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Study on Users' Acceptance of and Preference for Metaverse Education Platforms: Focusing on University Students

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ABSTRACT

Recently, active research has been conducted on the metaverse as a new education platform. However, only a few studies analyze the specific characteristics of this platform from potential users' perspectives. Therefore, based on literature reviews and expert surveys on education, this study specifies the attributes and levels to be considered in developing metaverse education platforms. An online survey was conducted among university students in South Korea, and conjoint analysis was performed to propose the conditions for education platforms optimized for university education. The results revealed that 85% of respondents were willing to use metaverse education platforms, and preferred virtual classrooms that enable indirect experience in a web-based personal computer environment. In particular, the respondents showed a high preference for the education platforms that were available at $5 per month and used newly created three-dimensional avatar characters of themselves. This study is significant since its results have strategic implications for expanding the metaverse's use as a new educational space.

Keywords: Metaverse, Virtual Reality, Education Innovation, Conjoint Analysis, Education Platform, Online Learning

Ⅰ. Introduction

The recent rapid advancements in virtual reality (VR) technologies and computer graphics enable the construction of a technological foundation for the metaverse. Many companies, including Roblox and Meta (formerly Facebook), are actively exploring the metaverse for business opportunities (Ning et al., 2023). Furthermore, metaverse technologies are poised to transform educational experiences, bringing teachers and students together in virtual spaces, enhancing vocational training, and creating new opportunities for lifelong learning (Nick Clegg et al., 2023). Accordingly, experts argue that the metaverse could

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potentially overcome the limitations of traditional education systems by replicating reality and enabling experiences that transcend time and space (Contreras et al., 2022; Mystakidis, 2022). Thus, the metaverse is viewed as a crucial tool in reshaping the current education system, offering a completely new learning cosystem (Onu and Mbohwa, 2023). For example, Hussain (2023) claimed that students could improve flow and learning effectiveness by listening and asking questions in class through their three-dimensional (3D) avatars in the metaverse. Moreover, Kshetri et al. (2022) and Suzuki et al. (2020) found that the metaverse improves users' problem-solving abilities by maximizing their collaboration skills. Owing to these advantages, the metaverse is expected to offer positive educational opportunities and outcomes to users (Chua and Yu, 2023).

Despite some controversy in research circles, e-Learning, mobile learning, and other innovative teaching methods are gaining global attention, with no signs of slowing down (ViewSonic, 2022). As a result, numerous studies have been conducted to underscore the importance of integrating the metaverse into the education system. Most of them examine the metaverse from the perspective of suppliers using bibliometric analysis (Kaddoura and Al Husseiny, 2023; Tlili et al., 2022), experimental studies conducted by experts (Lee et al., 2022; Schwaab et al., 2011), and the Delphi method (Kim et al., 2023; Kye, 2021; Lee, 2022; Na et al., 2022; Zhang et al., 2022). However, it is important to consider the views of potential users, while specifying future education platforms. Therefore, this study addresses the following two questions to examine potential users' acceptance of and preferences regarding metaverse education platforms:

Research Question 1. What are the characteristics of metaverse education platforms?

This study analyzes the research trends and characteristics of metaverse-based education through interviews with experts in education and technology fields. This identifies the specific attributes necessary for developing future metaverse education platforms. It further uncovers the differences between new and traditional educational platforms, including the diversity in engagement levels and effectiveness among potential users of these platforms.

Research Question 2. How do potential users evaluate metaverse education platforms?

A survey is conducted to clarify potential users' intentions to use metaverse education platforms and their metaverse preference types. This highlights the challenges posed by the diffusion of the platforms. This survey, utilizing conjoint analysis, aimed to understand the types of metaverse education platforms potential users aspire to use, highlighting the challenges and difficulties of adopting new platforms and deriving strategies to overcome them.

Ⅱ. Literature Review

2.1. Education and Information and Communication Technology (ICT)

As technology advances, computer-based experiential learning is increasingly popular in education (Kim et al., 2022). Simultaneously, the traditional method of face-to-face teaching, which relies on a curriculum developed between instructors and learners, is undergoing significant evolution.

Instructors create an environment for learning based on their academic schedule or regulations and adjust the levels of education to ensure the smooth flow of lectures (Darkwa and Antwi, 2021). The traditional method of imparting education enables in-

structors and learners to communicate and exchange learning material with each other. However, issues of poor interaction may occur (Rueda et al., 2017). Subsequently, new educational paradigms have been created, such as distance education (also known as distance learning) and smart education, following the development of information and communication technology (ICT) (Golubev and Testov, 2015). The use of ICT in education enables students to access digital information efficiently and effectively, and supports student-centered and self-directed learning (Fu, 2013). On the one hand, these paradigms have received significant research attention because they have the potential to overcome the limitations of traditional learning spaces where instructors and learners are separated. On the other hand, this method has mainly comprised online courses or video lectures, which can make learners feel isolated and demotivated (Koohang, 2004; Motiwalla, 2007).

In light of this, the emergence of the metaverse provides an exciting opportunity to address some of the pitfalls of traditional e-learning platforms by providing dynamic virtual spaces tailored to the course content (Viewsonic, 2022). Today, metaverse platforms use virtual reality/augmented reality (VR/AR), 3D virtual worlds, and artificial intelligence (AI) to create advanced forms of education. They are expected to increase flow and facilitate interaction and, thereby, provide a new learning experience (Moolenaar and Sleegers, 2015). This is because the metaverse can connect digital media and reality to provide an educational environment without time and space constraints (Fitria and Simbolon, 2022).

2.2. Education and the Metaverse

Today, education involves the one-way delivery of content and use of a standardized classroom environment and text-based learning material (Friesen, 2017). It poses several challenges, such as limitations in educational content, low student participation, and time and space constraints (Lin et al., 2022). Accordingly, virtual classrooms that combine VR/AR technology and high-quality communication networks are becoming increasingly popular (Contreras et al., 2022).

In the late 1990s, a VR-based platform called Construct3D was developed and implemented in high school and university education. However, the platform's inaccuracy in implementing structures in a virtual environment was indicated as a major flaw (Kaufmann et al., 2000). Nevertheless, the recent metaverse offers a highly immersive experience for users to enjoy an almost perfect digital life, although it has a much more complicated environment (Kye et al., 2021). In one study, 70.3% of the participating students responded that the Oral Emergency Medicine Exam conducted in Second Life's virtual world closely resembled the real exam (Schwaab et al., 2011). In addition, studies revealed that the learners who received airplane maintenance simulation training in the metaverse obtained higher examination scores than those who received online training (Lee et al., 2022). These cases exemplify the advantages of metaverse education platforms. Further, metaverse education promotes active and experiential learning (Sandrone, 2022). Therefore, Dahan et al. (2022) argue that the metaverse must be introduced in education to maintain the availability of learning.

Meanwhile, discussions are ongoing among stakeholders regarding the development of educational content suited to the metaverse from various technological, ethical, and social perspectives (Hussain, 2023; Tlili et al., 2022). According to Wang et al. (2022) and Zhang et al. (2022), addressing the limitations of the education system and ensuring its sus-

tainability involves maximizing the positive impacts of the Edu-Metaverse platform. These studies stress the need for inclusive social discussions to enhance active learner participation and integrate the metaverse into education effectively.

Previous studies have proceeded along three principal trajectories: (1) analyzing the characteristics of metaverse education; (2) exploring the potential the

<Table 1> Studies on Metaverse Education

Category	Author	Main Content	Method
Analyzing the characteristics of metaverse education	Chua and Yu (2023)	· Analyzed 640 articles to analyze the trends in applying the metaverse to education · The metaverse expanded educational opportunities in the learning process of users and provided positive outcomes	Bibliometric analysis
	Lin et al. (2022)	· Investigated the characteristics and application fields of platforms released by six universities and companies to analyze the metaverse technologies used in education · Big data, interaction technology, AI, game design, and blockchain are expected to be integrated in and contribute to the enhancement of education	Bibliometric analysis
	Kaddoura and Husseiny (2023)	· Examined 870 articles to explore ways to apply the metaverse to education · The metaverse contributes to personalized education and increased participant interaction activities according to its expandability	Bibliometric analysis
Possibility of introducing the metaverse in education	Lee et al. (2022)	· Conducted airplane maintenance simulation training for 40 trainees to suggest a training program using the metaverse · Learners trained in a metaverse environment reported more positive learning effectiveness compared those trained by online education	Experimental study
	Kim (2023)	· Collected opinions from 33 education experts on digital media and platform utilization to clarify the development and utilization of the metaverse in education · The metaverse must be actively applied to education since it can overcome the limitations of conventional learning and improve learning effectiveness	Delphi method
	Suzuki et al. (2022)	· Created a shared virtual learning space for more than 50 universities in Japan to clarify the concept of a metaverse learning environment · Users can face various problem situations through collaborative activities, such as real-world education	Experimental study
Challenges to and discussions on future educational innovation	Tlili et al. (2022)	· Analyzed 87 articles to apply the metaverse in education and establish future research direction · Need to discuss technological, ethical, and social perspectives on the metaverse	Bibliometric analysis
	Zhang et al. (2022)	· Analyzed 95 research articles to analyze the metaverse's potential tasks in education · Must overcome the commonly discussed disadvantages (limited social connectivity, the occurrence of crimes owing to the high level of individual freedom, difficulty in distinguishing virtual and real worlds, etc.)	Bibliometric analysis
	Kye et al. (2021)	· Discussed methods to apply the metaverse in education based on the categories provided by the Acceleration Studies Foundation to analyze the metaverse's possibilities and limitations · Must develop measures to prevent the misuse of personal information and create a framework to observe learner performance and support learning.	Delphi method

metaverse into educational settings; and (3) confronting challenges while promoting discussions on educational innovation. This research aims to delineate approaches for the metaverse's pragmatic application in educational contexts, as well as present a comparison to traditional online educational methods. This underscores the necessity of discourse regarding the metaverse's technological and societal implications in education. In tandem, academic inquiries are investigating the barriers and formulating strategies for the metaverse's responsible and effective incorporation into educational infrastructures.

Ⅲ. Method

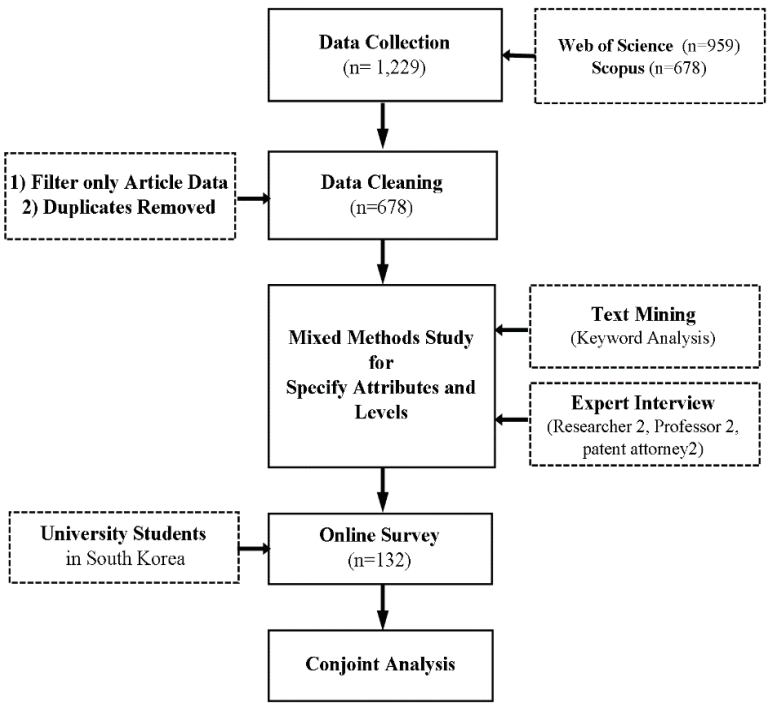
3.1. Survey Overview

This study process is shown in <Figure 1>.

First, text mining was conducted by collecting data from relevant studies to identify the characteristics of metaverse education platforms. Further, the keywords appearing in the abstracts of 678 articles published in Web of Science and Scopus were analyzed.

Second, based on the keyword analysis, attributes and their respective levels for the platforms were delineated through structured interviews and discussions. These sessions involved six experts, each with a minimum of five years of experience in sectors pertinent to ICT, the metaverse, and education. The panel comprised two government-funded researchers, an education professor, an ICT professor, and two patent attorneys , all of whom contributed to defining the characteristics of metaverse education platforms.

Third, an online survey was conducted on 132



<Figure 1> Research Overview

university students in South Korea. University students were selected as participants because they had obtained direct and indirect experience with online learning and the metaverse during the coronavirus disease 2019 (COVID-19) pandemic (Kurian et al., 2022; Misirlis and Munawar, 2023).

Further, to ensure the survey's reliability, an explanation of the survey's purpose and the metaverse was provided to the participants in advance using specific examples (Roblox, Zepeto, Minecraft, etc.).

Finally, a conjoint analysis of collected responses was performed to clarify the characteristics of the metaverse education platforms preferred by potential users. Since metaverse education platforms are only hypothetical alternatives in an uncertain environment, conjoint analysis was considered suitable to analyze university students' metaverse usage intentions and evaluations of important attributes and levels, and to derive the optimal conditions for using the metaverse in university education from the potential users' perspective (Luce and Tukey, 1964).

<Table 2> depicts the demographic characteristics of survey respondents.

3.2. Data Collection and Cleaning

To specify the characteristics of metaverse education platforms, this study collected and analyzed articles on metaverse education published in Web of Science and Scopus till December 31, 2022. Initially, 1,229 articles searched using keywords "Metaverse AND ((EDU) OR (Education) OR (College) OR (University) OR ((Higher) AND (Education)))" were collected. Subsequently, after removing duplicate entries, 678 articles were selected for analysis. Finally, a frequency analysis of the keywords that were mostly used to express and summarize the content of large document sets (Huh, 2018) was conducted. The keywords were refined to minimize the factors that might affect the analysis results.

Specifically, the sentences comprising the abstracts were tokenized into nouns, and the words that were not required for the analysis were removed using a stopword dictionary defined in Python's Natural Language Toolkit algorithm. Moreover, bigram analysis was conducted to identify the keywords suitable for analyzing two at once. For example, hyphens (-) were added between keywords, such as AUGMENTED and REALITY, to convert them into a single keyword, AUGMENTED-REALITY.

3.3. Selection of the Attributes and levels of Metaverse Education Platforms

This study examined the usage intentions and preferences of potential users for future educational platforms by analyzing 678 paper abstracts. This involved conducting a keyword frequency analysis and LDA-based topic modeling analysis. As a result, the keywords emerging from previous studies related to

<Table 2> Demographic Characteristics of Survey Respondents

Variable	Category	Respondents (%)	Variable	Category	Respondents (%)
Gender	Male	59 (45 %)	Grade	Freshman	29 (21.7 %)
	Female	73 (55 %)		Sophomore	18 (13.3 %)
Major	Social Science	95 (72 %)		Junior	57 (43.3 %)
	Engineering	37 (28 %)		Senior	28 (21.7 %)
Total		132 (100 %)	Total		132 (100 %)

metaverse education are focused on three main areas.

First, 'Metaverse Education Environment' includes 'augmented reality' and 'virtual world,' showcasing a blend of digital and real-life elements. It also emphasizes 'online' platforms, suggesting the significance of internet-based learning environments. Second, 'User Experience' aspect encompasses 'user,' 'experience,' 'realism,' '3D visualization,' 'pedagogy,' 'training methods,' 'immersion,' and 'interaction.' These keywords indicate that the research prioritizes the way users interact with and perceive the learning environment, focusing on realistic and immersive educational experiences. Lastly, 'Educational Tools' includes 'educational methods,' 'design principles,' 'platform functionality,' 'application usability,' and 'network infrastructure,' highlighting the practical components that facilitate learning. This suggests a need for tools that are not only functional but also user-friendly and well-integrated into the educational infrastructure.

These elements are considered core components of future educational platforms and are visually represented in <Figure 2> and <Table 3>.

<Figure 2> Major Keywords in Earlier Studies

Ⅳ. Results

4.1. Derivation of the Attributes of Metaverse Education Platforms

This study conducted interviews with six experts specifically selected for this study. This was done to ensure a comprehensive approach and overcome the limitations of relying solely on prior research data to identify the core attributes of metaverse education platforms. These interviews aimed to provide empirical support for the subsequent execution of an online survey. Prior research highlights how the technological characteristics of the metaverse can offer new value to education and produce different outcomes from traditional online education (Hwang and Chien, 2022). Building on this, we classified the key attributes of these platforms into five main categories: (1) device availablity affecting user accessibility; (2) educational value determining effectiveness learn-

<Table 3> Topic Modeling Analysis Results from Earlier Studies

Topic	Common Keywords	Distinctive Keywords
Augmented Reality-Based Educational Technology	'AUGMENTED-REALITY', 'TECHNOLOGY', 'VIRTUAL-WORLD'	'MODEL', 'USER', 'DATA', 'APPLICATION', 'VIRTUAL', 'SOCIAL', 'FUTURE
Student-Centered Virtual Learning Environment		'EDUCATION', 'ENVIRONMENT', 'EXPERIENCE', 'DIGITAL', 'VIRTUAL', 'APPLICATION', 'STUDENT'
Educational System Design and Interaction		'EXPERIENCE', 'DESIGN', 'ENVIRONMENT', 'SYSTEM', 'HIGH', 'USER', 'APPLICATION'

ing quality; (3) application across learning fields; (4) personal character representation for user individuality and participation; (5) service usage fee for platform accessibility and sustainability. These categories represent important elements for optimizing the use of the metaverse in educational contexts.

First, the various types of devices that connect reality to the metaverse can be classified. Specifically, Second Life can be accessed using a computer or smartphone (Contreras et al., 2022), and tools such as a head-mounted display (HMD) are required to obtain a highly immersive and vivid metaverse experience (Dincelli and Yayla, 2022). Therefore, the device types suitable for metaverse education platforms were classified into smart devices (phone and pads), personal computers (PCs) (desktops or laptops), and wearable devices (HMDs).

Second, the metaverse can provide different values to the educational process. Studies on the acceptance of new technologies mention new experiences, convenience of use, and enjoyment as important value factors (Chua and Yu, 2023; Suh and Ahn, 2022). Further, metaverse education platforms are new technologies that enable university students to obtain easy, indirect experiences in major-specific courses or practicums. Students can experience engaging and entertaining spaces during the learning process through avatars or virtual spaces that reflect their individual personalities. In addition, online learning is more convenient than offline education.

Third, for the metaverse's educational use, potential users can specify their experience. Offline lectures can be replaced by virtual online learning spaces. Following further development, the metaverse can be used as a tool to support mutual collaboration in community-centered discussions or team projects (Kshetri et al., 2022). In addition, it can serve as an auxiliary tool that enables immersive experience in situations requiring various theoretical lectures or practices, such as medical examinations (Schwaab et al., 2011) and airplane maintenance simulation training programs (Lee et al., 2022). Based on these results, this study examined the situations in which the metaverse was used as a virtual online learning space, an auxiliary tool for offline learning, and a support tool for mutual collaboration.

Fourth, in the metaverse, individuality can be expressed according to users' preferences. Further, individuals can be identified by showing their face in a virtual space through photos or real-time videos (Kato et al., 2022). Additionally, users can participate in the virtual world through 3D avatars that represent themselves (Kye et al., 2021). Using two-dimensional (2D) emoticons and text in messenger services, individuals can display personal characteristics representing their emotions and current status (Hwang et al., 2023). Therefore, this attribute is divided into three levels: photos or real-time videos, 3D avatars, and 2D emoticons and text.

Finally, this study consider service usage fees that can significantly affect the acceptance of new services (products). According to Dunnett et al. (2012), students are reluctant to use learning tools requiring the payment of relatively high fees. Therefore, three levels ($5, $7, and $10 per month) were considered to examine the impact of price.

4.2. Metaverse-Based Educational Framework

This study specifies the attributes and levels to be considered in developing metaverse education platforms and a conjoint analysis was performed to propose the conditions for education platforms. The survey revealed that a significant majority of university students (85%) expressed a positive intention toward using metaverse education platforms. This

<Table 4> Attributes and Levels of Metaverse Education Platforms

Attribute	Summary	Level	Consideration	Related Article
(1) Device Type	Device type suitable for metaverse-based education services	Smart device	Smart phone, Smart Pad (app based)	Contreras et al. (2022); Na et al. (2022); Dincelli and Yayla (2022)
		Desktop or Notebook	Notebook, desktop (web-based)	
		Head-Mounted Display	Virtual reality/Augmented reality device	
(2) Educational Value	Value provided by education	Easy indirect experience	Indirect experience in students' major classes or practical courses	Chua and Yu (2023); Ning et al. (2023); Zhang et al. (2022); Lin et al. (2022); Suh and Ahn (2022); Darkwa and Antwi (2021)
		Fun and enjoyable space	Avatar characters or a new virtual space	
		Convenience of online learning	Providing the convenience of online learning instead of offline learning in a virtual space	
(3) Educational Application Area	Field of educational application	Virtual online learning space	Replacing offline lectures and practice spaces with virtual spaces	Kshetri et al. (2022); Suzuki et al. (2022); Lee et al. (2022); Sandrone (2022); Schwaab et al. (2011)
		Auxiliary tool for offline learning	Providing an ultrarealistic experience during theoretical lectures or practice	
		Support tool for mutual collaboration	Community-oriented discussions or team projects	
(4) Personal Character Display	Method of showing an individual	A photograph or real-time video	Showing a photograph or real-time video reflecting one's real face	Kim (2023); Hussain (2023); Hwang et al. (2023); Dahan et al. (2022); Tlili et al. (2022); Kye et al. (2021)
		3D avatars	3D customized avatars	
		2D emoticons and text	2D emoticons and texts	
(5) Service Usage Fee	Appropriate service usage fee	$5	Minimum	Dunnett et al. (2012)
		$7	Median	
		$10	Maximum	

enthusiasm is likely influenced by the widespread adoption of remote learning during the COVID-19 pandemic and their familiarity with metaverse environments.

The model fit of the conjoint analysis was confirmed with a Pearson's R value, which is the correlation coefficient between observed and estimated preferences, of 0.902 ($P < 0.05$), validating the model's appropriateness. In addition, Kendall's tau value, which is the correlation coefficient between the planning used when developing the model and the test profile, was analyzed as 0.830 ($P < 0.05$).

Students ranked the method of personal character representation (27.6%) and educational applicability (22.7%) as the most critical factors when choosing a platform. These were followed by service usage fees (19.1%), device types (17.4%), and educational value (13.2%). This indicates that university students

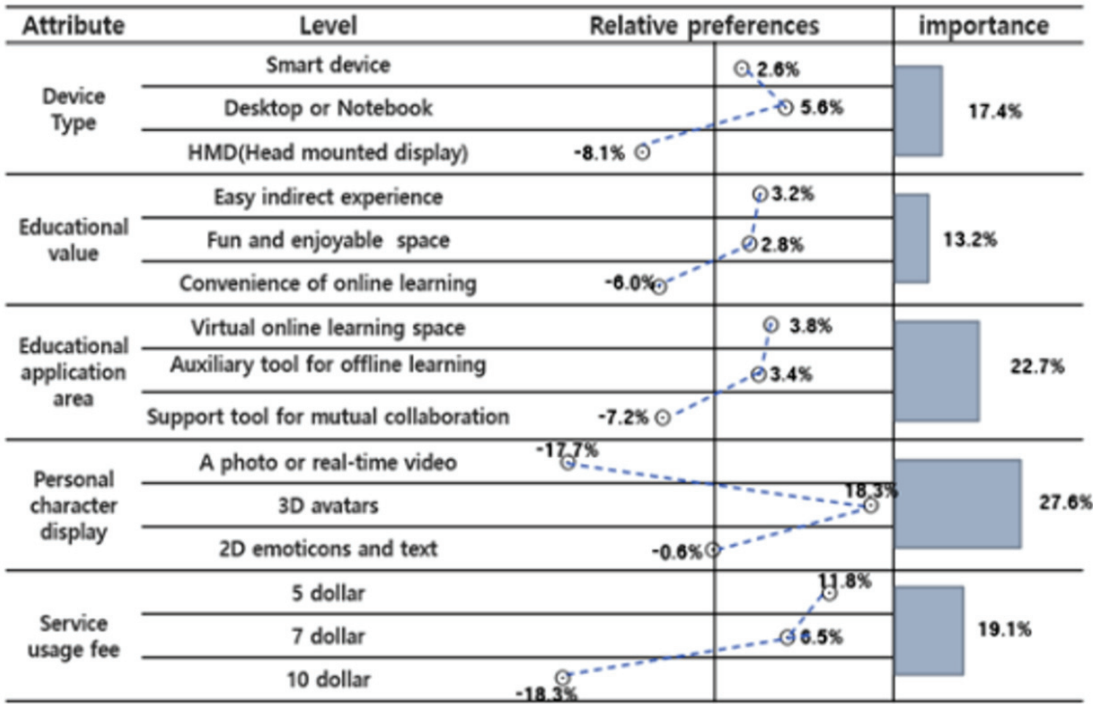
consider not only the cost but also the quality and diversity of the educational experience that platforms offer.

In terms of device preference, desktops or laptops (5.6%) were most favored, with smart devices (2.6%) following. Head-mounted displays (HMDs) tailored for education showed a comparatively lower preference (-8.1%). Regarding educational value, indirect experiences in major-specific courses or practicums (3.2%) and fun educational experiences in new virtual spaces (2.8%) were viewed positively, whereas the convenience of online learning received a lower preference (-6.0%).

University students highly valued representing themselves as 3D avatars in the metaverse environment (18.3%), showing less preference for using photographs or real-time videos (-17.7%) and 2D emoticons and text (-0.6%).

Despite the significance of service usage fees in many studies, this research found it to be of medium importance (19.1%). A fee of $10 per month was considered burdensome and fees less than $5 were preferred, highlighting how cost factors interact with other platform features.

The combination of these analysis results reveal how metaverse-education is more than an online, collaborative learning tool. Instead, it allows users to express themselves and experience education in a fun way. University students prefer platforms that are affordable and offer a variety of features that provide personalization and educational utility. An ideal metaverse education platform should balance cost efficiency with the quality of user experience, satisfying the diverse needs and preferences of university students. Specifically, the combination of services preferred by university students was found to



<Figure 3> Conjoint Analysis Results

be a virtual classroom where users can acquire experience indirectly on a web-based PC and use a newly created 3D-based avatar-type character for less than 5 dollar per month.

Ⅴ. Conclusions and Implications

5.1. Conclusions

The development of ICT has introduced a new learner-centered educational experience in traditional university education. In particular, the metaverse is expected to provide an immersive educational environment anytime and anywhere, beyond the limited physical space of the classroom. Accordingly, this study examined the acceptance and adoption of metaverse education platforms from the perspective of potential users. By analyzing earlier studies and conducting expert interviews, this study derived five major attributes of education platforms-device type, personal character display in the metaverse, educational application, educational value, and service usage fee-and specified their attribute levels.

Results revealed that 85% of university students had positive views on metaverse education platforms and preferred using desktops and laptops over HMDs. Moreover, they expected to have easy and fun-filled educational experiences from practicing in metaverse learning spaces. They did not prefer displaying themselves using real-time videos/photographs or 2D emoticons and text; however, they preferred to display themselves using 3D avatars. The adequate service usage fee was $5 per month. Finally, university students showed the highest preference for virtual practical training using PCs (laptops), using 3D avatars to represent themselves.

5.2. Implications of the Study

The results of this study indicate the following implications for users' acceptance of and preference for metaverse educational platforms.

First, it is necessary to change the educational method using metaverse in the field of university education. This can be confirmed by the high intention to use by the university students as they became accustomed to online learning during the COVID-19 pandemic. However, it was also confirmed that college students were aware of its limitations. In particular, the results indicate that the way of representing oneself through photos or videos is not preferred by the digital generation who value individuality. This can be seen in the same context as showing a high preference for a virtualized learning space that expresses oneself in a 3D avatar.

Second, to promote the adoption of metaverse education platforms, the dissemination of budget-friendly HMD devices that provide convenient typing and visual comfort is necessary. The findings of this study confirm that university students prefer using new educational platforms at low costs, with a preference for devices such as laptops over HMDs. These results suggest that while HMD devices are sold at higher prices by specific companies like Apple and Meta, laptops are more affordable and offer a variety of price ranges and features, allowing students to choose the one that best suits their needs.

Third, when metaverse is used in university education, the curriculum should be able to be personalised anytime, anywhere. According to the results of this study, metaverse-based education can be used with various devices such as smart devices and PCs, and can be used in the learning process at any time in the classroom or at home. In addition, one's individuality can be expressed, and various experiences

can be provided at low cost. This will make learning easier, more fun and more convenient than ever.

In the field of education, despite the introduction and development of numerous technologies for over 100 years, the education field was confined to the classroom. Traditionally, university education has been conducted in the form of one-sided transfer of knowledge by the professor in the classroom. In the course of COVID-19, contactless online education solutions have emerged. However, compared to technological innovation, the educational method has remained relatively unchanged. The educational sector should prepare for metaverse to overcome the problems of existing online education and to transform university education into more tailored education.

Future research could broaden the scope of available studies to include diverse demographics and additional factors influencing the adoption and effectiveness of metaverse education platforms. This expanded approach will help to overcome the limitations identified in previous studies and contribute to the optimal use of metaverse technologies in higher education contexts.

<References>

[1] Chua, H. W., and Yu, Z. (2023). A systematic literature review of the acceptability of the use of Metaverse in education over 16 years. *Journal of Computers in Education*, *1*(2), 615-665. https://doi.org/10.1007/s40692-023-00273-z

[2] Cohen, A. (1993). A new educational paradigm. *Phi Delta Kappan*, *74*(10), 791-795.

[3] Contreras, G. S., González, A. H., Fernández, M. I. S., Martínez, C. B., Cepa, J., and Escobar, Z. (2022). The importance of the application of the metaverse in education. *Modern Applied Science*, *16*(3), 1-34. https://doi.org/10.5539/mas.v16n3p34

[4] Dahan, N. A., Al-Razgan, M., Al-Laith, A., Alsoufi, M. A., Al-Asaly, M. S., and Alfakih, T. (2022). Metaverse framework: A case study on E-learning environment (ELEM). *Electronics*, *11*(10), 1616. https://doi.org/10.3390/electronics11101616

[5] Darkwa, B. F., and Antwi, S. (2021). From classroom to online: Comparing the effectiveness and student academic performance of classroom learning and online learning. *Open Access Library Journal*, *8*(7), 1-22. https://doi.org/10.4236/oalib.1107597.

[6] Dincelli, E., and Yayla, A. (2022). Immersive virtual reality in the age of the Metaverse: A hybrid-narrative review based on the technology affordance perspective. *The Journal of Strategic Information Systems*, *31*(2), 101717. https://doi.org/10.1016/j.jsis.2022.101717

[7] Dunnett, A., Moorhouse, J., Walsh, C., and Barry, C. (2012). Choosing a university: A conjoint analysis of the impact of higher fees on students applying for university in 2012. *Tertiary Education and Management*, *18*, 199-220. https://doi.org/10.1080/13583883.2012.657228

[8] Fitria, T. N., and Simbolon, N. E. (2022). Possibility of metaverse in education: opportunity and threat. *SOSMANIORA: Jurnal Ilmu Sosial dan Humaniora*, *1*(3), 365-375. https://doi.org/10.55123/sosmaniora.v1i3.821

[9] Friesen, N. (2017). *The Textbook and the Lecture: Education in the Age of New Media.* JHU Press.

[10] Fu, J. (2013). Complexity of ICT in education: A critical literature review and its implications. *International Journal of education and Development using ICT*, *9*(1), 112-125.

[11] Golubev, O., and Testov, V. (2015). Network information technologies as a basis of new educational paradigm. *Procedia-Social and Behavioral Sciences*, *214*, 128-134. https://doi.org/10.1016/j.sbspro.2015.11.604

[12] Huh, J. H. (2018). Big data analysis for personalized health activities: Machine learning processing for automatic keyword extraction approach. *Symmetry*, *10*(4), 93. https://doi.org/10.3390/sym10040093

[13] Hussain, S. (2023, April). Metaverse for education–Virtual or real?. In *Frontiers in Education* (Vol. 8, p. 1177429). Frontiers.

[14] Hwang, G. J., and Chien, S. Y. (2022). Definition, roles, and potential research issues of the metaverse in education: An artificial intelligence perspective. *Computers and Education: Artificial Intelligence*, *3*, 100082. https://doi.org/10.1016/j.caeai.2022.100082

[15] Hwang, Y., Shin, D., and Lee, H. (2023). Students' perception on immersive learning through 2D and 3D metaverse platforms. *Educational Technology Research and Development*, *71*, 1687-1708. https://doi.org/10.1007/s11423-023-10238-9

[16] Kaddoura, S., and Al Husseiny, F. (2023). The rising trend of Metaverse in education: Challenges, opportunities, and ethical considerations. *PeerJ Computer Science*, *9*, e1252. https://doi.org/10.7717/peerj-cs.1252

[17] Kato, R., Kikuchi, Y., Yem, V., and Ikei, Y. (2022, June). Reality Avatar for Customer Conversation in the Metaverse. In *International Conference on Human-Computer Interaction* (pp. 131-145). Cham: Springer International Publishing.

[18] Kaufmann, H., Schmalstieg, D., and Wagner, M. (2000). Construct3D: A virtual reality application for mathematics and geometry education. *Education and Information Technologies*, *5*, 263-276. https://doi.org/10.1023/A:1012049406877

[19] Kim, H. C., Park, I., and Kim, M. (2023). Suggestions for Developing a Metaverse Platform for Educational Purpose: A Delphi Study. *Journal of the Korea Society of Computer and Information*, *28*(2), 235-246. https://doi.org/10.9708/JKSCI.2023.28.02.235

[20] Koohang, A. (2004). Students' perceptions toward the use of the digital library in weekly web-based distance learning assignments portion of a hybrid programme. *British Journal of Educational Technology*, *35*(5), 617-626. https://doi.org/10.1111/j.0007-1013.2004.00418.x

[21] Kim, J. B., Watson, E., and Shin, S. I. (2022). Exploring the practical value of business games: Analysis with Toulmin's sensemaking framework. *Asia Pacific Journal of Information Systems*, *32*(4), 803-829.

[22] Kshetri, N., Rojas-Torres, D., and Grambo, M. (2022). The Metaverse and Higher Education Institutions. *IT Professional*, *24*(6), 69-73. https://doi.org/10.1109/MITP.2022.3222711

[23] Kurian, S., Ramanathan, H. N., and Pisker, B. (2022). The Correspondence of Culture and E-Learning Perception Among Indian and Croatian Students During the COVID-19 Pandemic. *Asia Pacific Journal of Information Systems*, *32*(3), 656-683. https://doi.org/10.14329/apjis.2022.32.3.656

[24] Kye, B., Han, N., Kim, E., Park, Y., and Jo, S. (2021). Educational applications of metaverse: possibilities and limitations. *Journal of Educational Evaluation for Health Professions*, *18*(32). https://doi.org/10.3352/jeehp.2021.18.32

[25] Lee, H., Woo, D., and Yu, S. (2022). Virtual reality metaverse system supplementing remote education methods: Based on aircraft maintenance simulation. *Applied Sciences*, *12*(5), 2667. https://doi.org/10.3390/app12052667

[26] Lin, H., Wan, S., Gan, W., Chen, J., and Chao, H. C. (2022). Metaverse in education: Vision, opportunities, and challenges. arXiv preprint arXiv:2211.14951.

[27] Luce, R. D., and Tukey, J. W. (1964). Simultaneous conjoint measurement: A new type of fundamental measurement. *Journal of Mathematical Psychology*, *1*(1), 1-27. https://doi.org/10.1016/0022-2496(64)90015-X

[28] Misirlis, N., and Munawar, H. B. (2023). An analysis of the technology acceptance model in understanding university students behavioral intention to use metaverse technologies. arXiv preprint arXiv:2302.02176. https://doi.org/10.48550/arXiv.2302.02176

[29] Moolenaar, N. M., and Sleegers, P. J. (2015). The networked principal: Examining principals' social relationships and transformational leadership in

school and district networks. *Journal of Educational Administration, 53*(1), 8-39.

[30] Motiwalla, L. F. (2007). Mobile learning: A framework and evaluation. *Computers & Education*, *49*(3), 581-596.

[31] Mystakidis, S. (2022). Metaverse. *Encyclopedia*, 2(1), 486-497. https://doi.org/10.1016/j.compedu.2005.10.011

[32] Na, H. C., Lee, Y. J., Kim, S. Y., and Kim, Y. S. (2022, May 31). A study on metaverse education platform: Cases analysis and suggestion. *Journal of Digital Contents Society, 23*(5), 827-836. https://doi.org/10.9728/dcs.2022.23.5.827

[33] Nick Clegg. (2023). How the Metaverse Can Transform Education, Retrieved from https://about.fb.com/news/2023/04/how-the-metaverse-can-transform-education/

[34] Ning, H., Wang, H., Lin, Y., Wang, W., Dhelim, S., Farha, F., ... and Daneshmand, M. (2023). A survey on the metaverse: The state-of-the-art, technologies, applications, and challenges. *IEEE Internet of Things Journal, 10*(11), 14671-14688. https://doi.org/10.1109/JIOT.2023.3278329

[35] Onu, P., Pradhan, A., and Mbohwa, C. (2023). Potential to use metaverse for future teaching and learning. *Education and Information Technologies*, *29*, 8893-8924. https://doi.org/10.1007/s10639-023-12167-9

[36] Rueda, L., Benitez, J., and Braojos, J. (2017). From traditional education technologies to student satisfaction in Management education: A theory of the role of social media applications. *Information & Management*, *54*(8), 1059-1071. https://doi.org/10.1016/j.im.2017.06.002

[37] Sandrone, S. (2022). Medical education in the metaverse. *Nature Medicine*, *28*(12), 2456-2457. https://doi.org/10.1038/s41591-022-02038-0

[38] Schwaab, J., Kman, N., Nagel, R., Bahner, D., Martin, D. R., Khandelwal, S., ... and Nelson, R. (2011). Using second life virtual simulation environment for mock oral emergency medicine examination. *Academic Emergency Medicine*, *18*(5), 559-562. https://doi.org/10.1111/j.1553-2712.2011.01064.x

[39] Smart, J., Cascio, J., Paffendorf, J. (2007). Metaverse Roadmap Overview; Acceleration Studies Foundation: San Pedro, CA, USA, Retrieved from https://www.w3.org/2008/WebVideo/Annotations/wiki/images/1/19/MetaverseRoadmapOverview.pdf

[40] Suh, W., and Ahn, S. (2022). Utilizing the metaverse for learner-centered constructivist education in the post-pandemic era: An analysis of elementary school students. *Journal of Intelligence*, *10*(1), 17. https://doi.org/10.3390/jintelligence10010017

[41] Suzuki, S. N., Kanematsu, H., Barry, D. M., Ogawa, N., Yajima, K., Nakahira, K. T., Shirai, T., Kawaguchi, M., Kobayashi, T., and Yoshitake, M. (2020). Virtual experiments in metaverse and their applications to collaborative projects: The framework and its significance. *Procedia Computer Science*, *176*, 2125-2132. https://doi.org/10.1016/j.procs.2020.09.249

[42] Tlili, A., Huang, R., Shehata, B., Liu, D., Zhao, J., Metwally, A. H. S., ... and Burgos, D. (2022). Is Metaverse in education a blessing or a curse: A combined content and bibliometric analysis. *Smart Learning Environments*, *9*(1), 1-31. https://doi.org/10.1186/s40561-022-00205-x

[43] ViewSonic. (2022). Metaverse education: What's next for virtual learning?, Retrieved from https://www.viewsonic.com/library/education/metaverse-education-whats-next-for-virtual-learning/

[44] Wang, M., Yu, H., Bell, Z., and Chu, X. (2022). Constructing an Edu-Metaverse ecosystem: A new and innovative framework. *IEEE Transactions on Learning Technologies*, *15*(6), 685-696. https://doi.org/10.1109/TLT.2022.3210828

[45] Zhang, X., Chen, Y., Hu, L., and Wang, Y. (2022). The metaverse in education: Definition, framework, features, potential applications, challenges, and future research topics. *Frontiers in Psychology*, *13*, 6063. https://doi.org/10.3389/fpsyg.2022.1016300

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