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Investigation of Teachers' Beliefs about Meta-Education

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ABSTRACT

In order to improve and facilitate students' learning experiences in teaching and learning environments, teachers' use of current technologies in these environments offers opportunities for 21st-century students. One of these current technologies is meta-education (metaverse) technology. It can be thought that teachers' beliefs about the metaverse may affect their use of this technology in educational environments. Based on this idea, in this research, it was aimed to determine the belief levels of teachers about meta-education and to examine them in terms of various variables. The causal comparison model, one of the quantitative research methods, was utilized. In the sample selection of the study, maximum variation sampling, one of the purposeful sampling methods, was used and the research was carried out with the participation of a total of 731 teachers. As a result of the research, it was determined that teachers' belief levels about the metaverse were at a medium level. Based on this, it can be said that teachers' beliefs about meta-education are neither negative nor positive. As a result of the analysis according to the variables, it was determined that teachers' beliefs about the metaverse did not differ in terms of gender, but they differed in terms of taking part in a scientific project, reading about the metaverse, using technology in education and following current technologies. Practical training should be planned for both teachers and prospective teachers on the effective use of metaverse technology in education, and their beliefs in these technologies should be nurtured.

Keywords: Metaverse, meta-education, belief, teacher.

Introduction

It can be said that it is inevitable for teachers to use current technologies in learning-teaching environments in order to improve and facilitate students' learning experiences. One of these current technologies is meta-education technology. The term metaverse first appeared in the science fiction movie "Snow Crash" published by Neal Stevenson in 1992 (Mystakidis, 2022). The concept of the metaverse, which is formed by merging the words "meta" and "universe," refers to a collective virtual environment that integrates both virtual and real physical environments through the use of computers (Wang et al., 2023). Although there is no standard set for the structure of the metaverse (Aria et al., 2023), it has six basic components, such as artificial intelligence (AI), virtual software, an economic component, computing infrastructure, 3D virtual worlds and a user (person) (Weinberger, 2022). The metaverse involves the integration of virtual reality (VR), augmented reality (AR) and other advanced technologies (big data, mixed reality, blockchain, digital twin, AI) to transform educational environments and provide immersive learning experiences for students (Lin et al., 2022; Kayyali, 2024). Thanks to these technologies, the metaverse goes beyond real-world possibilities and offers in-depth and interactive experiences to teachers and students (Wu, 2024). With the help of avatars and immersive 3D environments, the metaverse environment aims to provide learning experiences through enhanced interactivity in education where teachers and students interact economically and socially (Kye et al., 2021). Because the metaverse, which enables the creation of highly interactive and immersive learning-teaching environments by utilizing AR and VR, stands out with the potential to significantly transform education (AlGerafi et al., 2023). Thanks to 3D simulations developed with the help of AR and VR technologies, students can interact with environments that are difficult to access, such as historical sites or scientific laboratories (Paulauskas et al., 2023). Therefore, this immersive feature of the metaverse environment can increase students' engagement and facilitate experiential learning and knowledge retention. In addition, the metaverse provides students and teachers with motivations such as extended social interactions, virtual experience, extended entertainment, transfer awareness, and advantage seeking (Hong & Cho, 2023), and its potential to support students' personalized learning experiences makes learning engaging and fun, allowing

them to interact with and explore complex concepts (Akour et al., 2022). The changes provided by Metaverse in education are given in Figure 1.

Figure 1.

Changes in education enabled by the metaverse (Lin et al., 2022)

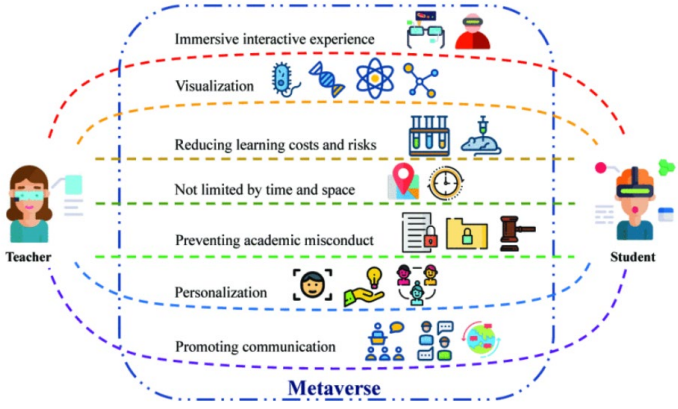

Figure 1 shows that the changes provided by metaverse technology in learning-teaching environments are (1) immersive interactive experience, (2) visualization, (3) reducing learning costs and risks, (4) not limited by time and space, (5) preventing academic misconduct, (6) personalization, and (7) promoting communication. It is possible for students to learn effectively by experiencing realistic experiences such as observation and practice in a virtual classroom environment with immersive interactive experience (Parong & Mayer, 2021). With visualization, students' visual learning is supported by simulating situations or abstract concepts that are difficult to experience in real physical environments in a virtual environment (Lin et al., 2022). With reduced learning costs and risks, experiments that are risky and costly to perform in real physical environments can be simulated in virtual environments, and both safe and economical facilities can be offered in learning-teaching environments. Not being limited by time and space allows students to learn independently of time and space by simulating places, events or workshops in different times and places (Veenman, 2023). With preventing academic misconduct, blockchain technology can easily monitor and control the publication and distribution of academic works by tracking the copyrights of the materials used in the virtual classroom environment (Sharples & Domingue, 2016). With personalization, students have the opportunity to learn at their own pace and in their own style (Zhao et al., 2022). Promoting communication can support students to work collaboratively and create social study rooms as well as teachers to hold meetings.

In addition to all these benefits of the metaverse, there are some challenging factors for its integration into teaching and learning environments. In order to successfully integrate the metaverse into teaching-learning environments, various factors such as special skills, standardization, network connectivity, certification, reliability, confidentiality, privacy, dependency and institutional readiness for effective use of the metaverse need to be considered (Lin et al., 2022; Onu et al., 2024). In addition to this, data storage for the metaverse, fast internet connection, infrastructure, and accessibility and price of the technologies required for the metaverse emerge as important challenges (Abilkaiyrkyzy et al., 2023; Rawat & Alami, 2023; Rajawat et al., 2025). According to Chen (2024), problems such as the difficulty of developing client programs for Android, Windows, iOS and other operating systems, as well as applications for various brands of VR, AR and MR glasses, difficulty of interaction due to limited signal collection capacity, slow content production cycle on the Metaverse platform, and game addiction are also prominent in immersive technologies such as Metaverse. In addition, the metaverse, which allows incorporating artificial intelligence and learning analytics, can also lead to ethical issues such as misuse of information and data privacy, which can negatively affect students (Al-Kfairy & Alfandi, 2024). In addition, it can be said that the haptic technologies used in metaverse technologies indirectly affect the use of these environments. Haptic technologies increase the immersion of users by affecting senses such as touch and collision in the virtual environment and providing more immersive senses (Han et al., 2024; Tang et al., 2024). Therefore, this technology is aimed to enable fast-paced interaction (Han et al., 2024). Despite the opportunities that haptic technologies offer to their users, it can be said that there are some difficulties in the development and use of this technology. These difficulties include portability and high cost, as well as delay, difficulty of integration and poor user experience (Fouad et al., 2023; Hayward, 2000). Another issue is the pedagogical problems that teachers may face in the integration of the metaverse into learning-teaching environments (Kaddoura & Al-Husseiny, 2023). Therefore, teachers need to have the necessary pedagogical knowledge to provide effective teaching and learning in the metaverse environment (Beck et al., 2024). Based on this, it can be said that in order to ensure effective and active learning in the metaverse environment, it is important for teachers to use pedagogical methods and tools that enable the development of educational materials in line with students' goals and individual needs. Based on this, teachers' use of pedagogical methods and tools in educational environments can be explained by the Technology Acceptance Model.

The Technology Acceptance Model (TAM), introduced by Fred Davis in 1986, advocates predicting and explaining users' acceptance of technology based on the Theory of Reasoned Action (TRA) (Davis, 1987). TRA, a well-established psychological theory, explains human behavior based on certain beliefs (Kashima & Gallios, 1993). The beliefs in the technology acceptance model are expressed as perceived ease of use and perceived usefulness (Akça & Özer, 2012). Perceived usefulness is defined as a person's belief that the system will increase his/her job performance, while perceived ease of use is explained as a belief pattern that a person will not spend effort in using the system (Venkatesh & Davis, 2000). Therefore, it can be said that an individual's beliefs about the relevant technology can be evaluated in order to predict his/her attitude towards using a certain technology. Because if teachers believe that the Metaverse can enhance their students' learning experiences and be useful in providing effective educational services, they are more likely to adopt this technology (Al-Kfairy et al., 2025). Therefore, technological features such as ease of use, accessibility, and reliability of the Metaverse are vital to adoption, as user-friendly design and intuitive navigation can increase the likelihood of users using the technology (Al-Kfairy et al., 2025). In addition, the technical robustness of the Metaverse, such as minimal latency, high-resolution graphics, and stable connectivity, helps create a seamless and immersive experience that is critical to maintaining user interest and engagement (Mitchell, 2024). In this context, teachers' beliefs that they can achieve more effective results with less effort thanks to technology can facilitate and accelerate the integration of technology into learning-teaching environments. Teachers' beliefs about this technology can be expected to be determinative on the integration and effective use of the metaverse, which is one of the current technologies utilized in the teaching process in recent years, into teaching environments. Therefore, it can be said that teachers' beliefs about the metaverse appear as an important factor.When the literature was examined, it was determined that teachers' knowledge levels, awareness levels, perceptions, readiness to design a learning environment, needs, usage levels, opinions and concerns regarding the metaverse were examined (Agrati, 2023; Alali & Wardat, 2024; Avcı & Çulha, 2024; Aydin, 2023; Eşin & Özdemir, 2022; Gürkan et al., 2023; Han & Hong, 2022; Jafari, 2023; Kanber et al., 2023; Kebeci, 2024; Kim & Huh, 2024; Kim & Chae, 2022; Lee, 2021; Lee & Hwang, 2022; Rachmadtullah et al., 2023; Saad et al., 2023; Shi et al., 2023; Turan et al., 2023). In addition, it was also seen in the literature that research on the metaverse was conducted on pre-service teachers.When the literature was examined, it was determined that the attitudes, knowledge levels, awareness, opinions, perceptions, and coping skills of teacher candidates regarding the metaverse and instructional design competencies were examined (Chen, 2024a; Choi, 2024; Görkem & Başarmak, 2024; Gün & Durmuş-Öz, 2024; Hwang, 2024; Lee & Kim, 2024; Jeong et al., 2021; Savaş et al., 2022; Tural & Koçak, 2023; Yilmaz & Coskun-Simsek, 2023; Yılmaz-Demirel & Köroğlu, 2024). However, it can be said that there is a lack of literature on teacher beliefs, which can be seen as an important factor for the integration and effective use of the metaverse in teaching environments, and teacher beliefs have been partially neglected.

Purpose of the Study

Thanks to this research, teachers' belief levels about metaverse were determined and examined in the context of various variables and thus contributed to the literature. In this study, it was aimed to determine the beliefs of teachers with different branches about metaverse (meta-education). In line with this purpose, answers to the following questions were sought.

1. What is the level of teachers' beliefs about metaverse (meta-education)?
2. According to which independent variables do teachers' beliefs about meta-education differ?
    a. Do teachers' beliefs about meta-education differ according to their gender?
    b. Do teachers' beliefs about meta-education differ according to their involvement in a scientific project?
    c. Do teachers' beliefs about meta-education differ according to their metaverse-oriented reading?
    d. Do teachers' beliefs about meta-education differ according to their use of technology in education?
    e. Do teachers' beliefs about meta-education differ according to whether they follow current technologies?

Method

Research Model

In this study in which teachers' beliefs about meta-education were examined in terms of different variables, the causal comparison model, which is one of the quantitative research methods, was utilized. The causal comparison model is a type of research in which the variables affecting the causes of an existing situation or

event are determined, and the independent variables affecting a dependent variable are tried to be determined in a cause-effect relationship (Büyüköztürk et al., 2015). In this study, teachers' beliefs about meta-education were taken as the dependent variable, and this variable was determined in terms of independent variables such as gender, taking part in the project, reading from any source related to meta-education, utilizing technology in education and following current technologies.

Population and Sample

The population of the study consists of 3976 teachers working in the province where the research was conducted, and the sample consists of 731 teachers with different branches and characteristics among these teachers. Büyüköztürk et al. (2015) emphasize that the sample size should be at least 351 when the population size is 4000 and the significance level is accepted as .05. In sample selection, maximum variation sampling, one of the purposive sampling methods, was used. Maximum variation sampling is the determination of different situations that are similar to each other in relation to the problem examined in the universe and conducting the study on these situations (Büyüköztürk et al., 2015). In this study, maximum diversity sampling was achieved by having teachers from different branches and genders. Accordingly, it can be said that the sample of 731 teachers from which the research data were obtained is sufficient. The demographic characteristics of the sample teachers are presented in Table 1.

Table 1.

Demographic Characteristics of Teachers

		f	%
Gender	Male	294	40.2
	Female	437	59.8
Branches	Preschool	60	8.2
	Primary School	208	28.5
	Quantitative Sciences	125	17.1
	Verbal Sciences	113	15.5
	Special Education	31	4.2
	Other	194	26.5

Table 1 shows that the sample group consists of teachers with different demographic characteristics.

Data Collection Tool

The Personal Information Form and Meta-Education Belief Scale were used to reach the research data. The Personal Information Form consists of a section in which the participants give information about their gender (Male/Female), branches (Preschool/Primary School/Quantitative Sciences/Verbal Sciences/Special Education/Other), taking part in a scientific project (Yes/No), reading about metaverse (Yes/No), utilizing technology in education (Frequently/Sometimes/Never) and following current technologies for education (Frequently/Sometimes/Never). Therefore, it can be said that data on independent variables were obtained through the personal information form. On the other hand, the Meta-Education Belief Scale was used to obtain data on the dependent variables of the study. This scale was developed by Erol et al. (2023) to determine teachers' meta-education belief levels. The scale consists of 22 items and is a five-point Likert type. According to this scale, the lowest average score that the participants can have is 1, while the highest average score can be 5. While 1 and 2 indicate that teachers' beliefs about meta-education are negative, 3 indicates that teachers' beliefs about meta-education are not positive but not negative either. 4 and 5 indicate that teachers' beliefs about meta-education are positive. Therefore, it was evaluated that if the average scores of the teachers' beliefs about metaverse were close to 1, they had low-level beliefs, and if they were close to 5, they had high-level beliefs. The evaluation for this is presented in Figure 2.

Figure 2.

Belief level assessment criteria

Erol et al. (2023) found that the item-total correlation values in the scale ranged from .64 to .77. It was also determined that the single-factor scale explained 44% of the total variance and the Cronbach Alpha coefficient was .90. In this study, the Cronbach Alpha coefficient was determined to be .923. The single-dimensional scale allowed teachers' beliefs about the perceived benefits of the metaverse to be determined. Some of the items in this scale are as follows: (1) "Educational services made with metaverse are more memorable for students.", (2) "Metaverse supports students' learning motivation.", (3) "Metaverse offers students the opportunity for personalized learning.", (4) "Metaverse positively affects the emotional development of students.".

The ethical process in the study was as follows:

- Ethics committee approval was obtained from Kafkas University Social and Human Sciences Research Ethics Committee (Date: September 4, 2023, Number: 48/23)
- Informed consent has been obtained from the participants.

Data Collection Process

After obtaining the necessary ethics committee permission to conduct the research, official permissions were obtained by applying to the provincial directorate of national education in order to ensure the participation of teachers working in the province where the research would be conducted. After the official permissions were completed, the data collection tools were distributed by the researchers to the teachers working in the schools in the provincial center together with the voluntary participation forms, and the data collection tools were collected together with these forms. However, in order to be able to reach the teachers working not in the city center but in the districts or villages of this province and to include them in the sample, the data collection tools and voluntary participation forms were transferred to the online environment via Google Forms, and thus data could be obtained. The online scale link created via Google Forms was shared on the WhatsApp groups of the provincial and district national education directorates in an attempt to reach teachers working in all schools. In order to inform teachers about the research during the online data collection process, they were first provided with instructions to obtain information about the purpose of the planned research and to indicate their voluntary participation. If they reached the information given about the research and confirmed that they were voluntary participants, they were asked to code the scale items and send them to the researchers. While face-to-face scale applications lasted 2 months and 1 week, the forms created for online scale applications, which started simultaneously with face-to-face scale applications, remained active for 3 months and 2 weeks. Reminder messages were sent monthly by the district national education directorates to participate in online scale applications. In both forms of data collection, in addition to informing the teachers about the purpose of the research, it was stated that the teachers' voluntary participation in the research would be taken as a basis, their names would not be mentioned in any part of the research, and the data obtained would not be used for any purpose other than the research. No incentives were provided to any participants. The data collection tools distributed both face-to-face and online by the researchers were returned by 813 teachers. However, 82 of the data submitted by the teachers were excluded from the scope of the study due to the teachers' refusal to be voluntary participants, coding more than one item for each item in the data collection tool, or incomplete coding. A total of 731 participant responses, in which voluntary participant consent was included and the data collection tools were presented accurately and completely, were evaluated within the scope of the research, and the data analysis process was started.

Data Analysis

Within the scope of the research, the data of 731 participants were analyzed using SPSS 20.0 (IBM SPSS Corp., Armonk, NY, USA) package program. The 'Compute Variable' function in SPSS 20.0 was used to calculate the mean scores of the items in the 22-item scale. The Kolmogorov-Smirnov test (Durmuş et al., 2013), which is used for samples of 50 and above, was used to determine whether the data obtained from the teachers using the Meta-Education Belief Scale showed normal distribution or not, and the skewness and kurtosis values were examined. The values obtained are presented in Table 2.

Table 2.

Normality Test Findings

Kolmogorov-Smirnov			Skewness	Kurtosis
Statistic	df	*p*		
.077	731	.09	-.321	.604

If the p value obtained as a result of the Kolmogorov-Smirnov analysis is greater than .05 and the skewness and kurtosis values are in the range of +2 and -2, it is accepted that the data have a normal distribution (Büyüköztürk, 2011; George & Mallery, 2010). In line with these values, Table 2 shows that Kolmogorov-Smirnov test values (p > .05) and kurtosis (-.321) and skewness (.604) values support the normality assumption.

After determining that the data had a normal distribution, descriptive analyses (descriptive statistics) were performed first. In this way, teachers' belief levels about metaverse were examined in general. Then, the scores of the teachers regarding the Meta-Education Belief Scale in terms of gender, taking part in a scientific project, and reading from any source about the metaverse were analyzed with an Independent Samples t-Test. In addition, it was determined that the “never” option for the variables of utilizing technology in education and following current technologies for education, for which three different options (Frequently, Sometimes and Never) were presented to the teachers for coding, was not specified by the teachers. For this reason, the analyses for these variables were also analyzed with an Independent Samples T Test. Statistical significance value was accepted as $p < .05$ for all analyses.

Results

Teachers' levels of beliefs about the metaverse were analyzed using descriptive analysis without depending on any variable and the related findings are presented in Table

3.

Table 3.

Teachers' Belief Levels about Metaverse

	N	$\bar{X}$	Sd	Min.	Max.
Teachers' belief levels about metaverse	731	3.38	.55	1.59	5.00

Considering the evaluation criterion presented in Figure 2, when the findings obtained in Table 3 are evaluated, it is seen that teachers' belief levels about metaverse are at a medium level ($\bar{X}$=3.38).

The Independent Samples T Test was used to examine whether teachers' beliefs about the metaverse differed in terms of gender, and the findings are presented in Table 4.

Table 4.

Examination of Teachers' Beliefs about Metaverse in terms of Gender

Groups	N	$\bar{X}$	Sd	df	t	*p*
Female	437	3.37	.54	729	.512	.609
Male	294	3.39	.57			

*p < .05 level is significant.

According to Table 4, teachers' beliefs about the metaverse do not show a significant difference according to their gender (p > .05). In this case, it can be said that the beliefs of male and female teachers about the metaverse are similar.

The results of the analysis carried out to determine whether teachers' beliefs about the metaverse differed according to whether they took part in a scientific project or not are presented in Table 5.

Table 5.

Examination of Teachers' Beliefs about Metaverse in terms of Taking Part in a Scientific Project

Groups	N	$\bar{X}$	Sd	df	t	*p*
Those Involved in Scientific Projects	332	3.47	.611	729	2.355	.019
Those Not Involved in Scientific Projects	399	3.35	.540			

*p <.05 level is significant.

When the analysis results given in Table 5 were examined, it was determined that teachers' beliefs about metaverse showed a significant difference according to the status of taking part in a scientific project (p < .05). It is seen that this difference is in favor of the teachers who took part in any scientific project (Those who took part in a scientific project, $\bar{X}$=3.47 >; Those who did not, $\bar{X}$=3.35). Based on this finding, it can be said that taking part in a scientific project positively affects teachers' beliefs about the metaverse.

The results of the analysis conducted to determine whether teachers' beliefs about metaverse differed according to whether they read an article, book or web page (such as a blog post) about metaverse are presented in Table 6.

Table 6.

Examination of Teachers' Beliefs about Metaverse in terms of Their Reading about Metaverse

Groups	N	$\bar{X}$	Sd	df	t	*p*
Those who read about the metaverse	326	3.52	.56	729	4.448	.00
Those who do not read about the metaverse	405	3.32	.54			

*p < .05 level is significant.

As seen in Table 6, it was determined that there was a significant difference between the teachers who read about the metaverse from any source and the teachers who did not (p < .05). In addition, this difference was found to be in favor of teachers who read about the metaverse (Readers, $\bar{X}$=3.52 >; Non-readers, $\bar{X}$=3.32). Based on this finding, it can be said that reading articles, books or web pages about the metaverse significantly affects teachers' beliefs about the metaverse.

In order to determine the teachers' use of technology in education, “frequently”, “sometimes” and “never” options were presented in the scale, and it was determined that only “frequently” or “sometimes” options were preferred by the teachers. Therefore, the independent samples t-test was used for the analysis of the two groups. The findings related to these analyses are presented in Table 7.

Table 7.

Examination of Teachers' Beliefs about Metaverse in terms of Their Use of Technology in Education

Groups	N	$\bar{X}$	Sd	df	t	*p*
Those who frequently use technology in education	387	3.41	.57	7292.254		.024
Those who sometimes use technology in education	344	3.31	.52			

*p <.05 level is significant.

When Table 7 is examined, it is determined that there is a significant difference between the teachers who frequently

use technology in education and the teachers who sometimes use technology ($p < .05$). It was determined that this difference was in favor of teachers who frequently use technology in education (Frequently, $\bar{X}$=3.41 >; Sometimes, $\bar{X}$=3.31). Based on this finding, as the frequency of using technology in education increases, teachers' beliefs about the metaverse can be expected to be positively affected.

"Frequently", "sometimes" and "never" options were presented to determine the teachers' following current technologies, and it was determined that only "frequently" or "sometimes" options were preferred by the teachers for this variable. Therefore, the Independent Samples T Test was used for the analysis of the two groups. The findings related to these analyzes are presented in Table 8.

Table 8.

Examination of teachers' beliefs about metaverse in terms of following current technologies

Groups	N	$\bar{X}$	Sd	df	t	*p*
Those who follow current technologies frequently	382	3.42	.59	729	2.159	.031
Those who sometimes follow current technologies	349	3.33	.51			

*$p < .05$ level is significant.

When Table 8 is examined, it is determined that there is a significant difference between the metaverse beliefs of teachers who frequently follow current technologies and teachers who sometimes follow current technologies ($p < .05$). It is seen that this difference is in favor of teachers who follow current technologies frequently (Frequently $\bar{X}$=3.42 > Sometimes $\bar{X}$=3.33). Based on this finding, it can be said that the difference in the frequency of current technology follow-up also positively differentiates teachers' beliefs about the metaverse.

Discussion

This study aimed to determine teachers' belief levels about the metaverse and examine them in terms of various variables.

Teachers' belief levels about the metaverse were found to be at a medium level ($\bar{X}$ =3.38). Based on this finding, it can be said that teachers' beliefs about the metaverse are not at a low level, but not at a high level either. According to TAM, variables such as teachers' perceived usefulness and perceived ease of use of technologies (Al-Kfairy et al., 2024) can be expected to affect their beliefs about the metaverse. It was found that teachers perceived the metaverse as an effective tool in improving students' learning performance (Rachmadtullah et al., 2023) and argued that metaverse enhances pedagogical benefits (Lee & Hwang, 2022). In addition, it was determined that teachers were interested in the metaverse (Rachmadtullah et al., 2023), had a positive attitude towards using metaverse (Aydın, 2023), and their awareness of metaverse was at a moderate level (Avcı & Çulha, 2024). At the same time, in the research conducted by Görkem and Başarmak (2024), it was determined that the current teacher trainings improved the knowledge, attitude and awareness levels of teacher candidates towards the metaverse as their education level increased. However, considering the research findings conducted by us, it can be argued that these trainings provided are developmental but not sufficient on their own. Because some factors other than the training provided can be expected to be effective. Because, teachers' unfamiliarity with the use of metaverse, their neutral self-confidence perceptions about integrating metaverse into their teaching processes (Aydın, 2023), their lack of interest in metaverse, their lack of sufficient knowledge about metaverse (Kim & Chae, 2022), their difficulties in technical implementation, the digital ethical risks brought by metaverse (Shi et al., 2023), teachers' thoughts that their students may have difficulties in adapting to new technologies and their concerns that they may encounter inappropriate content in the metaverse environment (Kebeci, 2024) can be considered as negative situations identified for metaverse. Considering TAM, it can be said that all these situations ensure that teachers' beliefs about metaverse do not remain at a low level, but they also prevent them from reaching a high level.

When teachers' beliefs about metaverse were analyzed according to gender, it was determined that there was no significant difference between male and female teachers. Considering that teachers' knowledge, attitudes and opinions about metaverse (Eşin & Özdemir, 2022), awareness of metaverse applications (Tural & Koçak, 2023), metaverse knowledge levels (Turan et al., 2023), metaverse awareness (Avcı & Çulha, 2024; Eşin & Özdemir, 2022) and attitudes towards the use of metaverse (Gün & Durmuş-Öz, 2024) do not show a significant difference between female and male teachers, it can be said that the findings of the study are supported. In addition, professional development providers, teacher educators, and school administrators, who are important stakeholders in educational activities, can be an effective factor in increasing teachers' beliefs in metaverse technologies. Because it has been determined that school administrators'

metaverse awareness is at a moderate level (Göktaş & Uygur, 2024), policymakers need to develop immersive technologies or metaverse literacy programs (McIntosh & Allen, 2024), and academics need more technical training to use metaverse technologies effectively (Ruiz Campo et al., 2023). Therefore, it can be argued that in the current situation, the knowledge, awareness and belief levels of policymakers, academics, school administrators and teachers regarding the metaverse need to be improved. In particular, school administrators have a leading and important role in educating qualified individuals for social development and modernization in educational activities (Tan et al., 2020). Necessary measures should be taken to improve the knowledge, awareness, and beliefs of not only teachers but also all stakeholders of education (school administrators, academics, students, and policy developers) regarding the metaverse. As schools navigate a rapidly evolving world, it is vital that all stakeholders in education take part in this transformation in understanding and shaping virtual learning environments (Butvilas & Kołodziejski, 2024).

It was observed that teachers' beliefs about the metaverse showed a significant difference in favor of taking part in a scientific project. Based on this finding, it can be said that teachers' participation in any scientific project positively affects their beliefs about the metaverse.Due to the interdisciplinary nature of the metaverse, its support for interdisciplinary study opportunities (Lee et al., 2021; Buragohain et al., 2023), and the fact that it is seen as a new field where people can interact socially (Collins, 2008), it can be thought that it enables teachers working in different disciplines to collaborate in project studies. This is because teachers can integrate materials and content from different disciplines into their own disciplines, thus paving the way for teachers to discover new approaches and solutions through interdisciplinary studies (Areepong et al., 2022). Thus, teachers can find the opportunity to explore the potential of metaverse platforms to improve learning outcomes in different disciplines through their interactive and immersive environments (Wu et al., 2023; İşgör-Şimşek & Baltaci, 2024). It is known that scientific projects contribute significantly to the professional development of teachers (Karataş & Öztay, 2023) and are of critical importance in supporting teachers' use of technological tools in their classrooms in their professional development (Higgins & Spitulnik, 2008). Therefore, it can be said that scientific projects indirectly encourage teachers to use technological tools. Based on this, it can be expected that teachers' participation in scientific projects on the use of the metaverse in education will contribute to the development of their beliefs about the metaverse.

When teachers' beliefs about metaverse were analyzed in terms of their reading from any source about metaverse, it was determined that teachers who read had a significantly higher belief than teachers who did not read. Based on this finding, it can be said that reading about the metaverse from any source improves the belief in this concept. Considering that teachers' beliefs in technology and digitalization depend on their interests (Tobinski, 2022; Velander et al., 2024), it can be said that the research findings are supported. In addition, it was determined that teachers were interested in using metaverse as a learning environment (Rachmadtullah et al., 2023). Reading on a topic of interest has a strong impact on the quality of learning by motivating the reader to understand and focus (Krapp, 1999). Therefore, we can argue that these readings are intended to improve one's knowledge and skills (De-Naeghel et al., 2012). Based on this, it can be argued that teachers tend to gain knowledge and skills about metaverse. Because interest in reading includes cognitive, affective and behavioral tendencies of an individual towards an action, a task or any concept (Hidi et al., 2004). In addition to these tendencies that push teachers to read, teachers' reading status is reflected in the teaching practices they use (McKool & Gespass, 2009). Therefore, it can be expected that teachers' reading about the metaverse will shape the teaching practices used by teachers.

Considering the frequency of teachers' utilizing technology in education and following current technologies, it was determined that teachers who frequently utilized technology in education and frequently followed current technologies had higher beliefs about metaverse. Based on this, it can be said that as the frequency of teachers' use of technology in educational environments increases, their beliefs about metaverse also increase. Considering that perceived usefulness and perceived ease of use of technology are important variables affecting the use or rejection of a new technology (Chua & Yu, 2024), it can be expected that teachers who frequently use technology in education and frequently follow current technologies will have higher beliefs about new technologies. Because teachers' beliefs towards technology are related to their frequent use of technology in the classroom (Li et al., 2019). According to the pedagogical use of technology, teacher beliefs diversify on the basis of individualized pacing, effective and interactive learning, integration and assessment of learning, and changing the learning culture (Jäääskelä et al., 2017). In addition to these, it can be said that teachers' beliefs that technology increases students' motivation and engagement (Voogt et al., 2016) lead teachers to utilize technology in education and to follow

current technologies. Therefore, it can be thought that the need for new technologies in learning-teaching environments every day (Szymkowiak et al., 2021) and the need for adaptive learning methods (Ding et al., 2017) as they carry out teaching activities with new generation learners (Generation Z) are effective in teachers' following current technologies. This situation increases the importance of using up-to-date technologies in learning and teaching processes (Satir & Korucu, 2023). It can be thought that metaverse attracts the attention of teachers because it includes AR and VR applications (Lytvynov et al., 2022), which are among the innovative technologies shown as the e-learning technologies of the future.

Conclusion and Recommendations

According to the findings obtained in the study, it was seen that the teachers' beliefs about the metaverse were at a medium level. Teachers' beliefs about metaverse can be raised to a high level with the measures to be taken to eliminate the negative situations related to metaverse. Among these measures, teachers can acquire knowledge about metaverse through practice-based training. Through practice-based trainings, teachers can be familiarized with metaverse before the teaching process and integrate it into the teaching process. Again, through these trainings, teachers' awareness of the ethical risks of the metaverse and the prevention of inappropriate content in the metaverse can be improved. In addition, while designing metaverse platforms, plans can be made to prevent the misuse of student data. In addition, educational policy makers can be expected to make arrangements for the use of metaverse in education in teacher training programs, in-service training programs and educational curricula. On the other hand, for the applicability of these arrangements, the provision of the necessary infrastructure in schools affiliated with the Ministry of National Education and the preparation of content related to metaverse can be listed as important elements in the dissemination of these technologies.

It was found that teachers' beliefs about the metaverse did not have a significant difference between male and female teachers. Considering that information technologies offer a new way of working independent of gender (Walby et al., 2007; Woodfield, 2000), it can be argued that the equality between male and female teachers regarding the use of metaverse in today's educational environments has reached the desired level. In order to maintain this equality, studies can be conducted on the interaction between these genders in the current situation regarding the use of metaverse.

Another finding obtained in the study is that teachers' beliefs about metaverse show a significant difference in favor of the status of taking part in a scientific project. Based on this finding, it can be suggested that teachers' participation in interdisciplinary projects should be supported. In addition, how teachers' beliefs about different technologies change in this context can be examined.

In the study, teachers' beliefs about the metaverse were compared in terms of whether they read about the metaverse from any source or not. According to the findings, it was determined that teachers who read about the metaverse had significantly higher beliefs than teachers who did not read. It can be expected that teachers' readings of the metaverse will affect their belief levels about the metaverse and shape the teaching practices that teachers use. However, this idea needs scientific evidence. It can be suggested to reach evidence for this idea through different research to be carried out in this field.

The final findings of the study are that teachers who use technology frequently in education and follow current technologies frequently have higher beliefs about the metaverse. Teachers who prefer to use technology in educational environments can be expected to have high beliefs about these technologies. Teachers who use technology in educational environments use and follow these technologies based on their evaluation of the positive effects of these technologies on their students' learning. However, detailed findings are needed regarding this idea. So, in the current situation, how current technologies are reflected in educational environments, for what purposes they are used by teachers, which technologies are used the most, and what factors determine this situation can be examined both interdisciplinary and discipline-specific. Based on these discussions, trainings can be planned for teachers on the importance of using metaverse in educational environments together with innovative technologies. This can be considered important for improving the current situation.

This research is limited to the 2023-2024 academic year. In addition, the research participants consisted of teachers working in a specific province. Research findings are limited to the data obtained with quantitative data collection tools.

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Informed Consent: Written informed consent was obtained from teachers who participated in this study
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