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An Empirical Study of the Effectiveness of Information Delivery in Metaverse: Does It Motivate Users to Take Action?

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Abstract

The metaverse remains a vital subject even in post-COVID-19 due to its potential as an advanced communication platform. Gather.town stands out for its user-friendly interface, facilitating social interactions in a virtual context. This study investigated how users reacted when introduced to five new mobile apps through individual one-on-one interactions in Gather.town. We compared it with conventional social methods such as face-to-face meetings, Zoom, and Kakaotalk social messenger. In experiment 1, user satisfaction and intimacy were gauged through a questionnaire, revealing no substantial differences across conditions. However, experiment 2, conducted a few days later without advance notice, unveiled a notable distinction in users' active practice. Participants who were informed via Gather.town displayed a considerably lower rate of actual installations of introduced apps on their mobile phones than those informed via face-to-face conversations or Zoom meetings. While the metaverse showed promise during the COVID-19 era, a more precise assessment of information delivery efficacy is essential now that face-to-face interactions have resumed. Gaining a profound understanding of the distinct characteristics of virtual social interaction environments will enable us to explore the metaverse's unique and advantageous attributes effectively.

Keywords: Metaverse; Gather.town; Zoom; Kakaotalk; Virtual Social Interaction; Effectiveness of Information Delivery; COVID-19; Communication Medium

Introduction

In recent times, the concept of the metaverse has captured attention as an intriguing and transformative idea within virtual reality and computer-mediated environments. This digital realm interconnects beyond traditional virtual worlds, encompassing augmented reality, mixed reality, and virtual reality platforms. Thanks to fast technological progress, the metaverse can be used in many ways, from socializing and having fun to learning, business, and work. The outbreak of COVID-19 introduced widespread social distancing measures and lockdowns, disrupting conventional face-to-face interactions and communication. In response, the metaverse gained prominence as an immersive digital space fostering virtual interactions and bridging connections while maintaining safety protocols. Digital twins became one of the alternatives as well. As an exemplary study, Alrashed et al. explored the opportunities where digital twins can be deployed to support business continuity [1]. As a branch of technical keys for a successful metaverse, the networked virtual environment is a distributed computer-based system

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simulating a virtual environment, which offers advanced communication and social interaction in the metaverse, where people can easily connect from anywhere in the world. Nowadays, many researchers have proposed and evaluated numerous technical solutions for technical improvement [2].

However, as the pandemic's impact lessens and restrictions ease, questions may arise about the metaverse's ongoing development in a post-COVID-19 era. It is crucial to recognize that the transformative influence of the metaverse surpasses its role in pandemic response. The metaverse can unveil novel possibilities and avenues for enhancing human experiences, promoting global connectivity, and reimagining traditional practices. There has been a significant surge in research exploring the practicality of the metaverse, indicating a growing curiosity about its potential benefits and real-world applications. Hurst et al. conducted a systematic literature review study of the entire virtual meeting environment [3]. Palos-Sanchez et al. suggested that virtual worlds could notably enhance the unity of remote working teams. Platforms like Gather.town or similar metaverse environments show promising potential in maintaining group cohesion across various events, which might surpass traditional video tools [4]. McClure et al. also confirmed the effectiveness of metaverse platforms and highlighted their advantages. In their study, participants favored Gather.town over alternative online systems like MS Teams [5]. Video-conferencing platforms offer a distinct opportunity for learners to engage with educators, peers, and curated materials at their own pace, tailoring the learning experience and nurturing relationships in distance-learning scenarios.

Several earlier studies have primarily examined the promising potential of various platforms, especially in the realm of virtual online learning. For instance, Nuguri et al. proposed a new environment for an advanced virtual learning named ‘vSocial’ and proved its superiority in educational stimulation and immersion [6]. Sriworapong et al. suggested that Gather.town demonstrated enhanced user-friendliness, engagement, enjoyment, and sociability among students. This advantage stems from its game-like environment, user-friendly features, and interface, making it one of the most promising alternatives for higher education's online learning [7]. Xin Zhao and McClure highlighted the benefits of the metaverse platform for virtual learning communities. They reported that Gather.town enables language teachers to create a virtual map and establish conversational scenarios using interactive games and multimedia materials [8]. Moreover, Latulipe et al. and Lee et al. proposed that Gather.town outperformed Zoom in terms of the sense of presence and spatial mobility it offered, the social presence facilitated through avatars, empowerment, emotional openness, as well as interface and social platform differences [9, 10]. Additionally, Kim et al. reported a significant advantage of Gather.town after six weeks of online learning, as confirmed by a questionnaire assessing learners' online presence and the effectiveness of online learning [11]. Fitria validated the metaverse's usefulness through similar research paradigms, mainly involving observation through interviews and questionnaires [12].

Furthermore, many studies have indicated that teleconferencing can be equally, if not more, effective than traditional face-to-face meetings or conventional desktop-based virtual experiences. Standaert et al. delved into the efficiency of telepresence during business meetings, comparing it to audio-conferencing, video-conferencing, and face-to-face interactions. They suggested that telepresence is comparably effective to face-to-face meetings [13]. In a different context, Ricci et al. uncovered that immersive virtual reality significantly enhances the shopping experience in the fashion industry. This approach yields a more favorable impact in terms of hedonic and utilitarian value, as well as user experience, compared to conventional desktop virtual reality [14]. Similarly, Kerrebroeck et al. explored the influence of virtual reality within the realm of transformational brand experience appeals in marketing communications. Their findings demonstrated that virtual reality triggers higher perceptions of vividness and presence than two-dimensional videos. These enhancements positively influence brand attitudes and stimulate consumers' intentions to make purchases [15].

However, most of previous studies have leaned towards conducting research with expectations of positive outcomes and optimistic potential benefits. Moreover, these prior works have primarily captured surface-level reactions from users. This issue was highlighted by Lo et al., who pointed out that the majority of current studies rely on limited evidence, often based on brief interventions (such as single sessions) and self-reported assessments (like surveys and interviews) [16]. We endorse their compelling arguments regarding various features of the metaverse. Further comprehensive studies should be conducted, delving deeper into the subject to reinforce and expand our understanding of universal implications and potential applications. This study aims to introduce a new perspective of exploring user reactions and feedback under the metaverse platform.

Experiment 1

Experimental Design

We created an introducing program that mimics activities often encountered in marketing and education, centered around sharing information. Through these simulated situations, our goal was to assess how effectively different forms of communication work in these areas. This program briefly introduced five good mobile apps for participants' everyday use. Snapshot images of these apps are shown in Fig. 1. ‘Alamy’ is a mobile scheduler app helping users keep their schedules by clearing various missions. ‘MS Lens’ is

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a pdf scanner providing an intuitive user interface and high quality scanning data to share others through mobile phone. 'Forest' is a time management tool and multi-purpose timer motivating users to utilize their time effectively. 'Google Translator' is one of the most promising real-time translating apps providing text, voice and video translation. 'Bank Salad' is a mobile account book with various useful functionalities for easy managing their budget. Since all the participants are Korean, the experimenter introduced domestic versions.

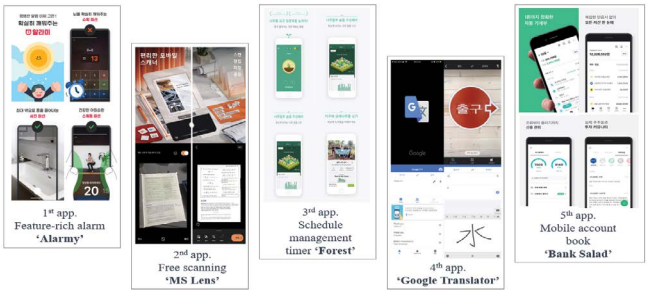

Figure 1: The five good mobile apps introduced in the experiment

Following the app introductions, participants were encouraged to install and utilize them. To gather user feedback, we developed a questionnaire. The questions in Table 1. were formulated based on previous studies in marketing and business research conducted in Korea [17, 18].

Table 1: A composition of the questionnaire

Items	Questions	Scale
Comprehensibility Y1)	I didn't know time was passing. (Y11)	5 Scale Measurement: Strongly Agree(5), Agree(4), Neutral(3), Disagree(2), Strongly Disagree(1)
	I concentrated on the topic. (Y12)	
	I understood the content well. (Y13)	
	The content was helpful. (Y14)	
	I got new information. (Y15)	
Interest (Y2)	This intrigued me. (Y21)	
	I am willing to recommend this to others. (Y22)	
	I wanted to download it. (Y23)	
	I want to be introduced to something new. (Y24)	
Intimacy (Y3)	The speaker felt friendly. (Y31)	
	I could trust what the speaker said. (Y32)	
	The speaker knew the content well. (Y33)	
	I wish the speaker's new topic. (Y34)	

Conditions (media platforms for delivering information)

We devised four distinct communication platforms for our experiment: a face-to-face meeting, a metaverse virtual meeting via Gather.town, a Zoom meeting, and communication through the Kakaotalk social messenger. Each condition involved one-on-one communication, where the experimenter introduced the five good mobile apps to individual participants. The same screenshots and a PPT slide file were used across all conditions to present the app features. Following the introduction, a wrap-up discussion took place, succeeded by a questionnaire gauging aspects such as comprehensibility, interest, and intimacy towards the topic and the presenter. Fig. 2 provides an overview of each condition with concise descriptions. The experiment duration for each person in all conditions was approximately 5±1 minutes.

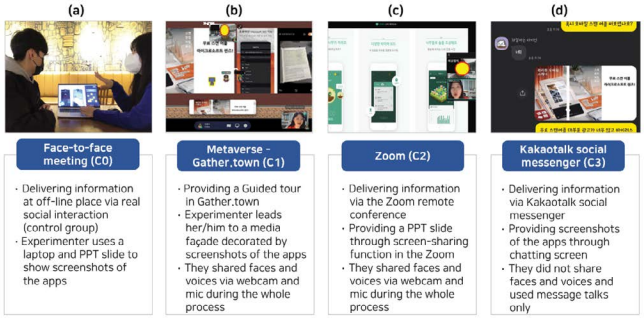

Figure 2: Experimental Conditions: (a) C0: Face-to-face offline meeting, (b) C1: Virtual meeting in the Gather.town, (c) C2: Virtual meeting via Zoom remote conference, and (d) C3: Message talk via social messenger – Kakaotalk

Face-to-face meetings (C0)

We designed a face-to-face meeting as a control group. As shown in Fig. 2. (a), the experimenter made an appointment to meet participants. After a short greeting, the experimenter showed a PPT slide introducing the five good mobile apps. Participants could freely toss the introducer questions or opinions about the topics during the introduction.

Metaverse - Gather.town (C1)

Gather.town is known widely as one of the metaverse platforms, a web-based virtual meeting software. It has been showing many successful use cases where the metaverse will be helpful in the future, albeit at a preliminary level. Like other metaverse solutions, it provides various components to build a virtual space occupied by you and others. It gives the ability to move and interact with other participants based on their location in the physical area, just like in real life. Users experience group activity, easily start and end side conversations and chats, or return to the main speaker, just like in an actual conference or other gathering. Instead of going to a Zoom breakout room, Gather.town lets you walk around tables and chairs, sit down and start a conversation as if you were in the virtual world. Gather.town's graphics are basic and it runs on a wide variety of computers with minimal lag. Low-resolution graphics are not a barrier to using the system. This feature is a significant strong point for its rapid spread to many use cases.

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We built up a new map in the Gather.town as shown in Fig. 3. After inviting a participant to log in to a given channel, the experimenter provided a guide tour service through a ready-made media façade decorated with screenshots describing the feature of the five good mobile apps. During the tour, the experimenter and the participant kept sharing faces and voices freely via webcam and mic during the whole process. The experimenter guided the participant and delivered information while maintaining the tour's speed to avoid missing her/his attention.

Figure 3: The Gather.town virtual space built for the experiment

Zoom (C2)

Zoom is a video conferencing platform available through a computer desktop or mobile app that allows users to connect online for video conferencing. During the COVID-19, Zoom has skyrocketed in popularity, with millions of people using it to stay in touch with others remotely. Zoom allows users to create and join virtual meeting rooms where they can communicate with each other using video and audio. Additional features allow participants to share their screens, share files, and text chat privately within a meeting group or with others in the meeting. Including Zoom, online conferencing solutions also can be futuristic marketing tools in many retails. As one of use case, Lau investigated the superiority of VR-based online virtual shopping over traditional web-based service. Even though their proposed solution could not provide interpersonal communications and try-on during virtual apparel shopping, they found a higher level of consumers' purchase intention and higher preference in the virtual world with hedonic shopping experiences [19]. Going one step further, Ghodhbani et al. summarized state-of-the-art image-based virtual try-on for fashion detection and synthesis [20]. They introduced advantages, drawbacks, and guidelines for selecting specific try-on models, including recent developments and successful applications.

In line with those studies, we designed virtual informative social interaction similar to the marketing activity. The experimenter invited a participant to a Zoom meeting room and after a short greeting, showed screenshots of the five good mobile apps through the screen-sharing function with brief introduction. They shared faces and voices via webcam and mic during the experiment for instant discussion about the topic.

Kakaotalk social messenger (C3)

SNS has played a new role as a promising media during COVID-19. As an advanced approach for measuring the impact of influence, Baniata et al. proposed a machine-learning model to measure the influencing factors on a particular community when social media forums promote it [21]. Like SNS, crowdsourcing is also futuristic media for sharing information between users on the internet. Bastanfard et al. proposed a new algorithm to improve image labeling accuracy in the crowdsourcing process [22]. These works could guarantee an improvement in effective social communication media in the future, even after COVID-19.

We designed C3 as a messenger app platform, which represents text based traditional online social interaction conditions. Kakaotalk is the most popular messenger app in Korea, a free mobile service that offers text messaging, voice and video calls, group chats. Users can create one-on-one conversations and group chats with no limit on users. Almost all smartphone users in Korea use Kakaotalk, over three times more than the second most popular app, Instagram. The social messaging platform can connect businesses with an enormous base of potential consumers worldwide. KakaoTalk also is under various marketing campaigns that extend far beyond Korea.

In this condition, after short greeting, the experimenter provided screenshots about the five good mobile apps. They did not share faces and voices during the experiment and only used text messages for discussion. Because the participants are so familiar with KakaoTalk, they hardly feel uncomfortable or awkward and sometimes communicate more comfortably and efficiently than face-to-face meetings.

Participants

We recruited 122 participants and invited them to a one-to-one conversation. All participants provided informed consent before testing, which includes an und erstanding of purpose of the study and data acquisition for the research. We carried out the experimental process in accordance with guidelines and regulations on the Institutional Review Board in Keimyung University. We designed the between-subjects experiment. The number of participants and experimental conditions are described in Table 2.

Table 3. shows the distribution of gender, occupation, and age. In our experiment, we mainly targeted young individuals between 10 and 20 years who are familiar with emerging social media platforms such as the metaverse and remote conferencing. By doing so, we could reduce the noise caused by participants' unfamiliarity with a specific social media platform.

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Table 2: Assigning participants to experimental conditions

Condition	Number of participants	Experimental condition
C0	30 persons, 15 males, 15 females, age: 22.0 (1.97)	Face-to-face meeting (Baseline)
C1	29 persons, 15 males, 14 females, age: 23.0 (2.78)	Gather.town
C2	30 persons, 15 males, 15 females, age: 23.5 (2.42)	Zoom
C3	33 persons, 15 males, 18 females, age: 22.7 (2.41)	Kakaotalk social messenger

Table 3: Gender, occupation, and age distribution of participants

	Distribution (%)			Distribution (%)	
Gender	Female	62(50.8%)	Age	18 years old	3(2.5%)
				19 years old	7(5.7%)
				20 years old	16(13.1%)
	Male	60(49.2%)		21 years old	17(13.9%)
				22 years old	16(13.1%)
				23 years old	18(14.8%)
Occupation	Student	80(65.6%)		24 years old	14(11.5%)
				25 years old	12(9.8%)
	Employee	22(18.0%)		26 years old	10(8.2%)
				27 years old	6(4.9%)
	Etc.	20(16.4%)		28 years old	3(2.5%)
Total			122		

Result

Eighteen out of 122 did not participate in the survey, so a factor analysis was conducted with a total of 104 data. To assess the construct validity of the satisfaction scale comprising 13 questions in Table. 1, we conducted an exploratory factor analysis (EFA) to extract factors. The extraction was based on a principal component analysis (PCA) using the varimax rotation method with Kaiser normalization. Considering that 'I understood the content well. (Y13)' exhibited a factor loading of 0.419, which was below 0.5, and was considered a variable that hardly belonged to the same factor. Therefore, it was removed from the analysis, and factor analysis was re-conducted. As shown in Table 4, the sample adequacy (MSA) was 0.916, indicating the suitability of the data for factor analysis. Additionally, Bartlett's test of sphericity yielded a value of 332.7 with p=0.000, signifying significant correlations among variables in the users' feedback at a significance level of 0.001, thus confirming the overall feasibility of factor analysis. The result revealed the extraction of two factors. The combined factor of 'Comprehensibility' and 'Interest' was named 'Satisfaction', while the second factor was named 'Intimacy'.

T-tests were conducted for the each factors, and as shown in Fig. 4, the results showed that there were no significant differences in average scores across all conditions. For C1, C2, and C3, the differences in mean scores compared to C0 ranged from 0.1 to 0.3. One consideration is the usage frequency of each condition in daily life. The experiment was conducted during COVID-19, resulting in a higher prevalence of Zoom usage, in which most schools led online classes using Zoom. Because the majority of participants were early 20 years students, Zoom was a most user-friendly social interaction platform compared to other conditions. As a result of this influence, although not statistically significant, it appears that Zoom obtained relatively higher satisfaction and familiarity scores, with 4.3 and 4.4, compared to other conditions.

Table 4: Factor analysis for the questionnaire

KMO test for sample adequacy	**0.916**		
Bartlett's test of sphericity	Approx χ^2	332.7	
	df	78	
	p	0.000 ***	
	Communality	Component	
		1	2
This intrigued me. (Y21)	0.752	-0..841	0.212
I am willing to recommend this to others. (Y22)	0.704	-0.757	0.362
I concentrated on the topic. (Y12)	0.583	-0.741	0.186
I wanted to download it. (Y23)	0.64	-0.721	0.348
I didn't know time was passing. (Y11)	0.61	-0.719	0.303
The content was helpful. (Y14)	0.571	-0.715	0.244
I got new information. (Y15)	0.486	-0.663	0.216
I want to be introduced to something new. (Y24)	0.663	-0.642	0.501
I could trust what the speaker said. (Y32)	0.752	-0.235	0.835
The speaker knew the content well. (Y33)	0.717	-0.151	0.833
I wish the speaker's new topic. (Y34)	0.75	-0.466	0.73
The speaker felt friendly. (Y31)	0.479	-0.396	0.568
Factor		Satisfaction	Intimacy
Eigenvalues		4.682	3.027
Variance explained(%)		39	25.2
Cronbach's alpha		0.908	0.792

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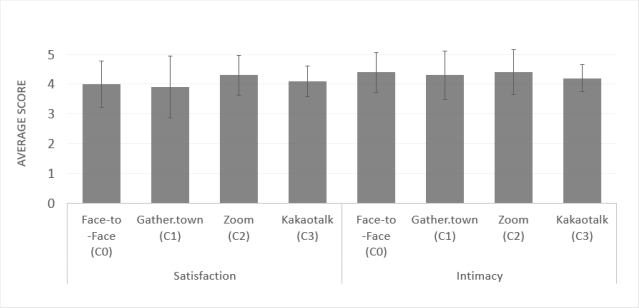

Figure 4: No significant difference were found in 'Satisfaction' and 'Intimacy' across all the conditions.

Experiment 2

Subjective observations during Experiment 1

In the experiment 1, we were unable to extract specific characteristics unique to the metaverse compared to other conditions. However, experimenters noticed differences in participants' implicit reactions. They reported several differences in non-verbal attitudes among participants after the introductions concluded. For instance, in the C0 condition, participants showed interest by alternating their attention between the experimenter's face and the slide screen on the laptop during the introduction. In contrast, they solely focused on the slide screen in other conditions.

Interestingly, Even though the Gather.town(C1) provided face/voice sharing like Zoom(C2), participants only gave attention to the avatar control in the virtual space. That was because the face/voice sharing window in C1 is somewhat auxiliary and might relatively lower the face/voice sharing-based social engagement.

To thoroughly observe additional aspects, we prepared Experiment 2 to examine whether information delivery across the conditions motivates users to take real actions. After several days had passed since the experiment 1, we contacted the participants via phone and asked the following three questions:

Q1. How many app names do you remember?

Q2. How many apps can you describe their features and functions?

Q3. How many apps did you actually install on your mobile phone?

Participants were unaware of this post-experiment survey in advance. Even those who did not respond to the first survey in Experiment 1 (18 individuals) voluntarily participated in Experiment 2, resulting in 122 participants surveyed, shown in Table 1 & 2.

Result

Average numbers of apps they remembered the names (Q1)

The total number of app names they remember amounted to 217, averaging around 1.78 out of 5 apps per person. As shown in Fig. 5, participants in the C0 and C2 conditions displayed a relatively higher count of remembered app names. As a result of T-test analysis, in the case of C0, the mean was 2.59, significantly higher compared to C1's mean of 1.31 (p=0.000). Similarly, C2 exhibited a mean of 2, which was significantly higher than C1 (p=0.020). In addition, C0 demonstrated notably higher values than C2 and C3 with means of 1.33 (p=0.042, p=0.000).

Average numbers of apps they could explain those features (Q2)

The participants' ability to recall and describe the functions and features of five good mobile apps revealed a total count of 346, averaging about 2.84 apps per individual. Notably, even if participants could not remember the app names, they demonstrated relatively strong memory for the functions of the introduced apps. As shown in Fig. 6, C0 and C2 again exhibited relatively high values in this aspect. Specifically, C0's count was significantly higher than that of both C1 and C3 (p=0.019, p=0.027). C2 displayed relatively higher values compared to C1 as well but did not reach a significant level (p=0.099). An intriguing finding is that C1 recorded the lowest average, suggesting an equivalent or lower level of information delivery efficacy than C3.

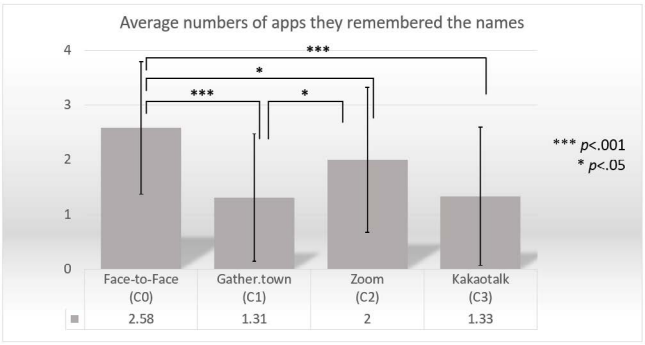

Figure 5: Comparison of numbers of apps participants remembered the names. Significant difference were found between control group(C0) and C1, C2, C3.

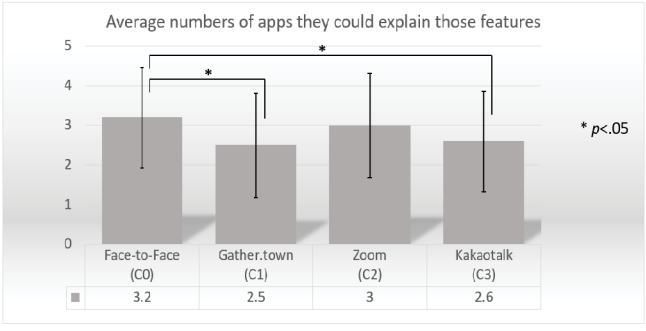

Figure 6: Comparison of numbers of apps participants could explain those features. Significant difference were found between control group(C0) and C1, C3.

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Average numbers of apps they 'actually' installed on their phones (Q3)

The crucial finding emerged from investigating the number of apps that participants actually installed on their mobile phones after the experiment 1. This observation is the most significant clue concerning the motivation of active practice. Total of 58 apps were installed by users, averaging approximately 0.48 apps per individual. This value is notably lower than the responses to the previous two questions (1.78 for Q1 and 2.84 for Q2). This gap suggests that motivating users to active practice is relatively more challenging. As shown in Fig. 7, our investigation revealed relatively high counts for C0 and C2. Once again, C1 demonstrated the lowest values. In the case of C1, the average number of installed apps was 0.27, which was 43.5% of C0 (p=0.037). In comparison with C2, the difference was also significant at 42.9% compared to C2 (p=0.025). Although not statistically significant due to high variability (standard deviation of C1 = 1.09), C1 exhibited lower values even compared to C2 (p=0.198).

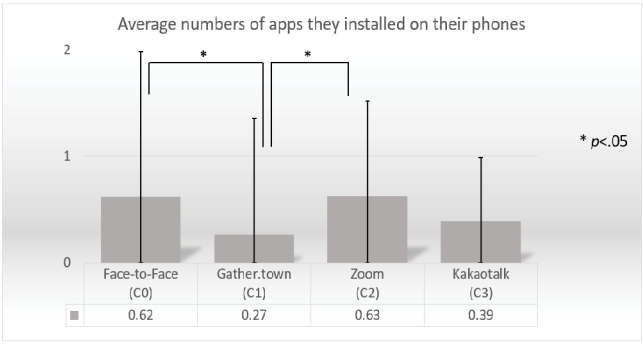

Figure 7: Comparison of numbers of apps participants installed on their phones. Significant differences were found between control group(C0) and C1, between C2 and C1.

Discussion

Hwang et al. and Zhao et al. have optimistically anticipated the potential for development in the educational domain within the metaverse while also outlining key issues [8]. Wang et al. also explored unique opportunities for metaverse approaches in the healthcare domain. They proposed that the healthcare metaverse solutions, including their developing MeTAI, will eventually become a practical facility with an optimistic forecast [23]. However, through our experiment, we propose several factors that should be more deeply considered in the context of the social interaction environment of the metaverse. Firstly, this experiment focused on one-to-one information delivery scenarios, which differed somewhat from conditions mainly used by one-to-many platforms like Gather.town or Zoom. Nevertheless, Zoom recorded higher values in our experiment than Gather.town, and in some aspects, Zoom was superior to face-to-face interaction. While these differences might not be statistically significant, this is worth considering. It suggests that in terms of interaction cohesion, the video interaction-centric nature of Zoom, where participants mainly see each other's faces, might be superior to the 2D virtual world character-based Gather.town. Secondly, this experiment was conducted during the COVID-19 period. The social atmosphere of avoiding direct meetings due to wearing masks and adhering to hygiene protocols would have negatively impacted face-to-face meeting condition. Despite this, the face-to-face meeting condition recorded the highest values across most indicators in the second experiment. This leads us to speculate that face-to-face meeting might possess relative hidden strengths that we have yet to uncover. If a similar experiment were conducted in a post-COVID-19 era, it would not be unreasonable to expect even more distinct superiority.

Similar to us, several prior studies were tossing some critical considerations in metaverse development related to this topic. In marketing domain, Ramadan investigated a metaverse integration between current media and retail channels in both of online and offline. He revealed that the marketing route will become complex when the metaverse platform is provided, and proposed four different expected scenarios for successful integration - The ideal path, the recovery path, the laggard path, and the deflection path [24]. Our study also suggests a similar point. In fact, in the case of face-to-face meetings, participants decide on a meeting place in advance and meet there. This is the most intuitive and direct form of interactive activity that we frequently experience in the real world. In contrast, both Gather.town and Zoom require several computer manipulations, including sharing the url, booting and logging in etc., to facilitate meetings. This even differs from the ease of using a smartphone to simply engage with social messenger like Kakaotalk. Moreover, when compared to Zoom, Gather.town might have had potential defects from reduced familiarity in terms of usage frequency and accessibility.

Han et al. studied consumer experience escapes regarding social, psychological, and physical implications of immersive technology exposure, including metaverse. They concerned self-indulgent escapism through VR consumer experiences, ethical considerations in the design of VR consumer experience escapes, and purposeful design of VR consumer experiences escapes through the theoretical insights and empirical evidence from literature on escapism [25]. Our study also raises similar issues. Users are clearly aware that interactions within the metaverse occur in a virtual environment. This inherent sense of unreality could be an intervention as a psychological barrier when relaying information or feelings acquired in the virtual environment to the real world. To address this, we expect advanced seamless switching interaction concepts or techniques in the future could lower the psychological boundaries between reality and virtuality.

Adapting to new media is always challenging for humans, especially in the early stages. Even in advanced metaverse environments aimed at maximizing realism, various human factor issues persist. These issues are closely related to users' preference in the realistic metaverse and are also one of the key factors of active practice motivation. For instance, when using Mixed Reality Head-Mounted Displays, issues like visuomotor deterioration due to visual displacement or decreased peripheral visual perception arise [26]. In line with the proposals put forth by Lau et al., Hwang et al., Ramadan et al., and Kerrebroeck et al. [27; 19; 24; 15] efforts to enhance the realism of the metaverse should be coupled with addressing potential human factor considerations, allowing users to effectively immerse themselves in virtual environments and directly influence real-world behaviors. Note that our experiment's scope is limited to experiments conducted within the context of widely adopted PC/mobile-based media; exploring the effectiveness of information delivery in immersive AR/VR environment could yield new findings and outcomes.

Conclusion

We designed the experiment to represent activities commonly found in marketing and education fields that involve information dissemination. In Experiment 1, survey results from participants did not reveal significant differences among conditions. This suggests that the brief one-to-one interactions for information delivery, which were conducted only within 5 minutes, were insufficient to demonstrate clear distinctions in users' satisfaction, and intimacy levels. However, experiment 2 has revealed that even within these short interactions, there were meaningful differences in users' long-term memory retention and actual behavior induction.

This paper tried to illuminate the changing dynamics of information delivery in the metaverse, providing valuable insights that can guide further exploration and enhancement of this promising futuristic communication platform. The regeneration of personalized layout in the metaverse space according to users' preferences is one of these exemplary cases [28]. Like their study, to secure a unique position and integrate into our daily lives, the metaverse must undergo a comprehensive examination from various perspectives to explore strong points and clear any elements that might hinder active practice. We suggest that these researches go further meticulously, continuously, and consistently in various use cases.

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