opinions on the use of metaverse technology in education, was with a high agreement. Based on the arithmetic averages, the statements were arranged in descending order. We found that the statement (I believe that metaverse technology can enhance my knowledge of the lecture topic) was ranked top with a mean of (3.79) and a high degree of agreement, then the statement (Metaverse technology will be used in classrooms in the near future) with an average reaching (3.78) and a large degree of agreement, then the statement (If it is possible to use metaverse technology in any lecture in the college) with an average of (3.64) and a large degree of agreement, then the statement (Metaverse technology has educational benefits) with an average of (3.61) and a large degree of agreement. , followed by the statement (If possible, metaverse technology increases the motivation for the lecture) with an average of (3.60), and finally the statement (If possible, metaverse technology makes the lecture content more enjoyable) with an average of (3.54) and a large degree of agreement.

The results of the arithmetic means and standard deviations of the sample members' responses about the benefits of using metaverse technology in the classroom showed that the overall average was (4.03) and falls into the fourth category (3.4 - 4.2), which means that the sample members' opinions about the benefits of using metaverse technology in the classroom was met with great approval. Based on the arithmetic means and standard deviations, the phrases were arranged in a descending order. We found that the phrase (metaverse technology increases the desire to learn) is ranked first with an average of (4.13) and a high degree of agreement, then the phrase (metaverse technology facilitates learning) with an average of (4.11) and a high degree of agreement, followed by the statement (Metaverse technology increases interest in the lesson and saves time) with an average of (4.09) and a large degree of agreement, then the statement (Metaverse technology provides focus on instructions) with an average of (4.08) and a large degree of agreement, and then the statement (If possible, the metaverse technology using outside the laboratory supports distance learning) with an average of (4.07) and a large degree of agreement, followed by the statement (Metaverse technology creates better understanding and active learning) with an average of (4.04) and a large degree of agreement, and then the statement (Metaverse technology is suitable for practical applied disciplines such as medicine and engineering because of the ease of creating a virtual reality for practical experiments and for students to participate from anywhere in these experiments, practically as if inside the classroom, with an average of (4.03) and a large degree of agreement, followed by the statement (Metaverse technology is a quick and effective learning method) with an average of (4.01) and a large degree of agreement, followed by the phrase (If it is possible to use metaverse technology as a means of interaction between teachers and classmates) with an average of (3.93) and a large degree of agreement, and finally the statement (Metaverse technology provides an enjoyable and flexible learning environment (at any time and in any place)) with an average of (3.81) and a large degree of agreement.

The results of the arithmetic means and standard deviations of the sample members' responses to the statements of risk level analysis showed that the overall average was (3.09), falling into the third category of the five-point Likert standard (2.6 - 3.4), which means that the sample members' level of risk analysis was with moderate agreement. Based on the arithmetic means and standard deviations, the statements were arranged in a descending order, and we found that the statement (Metaverse technology requires access to the Internet and depends on high-speed Internet connection, and Internet outage leads to a complete disruption of education that relies on it) was ranked first with an average of (4.28) and a very large degree of agreement. Then the statement (Metaverse technology requires a high-cost technical infrastructure) with an average of (3.91) and a large degree of agreement, followed by the statement (Metaverse technology provides a break from real life) with an average of (3.66) and a large degree of agreement, and then the statement (Metaverse technology has a negative impact on the social life of the individual) with an average of (3.25) and a moderate degree of agreement, followed by the statement (Metaverse technology causes health problems) with an average of (3.23) and an average degree of agreement, and then the statement (Metaverse technology constitutes an inability to maintain discipline in the classroom.) with an average of (3.15) and a moderate degree of agreement, and then the statement (Metaverse technology creates a permanent disability in learning) with an average of (2.63) and a moderate degree of agreement, followed by the statement (Metaverse technology creates distraction and inability to concentrate) with an average of (2.62) and a medium degree of agreement, and then the phrase (Metaverse technology makes learning difficult) with an average of (2.16) and a weak degree of agreement, and finally the statement (Metaverse technology is an inappropriate transfer of ideas) with an average of (2.02) and a weak degree of agreement.

The differences between personal variables in the axes of the study tool:

Table 2: Results of the difference test between the male and female samples in the axes of the study tool.

Axes	Gender	Sample	Average	Standard deviation	T value	Significance level
Participants' opinions about the use of metaverse technology in education	Male	69	17.8841	3.90526	1.311	0.199
	Female	20	19.1500	3.77352		
Participants' opinions on the benefits of using metaverse technology in the classroom	Male	69	40.7826	5.49564	1.344	0.191
	Female	20	38.4500	7.17800		

Participants' opinions about the disadvantages of using metaverse technology in the classroom	Male	69	36.6087	6.26197	0.218	0.829
	Female	20	36.2000	7.68183		

The table above shows the differences between the arithmetic means of males and females using the t-test for two independent samples on the axes of the study tool. We noticed the following:

Regarding the axis of the participants' opinions about the use of metaverse technology in education, we found that its value of the statistical significance level reached (0.199), which is greater than (0.05). This indicates that the participants' opinions about the use of metaverse technology in education does not differ according to gender at the level of statistical significance of (0.05).

For the axis of the participants' opinions about the benefits of using metaverse technology in the classroom, we found that its value of statistical significance level reached (0.191), which is greater than (0.05). This indicates that the participants' opinions about the benefits of using metaverse technology in the classroom does not differ according to gender at the level of statistical significance of (0.05).

Regarding the axis of the participants' opinions about the disadvantages of using metaverse technology in the classroom, we found that its value of statistical significance level reached (0.218), which is greater than (0.05). This indicates that the participants' opinions about the disadvantages of using metaverse technology in education does not differ according to gender at the Statistical significance level of (0.05).

Table 3: Results of the one-way analysis of variance (ANOVA) for the differences between the ages of the sample members in the axes of the study tool.

Axes	Sources of Variance	Sum of squares	Degree of freedom	Mean squares	F test value	Statistical significance
Participants' opinions about the use of metaverse technology in education	Between groups	66.237	3	22.079	1.482	0.225
	Within groups	1266.235	85	14.897		
	Total	1332.472	88			
	Between groups	143.204	3	47.735	1.364	0.259

Participants' opinions on the benefits of using metaverse technology in the classroom	Within groups	2973.853	85	34.987		
	Total	3117.056	88			
Participants' opinions about the disadvantages of using metaverse technology in the classroom	Between groups	215.595	3	71.865	1.709	0.171
	Within groups	3574.629	85	42.054		
	Total	3790.225	88			

The table above shows the differences between the ages of the sample members in the axes of the study tool by using the one-way analysis of variance (ANOVA) test:

Regarding the axis of the participants' opinions about the use of metaverse technology in education, we found that its value of the statistical significance level reached (0.225), which is greater than (0.05). This means that the participants' opinions about the use of metaverse technology in education does not differ according to age at the level of statistical significance of (0.05).

As for the axis of the participants' opinions about the benefits of using metaverse technology in the classroom, we found that its value of the statistical significance level reached (0.259), which is greater than (0.05). This indicates that the participants' opinions about the benefits of using metaverse technology in the classroom does not differ according to age at the statistical significance level of(0.05).

Regarding the axis of the participants' opinions about the disadvantages of using metaverse technology in the classroom, we found that its value of statistical significance level reached (0.171), which is greater than (0.05). This shows that the participants' opinions about the disadvantages of using metaverse technology in the classroom does not differ according to age at the statistical significance level of (0.05).

Table 4: Results of the difference test about the extent to which metaverse technology was used before.

Axes	Answer	Sample	Average	Standard deviation	T value	Significance level
Participants' opinions about the use of metaverse	Yes	74	18.1757	3.90419	0.038	0.970
	No	15	18.1333	3.96172		

technology in education						
Participants' opinions on the benefits of using metaverse technology in the classroom	Yes	74	40.0270	6.13763	0.937	0.358
	No	15	41.4000	4.95407		
Participants' opinions about the disadvantages of using metaverse technology in the classroom	Yes	74	37.0405	6.35575	1.558	0.138
	No	15	33.9333	7.17602		

The table above shows the differences between the arithmetic means of (using the metaverse technique) using the (t) test for the two independent samples on the axes of the study tool. The results are the following:

Regarding the axis of the participants' opinions about the use of metaverse technology in education, we found that its value of the statistical significance level reached (0.970), which is greater than (0.05). This means that the participants' opinions about the use of metaverse technology in education does not differ depending on the extent of the use of metaverse technology at the statistical level of significance of (0.05).

For the axis of the participants' opinions about the benefits of using metaverse technology in the classroom, we found that its value of statistical significance level reached (0.358), which is greater than (0.05). This means that the participants' opinions about the benefits of using metaverse technology in the classroom does not differ depending on the extent of the use of the metaverse technology at a statistical significance level of (0.05).

Regarding the axis of the participants' opinions about the disadvantages of using metaverse technology in the classroom, we found that its value of statistical significance level reached (0.138), which is greater than (0.05). This means that the participants' opinions about the disadvantages of using metaverse technology in the does not differ depending on the extent of use of the metaverse technology at a statistical significance level of (0.05).

Table 5: Results of the difference test about the extent to which metaverse technology enables permanent and meaningful learning in the classroom.

Axes	Answer	Sample	Average	Standard deviation	T value	Significance level
	Yes	74	18.0667	3.95014	0.602	0.554

Participants' opinions about the use of metaverse technology in education	No	15	18.7143	3.64646		
Participants' opinions on the benefits of using metaverse technology in the classroom	Yes	74	39.9733	5.83784	1.047	0.298
	No	15	41.7857	6.54192		
Participants' opinions about the disadvantages of using metaverse technology in the classroom	Yes	74	36.6800	6.60908	0.548	0.590
	No	15	35.6429	6.47608		

The table above shows the differences between the averages of (the extent to which metaverse technology enables permanent and meaningful learning in the classroom) through the t-test for the two independent samples in the axes of the study tool, so we found the following:

Regarding the axis of the participants' opinions about the use of metaverse technology in education, we found that its value of statistical significance level reached (0.554), which is greater than (0.05). This means that the participants' opinions about the use of metaverse technology in education does not differ depending on the extent to which the metaverse technology provides permanent and meaningful learning in the classroom at a statistical significance level of (0.05).

For the axis of the participants' opinions about the benefits of using metaverse technology in the classroom, we found that the value of statistical significance level reached (0.298), which is greater than (0.05). This means that the participants' opinions about the benefits of using metaverse technology in the classroom does not differ depending on the extent to which the metaverse technology provides permanent and meaningful learning in the classroom at a statistical significance level of(0.05).

Regarding the axis of the participants' opinions about the disadvantages of using metaverse technology in the classroom, we found that its value of statistical significance level reached (0.590), which is greater than (0.05). This means that the participants' opinions about the disadvantages of using metaverse technology in the classroom does not differ depending on the extent to which the metaverse technology provides permanent and meaningful learning in the classroom at a statistical significance level of(0.05).

5. Conclusion and future work:

The study results showed that the students' responses score regarding the use of metaverse technology in education was large, with an average of 3.66. Moreover, the degree of the students' responses about the benefits of using metaverse technology in the classroom was large, with an average of 4.03. The results also showed that the degree of the students' responses regarding the disadvantages of using metaverse technology in the classroom was moderate, with an average of 3.09. The results of the differences between the personal variables in the axes of the study tool showed that there were no statistically significant differences between gender or age in the axes of the study tool at the level of statistical significance of (0.05). There were no statistically significant differences between the extent to which metaverse technology was used before, or the extent to which metaverse technology provides permanent and meaningful learning in the classroom in the axes of the study tool at a statistical significance level of (0.05). Thus, according to the current study results, the use of metaverse technology to support and activate the performance of the educational process was positive according to the responses of the study sample of male and female students. The extent of the use and availability of metaverse technology can increase knowledge of the students' attitudes about how to use metaverse technology applications in the classroom and obtain information.

Knowing what students think about how to use metaverse applications in the classroom and obtain information represents the future of virtual learning in the medium and long term, as proved after the research analysis. In fact, metaverse technology has become a reality in some educational cases. There is still a long way to go for future lines of research to study the future of metaverse technology in education through a review of the literature and the viewpoints of all parties of the educational process. So, it is recommended to continue research on this topic for various other stages of education such as secondary and primary education and vocational education and training.

Indeed, this is due to the ability of interactive technology and its development in accessibility, which reflects its importance in terms of implementation with students, especially those with special needs. In addition, various barriers and obstacles can be overcome, such as the audio-visual and physical problems that students suffer from while learning using metaverse technology, and thus the necessity of research and innovation in this area provides a high degree of accessibility and adaptability.

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