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Abstract

This study aims to determine students' opinions about the educational use of the Metaverse. The study was conducted during the fall semester of the 2021-2022 academic year. The sample of the study consists of 34 second-year students at the Department of Computer Engineering of a state university in the Southeast Anatolia region of Turkey. The students participated in and evaluated the Metaverse. After the application, interviews were conducted with the participants to find out the students' opinions about Metaverse. In this study, a mixed-method in which both qualitative and quantitative research methods were considered together was used. As a result of the study, it was found that the majority of students had never used Metaverse before, but wanted to use the Metaverse environment in the classroom. Students indicated that Metaverse can be used in many fields and disciplines. However, they were hesitant to use Metaverse in all faculty courses. Students believe that the Metaverse can enhance their knowledge of the subject. In addition, students consider that Metaverse can make the course content more enjoyable and increase their motivation for the course. They also believe that Metaverse has pedagogical advantages and will be used in the classroom in the near future. As for the disadvantages, they mentioned that Metaverse makes learning difficult and distracted, students disconnected from real life, and violates class discipline.

Introduction

With the use of the internet in all areas and the introduction of internet-based technologies into our lives, a great change has taken place. The nature, quantity, and use of information have changed. In addition, the internet and the related technologies led to the emergence of several new technologies. One of these technologies is the Metaverse. This technology has entered our lives with the development of the concept of the virtual world (Dionisio et al., 2013).

Metaverse, a term derived from the words meta and universe, can be referred to as the upper universe. Metaverse is a computer-generated universe beyond the physical world. The concept of the Metaverse was first mentioned in 1992 by Neal Stephenson in his book *Snow Crash*. In this work, Stephenson described the Metaverse as an environment consisting of 3D graphics. In this environment, users represent themselves with images called avatars (Tasa, 2009).

Metaverse allows individuals to interact in a three-dimensional environment and enables the effective use of body language with visual communication and video chat between avatars and gestures (Owens, 2012). While expressing the concept of the Metaverse as a cyber-social reality, Kuş (2022) defines it as a new reality in which different technologies are shared. According to Gökçe Narin (2021), the Metaverse is a simulation of the natural world.

Although the Metaverse refers to an immersive 3D world, concepts regarding the nature and organization of the Metaverse have changed over time. According to the general trend, the Metaverse is a network of interconnected virtual worlds rather than a stronger version of a single virtual world (Dionisio et al., 2013). Therefore, to understand the Metaverse better, first, it is necessary to understand the concept of virtual worlds. Virtual worlds are environments that contain three-dimensional graphical worlds and are a kind of simulation of physical reality (Metcalf et al., 2011). According to Dickey (2005), virtual worlds are online desktop applications in which users can interact and move around in three-dimensional simulated environments. According to another definition, virtual worlds are environments in which independent users can interact online (Dionisio et al., 2013).

The origins of virtual worlds date back to the 1970s. It is possible to summarize the evolution of this concept in five phases (Dionisio et al., 2013). The first phase is based on text-based applications that emerged in the late 1970s. The second phase is the Habitat virtual environment, developed for various platforms in the 1980s. The Habitat virtual environment is a 3D online virtual environment with a commercial aspect. Habitat is the environment where the concept of the avatar was initially introduced. The third phase covered the period of the 1990s. During this period, examples of virtual worlds with better graphics emerged thanks to advances in computer processing power. Virtual worlds with 3D online features and social aspects started to appear during this period. The fourth phase of virtual worlds covered the years 2000 to 2010. During this period, virtual worlds were more developed and there were examples of virtual worlds with a certain economy and a large number of users. Content development tools were also developed, including various virtual world organizations. The fifth phase, whose most distinctive feature is the emergence of virtual worlds with open source code, occurred in the 2010s.

There are some criteria to understand whether an environment is a virtual world or a Metaverse (Dionisio et al., 2013):

1. **Realism:** This criterion means that users feel they are emotionally and psychologically participating in an alternate space. In the context of immersive reality, the behaviour of users close to physical reality is one of the Metaverse criteria.
2. **Ubiquity:** One of the features of the Metaverse is that it is accessible through different devices such as mobile devices, desktop computers, or tablets. This criterion also means that the user is recognized in the Metaverse environment, similar to real-life recognition, with his unique personal characteristics such as his physical attributes and identity information. Can the user's defined identity be maintained through various transitions in the Metaverse environment as in real life?
3. **Interoperability:** It is expressed as the ability of different systems and platforms to exchange information, as well as in communication skills. Do different Metaverse environments, such as the structure of the

internet that enables different networks and subnets, have common standards for the exchange and transport of objects, avatars, and behaviours?

4. Scalability: The scalability issue is related to the number of simultaneous avatars in the Metaverse, the number and complexity of objects, and the dimensions of interaction between concurrent users. Does the server architecture allow for the simultaneous existence of multiple people?

Metaverse is also classified as text-based and graphic-based. The text-based Metaverse aims to communicate mainly through textual content. In the text-based Metaverse, users can not only communicate directly but also use various social and game-based communication options. Each user has an ID. The Text-based Metaverse was widely used in the early days of the low-bandwidth internet. The Graphics-based Metaverse environments emerged with the development of computer games. The increase in processing power of computers, the development of graphics, and the emergence of multiplayer games have enabled the graphics-based Metaverse (Tasa, 2009).

The concept of the Metaverse, first mentioned in Snow Crash, has spread with the Second Life environment created in 2003, the 'There' environment also released in 2003, and the Minecraft game released in 2011. In 2021, however, it became more widely known when Mark Zuckerberg, the founder of the Facebook social networking site, founded the umbrella company Meta to associate Facebook and its subsidiaries with the Metaverse environment. According to Kraus (2022), the Metaverse seems to be the center of online social interaction in the future. Today, many applications are defined as a Metaverse environment. Roblox (www.roblox.com), Fortnite (epicgames.com/fortnite), Sandbox (www.sandbox.game), and Second Life (<https://secondlife.com>) are among the best-known examples (Gökçe Narin, 2021). More recently, sites such as Minecraft, Decentraland, and Horizon Worlds have also begun to offer a Metaverse environment. The Horizon Metaverse expected to go live in 2022, which Facebook and other companies will serve under the name Meta after Mark Zuckerberg's announcement, has drawn attention to the concept of the Metaverse (NTV, 2021). Although the Metaverse has been a popular concept so far, it has not been widely used due to the lack of high-quality computers and insufficient internet speed. But with the impact of the pandemic and the 5G era, it has become more important for remote communication (Lee et al., 2022).

In the literature, there are several studies on the Metaverse. Tasa (2009), for example, used the Metaverse in the terms of art and architectural design. This study examined examples of art and architecture in the Second Life environment. Papagiannidis and Bourlakis (2010), on the other hand, examined the online retail industry in the Metaverse in their study. In this study, it is found that the shortcomings of the traditional internet environment in terms of the online retail sector will be eliminated by the Metaverse. In another study, the Metaverse was preferred to gain new perspectives in archeology (Forte & Krillo, 2010). Volk (2008) pointed out the importance of the Metaverse for game development, and Jun (2020) examined the Metaverse from a religious perspective.

The Metaverse has also led to the emergence of new business models. With the entry of real-world companies into Metaverse, web-based business models have come to the fore. Cagnina and Ponian (2007) have examined how the Metaverse will affect business models. It is also evident that the Metaverse is being used in many areas.

A study on Smart Cities attempted to identify the issues that may arise in Smart Cities in the Metaverse environment (Kwon, 2021).

The Metaverse is an environment where voice communication is possible, similar to real life, and avatars, in which gestures and mimics are involved in communication, can also be created from the faces of real people. It is important that people who speak different languages can understand each other in this environment. Kanematsu et al. (2010) have developed a speech application that allows different people to communicate in the Metaverse without the need for translation.

As many studies related to Metaverse existed in a variety of areas, there are also studies on education in the Metaverse. These studies allow us to better understand education and its qualifications in a Metaverse environment. Gökçe Narin (2021) examined studies related to the Metaverse in education. According to the results of this study, cooperative learning, blended learning, student-centered learning, inquiry-based learning, and mobile learning were most commonly used in the Metaverse. When examining the areas related to the Metaverse, it can be seen that the studies are mostly associated with mathematics applications, engineering education, climbing training in sports, and training for the Boeing 737. Collaborative studies on the Metaverse were reviewed by Van Der Land et al. (2011). As a result of the aforementioned study, it has been determined that users experience a higher level of feeling of, realism, and interaction in Metaverse, which differs from classical computer-based collaborative projects with avatar-based interaction and shared virtual environment.

Gestures and facial expressions provide information about people's cognitive structures in the Metaverse as in the real world. Barry et al. (2015) conducted a study to capture eye blink behavior of avatars in the Metaverse. The number of eye blinks of participants in a problem-based learning activity was recorded using a special software. In the mentioned study, it was found that there was a linear relationship between the number of eye blinks of the participants and the difficulty of the problem.

The Purpose of the Research

When a new technology is used in education, qualitative studies are necessary to obtain in-depth information. Qualitative studies are also important to understand what students feel when learning in the Metaverse and what difficulties they face in this environment. Such studies are necessary to see how effective the results achieved by using Metaverse for educational purposes are.

In this study, it is important to obtain students' opinions to determine their learning experiences and education in the Metaverse. Thanks to the obtained opinions, it will be possible to get an idea of how educational environments can be used more efficiently. The study is also important to make students aware of the Metaverse. Again, a more ideal educational environment in the Metaverse can be designed by identifying the difficulties students encounter during their Metaverse experiences. In this context, the general objective of the current study is to determine students' opinions about the educational use of Metaverse applications.

Method

In this study, a mixed-method in which both qualitative and quantitative research methods were considered together was preferred. The mixed-method, combining quantitative and qualitative techniques within the same framework, allows for a better and more comprehensive understanding of research problems by taking advantage of both techniques (Baki & Gökçek, 2012). The quantitative part of the study was supported by the questionnaire prepared by the researchers. The study used the case study, one of the qualitative research designs, find out the students' opinions about the Metaverse. A case study can be described as an approach in which one or more examples of a case are studied in depth with a limited number of samples (McMillan & Schumacher, 2010; Yıldırım & Şimşek, 2013).

The study was conducted during the fall semester of the 2021-2022 academic year. The sample of the study consists of voluntarily participated second-year students of the Department of Computer Engineering of a state university in the Southeast Anatolia region of Turkey. The demographic data of the participants in the study are shown in Table 1.

Table 1. Demographical Characteristics of the Students

Variables	Category	f	%
Gender	Female	16	47.1
	Male	18	52.9
Age	≤19	2	5.9
	>20, ≤21	28	82.3
	≥22	4	11.8
Total		34	100

A total of 34 students, 16 (47.1%) female, and 18 (52.9%) male, participated in the study. In terms of age groups, two (5.9%) participants are 19 years old and younger, 28 (82.3%) participants are between 20 and 21 years old, and four (11.8%) participants are 22 years old and older. Since the study only included data from second-year students, it was found that a significant portion of the participants was 21 years old and younger.

Implementation Process

The study received institutional approvals to initiate the implementation process, conduct activities, and collect data. In the next phase, the content was created using various sources and materials for the application. The study was conducted in a computer lab environment for three class periods. In the first 20 minutes of the study, participants were informed about the purpose of the study, the content, and the features of the Metaverse environment in detail. Then, a Metaverse sample application allowed students to use and test this environment was presented. Students participated in as well as evaluated the Metaverse environment. After the application, interviews were conducted with the participants to get their opinion about the environment.

Data Collection Instrument

In the quantitative part of this study, an opinion survey was used as a data collection tool. For the qualitative part, a structured interview form developed by the researchers was used. The interview questionnaire was prepared by the researchers based on the literature (Uluyol & Eryılmaz, 2014). Also, the questionnaire was given its final form after being reviewed by three field experts and one language expert. The first section of the questionnaire contains questions to determine the demographic data of the participants. In this section, there are also four questions about the use of the Metaverse. There are also six Likert-type questions with five items on the use of Metaverse in the classroom. The reliability of the questionnaire was calculated as ($\alpha = 0.89$). For the qualitative aspect of the study, an interview form consisting of four questions was used to further explore the participants' opinions on the implementation process. Researchers pay an extra attention for the fact that the questions in the interview form were clear, open-ended, and flexible. Expert opinions were also taken into consideration for the interview form. A pilot study was conducted and necessary adjustments were made according to suggestions.

Data Analysis

The quantitative data obtained in this study were analyzed by descriptive analysis methods using the statistical program SPSS 23. For the analysis of qualitative data, the content analysis method was used. Considering the ethical rules, the names of the students in the study were kept confidential and the opinions of the participants were coded as S1, S2, S3 ... S34. To calculate the reliability of the data analysis, the percentage agreement formula recommended by Miles and Huberman (2015) was used. As a result of the calculations, it was found that the reliability value was 86%. In the literature, a reliability coefficient of 70% and above is considered reliable for research (Miles & Huberman, 2015). During the data analysis, some students' views on each topic were directly quoted, in order to avoid comments and generalizations.

Results

Several questions were asked to assess students' opinions on the educational use of the Metaverse. The related responses can be found in Table 2.

Table 2. Knowledge of Students Participating in the Study about the Metaverse

Variables	Category	f	%
Have you ever used Metaverse before?	Yes	10	29.4
	No	24	70.6
Would you like to benefit from the Metaverse in the classroom?	Yes	23	67.6
	No	5	14.7
	Undecided	6	17.6
Does Metaverse enable permanent and meaningful learning in the classroom?	Yes	15	44.1
	No	9	26.5
	Undecided	10	29.4

It was found that the majority of students (70.6%) who participated in the study had never used Metaverse before. However, 67.6% of the students indicated that they would like to use the Metaverse in the classroom. 44.1% of students believe that Metaverse will enable permanent and meaningful learning in the classroom.

The survey also asked participants in what areas and/or disciplines Metaverse could be used. Participants indicated more than one area/discipline in their responses as can be seen in Figure 1.

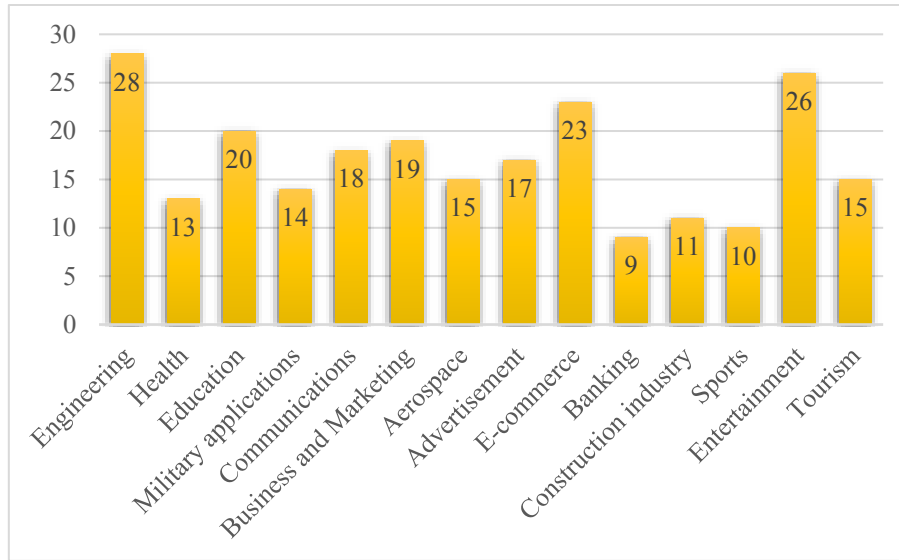


Figure 1. Areas/Disciplines in which the Metaverse can be used

Students indicated that the Metaverse can be used in many areas and disciplines. From the data in Figure 1, it appears that the Metaverse can be used primarily in engineering and entertainment. These fields/disciplines are followed by e-commerce, education, communications, business, and marketing.

The study also used a six-item questionnaire on the educational use of the Metaverse. The results of this questionnaire are summarized in Table 3.

Table 3. Participants' Opinions about the Use of the Metaverse in Education

Variables	\bar{X}
I believe Metaverse can enhance my knowledge on this subject	3.56
Metaverse can make the course content much more entertaining	3.75
Metaverse can increase motivation for the course	3.34
Metaverse has pedagogical benefits	3.29
Metaverse can be used in any course at the faculty	2.68
Metaverse will be used in classrooms in the near future	3.07

As can be seen in Table 3, students agree and believe that Metaverse can enhance their knowledge of the subject. The average score of students who believe that Metaverse can enhance their knowledge of the subject is 3.56. In addition, students believe that Metaverse can make the course content more entertaining and increase their

motivation for the course. They also agree that Metaverse has pedagogical benefits and will be used in the classroom in the near future. Another finding is that they are hesitant to use Metaverse in any faculty course. The average score of students who believe that Metaverse can be used in a faculty course is 2.68.

The study also sought students' opinions on whether the Metaverse could be used in education. The associated results are shown in Figure 2.

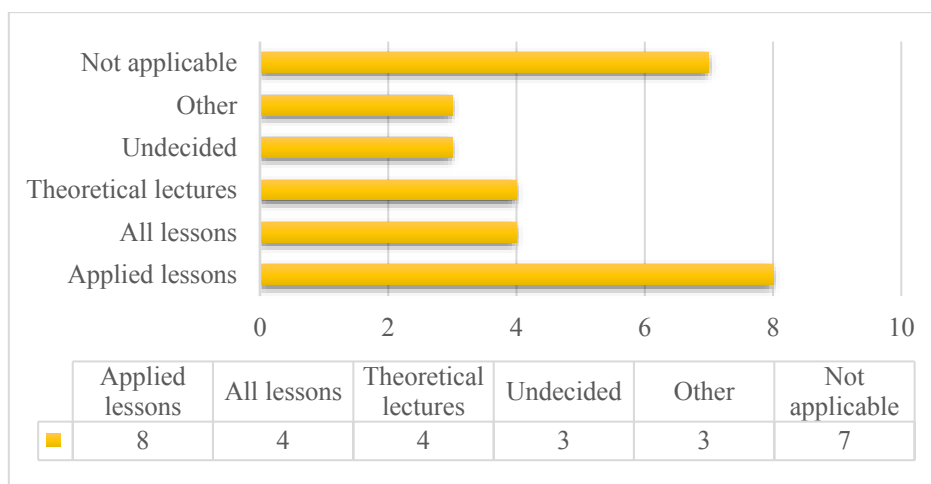


Figure 2. Applicability of the Metaverse in the Classroom

As a result of the evaluations, students' opinions about the applicability of the Metaverse in the classroom, such as "Applied lessons" (f=8), "All lessons" (f=4), "Theoretical lessons" (f=4), "Not applicable" (f=7) situations were observed. One of the statements from the interviews with students is as follows: S33: "I think it is better suited for use in more theoretical courses, but it can also be developed and used in laboratory-based courses...". Another student commented as follows: S16: "... can be used in engineering courses ...". On the other hand, all three students in this view talked about concepts (such as "games" and "internet") other than the courses mentioned, and the subheading "Other" was created for this situation. In addition, three students expressed undecided opinions about whether the Metaverse could be used in education. One student commented on this issue as follows: S3: "I did not decide about whether to use this application in my lessons or not..."

An open-ended question was also used in the research to get students' opinions on the advantages of using Metaverse in lessons. The results regarding to this are presented in Table 4. Regarding the benefits of using Metaverse in the classroom, students mentioned: "interaction with the teacher/classmates" (f=5), "provides a fun learning environment" (f=5), "flexibility (anytime, anywhere)" (f=4), and "increasing interest in the lesson" and "saving time" (f=3). Regarding to this situation, one student commented as follows: S17: "This makes the classes more fun ...". Another student expressed his opinion on this issue as follows: S27: "It increases focus on instruction because there will be a constant interactive student community". Another student expressed his opinion as follows: S20: "It saves time and can help us understand better visually". Two students who participated in the study stated that there were no benefits to using Metaverse in the classroom. Again, eight students did not comment on the benefits of using Metaverse in the classroom.

Table 4. Participants' Opinions on the Benefits of Using Metaverse in the Classroom

Variables	f
Interaction with teachers and classmates	5
Provides a fun learning environment	5
Flexible (anytime, anywhere)	4
Increases interest in the lesson	3
Saves time	3
Fast and effective learning	2
Better understanding	2
Active learning	2
Application outside the lab	2
Distance learning support	1
Development of imagination	1
Various interactive applications	1
Facilitation of learning	1
Visual learning	1
Provides focus on instruction	1
Active participation	1
Motivates instruction	1
Increases desire to learn	1
Visualization	1
It has no advantage	2

As part of the research, students' opinions were also sought on the disadvantages of using Metaverse in the classroom. The opinions can be found in Table 5.

Table 5. Participants' Opinions on the Disadvantages of Using Metaverse in the Classroom

Variables	f
To make learning difficult	4
Being a distraction	3
Inability to concentrate	2
Inability to maintain discipline in the classroom	2
Provides a break from real life	2
Causes health problems	1
Unconscious use	1
Malicious use	1
Restriction of privacy	1
Inadequate transmission of ideas	1
Permanent learning disability	1
Negative impact on the person's social life	1
Risk to safety	1
Technology dependency	1
Requires internet access	1
Lack of access to technology	1

Regarding to the disadvantages of using the Metaverse in class, students mentioned: "To make learning difficult" (f=4), "Being a distracting" (f=3), "Inability to concentrate" (f=2), "Inability to maintain discipline in the classroom" (f=2) and "Provides a break from real life" (f=2). According to this, one student commented as follows: S11: *"It can cause them to disconnect from real life and negatively affect their social life, family relationships, etc..."* Another student said the following about this issue: S6: *"I think it will ruin your eyesight"*. Another student said S27: *"To use this application, it is necessary to have technological tools such as internet and phone or computer. If the internet is weak, I think the application cannot be used effectively"*.

Discussion and Conclusion

In this era, known as the information and communication age, rapid changes are occurring in parallel with technological developments. With the increase and spread of technological tools, many people have begun to make greater use of these tools in their lives. Therefore, it has become inevitable for people who grow up in the age of technology to use these technologies in their educational lives as well. One of the technologies that we hear about frequently today and discuss its effectiveness in the learning and teaching process is the Metaverse that comes with the development of technology. The purpose of this study is to contribute to education by collecting students' opinions and thoughts about the use of the Metaverse in education and to make findings on the appropriateness of using this technology in education, both for today and the future. To make these determinations, questionnaires and structured interview forms were used on computer engineering students. This section provides detailed information about the results of the study. The obtained results were compared with the studies in the literature and their similarities and differences were discussed. In addition, suggestions for future studies are made based on the results of this study.

As a result of the research, it was found that students generally did not use the Metaverse before. Therefore, it can be concluded that the students do not have enough experience with the Metaverse application and they do not know the application very well. The main reason could be that Metaverse is not yet widely used and there is not enough research on its effectiveness in the learning and teaching process. However, with the announcement of Metaverse by social media giants such as Facebook and large technology companies as the future of the Internet, it can be stated that it has started to attract the attention of a wider audience and has become quite widespread in many fields in recent years (Gökçe Narin, 2021). However, in our research results, most students indicated that they wanted to use the Metaverse environment in the classroom. We can see the reason for this in the interviews with the students. We can say that students expressed positive opinions about Metaverse and therefore wanted to use the Metaverse environment since they believe that Metaverse provides permanent and meaningful learning, makes the classroom fun, activates students, and ensures their participation in the classroom. Based on our research findings, it is recommended that students should be allowed to use Metaverse and applications related to Metaverse should be transferred to the classroom environment to educate students about new technologies. For widespread use of the Metaverse in the classroom, teachers can be trained on this topic and applications can be included in textbooks. In this way, students can gain knowledge about the Metaverse and the ability to use such technologies.

One of the findings of the research is that while students are hesitant to use Metaverse in all faculty courses, they think it can be used in some courses, especially applied ones. However, students also indicated that Metaverse can be used effectively in the fields of engineering, entertainment, e-commerce, education, communication, business, and marketing. Therefore, it can be said that Metaverse, a new-generation technology, will be able to draw attention to its use in education in a short time, from preschool to university, thanks to its multiple functions. Augmented reality and virtual reality are technologies that have recently been used in all fields (Batdı & Talan, 2019). It is believed that the Metaverse will be used in many fields like these technologies. The first applications of the Metaverse were computer games consisting of virtual worlds. However, in addition to the entertainment industry, the concept of the Metaverse has been actively used in many different fields from literature to art and music to education over the years and has been the subject of academic studies (Gökçe Narin, 2021). The Metaverse can provide various benefits and can be effectively used in many fields such as engineering, mathematics, STEM education, aircraft instruction, and training (Akour, 2022). It can be said that the Metaverse, which will soon be part of daily life, will play a key role in all fields such as aviation, defense, and health (Siyayev & Jo, 2021). Another finding of the research is that students believe that Metaverse can increase their knowledge of the subject, make the course content more enjoyable, and increase their motivation for the course. Thus, the students have a positive attitude towards the use of Metaverse. They believe that Metaverse will be used in classrooms in the near future because it helps to motivate students, increase their interest in learning, and make classes interactive and enjoyable. The literature states that although the Metaverse platform has technical and ethical limitations, it is an important tool for increasing student motivation (Jeon & Jung, 2021).

As a result of the research, it was found that students expressed many opinions about the benefits of using Metaverse in the classroom. It was found that Metaverse makes the lessons interesting and varied, allows students to actively participate in the process, increases their curiosity, and makes the learning process fun, active, and effective. In addition, Metaverse can also be used to support distance learning by providing students with a flexible learning opportunity at any time and place. Students emphasized that Metaverse provides interaction opportunities, enhances imagination, facilitates understanding and learning, and makes the learning process effective and efficient. In addition, they indicated that the Metaverse increases interest and attention to the instruction and makes class time more productive by providing continuity in motivation. Metaverse can be effective in teaching expensive and dangerous events or topics that cannot be directly observed as augmented reality. Again, it is evident that Metaverse can visualize abstract structures in three dimensions, making the material more concrete and complex topics more understandable. It is therefore likely that these potentials of Metaverse in education will lead to an increase in research and effective use in the coming years. Metaverse also contributes to the development of 2D learning tools (Mystakidis, 2022).

On the other hand, students indicated that Metaverse has some difficulties and disadvantages in addition to its contribution to education and other areas. The limitations of Metaverse mentioned by the students were the hardware and technical problems of the application, the need for Internet access for the application, and the lack of access to technology. Other shortcomings of Metaverse caused technology addiction, screen addiction, and some health problems. Negative aspects of Metaverse also include problems such as interference with social life, inability to communicate thoughts appropriately, and disconnection from real life. Again, it was concluded that

the unconscious and malicious use of Metaverse would make learning difficult and prevent permanent learning. Students indicated that when Metaverse is used in crowded classrooms, problems such as disorder and noise, inability to maintain discipline in the classroom, and distraction of students' attention can occur. Such negative aspects create problems in the integration of Metaverse into educational environments and the use of these technologies by students and teachers. For Metaverse to be integrated into education and used effectively in educational environments, such drawbacks should be identified and eliminated. In addition, it is of great importance to conduct usability testing and pre-testing in the applications and eliminate software and technical problems. It is recommended to bring the necessary technical infrastructure to an appropriate level to avoid problems in the application. Again, for effective use of Metaverse in educational environments, preference should be given to applications that are appropriate for the curriculum, attract student attention, and take into account features such as student level and usefulness. It is suggested that many concepts, especially intangible, invisible, dangerous, or costly concepts, should be presented using Metaverse.

The purpose of this study is to determine students' opinions about the educational use of the Metaverse. In this regard, it is recommended that the results obtained in the study be carefully evaluated by researchers, practitioners, and policymakers and the necessary precautions should be taken. It is expected that the data obtained from these studies will provide necessary information to educators and digital designers who wish to implement the Metaverse in educational environments. In addition, they will serve as a guide for future studies on this topic. The Metaverse is a technology that has just begun to be used in educational environments. Therefore, in future studies, researchers can examine the effects of the Metaverse on variables such as academic performance, interest, attitude, and retention. In addition, those studying this topic can examine the reasons of why Metaverse is not preferred in education. Future studies can examine student satisfaction with this issue by including students from different educational levels and different geographic regions. Data can be examined in detail by using quantitative research or mixed research methods. In addition, studies can be conducted on the integration of Metaverse into courses.

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