

Presence and Effectiveness of Online Learning Using a Metaverse Platform: Gather.town

Hyunji Kim* and Myoungsung Kim

Abstract—Online learning is rapidly developing, and various strategies to effectively operate online learning are being discussed. In particular, online learning using the metaverse is expected to facilitate social communication and high presence. This study examined the presence and effectiveness of online learning using a metaverse platform. A class was conducted for six weeks using the metaverse platform Gather.town. A questionnaire was employed to verify the online presence of the learners and the effectiveness of the online learning, data were collected from students who participated in the class. Analysis of the online presence of the learners and the effectiveness of the online learning before and after the class revealed the following. The online presence of the learners who used the metaverse platform improved compared to before the class. The results, including those reflecting all sub-variables (teaching, social, cognitive), were statistically significant. Similarly, online effectiveness and its sub-variables (confidence in prerequisite skills, general beliefs about online learning, self-direction and initiative, and the desire for interaction with others) were statistically significant.

Index Terms—Metaverse, online learning, presence and effectiveness of online learning

I. INTRODUCTION

The educational environment has changed faster than expected worldwide because of the COVID-19 pandemic. The Korean government announced a temporary closure of classroom teaching and imposed online teaching because of the global outbreak of COVID-19. In particular, as online learning has become more active, various discussions regarding the modality are taking place.

Online learning is the use of the Internet to interact with the instructor, learners, and content; to access different kinds of learning materials; and to obtain support during the learning process to acquire knowledge, construct personal meaning, and grow from the learning experience [1]. Online learning has different advantages, depending on whether it is in real-time or non-real-time. Communication between instructors and learners has been recognized as important from analyzing the perceptions of online learners [2, 3].

A requirement for increasing the effectiveness of online learning is the sense of presence. Therefore, the community of inquiry (CoI) framework designed by Garrison, Anderson, and Archer [4] is an essential element in online learning. The CoI consists of three critical components: cognitive presence, social presence, and teaching presence, to create an effective

online educational community [4, 5]. In online learning, teaching, cognition, and social presence have significant effects on learning outcomes, such as self-efficacy, self-direction, and interaction [6]. These factors are important factors in online learning achievement [7].

To increase the online sense of presence and the effectiveness of learning online, various online lecture tools and platforms are being used. As interest in non-face-to-face activities and the virtual world has increased because of COVID-19, discussions about the metaverse are increasing. The metaverse is an expanded space that encompasses the virtual and the real world. However, it is not a simple combination of the world and virtual reality, but rather an interaction between the two [8]. In particular, the metaverse has the characteristics of a virtual world with enhanced relationships and sociality. The metaverse, which has no space-time constraints, can provide a sense of reality by connecting the real world and virtual space [9]. The metaverse reflects the real world, so it is possible to have the same experiences as the real world in the virtual world. The metaverse is being used in various fields. For example, universities are building virtual campuses for entrance ceremonies, lectures, festivals, and so on [9].

Therefore, this study examined whether the online presence of students and the effectiveness of online learning were improved in classes that used the metaverse platform Gather.town. Gather.town is suitable for use in classes because it enables participants to express themselves in virtual reality as an avatar; provides video, audio, and real-time chat services; and implements offices and classrooms. In this study, we measured the presence of the learners and the effectiveness of online learning before and after class using Gather.town.

The research questions were as follows:

Question 1: Does online learning using the metaverse platform Gather.town, affect the online presence of the learners?

Question 2: Does online learning using the metaverse platform Gather.town, affect the effectiveness of online learning?

II. LITERATURE REVIEW

A. Online Learning and Presence

Efforts to express actual education in online classes are expressed as “presence,” and research on teaching and learning methods is required to increase the sense of presence, even in non-face-to-face situations.

Heeter [10] defined presence as “the sense of being there”. Thus, presence in education can be seen as “the sense of

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being somewhere that you are educated". Garrison, Anderson, and Archer [11] divided the presence perceived by learners into teaching presence, social presence, and cognitive presence.

Teaching presence is not just a feeling that there is an instructor physically present, a learner also feels that the instructor teaches in a mutually interactive manner. Teaching presence is an important indicator of the active participation of learners in learning and meaningful learning experiences, it consists of teaching design and the facilitation of learning, which help learners to not deviate from the learning process [12]. Social presence denotes a subjective perception that the other learners are real and a feeling of being connected to the community. In an online learning environment, social reality plays an important role in forming intimacy, increasing learning satisfaction, and improving learning outcomes through the smooth exchange of opinions among learners [4, 12]. Cognitive presence is the ability of learners to understand the content of the subject area through learning activities and create and confirm the knowledge on their own, online. If the cognitive presence of the learner is high, they may be satisfied with the current learning and continue follow-up learning [12, 13].

Thus, presence is important for online learning. Accordingly, this study examined presence in online classes using Gather.town.

B. Online Learning and Effectiveness

Moore [14] first defined the teaching methods used in distance education, as follows: distance education is composed of teaching methods that are distinct from learning behavior; communication between learners and instructors is promoted through print, electronics, and machines. Internet-based online classes are one type of distance classes.

In terms of learning experience, online learning allows students to make free choices and control learning time and space use, utilization of teaching materials, and task performance. In particular, in terms of language education, online learning provides abundant communication opportunities [15], and improves problem-solving skills and reflective and critical thinking skills through social knowledge construction and collaboration [16]. In addition, international students living in their home country and taking online classes have the advantage of being able to conveniently access and utilize authentic learning textbooks and materials as well as experience the academic culture and atmosphere of the university [17].

In education, "effectiveness" is the result of planning and performing learning. Along with the quantitative expansion of online classes, many studies related to the learning effects of online education have been conducted. In particular, numerous studies of online education and its effectiveness have been conducted in response to COVID-19.

Many studies have shown that the effects of online learning are similar to or better than those of face-to-face learning, and that the former may be used to compensate for a lack of face-to-face classes. Allen and Seaman revealed that in 2015, more than 70% of academic leaders evaluated that learning outcomes of online education were equal or better than those of face-to-face methods [18]. Zimmerman and

Pons [19] studied how learning motivation, self-regulated learning strategies, and physical and environmental characteristics affect learning. Husman *et al.* [20] studied online learning before experience, self-directed learning ability, and online task-value recognition. Stewart *et al.* [21] studied online student support services and online education environments.

Among the numerous other studies, Bernard *et al.* [7] studied the development and predictive validation of an instrument to assess the achievement outcomes of online learning. They suggested that four factors predict online learning achievement: general beliefs about online learning, confidence in prerequisite skills, self-direction and initiative, and the desire for interaction. Such online education is related to use of the metaverse in education, as described below.

C. Metaverse in Education

Metaverse is a combination of "meta" meaning "beyond" and "virtual" and "universe" meaning the "world." The metaverse is not an entirely new concept; it was first coined in 1992 by Neil Stevenson in the virtual reality-based science fiction novel, "Snow Crash." There are already famous and popular examples, such as Second Life and the massive multiplayer online role-playing game, World of Warcraft, which has attracted millions of players [22]. The founder of Facebook Inc., Mark Zuckerberg, changed the name of the company to Meta, Inc.

The metaverse is not a new concept in education. For example, Kemp and Livingstone [23] discussed how to improve the learning process by combining a virtual world, "Second Life," with a learning management system. Snelson *et al.* [24] used World of Warcraft to teach research methods in online doctoral education: a student-instructor duoethnography. Reyes [25] developed a metaverse that uses augmented reality (AR) and mobile learning to teach mathematics.

Then, what is the meaning of metaverse in education? The difference between a metaverse and other existing online education is that the former combines "ego, world, and expansion of life experience" [26]. The "ego" in the metaverse is expressed as an avatar. This enables participants to change their identity in the metaverse, becoming a "new" self. In the case of the "world", the real world is present in the metaverse, but it can be expanded or augmented beyond reality, time, and space. This also applies to "experience", which can be expanded to personal and social experiences that are difficult to experience in real space. This expansion through "ego, world, and experience" expands the life of metaverse users, encouraging voluntary participation and immersion.

If a metaverse is used in education, it could represent expansion of the learner's "ego, world, and experience." General online teaching and learning methods are also effective, but there they are limited in terms of reality, emotion, safety, and so forth.

According to the Acceleration Studies Foundation, there are four types of the metaverse. AR makes virtual objects overlap in real space, and can be used for activities that involve carefully observing and understanding content that is

difficult to directly observe or explain in textbooks and for learners to experience and organize knowledge. Lifelogging is about sharing daily experiences or information about people and can be used mainly for activities that involve sharing thoughts through social media and social network service (SNS). The Mirror World means that a virtual world is embodied as if the real world is reflected in a mirror for a specific purpose. Virtual reality (VR) is a newly constructed virtual space that is different from reality. Conferences and classes may be held here, as may meetings with various characteristics.

VR is used in this study. Additionally, as described above, there have been various attempts to use the metaverse in education. Further, platforms for presenting an educational metaverse are being continuously developed, and commercial metaverse platforms are gradually changing for educational purposes.

III. METHODOLOGY

The class was conducted using the metaverse platform “Gather.town” to determine whether classes using a metaverse improve the online presence of students and the effectiveness of the online classes. Gather.town is an easy-to-use office environment-based system suitable for educational use. This class was conducted for two hours a day for six weeks. The class proceeded in four stages. The space in Gather.town was made similar to the real classroom or campus suitable for each activity step to give students a sense of reality and dynamism.

Step 1: Discussion was conducted in groups on topics provided in advance. Each group consisted of 4–5 students, and both intragroup and intergroup discussions about the contents of the class were conducted (Fig. 1).



Fig. 1. Step 1. Group discussion.

Step 2: Discussion was conducted with a whole class about the topic discussed in each group (Fig. 2).



Fig. 2. Class discussion in Gather.town.

Step 3: After the discussion, the class proceeded with a lecture by the instructor and a class discussion (Fig. 3).

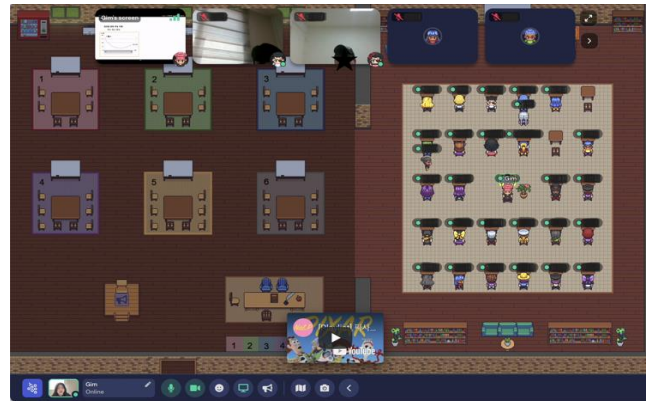


Fig. 3. Lecture in Gather.town.

Step 4: Practice assignments were conducted for each team to apply what they had learned (Fig. 4).

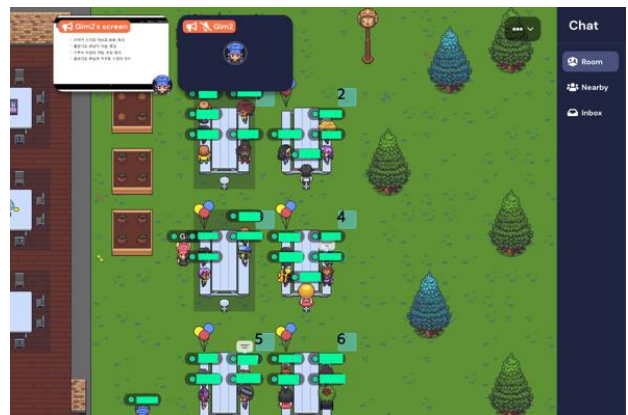


Fig. 4. Group activity in Gather.town.

A. Research Design

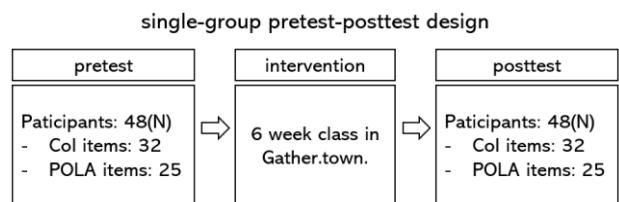


Fig. 5. Research design.

This study used a single-group pretest-posttest design. One group received a pretest, then the treatment, and then the posttest; the pretest and posttest were the same [27]. This design permits intervention-related changes to be assessed.

B. Participants

The participants for this study were 48 university students in Korea (24 (50.0%) male and 24 (55%) female). They were all students taught by the same professor and had no experience of learning in Gather.town.

C. Data Collection

A questionnaire was given to the students who participated in the class before and after class to verify the relationship between the classes using metaverse and the online presence of the learners and the effectiveness of the online class.

The instrument used to measure online presence was the

CoI instrument developed by Swan *et al.* [5]; the Korean version of the CoI instrument has been validated with Korean university students [21]. To measure the effectiveness of online learning using the metaverse platform, the predicting online-learning achievement questionnaire developed by Bernard *et al.* [7] was used. The items of the questionnaire were designed to address the comfort of the student with some of the basic skills and components of online learning and assess their independence as learners (see Table I).

All items were measured on a 5-point Likert scale ranging from “strongly agree” to “strongly disagree.”

TABLE I: PRESENCE AND EFFECTIVENESS OF ONLINE LEARNING

Instrument	Variables	Number of items
The Community of Inquiry	teaching presence	12
	social presence	12
	cognitive presence	8
Predicting Online Learning Achievement	confidence in prerequisite skills	8
	general beliefs about online learning	8
Achievement	self-direction and initiative	4
	desire for interaction with others	5

D. Data Analysis

The collected pre- and post-data were analyzed utilizing

TABLE II: PRESENCE OF ONLINE LEARNING

Variables	t-test	M	N	SD	t
Teaching presence	Pre	4.33	45	0.494	-4.029***
	Post	4.65	45	0.445	
Social presence	Pre	3.97	45	0.523	-6.333***
	Post	4.49	45	0.477	
Cognitive presence	Pre	3.75	45	0.645	-7.196***
	Post	4.44	45	0.515	
Community of Inquiry	Pre	4.02	45	0.489	-6.874***
	Post	4.52	45	0.446	

*** $p < 0.001$

According to the results, the learners felt that they interacted with other learners, instructors, and the learning community through metaverse learning as they would in a real classroom, and it was found that they were learning meaningfully and in-depth. Students can express themselves through avatars and have more freedom to interact with others in Gather.town.

TABLE III: EFFECTIVENESS OF ONLINE LEARNING

Variables	t-test	Mean	N	SD	t
Confidence in prerequisite skills	Pre	3.92	45	0.649	-4.238***
	Post	4.37	45	0.533	
General beliefs about online learning	Pre	3.78	45	0.633	-3.479**
	Post	4.16	45	0.616	
Self-direction and initiative	Pre	3.81	45	0.704	-2.728**
	Post	4.11	45	0.809	
Desire for interaction with others	Pre	3.80	45	0.662	-5.106***
	Post	4.34	45	0.513	
Predicting Online Learning Achievement	Pre	3.83	45	0.486	-4.631***
	Post	4.24	45	0.489	

*** $p < 0.001$, ** $p < 0.01$

SPSS 26.0 ver. For statistical analysis of pre–post-tests, a paired-samples t-test was conducted. The paired-samples t-test is suitable for analyzing the effect of a program on the same sample extracted from the same population. In particular, it is frequently used to compare the mean of the effect of a program on the same sample drawn from the population.

IV. RESULTS

A. Presence of Online Learning

To examine whether there was a significant difference in the pre-test and post-test presence of online learning, a paired-samples t-test was conducted with variables consisting of each subscale of the CoI.

For all variables, the mean of the post-score was higher than the mean of the pre-score, as shown in Table II. There were significant differences in three subscales: teaching presence ($t = -4.029, p < 0.001$), social presence ($t = -6.333, p < 0.001$), and cognitive presence ($t = -7.196, p < 0.001$). Comparing the mean of pretest and posttest of the community of inquiry including all subscales was significant ($t = -6.874, p < 0.001$).

B. Effectiveness of Online Learning

The statistically significant differences between the pre-test and post-test means of online effectiveness are presented in Table III. Paired-samples t-tests were conducted with the variables that predicted online-learning achievement for each subscale.

For all variables, the post-score mean was higher than the pre-score mean, as shown in Table III. There were significant

differences in four subscales: confidence in prerequisite skills ($t = -4.238, p < 0.001$), general beliefs about online learning ($t = -3.479, p < 0.01$), self-direction and initiative ($t = -2.728, p < 0.01$), and the desire for interaction with others ($t = -5.106, p < 0.001$). Further, Comparing the mean of pretest and posttest of the predicting online learning achievement including the four sub-variables was significant ($t = -4.631, p < 0.001$).

Therefore, online learning using the metaverse platform had positive effects on online-use skills and improved the efficacy of online learning, self-direction, and online interaction. Online communication and learning (e.g., discussion with other students, group activities) were found effective in classes conducted via Gather.town.

V. DISCUSSION AND CONCLUSION

This study examined if the online presence of the learners and the effectiveness of online learning were improved in a class in a metaverse environment. Accordingly, a class was conducted for six weeks using the metaverse platform Gather.town and data regarding the online presence of the learners and the effectiveness of the online learning were collected from students who participated in the class.

After using the metaverse platform in class, it was found that the presence and effectiveness of online learning improved. With Gather.town, educators and students can create a virtual school experience that is equivalent to any in-person class. Students experienced various learning activities while interacting with instructors and classmates through discussions and group activities in the metaverse environment. In this process, students felt a sense of reality as if they were in an offline class, and recognized that online learning skills and self-direction were improved.

In previous studies, the relationship between teaching presence and academic achievement or learning satisfaction in online learning became stronger as the length of the education period increased [6]. In addition, the same study found similar results for social presence. Compared with the results of previous studies, it seems that the students' experiences in the metaverse environment affected the presence and learning effectiveness in a complex manner, resulting in positive outcomes in this study.

Teaching presence, cognitive presence, and social presence are essential elements for successful learning, and interaction among three presences should be actively performed in the online learning environment. Additionally, since online learning environments are becoming more diverse, it is necessary to maximize learning effectiveness according to each environment.

Currently, various metaverse platforms are being commercialized. However, the metaverse platform used in this study was a specific platform called Gather.town. It was very simple to use because avatars and virtual spaces were generated using simple two-dimensional graphics. The simple graphics did not mean that the learning effects were poor. This class was visually appealing and easy to use; students and instructors had a generally comfortable experience. To develop education in a virtual space in this

way, it is necessary to analyze various metaverse platforms to provide an optimal educational environment for learners.

There are the four types of metaverse, AR, Lifelogging, Mirror world, and VR. However, the distinctions among these types are becoming ambiguous, and with the development of technology they are being used in complex ways in various fields. Accordingly, it is important to appropriately optimize each metaverse for its intended purpose.

After the spread of COVID-19, activities that were thought to be only possible face-to-face are being converted to virtual reality and are rapidly expanding into various fields, such as education. However, these social communication or connections in the metaverse are weaker than are interactions in the real world. Since the most suitable metaverse platform may vary according to the purpose and target of the class, empirical research is needed to with actual classes to examine the effectiveness of specific metaverse implementations [9]. Thus, research into the metaverse in educational applications for sustainable and effective online learning should be continued.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Hyunji Kim conducted the research, and collected and analyzed the data. Myoungsung Kim studied the literature review. Kim and Kim cross-reviewed each other and wrote the paper. Both authors approved the final version of the manuscript.

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