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Analysis of Factors Influencing Middle School Teachers' Intention to Adopt Metaverse-Based Education: Based on a Modified UTAUT Model

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Abstract

This study aims to analyze the factors influencing middle school teachers' intention to adopt metaverse-based education by integrating the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). Specifically, it focuses on how educational usefulness, ease of use, social influence, and facilitating conditions affect teachers' acceptance intention. A survey was conducted with 208 middle school teachers across the country, and the collected data were analyzed using path analysis conducted within the framework of Structural Equation Modeling (SEM) based on observed variables.

The analysis revealed that educational usefulness and ease of use had significant positive effects on acceptance intention. Although social influence did not have a direct effect on acceptance intention, it functioned as a significant mediating variable that strengthened the effects of educational usefulness and ease of use. The Sobel test confirmed the significance of indirect effects, with educational usefulness and ease of use showing significant mediated effects via social influence. Meanwhile, facilitating conditions moderates these relationships, enhancing the effect of ease of use on acceptance intention and weakening the effect of educational usefulness.

This study underscores the importance of providing systematic training to enhance teachers' confidence in using metaverse technologies, improving technological infrastructure, and fostering a supportive school environment. The findings offer both policy and practical implications and suggest directions for future research.

Keywords : Metaverse-based Education, Technology Acceptance, Teacher Attitudes, Educational Usefulness, Path Analysis

Analysis of Factors Influencing Secondary School Teachers' Intention to Adopt Metaverse-Based Education: Based on a Modified UTAUT Model

1.Introduction

The acceleration of digital transformation, along with the growing interest in virtual economies and digital assets, has increased the potential for utilizing metaverse technologies in education. In particular, the planned introduction of AI-based digital textbooks in 2025 and the emphasis on digital technology integration in the 2022 revised national curriculum highlight the growing importance of establishing a learning system that fosters creative thinking and digital literacy, which are essential for future society (Ministry of Education, 2022).

These changes are accelerating the innovation of learning environments and promoting a paradigm shift toward learner-centered education (Baek, 2023). Metaverse-based education has the potential to enhance teacher-student interaction, increase learner engagement and immersion, and support the development of self-directed learning environments (Baek, 2022; Kim, 2023). For instance, the study by Lee et al. (2024) reported that remote education using a metaverse platform (Gather Town) positively influenced learning immersion and outcomes.

However, despite its potential, the level of metaverse adoption in secondary education remains relatively low. This is largely due to structural factors such as the lack of practical application opportunities, limitations in teacher training programs, and insufficient support for technological infrastructure (Kim, 2022; Bae, 2023). Since secondary school teachers are the primary agents in educational practice, their intention

to adopt metaverse-based education is a critical factor in ensuring its successful implementation and sustainability. Therefore, it is essential to empirically identify the factors influencing their acceptance intention.

Most existing studies have focused on college students or general users, with relatively few targeting secondary school teachers. There is a lack of studies that integrate the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) within an educational context.

Accordingly, this study aims to analyze the factors affecting secondary school teachers' acceptance intention toward metaverse-based education by integrating the theoretical strengths of TAM and UTAUT. Specifically, it redefines the constructions of "educational usefulness" and "ease of use" from TAM to fit the educational context and includes "social influence" and "facilitating conditions" from UTAUT. The findings of this study are expected to contribute to the development of practical and policy strategies for the effective implementation and diffusion of metaverse-based education.

2. Theoretical Background

2.1 Characteristics and Cases of Metaverse-Based Education

The term Metaverse is a compound of “Meta” (beyond) and “Universe,” referring to a digital space where reality and virtuality are integrated. It is attracting attention as a next-generation platform that creates social, economic, and educational value beyond simple virtual reality (Kim, 2020; Hong, 2021). In the field of education, metaverse technologies such as virtual reality (VR) and augmented reality (AR) are actively utilized as tools to enhance learners’ immersion and interaction (Yoo et al., 2018).

The core characteristics of metaverse-based education can be summarized as

presence, flow, and interactivity. These elements are organically connected and work together to strengthen learners' cognitive, emotional, and social experiences. Presence refers to the sensation of perceiving a virtual space as real, forming the foundation of immersion (Steuer, 1993), while flow refers to a psychological state in which learners are deeply engaged in a task, losing awareness of time and space (Csikszentmihalyi, 1990). This immersion is further enhanced in interactive environments, where real-time interaction between learners and content, or between learners themselves, boosts engagement, emotional stability, and learning persistence (An, 2022; Hwang, 2023).

These characteristics of the metaverse have been realized in various ways in educational settings. In Korea, a representative example is the "Virtual Laboratory" jointly developed by EBS and the Ministry of Education, which allows high-risk science experiments to be safely conducted in virtual spaces, thereby enhancing learners' intuitive understanding and experiment success rates (Jung, 2021). Internationally, Minecraft Education Edition has been used to foster creative problem-solving and collaboration skills (Kye, 2021), while platforms like AltspaceVR enable real-time collaborative environments between teachers and learners, offering immersive learning experiences.

Previous studies have also demonstrated the integrative learning effects of metaverse environments. Bae (2023) reported that learning environments based on presence simultaneously enhance learners' immersion and creative thinking, while Kim (2023) found that classes with higher levels of interaction within the metaverse increase learners' sense of belonging and achievement. In addition, Kim, S., and Kim, H. (2021) analyzed that elements of challenge and reward in game-based environments promote

learners' immersion and continued participation. Their study, which involved a design class using Minecraft, empirically showed that learners' immersive experiences could lead to emotional satisfaction and voluntary engagement—providing empirical support for the roles of flow and interactivity emphasized in metaverse environments. In particular, the ability of game-based elements to simultaneously stimulate intrinsic motivation and immersion underscores the importance of incorporating challenge and feedback structures in metaverse instructional design.

In this way, the metaverse functions as an educational platform that naturally fosters learner immersion, participation, understanding, and communication, thereby transforming teaching and learning experiences into more immersive and expansive forms.

2.2 Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT)

The Technology Acceptance Model (TAM), proposed by Davis (1989), has been widely used to predict and explain whether users will accept new technologies. This model posits that two key factors — Perceived Usefulness and Perceived Ease of Use — affect users' behavioral intention to adopt a technology, which subsequently leads to actual usage behavior.

Perceived Usefulness refers to the degree to which users believe that using a particular technology will enhance their job or learning performance, while Perceived Ease of Use indicates the extent to which the technology is perceived as easy to use. These two factors influence user attitudes and, ultimately, play a crucial role in forming the intention to adopt a given technology (Davis, 1989). Several empirical studies across various domains have validated the relationship between these variables and behavioral intention. For

instance, Kim (2009) reported that smartphone users who perceived the technology as helpful for acquiring information and improving productivity showed higher behavioral intention to adopt it. Similarly, Jung (2009) found that learners who recognized the usefulness of mobile learning were more likely to continue using the technology.

In addition, Baek (2024) demonstrated that perceived ease of use significantly influenced user satisfaction and behavioral intention in the context of VR-based digital education. Jeong (2024) confirmed that perceived ease of use was a key antecedent of sustained usage intention for generative AI tools, while Kim (2015) showed that for elementary and secondary school teachers, the more intuitive and user-friendly the technology was, the higher their intention to adopt it.

These findings suggest that in the context of metaverse-based education as well, the two core TAM variables — perceived usefulness and ease of use — may significantly influence teachers' behavioral intention to adopt the technology (see Table 1).

Table 1. *Prior Studies Verifying the Relationship Between Perceived Usefulness, Perceived Ease of Use, and Behavioral Intention*

Domain	Target	Model	Verified Relationship	Author
Smartphones	Smartphone Users	TAM	Perceived Usefulness → Acceptance Intention	Kim (2009)
Foreign Language Mobile Learning	High school and University Students	TAM	Perceived Usefulness → Acceptance Intention	Jeong (2009)
VR Digital Education	Pre-service Teachers	VR-TAM	Perceived Ease of Use → Acceptance Intention	Baek (2024)
Generative AI	University Students	TAM, ECM	Perceived Ease of Use → Acceptance Intention	Jeong (2024)
Smart Device Usage	Elementary and Secondary School Teachers	TAM	Perceived Ease of Use → Acceptance Intention	Kim (2015)

The Unified Theory of Acceptance and Use of Technology (UTAUT), proposed by Venkatesh et al. (2003), is a theoretical model that supplements the limitations of previous technology acceptance models. It explains users' behavioral intention to use and actual usage behavior through four core constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. Notably, UTAUT extends the technology-focused TAM by incorporating social and environmental factors, thereby offering a more comprehensive and realistic framework for explaining technology acceptance.

This study focuses on two core variables from UTAUT—social influence and facilitating conditions—to explain secondary school teachers' behavioral intention to adopt metaverse-based education. In this context, social influence is conceptualized as a mediating variable, while facilitating conditions are set as a moderating variable to be empirically tested.

Social influence refers to the impact of expectations or support from people around the user (e.g., fellow teachers, administrators, or parents) on their intention to use a specific technology. Prior research has shown that social influence affects behavioral intention both directly and indirectly, the latter occurring through the mediation of perceived usefulness and perceived ease of use (Kim, S., 2021; Lee, H., 2023; Wei, W., 2021; Kim, B., 2021). These findings suggest that in the context of metaverse-based education, social influence may significantly affect teachers' acceptance intentions.

Facilitating conditions refer to external environmental factors such as resources, infrastructure, and policy support that enable technology use. When users perceive sufficient support, their behavioral intention is expected to be strengthened. Prior studies have confirmed that facilitating conditions not only directly influence behavioral intention

but also moderate the relationships between perceived usefulness, perceived ease of use, and behavioral intention (Park, B., 2021; Kim, J., 2018). Accordingly, in metaverse-based education, providing adequate technical and organizational support may significantly enhance teachers' intention to adopt the technology (see Table 2).

2.3 Theoretical Framework of the Study

This study integrates key variables from the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) to analyze the

Table 2. *Previous Studies Supporting the Relationship Between Perceived Ease of Use and Acceptance Intention*

Domain	Target	Model	Verified Relationship	Author
AI-Based Personalized Education	Middle School Teachers	UTAUT	Social Influence → Acceptance Intention	Lee (2023)
AI-Integrated Education	Elementary School Teachers	UTAUT	Social Influence → Acceptance Intention	Kim (2021)
Contactless Food Delivery Services	Korean and Chinese Consumers	TAM, TPB	(Perceived Usefulness, Perceived Ease of Use) → Subjective Norms → Acceptance Intention	Wei (2021)
Crowdfunding	Sponsors	TRA, TAM, UTAUT	Project Usefulness → Social Responsibility → Participation Intention	Kim (2021)
Mobile Performance Videos	General Users	UTAUT2	Performance Expectancy → Facilitating Conditions (Moderator) → Acceptance Intention	Kim (2018)
Service & Consumer Behavior	General Users	UTAUT2	Perceived Ease of Use → Facilitating Conditions (Moderator) → Acceptance Intention	Park (2021)

factors influencing middle school teachers' intention to adopt metaverse-based education. While previous studies on technology acceptance have primarily relied on either TAM or UTAUT, each model has its own theoretical strengths as well as structural limitations.

TAM, proposed by Davis (1989), explains technology acceptance based on users' perceptions of perceived usefulness and perceived ease of use. In the context of education, when teachers evaluate the usefulness and usability of metaverse tools for instruction, these factors become critical in their decision-making process (Bae, 2023; Baek, 2024). However, TAM focuses primarily on internal cognitive factors and lacks the capacity to fully account for external influences such as social and institutional support (Venkatesh et al., 2003).

To address this limitation, the present study incorporates two key variables from UTAUT: social influence and facilitating conditions. UTAUT, which consists of performance expectancy, effort expectancy, social influence, and facilitating conditions, is widely regarded as a comprehensive model for explaining technology acceptance in organizational contexts (Venkatesh et al., 2003). Among these, social influence refers to the expectations and support from peers, administrators, and parents—factors that are particularly relevant in educational settings. Facilitating conditions encompass environmental supports such as infrastructure, policy, and professional training, which significantly affect teachers' ability to adopt new technologies (Kim, 2022; Lee, 2023).

Meanwhile, performance expectancy and effort expectancy in UTAUT are conceptually like perceived usefulness and perceived ease of use in TAM. However, these UTAUT variables tend to reflect general expectations toward technology rather than addressing the practical and experiential aspects of immersive tools like the metaverse,

which emphasize interactivity, presence, and engagement (Kim, 2021). Therefore, this study refines overlapping variables and combines the practical explanatory power of TAM with the contextual depth of UTAUT to propose an integrated analytical framework.

Additionally, the relationships among variables were structured based on theoretical justification. Educational usefulness and ease of use were designated as independent variables influencing behavioral intention, a relationship consistently validated in TAM-based research (Davis, 1989). Social influence was set as a mediating variable, based on the theoretical assumption that perceptions of usefulness and ease of use may indirectly influence acceptance through social expectations (Venkatesh et al., 2003; Han & Kang, 2012). Facilitating conditions were defined as a moderating variable, considering their role in enhancing or weakening the strength of other predictors in the adoption process (Park, 2021; Kim, 2018).

The key variables were also redefined to align with the context of secondary education. Perceived usefulness in TAM was renamed as educational usefulness, referring to the extent to which metaverse technology enhances learning outcomes and instructional quality, contributing to the achievement of educational goals. This includes sub-factors such as improved learning speed, academic achievement, and teaching quality (Kim, 2015; Bae & Kim, 2024).

Perceived ease of use was redefined as ease of use, representing how intuitive and accessible the technology is for both teachers and students, and how easily it can be incorporated into classroom activities. This has been empirically validated in both Davis (1989) and Baek (2024) study on VR-based education.

Social influence refers to the perceived expectations and support from surrounding

individuals such as fellow teachers, administrators, and parents. This construction can be further divided into dimensions like social image, interaction expectations, and social support (Kim, 2021; Lee, 2023; Kim, 2021). Finally, facilitating conditions encompass external factors such as infrastructure, resources, and policy support that enable teachers to implement metaverse technologies in their classrooms. Prior studies have shown that these conditions significantly moderate the relationship between perceived usefulness or ease of use and behavioral intention (Park, 2021; Kim, 2018).

By redefining and integrating core concepts from TAM and UTAUT to fit the educational context, this study seeks to enhance theoretical understanding of metaverse adoption and contribute to practical strategies for implementation in secondary schools. Based on this framework, the following hypotheses and research model (see Figure 1) are proposed:

- (H1) Middle school teachers' perceived educational usefulness of metaverse-based education will positively influence their intention to adopt it.
- (H2) Middle school teachers' perceived ease of use of metaverse technology will positively influence their intention to adopt it.
- (H3) Educational usefulness will positively influence behavioral intention through the mediating role of social influence.
- (H4) Ease of use will positively influence behavioral intention through the mediating role of social influence.
- (H5) Facilitating conditions will moderate the relationship between educational usefulness, ease of use, and behavioral intention.

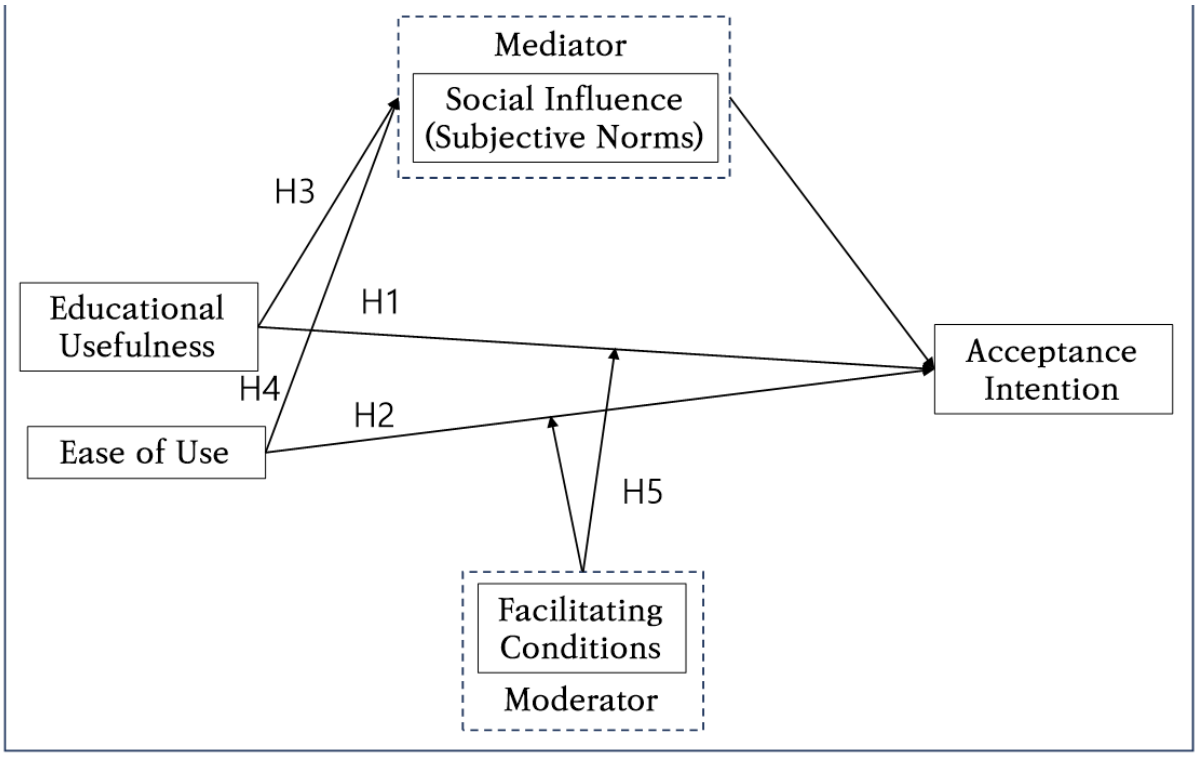
3. Research Methods

3.1 Research Participants

This study aimed to analyze the factors influencing middle school teachers' intention to adopt metaverse-based education. The participants consisted of 208 in-service middle school teachers across South Korea. To ensure feasibility and accessibility, a convenience sampling method was employed. In forming the sample, efforts were made to ensure diversity and representativeness by considering various demographic characteristics, including gender, age, teaching experience, region, school type, subject taught, and experience with metaverse-based instruction.

Participants were recruited through nationwide teacher communities and the researcher's professional network. Teachers who met the study criteria voluntarily participated. Prior to the survey, all participants were fully informed—both online and in writing—about the

Figure 1. *Research Model*



purpose and procedures of the study, their right to voluntary participation, and the data privacy policy. Informed consent was obtained before participation. As a token of appreciation, some participants received small digital gift vouchers.

This study was conducted in compliance with ethical standards. As it involved an anonymous, non-experimental online survey that did not pose any physical or psychological risk nor collect sensitive personal information, it was exempt from Institutional Review Board (IRB) review under the provisions of the "Bioethics and Safety Act." Accordingly, formal IRB approval was not obtained.

Table 3 presents the demographic characteristics of the 208 middle school teachers who participated in this study. In terms of gender, female teachers accounted for the majority at 72.1%. The largest age group was teachers in their 30s, comprising 60.6% of the sample. Regarding teaching experience, those with less than 5 years of experience represented the highest proportion at 46.2%. In terms of regional distribution, a significant number of teachers were from Seoul (37%) and the Gyeonggi region (22.6%). Most participants (78.4%) were employed in middle schools.

Subject areas were relatively evenly distributed among Korean, English, and Mathematics teachers, and the sample also included teachers from various other subject groups such as Social Studies, Science/Technology/Information, and the Arts. Only 15.4% of participants reported having experience with metaverse-based instruction, indicating that the use of the metaverse in actual educational settings is not yet widespread. This finding supports the necessity of the present study, which seeks to explore the factors influencing the acceptance of metaverse-based education.

Table 3. *Demographic characteristics of research participants*

Variable	Category	n	%
Gender	Male	58	27.9%
	Female	120	72.1%
Age	20s	49	23.6%
	30s	126	60.6%
	40s	21	10.1%
	50 or older	12	5.8%
Teaching Experience	Less than 5 years	96	46.2%
	5 to less than 10 years	69	33.2%
	10 to less than 15 years	20	9.6%
	15 to less than 20 years	7	3.4%
	20 years or more	16	7.7%
Region	Seoul	77	37%
	Gyeonggi Province	47	22.6%
	Gangwon Province	26	12.5%
	Gyeongsang Province	46	22.1%
	Jeolla Province	5	2.4%
	Chungcheong Province	6	2.9%
	Jeju Province	1	0.5%
School Type	Middle School	163	78.4%
	High School	45	21.6%
Grade Level (Multiple Responses Allowed)	1st Grade	90	43.3%
	2nd Grade	105	51%
	3rd Grade	67	32.2%
Subject	Korean	54	26%
	English	51	24.5%
	Mathematics	48	23.1%
	Social Sciences (History/Geography/Civics)	14	6.7%
	Science/Technology	26	12.5%
	Arts/Music/Physical Education	6	2.9%
	Others	9	4.3%
Experience with Metaverse-based Classes	Yes	32	15.4%
	No	176	84.6%

Note. A total of 208 middle and high school teachers participated in the survey. Percentages are based on valid responses. Multiple responses were allowed for the grade level item only.

3.2 Measurement

This study developed a structural research model to analyze the factors influencing secondary school teachers' intention to adopt metaverse-based education, based on the Technology Acceptance Model (TAM: educational usefulness, ease of use) and the Unified Theory of Acceptance and Use of Technology (UTAUT: social influence, facilitating conditions). The survey items were constructed based on the original TAM and UTAUT scales (Davis et al., 1989; Venkatesh et al., 2012) and were revised and supplemented by referring to prior studies such as Kim (2021), Shin (2013), Joo (2018), and Lee (2023), to suit the context of secondary education.

Table 4. *Number of Items and Reliability by Variable*

Variable Type	Key Variable	Number of Items	Cronbach's α	Author(s)
Demographic Characteristics		9	-	-
Independent Variable	Educational Usefulness	7	0.896	Davis (1989); Kim (2021); Ju (2018)
	Ease of Use	7	0.922	Davis (1989); Shin (2013); Ju (2018)
Mediating Variable	Social Influence	4	0.873	Venkatesh, V. et al. (2012); Choi (2023); Park (2018); Yu (2018)
Moderating Variable	Facilitating Conditions	4	0.890	Venkatesh, V. et al. (2012); Kim (2021); Lee (2023); Koo (2023)
Dependent Variable	Acceptance Intention	5	0.880	Venkatesh, V. et al. (2012); Shin (2013); Lee (2023); Ju (2018)
Total Items		36		

Note. The questionnaire items were reviewed and revised based on expert validation by professionals in education, media, and technical education. A total of 208 participants were included in the analysis. Cronbach's α values ranged from .873 to .922, indicating satisfactory internal consistency (α > .70). The full questionnaire is available in the Appendix.

The questionnaire consisted of a total of 38 items across five domains: educational usefulness, ease of use, social influence, facilitating conditions, and acceptance intention. Each item was rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), and the number of items and Cronbach's α values for each construct are presented in Table 4. In addition, open-ended questions were included to collect qualitative data regarding teachers' perceptions of shortcomings in metaverse-based education, needed improvements, and the positive or negative impacts on learners.

Data collection was conducted over approximately two weeks in 2024, utilizing both online and offline methods through nationwide teacher communities and the researcher's professional network. A total of 208 responses were collected, and only those that met reliability and validity criteria were included as valid samples for analysis.

The data collected was analyzed using SPSS 26.0 and AMOS 26.0 according to the following procedures:

First, frequency and descriptive statistical analyses were conducted to examine the demographic characteristics of the participants and the distribution of key variables. Skewness and kurtosis were also analyzed to assess the normality of the data.

Second, Cronbach's α coefficients were calculated to assess the internal consistency of the survey instrument. All variables showed values ranging from 0.873 to 0.922, meeting the acceptable reliability threshold of 0.7 or higher.

Third, principal component analysis (PCA) was conducted to verify the factor structure of the items and to confirm the construct validity of the measurement tool.

Fourth, Pearson correlation analysis was conducted to examine the relationships

among the key variables.

Fifth, stepwise regression analysis was used to verify the direct and indirect effects among independent variables, mediating variables, and the dependent variable. Where necessary, Sobel tests were employed to assess the statistical significance of the mediating effects.

Sixth, hierarchical regression analysis was conducted to examine the effects of moderating variables (e.g., facilitating conditions and age). In addition, prior to the structural equation modeling (SEM) analysis, multicollinearity among independent variables was assessed through the Variance Inflation Factor (VIF), and the results are presented in the Results section.

Finally, this study employed a Structural Equation Modeling (SEM) approach—specifically in the form of a path analysis using observed variables—to examine the overall model fit and the structural paths among the variables. Model fit was assessed using indices such as CFI, TLI, and RMSEA, and statistical significance was determined at the $p < .05$ level.

4. Research Results

4.1 Descriptive Statistics and Normality Analysis

In this study, descriptive statistics were conducted to confirm the normality of the sample, examining the mean (M), standard deviation (SD), skewness, and kurtosis. The results of the descriptive statistics analysis are shown in Table 5.

The findings were as follows: Educational usefulness (M = 3.8736, SD = 0.80023), ease of use (M = 3.7905, SD = 0.90109), social influence (M = 3.7043, SD = 0.97911),

Table 5. *Descriptive Statistics and Normality Analysis of Measured Variables*

Variable	Mean (M)	Standard Deviation (SD)	Skewness	Kurtosis
Educational Usefulness	3.8736	0.80023	-1.437	1.369
Ease of Use		0.90109	-1.110	0.149
Social Influence	3.7043	0.97911	-0.896	-0.344
Facilitating Conditions	3.7404	0.97828	-1.000	-0.056
Acceptance Intention	3.9231	0.83049	-1.549	1.652

Note. All variables were assessed for normality based on skewness and kurtosis. Skewness and kurtosis values fell within the acceptable range of ±2, indicating that the data met the assumption of normality (George & Mallery, 2010). N = 208.

facilitating conditions (M = 3.7404, SD = 0.97828), and acceptance intention (M = 3.9231, SD = 0.83049). The skewness values of all measured variables ranged from -1.549 to -0.896, and the kurtosis values ranged from -0.056 to 1.652, satisfying the normality criterion of ±2. Therefore, the data in this study are considered to follow a normal distribution, confirming their suitability for further statistical analyses.

In this study, to examine the current state of middle and high school teachers' acceptance intention for metaverse-based education in detail, the mean and standard deviation of acceptance intention were calculated according to key demographic characteristics. The results are presented in Table 6.

The overall mean for acceptance intention was 3.923, with the detailed results as follows. By gender, male teachers (M=4.038, SD=0.662) showed slightly higher acceptance intention compared to female teachers (M=3.879, SD=0.885). By age group, teachers in their 20s (M=4.286, SD=0.449) and 30s (M=3.927, SD=0.835) exhibited relatively higher acceptance intentions, while those in their 40s (M=3.278, SD=0.943) and 50s or older (M=3.533, SD=1.007) showed lower values.

Table 6. *Mean and Standard Deviation of Acceptance Intention by Key Demographic Characteristics*

Dependent Variable	M	SD	Demographic Information		n	M	SD
Acceptance Intention	3.923	0.830	Gender	Male	58	4.038	0.662
				Female	150	3.879	0.885
			Age	20s	49	4.286	0.449
				30s	126	3.927	0.835
				40s	21	3.278	0.943
				50 or oler	12	3.533	1.007
			Teaching Experience	less than 5 years	96	4.223	0.521
				5 to less than 10 years	69	3.933	0.860
				10 to less than 15 years	20	3.420	1.022
				15 to less than 20 years	7	2.857	0.728
				20 years or	16	3.175	0.932
			School Type	middle school	163	4.048	0.757
				high school	45	3.471	0.930
			Subject	Korean	54	4.122	0.659
				English	51	3.839	0.989
				Mathematics	48	3.929	0.813
				Social Sciences (History/Geography/Civics)	14	4.114	0.825
				Science/Technology	26	3.754	0.851
				Arts/Music/Physical Education	6	4.100	0.452
				Others	9	3.244	0.684
			Usage Experience	Yes	176	3.863	0.857
				No	32	4.256	0.566

Note. N = 208. This table presents the mean and standard deviation of acceptance intention scores by demographic characteristics, including gender, age, teaching experience, school type, subject taught, and experience with metaverse-based classes.

By teaching experience, teachers with less than 5 years of experience (M=4.223, SD=0.521) had the highest acceptance intention, while those with 15–20 years of experience (M=2.857, SD=0.728) had the lowest. In terms of school type, middle school teachers (M=4.046, SD=0.757) showed higher acceptance intention than high school teachers (M=3.471, SD=0.930).

Regarding subject areas, teachers of social studies (M=4.114, SD=0.825) and arts (M=4.110, SD=0.452) displayed the highest acceptance intention, while teachers of other subjects (M=3.244, SD=0.684) showed the lowest. Finally, teachers with experience using the metaverse (M=4.256, SD=0.566) exhibited higher acceptance intention than those without such experience (M=3.863, SD=0.857).

These findings suggest that gender, age, teaching experience, school type, subject area, and metaverse experience are significant factors influencing teachers' acceptance intention. Notably, teachers with less experience and those with metaverse experience showed relatively higher acceptance intentions, indicating that experience and environmental factors may play a critical role in the initial adoption of new technologies.

4.2 **Results of Reliability and Factor Analysis of the Measurement Tools**

Principal component analysis (PCA) and reliability analysis (Cronbach's alpha) were conducted to verify the validity and reliability of the variables—educational usefulness, ease of use, social influence, facilitating conditions, and behavioral intention—perceived by middle school teachers regarding metaverse-based education. Although the questionnaire items were based on existing validated scales, several items were revised and restructured to reflect the characteristics of the target group (middle school teachers) and the educational context. Therefore, PCA was conducted to reassess the structural validity and

to examine the clarity of factor structure and the explained variance among variables.

The results indicated that the factor loading for all items were above 0.7, confirming that each factor demonstrated clear structural consistency. Additionally, Cronbach's alpha coefficients for all variables were above 0.7, validating the internal consistency and reliability of each factor. Table 7 presents the combined results of the factor analysis and reliability testing.

Specifically, educational usefulness (α=0.896), ease of use (α=0.922), social influence (α=0.873), facilitating conditions (α=0.890), and acceptance intention (α=0.880) all exhibited high reliability. These results demonstrate that the measurement tools used in this study are both stable and reliable for assessing each variable, supporting the credibility and validity of the study's findings (see table 7).

In addition, Variance Inflation Factor (VIF) values were calculated to assess potential multicollinearity among the independent variables. The results showed that all VIF values were below the threshold of 10 (Educational Usefulness: 5.63, Ease of Use: 3.28, Social Influence: 3.80, Facilitating Conditions: 3.87), indicating no serious multicollinearity issues. Thus, the assumption of independence among variables — required for path analysis — was met.

4.3 **Regression Analysis and Mediation Effect Verification**

This study examined the relationships between the independent variables (educational usefulness, ease of use), the mediating variable (social influence), and the dependent variable (acceptance intention) to analyze the factors influencing middle school teachers' acceptance intention of metaverse-based education. Stepwise regression analysis and the Sobel test were conducted, and the results are as follows:

4.3.1 Stepwise Regression Analysis

In Step 1, the analysis examined the effects of the independent variables, educational usefulness and ease of use, on the mediating variable, social influence. The results indicated significant positive effects for both independent variables. Educational

Table 7. *Factor Loadings and Cronbach's Alpha for Measurement Items*

Variable	Item	Factor Loading	Cronbach's α
Educational Usefulness (EU)	Eu3	0.865	0.896
	Eu1	0.846	
	Eu5	0.809	
	Eu7	0.770	
	Eu4	0.762	
	Eu6	0.758	
	Eu2	0.722	
Ease of Use (EOU)	EOU6	0.850	0.922
	EOU1	0.846	
	EOU3	0.841	
	EOU5	0.838	
	EOU4	0.830	
	EOU7	0.819	
	EOU2	0.759	
Social Influence (SI)	SI2	0.875	0.873
	SI3	0.866	
	SI1	0.860	
	SI4	0.809	
Facilitating Conditions (FC)	FC3	0.887	0.890
	FC1	0.866	
	FC4	0.861	
	FC2	0.857	
Acceptance Intention (AI)	AI3	0.845	0.880
	AI5	0.839	
	AI1	0.817	
	AI4	0.815	
	AI2	0.804	

usefulness demonstrated a regression coefficient of $\beta = 0.797$, $t = 18.967$, $p < 0.001$, while ease of use had a regression coefficient of $\beta = 0.826$, $t = 21.065$, $p < 0.001$. These findings suggest that when teachers perceive metaverse technology as more educationally beneficial or easier to use, their perceptions of peer and administrative support, as well as social expectations for the technology, are strengthened.

In Step 2, the direct effects of the independent variables on the dependent variable, acceptance intention, were analyzed. Both educational usefulness and ease of use were found to have significant positive impacts on acceptance intention. Specifically, educational usefulness showed a regression coefficient of $\beta = 0.901$, $t = 29.889$, $p < 0.001$, and ease of use exhibited a regression coefficient of $\beta = 0.849$, $t = 23.085$, $p < 0.001$. These results indicate that teachers are more likely to adopt metaverse-based education when they perceive the technology as both educationally beneficial and easy to implement.

In Step 3, the mediating variable, social influence, was included in the analysis to examine the indirect effects of the independent variables on the dependent variable. The results revealed significant indirect effects for both educational usefulness and ease of use on acceptance intention through social influence. Educational usefulness had an indirect effect with a regression coefficient of $\beta = 0.735$, $t = 15.331$, $p < 0.001$, and ease of use had an indirect effect with $\beta = 0.607$, $t = 9.752$, $p < 0.001$. Additionally, social influence itself had a significant positive direct effect on acceptance intention, with a regression coefficient of $\beta = 0.209$, $t = 4.360$, $p < 0.001$. These findings highlight the critical role of social influence as a partial mediator, amplifying the effects of educational usefulness and ease of use on teachers' acceptance intention.

The results also suggest that social influence encompasses both perceptions of peer and administrative support, emphasizing its importance in the adoption of metaverse-based education. This highlights the need for collaborative and supportive environments to promote the effective integration of new educational technologies (Table 8).

Table 8. *Results of Stepwise Regression Analysis*

Step	Independent Variable	Mediating Variable	Dependent Variable	Unstandardized Coefficient		Standardized Coefficient	t	Significance (p)
				B	Standard Error	β		
Step 1 (Path A)	Educational Usefulness	Social Influence		0.797	0.042	0.797	18.967	0.000
	R^2= 0.636, F= 359.730							
	Ease of Use	Social Influence		0.826	0.039	0.826	21.065	0.000
	R^2= 0.683, F=444.753							
Step 2 (Path B)	Educational Usefulness		Acceptance Intention	0.901	0.030	0.901	29.889	0.000
	R^2= 0.813, F= 893.331							
	Ease of Use		Acceptance Intention	0.849	0.037	0.849	23.085	0.000
	R^2= 0.720, F= 532.921							
Step 3 (Path C)	Educational Usefulness	Social Influence	Acceptance Intention	0.735	0.048	0.735	15.331	< 0.001
	R^2= 0.827, F= 495.214							
	Ease of Use	Social Influence	Acceptance Intention	0.607	0.062	0.607	9.752	< 0.001
	R^2= 0.746, F= 305.136							
		Social Influence	Acceptance Intention	0.209	0.048	0.209	4.360	< 0.001

Note. N = 208. Results from the stepwise regression analysis indicate that all independen and mediating variables significantly influenced the dependent variable (Acceptance Intention). The explanatory power (R^2) of each model was relatively high, confirming the model's suitability. All effects were statistically significant at p < .001.

4.3.2 Sobel Test

To further verify the mediating effect of social influence, a Sobel test was conducted. The results showed that the indirect effects of educational usefulness and ease of use on acceptance intention, mediated by social influence, were statistically significant ($Z = 6.54$, $p < 0.001$; $Z = 7.21$, $p < 0.001$).

These findings indicate that social influence acts as a key mediating variable, enhancing the relationship between independent variables and dependent variables. It plays a critical role in increasing teachers' acceptance intention toward metaverse-based education, highlighting its importance in this context (refer to Table 9).

4.4 **Regression Analysis and Examination of Moderating Effects**

This study analyzed the moderating effect of facilitating conditions on the relationship between the independent variables (educational usefulness, ease of use) and the dependent variable (acceptance intention). Hierarchical regression analysis was conducted using interaction terms to determine whether the influence of the independent variables on acceptance intention changes depending on the level of facilitating conditions (see Table 10).

Table 9. *Sobel Test Results*

Path	Z-value	Significance (p)
Educational Usefulness → Social Influence → Acceptance Intention	6.54	< 0.001
Ease of Use → Social Influence → Acceptance Intention	7.21	< 0.001

Note. N = 208. The Sobel test was conducted to examine the statistical significance of th mediating effect. All paths were found to be statistically significant at the p < .001 level, indicating that social influence plays a significant mediating role in the relationships between educational usefulness, ease of use, and acceptance intention.

The interaction between educational usefulness and facilitating conditions had a significant negative effect on acceptance intention (β = -0.366, t = -5.169, p < 0.001). This suggests that when facilitating conditions—such as technical support, infrastructure, or training—are sufficiently provided, the relative importance of educational usefulness in influencing teachers' intention to adopt metaverse education diminishes. In other words, in well-supported environments, teachers may rely less on their own perceptions of educational value because external support compensates for this factor. This implies that the effect of educational usefulness is more pronounced in settings where such external support is lacking.

Conversely, the interaction between ease of use and facilitating conditions showed a significant positive effect on acceptance intention (β = 0.236, t = 3.258, p < 0.01). This

Table 10. *Verification of Moderation Effect of Facilitating Conditions*

		model 1			model 2		
Variables		B	t	β	B	t	β
Independent Variables	Educational Usefulness	0.646	12.17	0.646	0.450	7.147	0.450
	Ease of Use	0.302	5.687	0.302	0.421	5.885	0.421
Moderating Variable	Facilitating Conditions				-0.013	-0.205	-0.013
Interaction	Usefulness × Facilitating Conditions				-0.250	-5.169	-0.366
	Ease of Use × Facilitating Conditions				-0.176	3.258	0.236

Note. N = 208. The interaction terms with the moderating variable (Facilitating Conditions) showed significant moderating effects on both independent variables. Specifically, the interaction between Educational Usefulness and Facilitating Conditions demonstrated a negative moderating effect (β = -0.366, p < .001), while the interaction between Ease of Use and Facilitating Conditions showed a positive moderating effect (β = 0.236, p < .01).

indicates that in environments with strong facilitating conditions, the perceived ease of use becomes even more influential in shaping teachers' willingness to adopt metaverse education. Supportive environments may reduce technical or psychological barriers, thereby allowing ease of use to play a more central role in the adoption process.

Taken together, these results suggest that strategies for promoting metaverse-based education should be adapted according to the level of facilitating conditions. In resource-rich settings, enhancing ease of use through training, user-friendly platforms, and clear guidance may be most effective. On the other hand, in environments with limited support, it is critical to emphasize and clearly demonstrate the educational value of the metaverse to motivate teachers' acceptance.

4.5 **Structural Model Verification**

Prior to conducting the path analysis, the correlations among the key variables were examined. As presented in Table 11, all correlation coefficients among Educational Usefulness, Ease of Use, Social Influence, Facilitating Conditions, and Acceptance Intention were statistically significant and ranged from 0.775 to 0.901, indicating strong positive relationships.

The correlation between educational usefulness and acceptance intention was especially high (r = 0.901), implying a strong potential influence. The correlation between facilitating conditions and ease of use (r = 0.899) also highlights the role of supportive environments in enhancing perceived ease of using metaverse technologies. While some coefficients exceeded 0.8, variance inflation factors (VIFs) in the regression analyses were within acceptable limits, indicating that multicollinearity was not a critical concern.

To test the proposed research model, structural equation modeling (SEM) was

employed. Since the analysis was based solely on observed variables without latent constructions, it corresponds to a path analysis in statistical terms. As shown in Table 12, the model fit indices — $\chi^2 = 6.467$, df = 2, p = 0.039, TLI = 0.977, CFI = 0.997, and RMSEA = 0.104 (90% CI: 0.020–0.198) — mostly met the recommended thresholds, indicating an acceptable model fit.

The results of the path analysis are summarized in Table 13 and Figure 2. Both Educational Usefulness ($\beta = 0.424$, $p < 0.001$) and Ease of Use ($\beta = 0.339$, $p < 0.001$) had significant positive effects on Acceptance Intention, highlighting the importance of perceived utility and convenience in the adoption of metaverse-based education.

Although social influence did not show a statistically significant direct effect on acceptance intention ($\beta = 0.073$, $p = 0.078$), the Sobel test confirmed its significant mediating role. Both indirect paths—educational usefulness → social influence → acceptance intention ($Z = 6.54$, $p < 0.001$) and ease of use → social influence → acceptance intention ($Z = 7.21$, $p < 0.001$)—were statistically significant, highlighting social influence as a key mediating variable.

Additionally, moderation effects of facilitating conditions were tested. The interaction between educational usefulness and facilitating conditions negatively influenced acceptance intention ($\beta = -0.212$, $p < 0.001$), suggesting that in supportive environments, the impact of educational usefulness may diminish. In contrast, the interaction between ease of use and facilitating conditions positively influenced acceptance intention ($\beta = 0.138$, $p = 0.004$), indicating that ease of use becomes more impactful when technical support and infrastructure are sufficient.

These findings support the structural integrity of the proposed model and provide

nuanced insights into how both individual perceptions and contextual factors jointly shape teachers' acceptance of metaverse technologies in education.

Table 11. *Correlation Analysis Among Variables*

Variable	1	2	3	4	5
Educational Usefulness	1				
Ease of Use	0.848**				
Social Influence	0.797**	0.826**			
Facilitating Conditions	0.804**	0.899**	0.849**		
Acceptance Intention	0.901**	0.849**	0.795**	0.775**	

*Note. N = 208. *p < 0.05, **p < 0.01, ***p < 0.001*

Table 12. *Model Fit Analysis Results*

Indicator	χ^2	df	p	TLI	CFI	RMSEA (90% Confidence Interval)
Structural Model	6.467	2	0.039	0.977	0.997	0.104 (0.020–0.198)

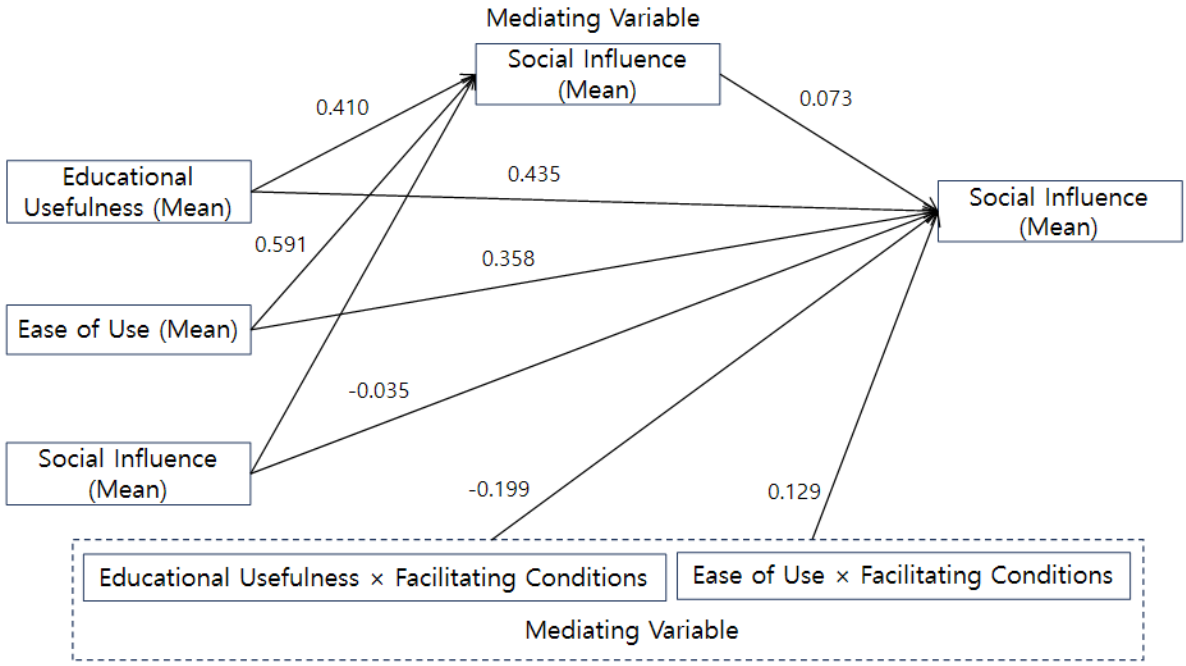
Note. N = 208

Table 13. *Results of Path Coefficients and Significance Analysis for the Structural Model*

Path	Unstandardized Coefficient (B)	Standardized Coefficient (β)	S.E.	t	p
Educational Usefulness → Social Influence	0.410	0.402	0.087	4.718	***
Ease of Use → Social Influence	0.591	0.597	0.077	7.661	***
Social Influence → Acceptance Intention	0.073	0.073	0.042	1.762	0.078
Educational Usefulness → Acceptance Intention	0.435	0.424	0.068	6.411	***
Ease of Use → Acceptance Intention	0.358	0.339	0.071	5.068	***
Facilitating Conditions → Acceptance Intention	-0.035	-0.036	0.054	-0.639	0.523
Educational Usefulness × Facilitating Conditions → Acceptance Intention	-0.199	-0.212	0.040	-5.303	***
Ease of Use × Facilitating Conditions → Acceptance Intention	0.129	0.138	0.045	2.879	0.004

*Note. N = 208. *p < 0.05, **p < 0.01, ***p < 0.001*

Figure 2. *Standardized Path Coefficients of the Structural Model*



Moreover, since this study conducted analysis focusing solely on the observed variables without incorporating a measurement model with latent variables, it corresponds statistically to a form of path analysis within the broader framework of Structural Equation Modeling (SEM).

5.Conclusion and Recommendations

5.1 Summary

This study analyzed the factors influencing middle school teachers' intention to adopt metaverse-based education, based on a research model that integrates the core constructions of the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). The effects of four key variables — educational usefulness, ease of use, social influence, and facilitating conditions — on acceptance intention were examined using stepwise regression analysis, the Sobel test, and path analysis within the framework of Structural Equation Modeling (SEM).

The analysis revealed that educational usefulness and ease of use had significant positive effects on acceptance intention. Educational usefulness emerged as a crucial factor that contributes to enhancing learning outcomes and motivating learners, which aligns with previous research findings (Davis, 1989; Kim, 2021).

Although social influence did not show a significant direct effect on acceptance intention, it demonstrated a meaningful mediating effect in the indirect path between the independent variables and acceptance intention. This suggests that interactions with fellow teachers, parents, and administrators can facilitate the acceptance of metaverse technology.

Meanwhile, facilitating conditions showed a positive moderating effect on the relationship between ease of use and acceptance intention, while exhibiting a negative moderating effect on the relationship between educational usefulness and acceptance intention. This implies that in the early stages of technology adoption, technical infrastructure and support may effectively enhance ease of use, but in overly supportive environments, expectations regarding educational usefulness may be relatively diminished.

5.2 Implications and Limitations

This study holds academic significance in that it analyzes teachers' intention to adopt metaverse-based education through an integrated approach combining the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). By redefining perceived usefulness and perceived ease of use in the context of education, the study provides a more practical and concrete analysis. Unlike previous studies that mainly focused on university students or general consumers, this study targeted middle school teachers, the key agents of practice in actual school settings, thus offering differentiated and practical implications (Kim Eun-sook, 2022).

Moreover, by analyzing the moderating effect of facilitating conditions, the study empirically identified how environmental support interacts with perceived ease of use and perceived usefulness in the adoption of metaverse technology. This provides foundational data for establishing future policies and practical strategies. The result that perceived usefulness and ease of use significantly influence adoption intention reaffirms the validity of TAM in educational settings, supporting Davis (1989) and Kim (2021).

The finding that social influence does not have a direct effect but functions as a mediating variable suggests that the support of peers, administrators, and parents may play a crucial role beyond individual teacher perceptions when adopting metaverse technologies. This implies that indirect mechanisms such as the establishment of communication channels could be effective in teacher training or policy design. The dual moderating effects of facilitating conditions also offer practical insight—while they positively moderated the relationship with ease of use, they negatively moderated the relationship with perceived usefulness. This suggests that the level of technical and environmental support can subtly affect teachers' autonomy and attitudes toward adoption.

Additionally, the study highlights the potential connection between metaverse learning environments and psychological elements such as immersion, presence, and sense of belonging. By identifying the real-world barriers and opportunities teachers face in implementing metaverse tools, the study offers meaningful practical insights for application in schools. It also suggests that factors such as content quality, ethics, and platform reliability can influence teachers' intention to adopt metaverse education.

Furthermore, this study conducted a path-focused analysis based on observed variables. Statistically, this corresponds to path analysis within the broader framework of

Structural Equation Modeling (SEM). Although high correlations ($r > .80$) were observed among variables, the Variance Inflation Factor (VIF) values for all independent variables were below the threshold of 10, indicating no serious multicollinearity problem. This confirms that the proposed causal path structure was statistically well-designed and supports the structural validity of the research model.

However, this study has several limitations. First, since the participants were limited to middle school teachers, generalization to other educational levels such as elementary, high school, or university may be restricted. Second, due to the cross-sectional nature of the research design, changes in teachers' adoption intention over time could not be tracked. Future research should consider a longitudinal design to examine the sustainability and long-term effectiveness of metaverse-based education. Third, the study did not distinguish between different types of metaverse technologies (VR, AR, mirror worlds, etc.) or platforms, which may limit the precision of analysis. Follow-up research should incorporate the unique features and functional differences of various metaverse types. Lastly, this study did not include psychological variables such as presence, immersion, or belonging as independent factors, which limits the comprehensive understanding of learners' experiential and emotional responses. Future research should consider a multilayered analysis that incorporates these psychological aspects.

5.3 Recommendations

Based on the findings of this study, the following policy and practical recommendations are proposed to enhance middle school teachers' intention to adopt metaverse-based education.

First, hands-on teacher training programs should be developed and implemented

to enable teachers to actively utilize metaverse technologies. According to Davis's (1989) Technology Acceptance Model (TAM), perceived ease of use is a critical factor influencing users' acceptance of technology. Kim (2021) also analyzed that in AI-based education, teacher competence and preparedness significantly affect acceptance intention. Therefore, training programs should go beyond theoretical instruction and focus on the development and practical use of instructional content applicable to real classroom settings.

Second, for metaverse-based education to be successfully established, technological infrastructure in educational environments must be supported. In the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh et al. (2003), facilitating conditions—the physical and institutional support available to users—are shown to have a direct impact on behavioral intention. Kim (2022) pointed out that a lack of infrastructure, such as equipment and networks, is a major barrier to the introduction of metaverse in science education. Therefore, financial support should be provided in consideration of regional equity in access to technological resources.

Furthermore, establishing a cooperative foundation among teachers, parents, and administrators is essential. Technology acceptance is not solely driven by individual competence but is also influenced by social support, which aligns with the UTAUT variable social influence (Venkatesh et al., 2003). Han and Kang (2012), in a study on special education teachers, reported that social influence had a significant effect on their intention to adopt smart media technologies. This underscores the need for community-based support and consensus in the implementation of metaverse education.

The development and sharing of instructional content applicable in real classrooms is also crucial. When teachers are provided with practical and specific

materials that can be directly used in lessons, metaverse technology can be more naturally integrated into teaching. Hwang (2023) emphasized that, in analyzing the applicability of metaverse platforms in education, content design must be accompanied by ethical sensitivity training. This aligns with the present study's findings, which identified educational usefulness as a significant predictor of acceptance intention.

Finally, to complement the limitations of this study, future research should include teachers from elementary and high schools to allow for comparative analyses across different educational stages. In addition, future studies should analyze the differential impacts of various metaverse types (e.g., VR, AR, mirror worlds) and platforms. A longitudinal research design is also necessary to examine how acceptance intention changes over time and to verify the sustainability of technology use (Venkatesh et al., 2012).

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[Appendix 1] Survey Questionnaire

A Survey on the Instructional Use of the Metaverse in Middle School Teachers' Classrooms

Part I. General Information

Please check (✓) or fill in your response.

1. **Gender**

   (1) Male (2) Female

2. **Age** (in full years): _____ years

3. **Years of Teaching Experience**: _____ years

4. **Region of Your Current School**

   (1) Seoul (2) Gyeonggi (3) Gangwon (4) Gyeongsang

   (5) Jeolla (6) Chungcheong (7) Jeju

5. **School Level Where You Currently Teach**

   (1) Middle school (2) High school

6. **Grade(s) You Currently Teach** (check all that apply)

   (1) 1st year (2) 2nd year (3) 3rd year

7. **Subject Area**

   (1) Korean (2) English (3) Mathematics (4) Social Studies (History/Ethics, etc.)

   (5) Science/Technology/ICT (6) Arts and Physical Education (7) Others

8. **Have you ever conducted a class using the metaverse?**

   (1) Yes (2) No

9. (Only if "Yes" above) What platform did you use for metaverse-based instruction? Please briefly describe what type of content was taught using the metaverse.

Part II. Perceptions and Attitudes Toward Metaverse-Based Instruction

Please indicate your level of agreement with the following statements by marking (✓) the most appropriate response.

Construct	Statement
Educational Usefulness	1. Metaverse-based instruction helps students better understand abstract concepts.
	2. It increases student engagement and motivation.
	3. It enables more efficient goal achievement in class.
	4. It helps reduce class preparation time.
	5. It enhances lesson planning efficiency.
	6. Digital literacy and metaverse skills are essential for students to thrive in the future.
	7. It helps improve students' concentration.
Ease of Use	1. Using metaverse tools in class is easy.
	2. Operating the platform is not difficult.
	3. It helps create a more engaging learning environment.
	4. Preparing metaverse-based lessons is easy.
	5. Conducting lessons using the metaverse is accessible.
	6. I can easily understand metaverse features.
	7. I can easily utilize various functions of the metaverse.
Social Influence	1. My colleagues and administrators support the use of metaverse in education.
	2. People around me are already using metaverse in class.
	3. I feel social pressure to use metaverse-based tools in my teaching.
	4. If I don't keep up with the trend, I might fall behind.
Facilitating Conditions	1. My school provides sufficient network and hardware infrastructure.
	2. Technical support is readily available when using the metaverse in class.
	3. I have enough opportunities for professional development related to the metaverse.
	4. Platforms needed for metaverse instruction are easily accessible.
Acceptance Intention	1. I intend to continue using the metaverse in my future classes.
	2. I believe it will increase student participation.
	3. I expect it will improve students' digital literacy.
	4. I would recommend metaverse-based instruction to my colleagues.
	5. I believe it is necessary to adopt new instructional methods such as the metaverse.