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Retraction

Retracted: Exploring the Impact of Avatar Customization in Metaverse: The Role of the Class Mode on Task Engagement and Expectancy-Value Beliefs for Fashion Education

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Jang and J. Kim, "Exploring the Impact of Avatar Customization in Metaverse: The Role of the Class Mode on Task Engagement and Expectancy-Value Beliefs for Fashion Education," *Mobile Information Systems*, vol. 2023, Article ID 2967579, 13 pages, 2023.

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Research Article

Exploring the Impact of Avatar Customization in Metaverse: The Role of the Class Mode on Task Engagement and Expectancy-Value Beliefs for Fashion Education

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This study aims to explore the impact of avatar customization in metaverse environments, especially for fashion education. Considering the unique nature of fashion as an educational field in which theories and practices are equally significant, the impact of class modes (theoretical versus practical) on expectancy and value toward the class in the metaverse environment is empirically investigated, with task engagements as mediators. Students' creative self-efficacy, an individual characteristic, was considered as a moderator. A total of 38 female undergraduate students participated voluntarily. In the experimental session, the participants were randomly allocated to one of the two class mode conditions, theoretical or practical. They were then asked to customize their own avatars for use in the metaverse class and write a descriptive essay about the avatar they made. The results showed that the practical class mode evoked higher engagements (i.e., dedication and absorption), which demonstrates the participants' positive expectancy (i.e., self-efficacy for learning and performance) and value (i.e., task value belief) toward learning in the metaverse class. Interestingly, participants' creative self-efficacy played a moderating role in the impact of dedication on expectancy and value in different directions, while the impact of absorption was positive regardless of participants' creative self-efficacy level. Additionally, we found that expectancy and value toward learning led to the participants' positive class engagement intention.

1. Introduction

Over the past 50 years, information and communications technology (ICT) has progressed at an unpredictably high rate since the introduction of personal computers. Accordingly, Kessler and Buck [1] describe the characteristics of changes in communication and learning methods as digitalization, mobility, and ubiquitous. However, these changes do not simply mean that human communication methods are rapidly changing due to technological changes in the communication environment. This also implies that the field of human activity is expanding into a virtual environment [2]. Human communication methods are being digitalized, networked, and virtualized in ways that are profoundly changing the way and content of human experience and learning. The term "virtual" has been repurposed to imply "almost real." It has the connotation that virtuality only imitates reality and is different from or does not reach the level of reality. However, the "virtual" reality experienced by mankind today and the "virtual world" to which scientific and technological research is oriented do not simply copy or replicate reality but are used at the level of the concept of expanding beyond reality or creating a new world [3]. In particular, with the advent of the metaverse triggered by digitalization, humans are performing sensory, cognitive, and emotional experiences of a different dimension than ever before, communicating with others or learning the world in it. Furthermore, "extended reality," "augmented reality," "metaverse," and "nonfungible tokens" (NFTs) are new terminologies highlighting how

many digital and media tools are affecting human experiences, such as communication and learning.

COVID-19 has recently accelerated the transformation to the metaverse. "Metaverse" refers to a space that transcends reality, where the real world is experienced or reproduced through various virtual spaces, and it represents a world that includes both the real and the virtual worlds. Users go beyond reality's physical limits (extended and augmented reality), work in the virtual world (metaverse) through avatars that replace reality's existence, cross the boundaries between reality and virtual reality (mixed reality), and experience the metaverse in various ways [4]. Given that metaverse experiences are actively used through convergence with social network services, numerous simulations, and online games, it is increasingly becoming a space for learning and communication, where users may completely express their imagination and creativity [5]. These metaverse experiences are recognized as an important driving force that can lead the future society in various aspects, such as industrial technology, scientific inquiry, education and learning, and sociocultural fields, and are not simply applied to the level of games or social communication. In particular, in terms of education and learning, metaverse has scalability and efficiency beyond the limitations of time and space and face-to-face and physical learning. Furthermore, investigations are being conducted to explore whether it can be applied to a variety of subject knowledge or learning areas and if it can provide users with meaningful and effective experiences [6].

In general, the traditional online learning environment has a big limitation in promoting students' engagement [7], and this engagement is very important to improve online instruction qualities [7]. It is especially true for fashion education, where delivering practical knowledge and skills are crucial aspects [8]. Consumer and market data, as well as trends, are used to plan products in the fashion industry. In addition, adding design work based on a fashion designer's creativity can give value to the product as a one-of-a-kind fashion product offered to consumers in the market. Therefore, curriculums that promote both theoretical classes that emphasize analytical thinking and strategic planning, as well as practical courses that inspire creativity and application, are used in fashion education to educate professionals in the fashion industry. In this situation, many concerns have been identified in the non-face-to-face online education environment due to the characteristics of fashion education, which emphasize both theoretical and practical courses. Non-face-to-face online learning has a number of drawbacks, including poor class quality, decreased student concentration and motivation, lower student satisfaction with class, and limitations in instructor-student interactions. Moreover, due to the characteristics of practical courses in which mutual interaction and real-time feedback are important, there are further issues in terms of the mismatch of class expectations, learning limitations, and learning satisfaction.

However, recently, studies on metaverse-based education have reported that it can increase learners' interest [9] as well as their presence in learning and visual immersion [10]. Likewise, virtual reality (VR) content applied in the metaverse has been found to be effective in increasing the concentration of content for learners and improving learning immersion and class participation [11, 12]. Therefore, the advantages of metaverse-based education can be expected to effectively apply to fashion education, especially for overcoming the limitations of online practical classes which need students' active participation. Then, how can it promote students' engagement in online learning? Metaverse experience is started with avatar creation in general. Noticing this process is mandatory for entering the metaverse platform, we focused on the impact of avatar customization tasks for evoking engagement.

This article aims to explore the impact of learning in the metaverse environments for fashion education, regarding avatar customization task's impact on students' class engagement. Considering the unique nature of fashion as an educational field in which theory and practices are equally significant, this article empirically investigates the impact of class modes (theoretical versus practical) on expectancy and value toward the class in the metaverse environment through the mediating role of task engagement. For this purpose, the learning experience of students participating in fashion education by creating their avatars in ZEPETO, a representative metaverse platform, was studied. Through this approach, the direction of metaverse-based fashion education was proposed as an alternative to overcome the limitations of non-face-to-face online education. Furthermore, this study suggests a direction for a differentiated teaching method to improve the learning satisfaction of theoretical and practical classes using metaverse. Thus, it contributes to enhance the effectiveness of the theoretical and practical education of fashion education, which could not be implemented in non-face-to-face online learning situations.

2. Theoretical Background

2.1. Expectancy-Value Beliefs toward Learning. Researchers have been trying to predict academic achievement at university, and previous studies have shown that high levels of metacognition, motivation, and behavior—the three components of self-regulated learning—are considered important determinants of academic performance [13]. Among the three determinants, motivation is essential to learning in all contexts, but it is especially important in online learning. In an online learning environment, students have a high degree of freedom and a low level of regulation, so they must remain self-motivated to learn so that they can successfully achieve the target learning and performance outcomes [14]. According to the expectancy-value theory of motivation [15], achievement-related motivation stems from a combination of an individual's performance expectancy and subjective task values. Students, for example, are more likely to pursue an activity if they expect themselves to do well in it and value it. In explaining learning motivation, the expectancy-value theory emphasizes the dual importance of competency-related beliefs (i.e., expectancy to succeed) and values. Furthermore, many previous studies provided strong empirical support for this theory [15].

Pintrich and De Groot [16] proposed a general theoretical framework for evaluating the motivational direction of university students and the use of various learning strategies for the university course. In addition, based on this, Motivated Strategies for Learning Questionnaire (MSLQ) was developed [17, 18]. The MSLQ is broadly adopted in the educational research field as a self-reporting tool designed to assess college students' motivational orientation and use of different learning strategies for college courses based on a general cognitive view of motivation and learning strategies (Credé and Phillips [13]). The motivational section of the MSLQ consists of three components: (1) expectancy, (2) value, and (3) affective. The third general motivational component, the affective, deals with the responses to test anxiety, which reflects students' concerns about tests. Based on the expectancy-value theory, we focus more on the expectancy and value components.

The expectancy component represents the student's belief that the task can be accomplished. Specifically, it reflects two aspects of expectations: expectations for success and self-efficacy. Expectations of success refer to performance expectations and are specifically related to task performance. Self-efficacy is a self-assessment of one's ability to complete a task, and it includes judgments about students' ability to complete tasks and their confidence in their skills to perform those tasks. Meanwhile, the value component focuses on why students engage in academic assignments [17, 18]. Previous research has empirically confirmed the impacts of expectancy and task value of choice or performances of specific subjects, such as mathematics and language arts [19]. Other studies have shown that expectancy beliefs have a strong influence on achievement, whereas subjective values have a significant influence on choice, effort, and persistence [20]. In addition, Doménech-Betoret et al. [20] and Ramirez-Arellano et al. [21] provided empirical evidence proving the direct and positive impacts of expectancy-value beliefs on student achievement and satisfaction.

Several previous studies revealed that virtual learning environments can lead to higher self-efficacy [22] and e-learning acceptance [8]. However, most of them did not consider different class modes. Class modes can be divided into two: theoretical and practical. Fashion education especially needs to be focused on developing practical knowledge, as craft-related and practical vocational knowledge and skills are crucial aspects of fashion product development [23]. In another field which is needed practical learning importantly, such as medical education, they are discussing that practical experiences in the laboratory, as dynamic components for developing hands-on skills, are important for the accomplishment of active learning of students [24]. In the case of the practical class, active participation and interactivity of the students a premised, but it has not been empirically confirmed whether the practical class mode itself evokes the students' intention to participate compared to the theory class. Also, when these hands-on classes are conducted online, it has not been confirmed how online assignment activities affect students' actual participation behavior and results.

A study based on expectancy-value theory and the unified theory of acceptance and use of technology (UTAUT) [8] confirmed that educational compatibility and technological expectancy, two aspects of expectations, which are important factors in determining e-learning acceptance. In this study, "educational compatibility" is defined as the degree to which an e-learning system is perceived to match student learning expectations. For the overall effect on behavioral intentions in learning, educational compatibility has been proven to be more important than technological expectancy. Regarding fashion education, the practical class mode generally requires a higher level of interaction and participation from students compared to the theoretical class mode. Given the importance of ensuring consistency between the possibilities offered by the online education system and the learning content to achieve students' expected learning expectations [8], we expect that it is more effective when the practical teaching mode is presented in the metaverse environment, especially in fashion education, because it provides interactivity and participatory environment. Furthermore, it is expected that a greater effect can be obtained by matching the learning expectations.

In addition, regarding the context of mediated learning online, Sansone et al. [14] defined expectancy as a goal-defined motivation. In their study on HTML learning using a computer, they presented a class using a different learning frame: the theoretical or practical class. The findings of this study revealed that when the initial frame of instructions creates explicit connections to how the technology can be used in real life (i.e., practical frame), students can be more actively engaged in how they use online classes, and higher engagement leads to higher motivation toward learning [14]. These results also imply that the practical class, especially in fashion education in which the practical application is crucial, can be more effective in evoking students' expectancy toward learning than the theoretical class mode. Based on the aforementioned literature and discussions, we suggest the following hypothesis:

> H1: when the class type is practical (vs. theoretical), students' (a) self-efficacy and (b) task value toward learning will be higher.

2.2. Engagement: Dedication and Absorption. In the online setting, active participation is needed for effective learning [25]. Related to this, computer-based learning environments allow individuals to actively engage in learning activities and regulate their own thoughts and behaviors during the learning session. The active engagement has long been recognized as critical to continuous learning; thus, online learning appears to be especially beneficial in facilitating motivated learning [14].

Engagement at work and study refers to a positive, fulfilling, and work/study-related state of mind and includes the following three subdimensions: vigor, dedication, and absorption [26, 27]. Vigor is characterized by high levels of energy, mental effort, mental resilience, and time flies while doing a task [27–29]. Dedication refers to the strong involvement in or passion for learning and is characterized by

the cognitive sense of meaningful, fulfilling, inspiration, and challenge/purpose experienced by an individual when studying [27, 29]. Finally, absorption refers to the extent of a sense of being fully concentrated, attentive, and deeply engrossed in a task, whereby time passes quickly [27, 29].

Notably, although the three components usually have a high correlation with one another, these are separately used in previous studies [28]. Among them, the concept of vigor is somewhat overlapped with absorption, thus reflecting mental vigor that comes partly from "repetitive performance." For example, scale items of vigor include "I can continue doing this task for very long periods at a time," "I feel strong and vigorous when I am doing this task," and "In this task, I always persevere, even when things do not go well" [30]. Previous studies have shown an insignificant effect of vigor in the working or studying context [31]. In fact, one study revealed that vigor played a role as a predictor for the other two engagement dimensions [30]. Therefore, for the current study, we focus on the other two components: dedication and absorption.

Regarding the influence of the class modes, the practical class requires more engagement, such as interactions and real-time feedback, between students and instructors, while the former basically perceive the theoretical class as a one-sided class [32–34]. According to the literature, the characteristics or resources of tasks are an important factor in determining whether to engage in a task [35, 36]. Quinn [37] discovered that the type of task performed by individuals affects the extent to which they experience flow, the experience related to the engagement. Therefore, we expect that the intrinsic characteristics of the theoretical and practical class modes will also affect students' participation in tasks.

The previous literature on the relationship between job engagement and behavior suggests that work engagement is positively related to energy, self-efficacy [38], and work involvement, all of which require perseverance and internal drive to delve deeply into concepts and find new solutions [39]. Adil et al. [39] confirmed that employees with high work engagement are more likely to be involved in their work, and such employees tend to be intrinsically motivated to extend their services and commitment to creative work beyond their formal work roles. Therefore, based on the relationship between engagement and motivation (i.e., expectancy-value beliefs), we expect the mediating roles of task engagement, dedication, and absorption and propose the following hypotheses:

H2-1: the impacts of class type on (a) self-efficacy and (b) task value toward learning will be mediated by students' dedication to the task

H2-2: the impacts of class type on (a) self-efficacy and (b) task value toward learning will be mediated by students' absorption of the task

2.3. Individual Characteristic: Creative Self-Efficacy. Creative self-efficacy is an individual characteristic that promotes creative outcomes and espouses the belief that an individual is capable of developing new and useful ideas on their own [40]. Creative self-efficacy is defined as one's own judgment of his/her creative abilities and the belief that one can be creative in one's work or study [41, 42]. These beliefs are a predictor of an individual's creative performance [42]. Furthermore, openness to experience has been found to be positively related to the creative self-efficacy scale scores [43], implying that creative self-efficacy may be a more important trait in the metaverse environment for accepting and adapting new learning experiences.

Furthermore, creative self-efficacy is a key factor in achieving innovative outcomes [44]. People with low creative self-efficacy are less likely to engage in innovative tasks because they tend to question their ability to innovate when they encounter problems in their work and do not believe in themselves that they can produce effective innovative results to improve the situation [45]. Conversely, people with high creative self-efficacy have confidence and strong motivation to achieve innovative goals and actively seek information and ways to improve when faced with problems [42, 44].

According to previous studies, people with high creative self-efficacy are motivated to take creative actions more easily [46] and set difficult goals for themselves [47]. According to goal management theory, these goals increase people's work motivation [48]. In addition, people with high self-efficacy do not view creative tasks as threats to be avoided but rather as challenging activities that drive them to exert maximum effort to master these challenging activities, which in turn, help maintain persistence when faced with such situations [49]. Creative self-efficacy moderates the positive relationship between work engagement and creative work involvement [39]. Specifically, creative self-efficacy significantly increases the positive relationship between work engagement and creative work involvement, suggesting that people with higher creative self-efficacy are more likely to actively engage in creative activities. Therefore, we proposed the following hypotheses:

H3-1: the mediating impacts of dedication on (a) self-efficacy and (b) task value will be moderated by creative self-efficacy

H3-2: the mediating impacts of absorption on (a) self-efficacy and (b) task value will be moderated by creative self-efficacy

The conceptual research model of this study is provided in Figure 1.

3. Methodology

3.1. Stimuli. For this article, we created a mockup of an avatar making simulation, using actual avatar and item images found in a commercialized metaverse platform. Before they participate in a new fashion class, participants were asked to choose an avatar using ZEPETO, a Naver metaverse platform. The avatar customization task is a basic course for participating on a metaverse platform, also considered that this process will raise the students' engagement in the class in the metaverse by inputting their own effort, regardless to the class mode. The avatar's fashion style was determined by combining hair, top, and bottom,

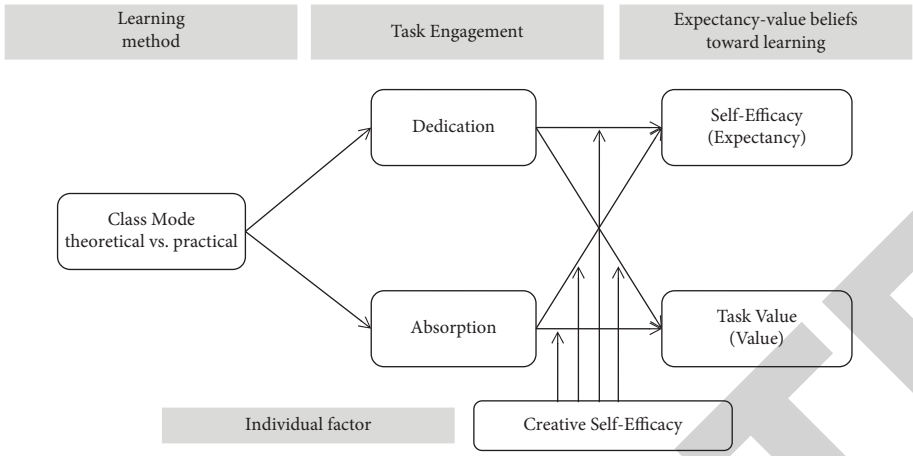

Figure 1: conceptual research model.

with four alternatives for each, resulting in a total of 64 avatar fashion styles based on the 4*4*4 combination of hair, top, and bottom.

The participants were asked to select an avatar in accordance with the environmental characteristics of the metaverse as a platform, where "I"—represented by the avatar—interacted with other people in the virtual world. Furthermore, interacting with other users via avatars is a way to meet the needs of the MZ generation, which is characterized by the ability to express many identities by dividing them into real and additional characters [50]. A recent study [51] established the influence of an avatar on learning presence and visual attention in the metaverse learning environment. The avatar decoration act, in which participants chose a fashion style, is an essential visual means of expressing themselves at the start of the experiment and establishes expectations that the class would be held in a metaverse. As one's own avatar is directly managed to move around space and actively participate in activities, it is believed that active learning will occur, and the learning effect will rise when this is applied to learning [52]. In addition, because the participants wrote an essay explaining why they chose the avatar fashion style, they used it as a device to engage themselves more in the content of the class.

The hair, top, and bottom stimulants that made up the avatar fashion style used in the experiment were selected through a preliminary survey of 22 college students in a fashion design class at a university in the metropolitan area in Korea in May 2022. The reason for setting the avatar style was explained by having to sign up for Naver ZEPETO and the avatar picture was attached. In the preliminary survey, the participants either selected avatars wearing easy casual wear that reflected styles similar to their real selves or avatar characters that reflected a bold style that they had never tried before due to body shape or social evaluations. Based on these results, hoodies, jeans, striped T-shirts, and pleated skirts were suggested as options for selecting avatar clothes similar to the fashion styles of actual college students. Short hair with glasses and short hair with hair rolls were also presented. Conversely, character hoodies, sleeveless and mesh items, garter belt-decorated hot pants, and pink short skirts were also presented as options for choosing a fashion style for an avatar who wanted to escape from reality and freely express oneself in a virtual environment. Two-tone hair or pink long hair was also suggested. The pictures of each of the basic selection stimuli are provided in Figure 2, and the final mockup of avatar making simulation image is provided in Figure 3.

3.2. Participants and Procedures. For this research, only females were recruited in an online survey to control the influence of exogenous variables, such as gender, considering the metaverse avatar stimuli target women. A total of 42 undergraduate students were recruited through internal advertisements in fashion-related department at several universities in South Korea where the metaverse platform is actively tested for learning, and they agreed to voluntarily participate in the experiment. The study employed a between-subjects design (the class mode, theoretical vs. practical). Especially, the independent variable in the current study was manipulated by class mode to reflect the different participation intention levels as an index of congruency between class modes and the characteristics of the metaverse learning environment. We first asked the participants to respond to questions regarding their prior knowledge about their major and metaverse with three items each. The questions were adopted from the brand knowledge scale by Algesheimer et al. [53] and adjusted to fit the current research. Next, the participants were asked to respond to the six items of creative self-efficacy scale [43].

Next, the participants were assigned randomly to one of the two conditions based on two scenarios (the class mode, theoretical vs. practical) with simple definitions of the metaverse. Fashion marketing and fashion studio class was selected for each theoretical and practical class, respectively, since they are basic and core classes for most universities with department related to fashion. The participants in the theoretical class mode condition were given a scenario in which they were making an avatar to participate in a new class on an online metaverse platform for the next day: "You, a student of fashion design, are making an avatar to

	Real world styles		Virtual world styles	
Hair				
Top				
Bottom				

Figure 2: Each item selected for the study stimuli.

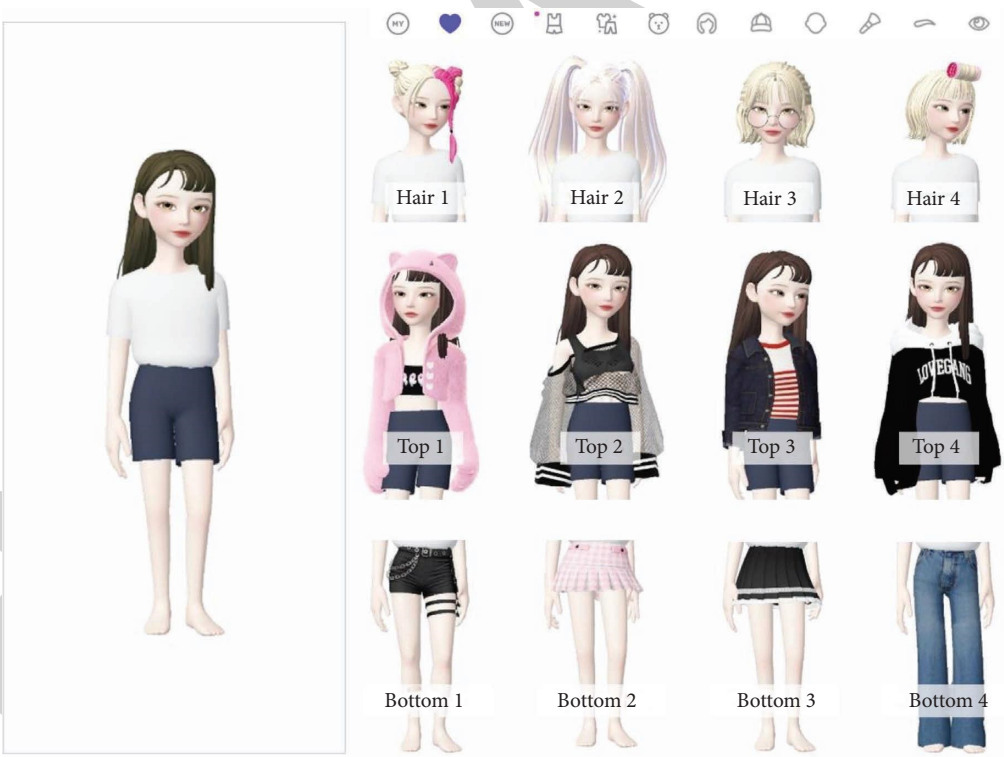

Figure 3: The mockup of avatar making simulation image for this study.

participate in a class to be held tomorrow via an online metaverse platform, ZEPETO. This is the first task of the new class, 'Creating my avatar for use in class.' The class you will be participating in is the <Fashion Marketing> class, which analyzes markets and consumers using big data analysis methods. Select the fashion style of your avatar to participate in the <Fashion Marketing> class, one for each hair/top/bottom, and combine them. Now, as a student taking a new class on the next page, think carefully about the class and perform the first task, "Creating my avatar to be used in class." Meanwhile, the participants in the practical class mode condition <Fashion Studio> were given a scenario to develop creative fashion design products through confirmation from current fashion designers.

In the task phase, the participants were provided the stimuli that included a basic female avatar with four options each for the hair, top, and bottom items. The completed avatars were provided after finishing the item selection, and the participants were asked to write an essay describing their avatars and why they chose the items for this class. When the participants finished their essay tasks, they were informed of the following: "You have just completed the first assignment of your new class. From the next page, answer the questions by recalling the topic of the new class and the task you just performed."

Right after finishing the task, the participants were asked to select which class is the new class they enrolled in while thinking about the scenario and the task in between <Fashion Marketing> and <Fashion Studio>. If a participant selected the wrong answer, then the survey ended based on our screening criteria. The subsequent main survey included questionnaires about perceived avatar customization level (two items) [30], participation intentions for manipulation checking (one item) [53], class engagement intention (five items) [53], prior knowledge about this new class topic (three items) [53], engagement: dedication and absorption (six items each) [30], expectancy: self-efficacy for learning and performance (eight items) [54], and value: task value (six items) [54] on five-point Likert scales. All measurements were reviewed and revised to fit the context of the current study without compromising their original meaning or purpose. Finally, we requested demographic information from the participants. After removing four observations due to an incomplete survey, we used 38 questionnaires for the final analysis ($N_{\text{theoretical}} = 20$ and $N_{\text{practical}} = 18$).

4. Results

Based on the participants' demographic information, the 38 female participants' mean age was 20.08 years (range, 18–25). There were 19 freshmen, 10 sophomores, 6 juniors, and 3 seniors with a mean grade year of 1.82. In terms of marital status, all the participants were single. The adjusted measurements for statistical analysis after checking validity and reliabilities are provided in Table 1. Before conducting the hypothesis testing, we performed a t-test to check whether there was a difference in the perceptions of the avatar customization level between the two conditions. The results showed no significant difference ($M_{\text{theoretical}} = 4.03$ vs. $M_{\text{practical}} = 4.31$; $t(36) = -1.32$, $p = 0.19$). For manipulation checking, we performed a t-test with the class mode as an independent variable and the participation intention as a dependent variable. The analysis showed that the participation intention was statistically higher in the practical class mode than in the theoretical class mode ($M_{\text{theoretical}} = 3.79$ vs. $M_{\text{practical}} = 4.21$; $t(36) = -1.32$, $p < 0.05$). Therefore, we proceeded to perform the hypothesis testing.

4.1. The Impacts of Class Mode on Self-Efficacy and Task Value. To test H1(a) and (b), we performed the one-way ANOVA test with each class mode as an independent variable and (a) self-efficacy and (b) task value as the dependent variables. The participants' prior knowledge about their major, metaverse, and this new class were entered as covariates together. The results revealed statistically significant differences in both expectancy-value beliefs: self-efficacy ($F(33) = 5.80$, $p < 0.05$) and task value ($F(33) = 5.30$, $p < 0.05$). Both expectancy and value beliefs were higher in the practical class condition than in the theoretical class condition; therefore, H1(a) and H1(b) are supported. Then, we entered their prior knowledge about their major, metaverse, and this new class topic as covariates for every analysis.

4.2. The Mediating Effects of Dedication and Absorption. Hypotheses 2-1 and 2-2 predict the mediating roles of task engagement, dedication, and absorption between the class mode on self-efficacy (expectancy belief) and task value (value belief). To test H2 and examine the mediation model, we used SPSS Macro Process [55] Model 4 with 95% confidence intervals (CI) and 5,000 bootstrap samples [55, 56]. First, we entered the class mode as the independent variable (theoretical class = 1 and practical class = 2), self-efficacy and task value as the dependent variables, and both of task engagements, dedication and absorption, together with the three covariates.

The results showed that the mediation effect (i.e., the indirect effect of class mode on self-efficacy) of absorption was significant (effect = .429 and 95% CI: (0.049, 1.259)), while the mediation effect of dedication (effect = .037 and 95% CI: (−0.553, 0.431)) and direct effect of class mode on the self-efficacy were not significant (effect = 0.034, $p = 0.86$). Specifically, when the class mode was practical (vs. theoretical), dedication ($\beta = 0.59$, $p < 0.01$) and absorption ($\beta = 0.54$, $p < 0.01$) were statistically higher. However, the positive effect of dedication on self-efficacy was insignificant ($\beta = 0.06$, $p = 0.83$), while that of absorption on self-efficacy was significant ($\beta = 0.79$, $p < 0.05$).

When the task value was entered as the dependent variable, the result also showed the same pattern. The mediation effect of absorption was significant (effect = 0.427 and 95% CI: (0.104, 0.860)), while the mediation effect of dedication (effect = 0.105 and 95% CI: (–0.209, 0.379)) and the direct effect of class mode on self-efficacy were not significant (effect = –0.119, $p = 0.43$). Specifically, when the class mode was practical (vs. theoretical), dedication ($\beta = 0.59$, $p < 0.01$) and absorption ($\beta = 0.54$, $p < 0.01$) were both statistically higher. However, the positive effect of dedication on self-efficacy was insignificant ($\beta = 0.18$, $p = 0.45$), while the positive effect of absorption on self-efficacy was significant ($\beta = 0.78$, $p < 0.01$), thus supporting H2-2.

Therefore, we conducted additional analysis, with dedication as a mediator independent of the effect of absorption to provide richer explanation with stricter hypothesis testing. The results revealed that the mediation effect of dedication was significant (effect = 0.405 and 95% CI: (0.097, 0.784)), while the direct path of class mode on self-efficacy was insignificant (effect = 0.094, $p = 0.65$). When the task value was entered as the dependent variable, the result also showed the significant mediation effect of dedication (effect = 0.405 and 95% CI: (0.097, 0.784)), thus supporting H2-1.

Table 1: Measurement items.

Variables		Items	Mean	SD	Cronbach's α
Prior knowledge	Major	When compared to other people, I know a lot about my major	3.32	0.99	0.86
		My friends consider me an expert regarding my major	3.00	0.99	
		I consider myself very experienced with my major	2.89	1.03	
	Metaverse	When compared to other people, I know a lot about metaverse	2.84	1.05	0.87
		My friends consider me an expert regarding metaverse	2.18	0.90	
		I consider myself very experienced with metaverse	2.39	1.08	
	New class topic	When compared to other people, I know a lot about this new class's topic	3.03		0.92
		My friends consider me an expert regarding this new class's topic	2.50		
		I consider myself very experienced with this new class's topic	2.71		
Creative self-efficacy		I know I can efficiently solve even complicated problems	3.18	0.80	0.91
		I trust my creative abilities	3.68	0.93	
		Compared with my friends, I am distinguished by my imagination and ingenuity	3.53	0.98	
		I have proven many times that I can cope with difficult situations	3.71	0.90	
		I am certain I can deal with problems requiring creative thinking	3.53	1.01	
		I am good at proposing original solutions to problems	3.53	0.95	
Perceived avatar customization level		I am allowed to select the avatars (characters) for the online metaverse class according to my taste	4.16	0.68	0.94
		I am allowed to adjust the settings of the avatars (characters) for online metaverse class according to my taste	4.16	0.68	
Participation intentions (manipulation check)		I will actively participate in this class's activity	4.00	0.66	N.A.
Class engagement intention		I benefit from following this class's rules	3.63	0.68	73
		I am motivated to participate in this class's activities because I feel better afterwards	3.68	0.66	
		I am motivated to participate in this class's activities because I am able to reach personal goals	3.82	0.73	
Task engagement	Dedication	This task of the new class inspires me	3.68	0.74	0.90
		I found this task of the new class full of meaning and purpose	3.58	0.68	
		I am excited when doing this task of the new class	3.42	0.68	
		I am interested in this task of the new class	3.66	0.63	
		I am proud of doing this task of the new class	3.82	0.69	
	Absorption	Time flies when I am doing this task of the new class	3.63	0.79	0.89
		Doing this task of the new class is so absorbing that I forgot about everything else	3.24	0.71	
		I am rarely distracted when doing this task of the new class	3.74	0.76	
		I am immersed in this task of the new class	3.53	0.76	
		My mind is focused when doing this task of the new class	3.68	0.78	
		I pay a lot of attention to this task of the new class	3.63	0.71	
Expectancy belief, self-efficacy		I believe I will receive an excellent grade in this class	3.68	0.81	0.95
		I'm certain I can understand the most difficult material presented in the readings for this course	3.50	0.76	
		I'm confident I can understand the basic concepts taught in this course	3.82	0.80	
		I'm confident I can understand the most complex material presented by the instructor in this course	3.53	0.83	
		I'm confident I can do an excellent job on the assignments and tests in this course	3.61	0.86	
		I expect to do well in this class	3.89	0.73	
		I'm certain I can master the skills being taught in this class	3.63	0.91	
		Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class	3.84	0.68	
Value belief, task value		I think I will be able to use what I learn in this course in other courses	3.76	0.82	0.92
		It is important for me to learn the course material in this class	3.89	0.73	
		I am very interested in the content area of this course	3.74	0.72	
		I think the course material in this class is useful for me to learn	3.82	0.69	
		I like the subject matter of this course	3.66	0.75	
		Understanding the subject matter of this course is very important to me	3.74	0.76	

4.3. The Moderating Role of Creative Self-Efficacy. H3 predicts that, in the path between task engagements and expectancy-value beliefs, the mediating effects of task engagement depend on students' creative self-efficacy. To test H3 and examine the moderated-mediation model, we used SPSS Macro Process [54] Model 14 with 95% CI and 5,000 bootstrap samples [55, 56]. The class mode was the independent variable (theoretical class = 1 and practical class = 2), creative self-efficacy was the moderator, and self-efficacy and task value were the dependent variables for each analysis. Both task engagements and dedication and absorption together were entered as mediators with the three covariates.

First, we conducted an analysis to examine whether the relationships between the task engagement variables and self-efficacy were moderated by creative self-efficacy. The results revealed that both the moderated-mediation effects of dedication (effect = –0.799, 95% CI (–1.710, –0.149)) and absorption (effect = 0.769, 95% CI (0.121, 1.670)) were significant. Therefore, H3-1(a) and H3-2(a) were supported. Specifically, the direct effects of the class mode on dedication ($\beta = 0.59$, $p < 0.01$) and absorption ($\beta = 0.54$, $p < 0.01$) were significant, thus revealing that the practical (vs. theoretical) class evoked higher task engagements. Dedication ($\beta = 4.83$, $p < 0.01$) and absorption ($\beta = -4.32$, $p < 0.05$) had significant effects on self-efficacy. Furthermore, the effects of the interaction terms between dedication and creative self-efficacy ($\beta = -1.36$, $p < 0.01$) and that between absorption and creative self-efficacy ($\beta = 1.41$, $p < 0.01$) on self-efficacy were all statistically significant.

Interestingly, the Johnson–Neyman technique revealed that the indirect conditional effect of dedication is statistically significant for those whose creative self-efficacy is lower than 3.07 or higher than 4.20. Specifically, for the participants with relatively low creative self-efficacy (i.e., lower than 3.07), results showed that the higher the dedication level, the higher the expectation for self-efficacy. Meanwhile, the participants with relatively high creative self-efficacy (i.e., higher than 4.20) showed that the higher dedication level can harm the expectation for self-efficacy. Furthermore, the results also revealed that the indirect conditional effect of absorption was statistically significant for those whose creative self-efficacy was higher than 3.5. Specifically, for the participants with relatively high creative self-efficacy (i.e., higher than 3.5), results showed that the higher the absorption level, the higher the expectation for self-efficacy (see Figure 4). In other words, the results revealed that dedication in low self-efficacy participants and absorption in high creative self-efficacy participants could elicit self-efficacy expectations.

Next, we conducted an analysis to examine whether the relationships between both task engagement variables and task value were moderated by creative self-efficacy. The results revealed that both the moderated-mediation effects of dedication (effect = –0.530 and 95% CI: (–1.625, 0.008)) and absorption (effect = 0.769 and 95% CI: (0.121, 1.670)) were not significant. Therefore, H3-1(b) and H3-2(b) were rejected, indicating that task engagements can elicit expectancy and value beliefs regardless of the participants' creative self-efficacy levels. However, we checked every path's detailed statistic for gaining more insights from the results. When we checked the path from task engagements to the task value, the direct effect of dedication ($\beta = 3.31$, $p < 0.05$) was significant, while that of absorption ($\beta = -2.24$, $p = 0.12$) was insignificant. Moreover, the effect of the interaction terms between dedication and creative self-efficacy ($\beta = -0.90$, $p < 0.05$) and between absorption and creative self-efficacy ($\beta = 0.90$, $p < 0.05$) on the task value was statistically significant.

The results obtained after using the Johnson–Neyman technique revealed that the indirect conditional effect of dedication was statistically significant for those whose creative self-efficacies were lower than 3.06. Specifically, the participants with relatively low creative self-efficacy (i.e., lower than 3.06) showed that the higher the dedication level, the higher the expectation for the task value. Meanwhile, the results further revealed that the indirect conditional effect of absorption was statistically significant for those whose creative self-efficacies were higher than 3.2. Specifically, for the participants with relatively high creative self-efficacy (i.e., higher than 3.2), the results showed that the higher the absorption level, the higher the expectation for self-efficacy (see Figure 5). In other words, the dedication of participants with low self-efficacy and the absorption of those with high creative self-efficacy tended to induce task value expectation. This is consistent with the moderating effects of creative self-efficacy between task engagements and self-efficacy expectations.

Additionally, we conducted two regression analyzes for class engagement intention as the dependent variable and self-efficacy and task value as the independent variables, with three covariates. The results showed significant positive effects of self-efficacy ($\beta = 0.63$, $t = 4.827$, and $p < 0.001$) and task value ($\beta = 0.62$, $t = 4.701$, and $p < 0.001$) on the class engagement intention. Moreover, the higher the expectation and value beliefs, the higher the class engagement intention.

5. Discussion

The findings highlight the notion that the educational approach type (i.e., the class mode) can have an impact on students' task engagement and expectancy-value beliefs toward their learning and performance. Considering the unique nature of fashion as an educational field in which theories and practices are equally significant, this study empirically investigated the impact of class modes (theoretical versus practical) on expectancy and value toward a class within a metaverse environment by mediating the effects of task engagement. Because creativity is a core value of fashion industry [57], most practical classes in fashion schools are focusing on promoting students' creativity for developing new fashion products. In this regard, we expected that creating their own avatar appearance can effectively evoke students' engagement since it is well matched with the purpose of the fashion practical class. In addition, students' creative self-efficacy, an individual characteristic, was also considered as a moderator.

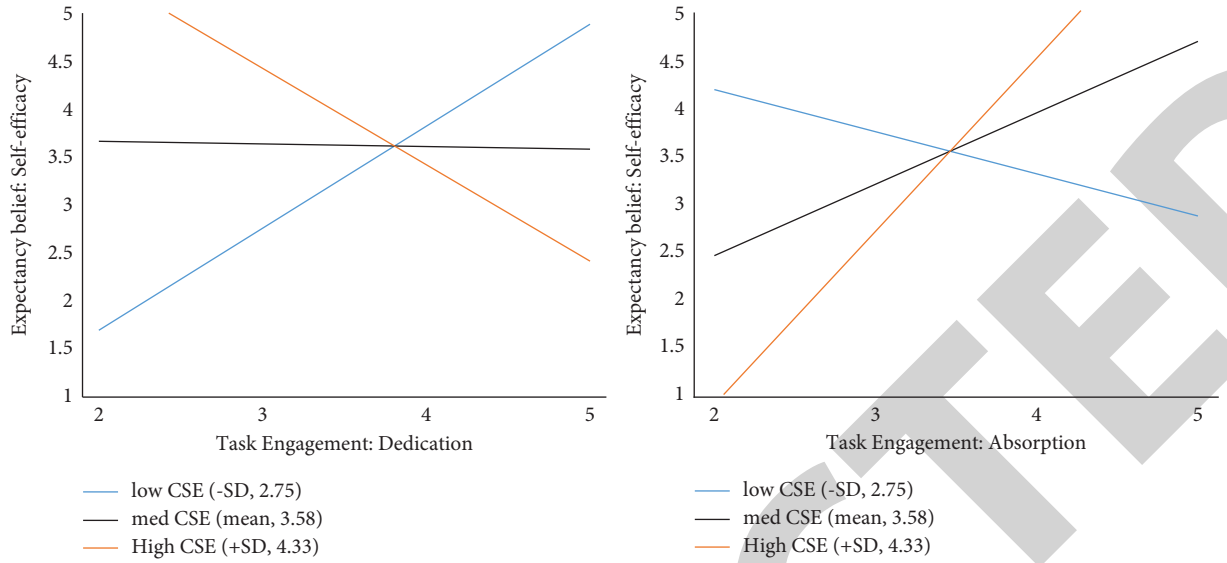

Figure 4: Conditional effects of dedication and absorption on self-efficacy according to the consumers' creative self-efficacy level.

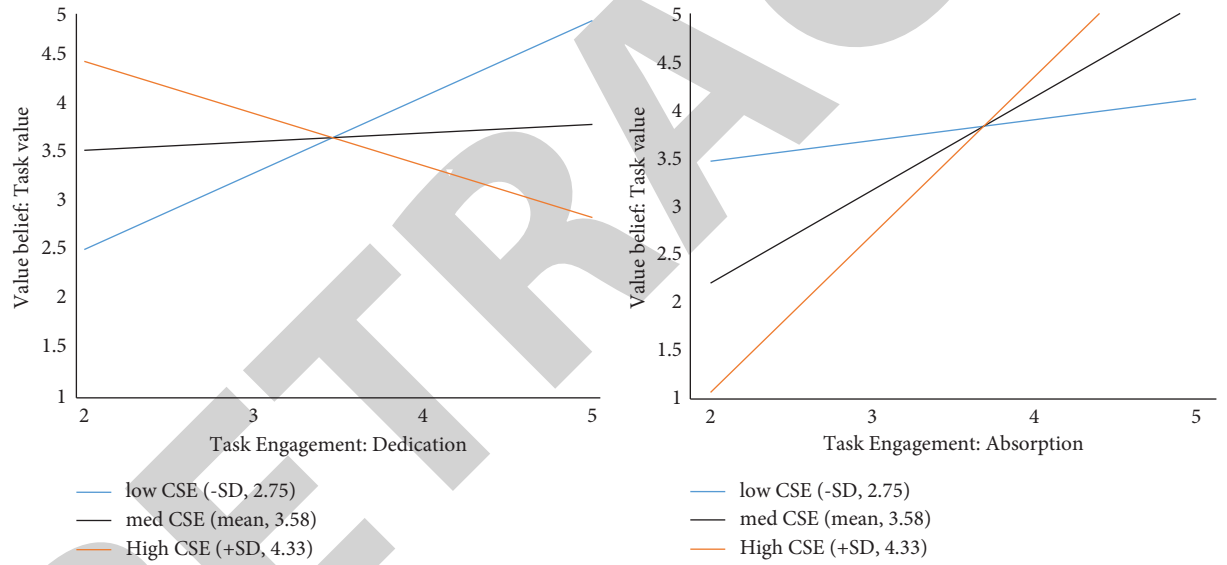

Figure 5: The conditional effect of dedication and absorption on the task value according to consumers' creative self-efficacy levels.

The results revealed that the practical class mode evoked higher engagements (i.e., dedication and absorption), which evoked the participants' positive expectancy (i.e., self-efficacy for learning and performance) and value (i.e., task value belief) toward learning in the metaverse class. Interestingly, the participants' creative self-efficacy played moderating roles in the respective impacts of dedication on expectancy and value in different directions, while the impact of absorption was positive regardless of the participants' creative self-efficacy level. Additionally, we found that expectancy and value toward learning led to the participants' positive class engagement intentions. This finding is notable in which a metaverse classroom can evoke students' engagement via avatar creating process especially for practical classes even if it is an online environment. According to the expectancy-value theory, human behavior is predicted by an individual's behavioral intentions. A person's intention to perform a particular behavior is based on his/her expectations or assessment of value beliefs and behavior. Thus, behavior can be viewed as a function of expectations for behavior and the value of behavioral outcomes [58]. We confirmed that the different educational approaches influence the level of student engagement, which in turn, forms expectations and value beliefs about the class in the metaverse environment. Furthermore, our study additionally verified that expectancy-value beliefs lead to class engagement intention, which is a behavioral intention for learning.

When the participation level of students according to the class mode was checked, the task related to the metaverse learning environment induced higher task dedication and

task absorption in the practical class than in the theoretical class. High task engagement had a positive effect on self-efficacy toward learning and task value. As confirmed by Chen [8], these results highlight the importance of educational compatibility in the online learning environment: this means that the possibilities provided by the online education system are consistent with the learning content and students' expected learning expectations, which are critical to the effect on the behavioral intention. The metaverse environment provides a new level of sensory, cognitive, and emotional experience, enabling communication and learning in new ways. This shows that the metaverse environment can be particularly suitable for practical classes, such as fashion classes that require imagination, creativity, and appropriate application of concepts that have been learned in class.

At the same time, it is worth paying attention to the effect of dedication when examining the moderating effect of creative self-efficacy in more detail. For self-efficacy toward learning and performance, the participants with relatively low creative self-efficacies showed that the higher the dedication level, the higher the expectation for self-efficacy. Meanwhile, the participants with relatively high creative self-efficacy showed that higher dedication levels can harm the expectation for self-efficacy. Similarly, for the task value belief, the participants with relatively low creative self-efficacy showed that the higher the dedication level, the higher the expectation for the task value. This finding suggests that the metaverse learning environment can play a positive role even for students with somewhat low creative self-efficacy. In particular, it was important for them to experience the challenge of learning and attain a sense of purpose in the process of engagement. Therefore, if the instructor leads students with low creative self-efficacy to cognitively recognize the meaning and challenge/purpose of this class while providing sufficient absorption by utilizing tools, such as avatars in the metaverse environment, then we can expect students' active participation and high learning outcomes.

In areas where development of creativity is significant, such as fashion, individual creativity and creative self-efficacy play an important role in the learning process and performance. In a metaverse platform, users go beyond reality's physical limits (extended and augmented reality), work in the virtual world (metaverse) through avatars that replace reality's existence, cross the boundaries between reality and virtual reality (mixed reality), and experience the metaverse in various ways. These experiences are actively used through convergence with social network services, numerous simulations, and online games and are increasingly becoming a space for learning and communication, where users may completely express their imagination and creativity. In addition, metaverse-based fashion education, which increases learners' immersion and interest, as well as promotes visual immersion, has also been shown to improve fashion education, where it is important to simultaneously promote analytical thinking and creative application to maximize the educational effect.

Although this study confirmed the role of creative self-efficacy as a characteristic possessed by an individual, the metaverse environment itself may enhance an individual's creative self-efficacy. Although there are many studies, which asserted that creative self-efficacy can be fostered by characteristics of environments [59, 60], only a few have investigated whether online and metaverse educational environments increase creative self-efficacy. Previous research has shown that the extent to which creative self-efficacy develops over time depends on learners. Tierney and Farmer [46] argued and empirically demonstrated that creative role identity, that is, identification with a creative role in the workplace, predicts changes in creative self-efficacy. Thus, considering this notion, creating an avatar by exercising creativity itself can cultivate students' creativity and enable them to identify themselves with their creative avatars. This may affect their performance in classes that require these qualities. The production and use of avatars are a characteristic activity in the current metaverse environment, and further discussion and empirical research on the impact and role of avatars may be needed in the future.

In investigating human learning and behaviors in metaverse environments, there is a lack of applicable metaverse platforms and various stimuli, especially for empirical and experimental research. This is one of the reasons this study provides task experience sessions for the metaverse class instead of the real experience in the metaverse platform. To produce an effective experimental design to investigate the impacts of each factor of metaverse environments, further research will be needed to compare and analyze the characteristics of the currently commercialized metaverse platforms and to devise a method to control various variables in the metaverse environment so that they can be used for experimental research.

In addition, this study conducted experiments on female undergraduate students who were familiar with relatively new online platforms. They were mainly in lower grades in university, and we tried to control their previous subject knowledge and experiences. Still, given that the response, effectiveness, and learning outcomes in relation to their metaverse experiences may vary depending on the characteristics of the consumer group, such as age and gender, therefore, it is necessary to analyze the impact of metaverse learning on more diverse consumer groups. Also, this study has a limitation with the small sample sizes. Therefore, future research needs to replicate the findings of this research with a larger sample size to enhance the results' validity and reliability. Finally, as technology development accelerates, not only educational content but also educational tools and educational environments are rapidly changing. We hope that this study will provide insights into education for a new era and serve as a useful guide for further research.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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