Group Work Using Active Learning:
A Comparison of Students' Evaluations of Face-to-Face and Online Lessons

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ABSTRACT

An active learning group work course at "A" university in Japan is characterized by two-way interactions between students as well as between teachers and students. The spread of COVID-19 prompted a shift from in-person lessons to online synchronous lessons in 2020 and 2021. This mixed methods study analyzes data from a combined structured and open-ended questionnaire completed by 5,268 students. The results showed that online lessons were significantly more highly evaluated than face-to-face lessons in terms of enhancing students' understanding of student life, sense of belonging, expressing one's opinions and listening to those of others, and self-regulation of attendance and gaining an in-depth understanding of the course material. However, face-to-face lessons were preferred for small class sizes, interactions with students who have different ideas, and group learning activities. Open-ended responses indicated that conducting online classes via Zoom improved students' perceptions of group learning and interaction in this setting.

KEYWORDS

Face-to-Face Lessons, Learning Management Systems (LMSs), Online Lessons, Online Meeting Services, Student Satisfaction

INTRODUCTION

The rapid spread of COVID-19 in 2020 prompted restrictions on face-to-face classes in higher education institutions worldwide. Many cases of online lessons during the pandemic and their impact on students have been reported from various research fields. For example, studies have examined the application of online lessons to sports education (Aditya et al., 2021; Yoo et al., 2021; Zepeda-Martínez et al., 2021), nursing education (Lee & Suk, 2021; Lim, 2021; Rusnani & Wan, 2021; Susana et al., 2021), and programming education (Nofyta et al. 2022; Park, 2021), among others. Although among current research about online lessons, there are few studies focusing on students' satisfaction with

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lesson practice and evaluation involving synchronous interactive group work. Synchronous interactive group work is those in which academic staff members present subject material, then facilitate students to engage with it through group work in real time. To address this gap, this study examined student satisfaction with an active learning group work course characterized by interactions between students as well as between teachers and students before and after the spread of COVID-19, which prompted a shift from in-person lessons to online synchronous lessons in 2020 and 2021.

The study compares data from an annual questionnaire completed during the period of face-to-face lessons in the 2019–20 school year with results during the 2020–21 and 2021–22 school years. Online synchronous lessons are called in several ways, such as simultaneous two-way classes or simultaneous delivery classes. Specifically, a web conferencing system is used to send and receive video and audio data, and lectures are conducted while teachers and students are communicating at the same time. This online class is similar to a face-to-face class in an actual classroom using a web camera and microphone. Real-time images of people participating in the class are displayed on the screens of computers, tablets, smartphones, etc., and there is an advantage that teachers and lecturers can take regular lessons while away from the lecture room or research institute.

This study used a mixed structured and open-ended questionnaire to compare students' satisfaction with face-to-face and online synchronous lessons entailing two-way interaction between classmates as well as between teachers and students. As a result, the online classes were less relevant to student-to-student and student-to-teacher interactions (enhancing students' understanding of student life, sense of belonging, expressing one's opinions and listening to those of others, self-regulation of attendance and gaining an in-depth understanding of the course material). On the other hand, face-to-face lessons were preferred for items that seemed to involve student-to-student and student-to-teacher interactions (smaller class sizes, interactions with students who have different ideas, and group learning activities).

The research question in this study was student satisfaction with active learning group work courses featuring interaction between students and between teachers and students before and after the COVID-19 epidemic that prompted the shift from face-to-face lessons to online. It is to clarify whether there is a difference in degree.

The structure of this paper is as follows. The next section discusses the background literature related to this research. The subseqent sections detail the methodology, the research question to be addressed and the research design used followed by an analysis of the results. The final section discusses the results and provides conclusions.

BACKGROUND

Findings on the educational effectiveness of and student satisfaction with online classes since the pandemic have been mixed. On one hand, some research has emphasized students' favorable perceptions of enhanced communication, convenience, and flexibility in online learning (e.g., Chandrasiri & Weerakoon, 2022; Elshami et al., 2021; Landrum et al., 2021). On the other hand, other studies have found neutral or negative effects of online classes. Challenges have included increased teacher workload (Nagai & Kaneko, 2021), reduced student motivation (Chandrasiri & Weerakoon, 2022), technical difficulties (Dinh & Nguyen, 2020; Jeong et al., 2021), and limited interaction (Almahasees et al., 2021; Giray, 2021; Landrum et al., 2021), among others.

Jeong et al. (2021) investigated the correlation between student satisfaction and the effects of practical training and theoretical lectures in face-to-face and online lectures. They found that students preferred to receive pre-recorded lectures online due to the lack of commuting time and the ability to easily review course content; however, technical problems related to facilities, access and poor concentration were cited as problems. Jang et al. (2021) analyzed surveys evaluating radiology students' satisfaction with online lessons and reported high levels of learner satisfaction; they highlighted a correlation between satisfaction and content quality. Kim (2021b) analyzed the educational effects of

online lessons in elementary school social studies using Minecraft. Students in the experimental group asked more questions and provided more explanations and opinions in the Minecraft virtual space, and the degree of academic achievement, learning attitude, and sense of location were significantly improved compared to the control group.

Miyaguni et al. (2021) found that an online science education program had both advantages and disadvantages compared to the conventional face-to-face program and suggested that the post-COVID era could lead to new lesson styles. Kim et al. (2021) analyzed students' participation levels in video, face-to-face, and hybrid lessons in a computer science course, finding that levels of class participation and learner interaction in the online environment had the greatest effects on enhancing learning. Another study highlighted positive correlations between students' expected learning effects and satisfaction as well as ease-of-use and expected time benefits and emphasized the important role of teacher-learner interaction in influencing satisfaction levels (Kim, 2021a).

A study of online classes at Hokusei Gakuen University found that the increased burden on teachers was not balanced by the educational outcomes (Nagai & Kaneko, 2021). Warikar et al. (2021) reported that online learning did not affect students' motivation to learn. Dinh and Nguyen (2020) assessed students' satisfaction with online vs. face-to-face settings in a social work course in Vietnam and reported significantly higher satisfaction with traditional face-to-face classes.

Interaction with classmates and instructors is an important dimension cited in studies of students' satisfaction with online learning (Chigeza & Halbert 2014; Parahoo et al., 2016; Landrum et al., 2021). Pre-pandemic studies have demonstrated that interpersonal communication between students and teachers positively affect student engagement and satisfaction (Chigeza & Halbert 2014; Kuo et al., 2013; Nortvig et al. 2018). Wu et al. (2010) found student-instructor interaction to have a significant positive effect on online learning climate and performance expectations, which in turn contributed to student satisfaction. However, whereas Kuo et al. (2013) found learner-instructor interaction to be a significant positive predictors of student satisfaction, learner-learner interaction was insignificant.

Students have reported perceiving less instructor support in the absence of face-to-face interaction with instructors (Simonson et al., 2019), and studies have highlighted challenges understanding instructors' expectations in online environments (Boyd, 2008; Platt et al., 2014). Students have also described difficulty interacting with peers in online environments (AlHamad et al., 2014; Boyd, 2008; Dyrbye et al., 2009; Horspool & Lange, 2012). Carver (2014) highlighted the importance of face-to-face interactions for student collaboration and psycho-social learning The psychosocial learning environment covers psychological and social factors that have consequences for satisfaction, health, and ability to perform at the place of study. Recent studies indicate that the situation has changed little in the past couple of years. For example, Almahasees et al.'s (2021) study of online learning in Jordan during the COVID-19 pandemic found that students reported a lack of student–teacher interactions as a substantial challenge. Similarly, Dinh and Nguyen (2020) and Giray (2021) reported significantly higher satisfaction with student-teacher and student-student interactions in traditional face-to-face classes than in online settings. Lin (2022) compared students' satisfaction with a business statistics course conducted both face-to-face and online. The results indicated that although students exhibited higher overall performance and satisfaction in face-to-face classes, conducting online sessions via Zoom enhanced their satisfaction and reduced the gap in effective instruction between the two settings.

METHODOLOGY

Research Question

The research question in this study was student satisfaction with active learning group work courses featuring interaction between students and between teachers and students before and after the

COVID-19 epidemic that prompted the shift from face-to-face lessons to online. It is to clarify whether there is a difference in degree.

Research Context

The Center for the Advancement of "A" University Education (AEC) was established in Japan in April 2010 to address the challenges arising from an increasing number of students leaving the university due to a loss of motivation or reduced academic achievement. One purpose of the center is to provide common subjects that all university students need to complete in the first year.

AEC began providing the course titled "Independence and Experience" in 2010. The goal of the course is to help students develop a sense of belonging at the university, clarify their ideals and objectives, and improve their self-awareness by interacting with peers. The course content of "Independence and Experience" has been planned by the teachers of the AEC and is managed in a unique manner. Specifically, teachers have worked on (1) a cross-faculty/departmental class organization (70 classes); (2) cooperative learning and experiential learning in small classes (30 students); (3) lessons shared by the teachers of the AEC and full-time teachers from each faculty; (4) lessons implemented using a standard syllabus, a standard teaching plan, and shared teaching materials; (5) lessons supported by an Student Assistant (SA) / Teaching Assistant (TA) and SA coach; and (6) lessons provided by various members (cross-faculty/departmental class organization). To conduct lessons using the standard syllabus, standard teaching plan, and shared teaching materials, the AEC's teachers take the leading role in providing lessons. One lead teacher supports approximately six subject expert teachers.

The AEC has adopted Kolb's learning methods of experiential and independent learning (Kolb, 1983, Kolb & Kolb, 2017). Students participate in an activity and then describe the content of the lesson, reflecting and conceptualizing the details to utilize the results in the following lesson. The aim is for students to complete these steps as a regular part of their daily study regime (Figure 1; Suzuki, 2021). To acquire this subjective learning method, students must repeat the process of active learning based on cooperative learning. They draw their own conclusions, express and exchange opinions, and then rethink the topic.

The lessons consist of three sections. In Section 1, students meet various people and learn how to interact with them. In Section 2, they work in groups and begin learning as university students. In Section 3, they compile their four-year study plan while considering their post-graduation plans (Table 1).

Beginning in spring 2021, the course shifted from in-person to online mode. It was a major challenge for the university to reorganize and provide the lessons, which were originally designed to be delivered face-to-face with students split into small groups. The university finally started providing the lessons two weeks after the originally scheduled date, after adding several changes. In the 2021–22 school year, all lessons were provided via Zoom combined with a learning management system (LMS). Online synchronous interactive lessons entailed interactions between students as well as between students and teachers. Group work comprised groups of about four people, and two or three two-way interactions (discussion, etc.) were conducted within the 90-minute class period (Figure 2).

We also changed the order of the lessons (Tables 2 and 3). The first seven lessons could be implemented using the assignments prepared on the LMS. However, from the eighth lesson onward, lesson plans used Zoom and LMS to enhance the discussions between students. Students could prepare for the subject by reading the corresponding pages of printed workbooks distributed in advance; however, they could only access the assignments published on the LMS during the initially scheduled face-to-face lesson. They were instructed to work on their LMS assignments during the class hour. The lessons were designed to encourage active interaction between students as well as students and teachers using the assignments on the LMS, and various strategies were employed. For example, in some lessons, the students watched videos or reviewed their assignments together using the shared browsing function of the LMS or the bulletin board; when a student posted a question, other

Table 1. Lesson structure for "Independence and Experience:" 2019–20 school year

Section 1	1	Orientation
	2	Meeting other people in a new environment
	3	Thinking about what it means to study at a university
	4	Listening to and understanding other people (1)
	5	Listening to and understanding other people (2)
	6	Thinking about rules and manners
Section 2	7	Getting to know about A University
	8	Describing A University to other people
	9	Getting to know about the library
	10	Interviews with academic staff
	11	Appreciating the importance of yourself and other people
Section 3	12	Learning from graduates
	13	Thinking about your profession and yourself
	14	Projecting your future university life
	15	A message to yourself in the future

Figure 1. Steps of experiential learning in "Independence and Experience"
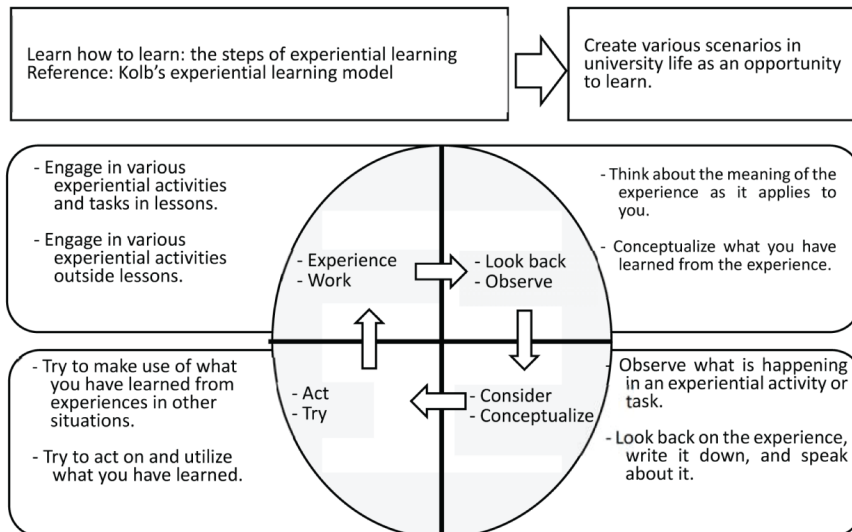
teachers or students expressed their opinions. Following each lesson, the students were required to post a review on the LMS, after which the teacher provided individual feedback. The students were not given credit for the lesson until they posted a review on the LMS.

Research Design

This study employed a mixed methods design entailing a cross-sectional comparison of online and face-to-face educational delivery methods. Participants were three cohorts of students from different

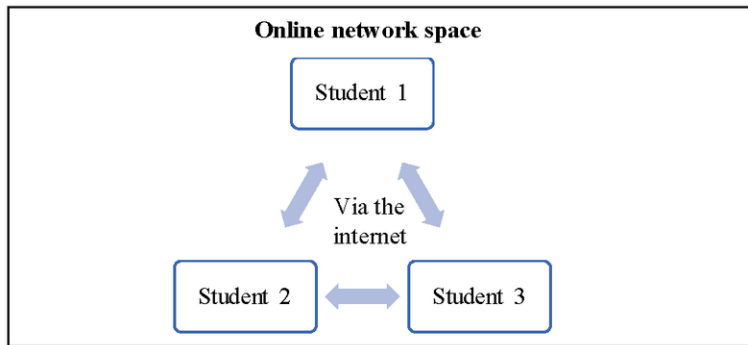**Figure 2. Image of two-way interaction group work in online virtual space**

Table 2. Changes in lesson content during the 2020-21 school year

Lesson number	Lesson content	Previous Lesson number	Implementation Method
1	Orientation (1)	1	On-demand lessons using LMS
2	Orientation (2)	1	
3	Meeting other people in a new environment and thinking about what it means to study at university	2·3	
4	Getting to know about A University	7	
5	Listening to and understanding other people	4	
6	Thinking about rules and manners (1)	6	
7	Appreciating the importance of yourself and other people	11	
8	Thinking about rules and manners (2)	6	On-demand lessons using LMS Zoom and LMS
9	Describing A University to other people	8	
10	Learning from graduates	12	
11	Being aware of your own characteristics	13	
12	Projecting your future university life	14	
13	A message to yourself in the future	15	

academic years: 2019–20, 2020–21, and 2021–22. The academic year that students were enrolled in the "Independence and Experience" course determined their cohort assignment to the traditional method (2019–20) or their cohort assignment to the integrative approach (2020–21, 2021–22).

Participants and Measures

A total of 5,268 students completed the questionnaires, including 1,960 in 2019–20, 2,001 in 2020–21, and 1,307 in 2021–22. Students completed course evaluation questionnaires consisting of nine items after the final lesson on the LMS. The questions had four possible answers: 1= strongly agree, 2 = agree, 3 = Disagree, and 4 = Strongly disagree (Table 4). In addition, each of the items was accompanied by an open-ended question to collect further details on students' impressions. This study was approved by the research ethics committee of the university to which the first author belongs. All participants gave informed consent.

Table 3. Class content in the 2021–22 school year

Lesson number	Class description	Implementation Method
1	Orientation	Zoom and LMS
2	Getting to know each other by introducing yourself	
3	Meeting other people in a new environment	
4	Making friends	
5	Thinking about studying at university	
6	Listening to and understanding other people	
7	Thinking about rules and manners	
8	Appreciating the importance of yourself and other people	
9	Getting to know about A University	
10	The diverse range of people at A University	
11	Learning from graduates	
12	Being aware of your own characteristics	
13	Projecting your future university life	
14	Deepening interactions with other people	
15	A message to yourself in the future	

Table 4. Question items in the course evaluation questionnaires

Q1	What you should do as a student (Student life)
Q2	Knowing the history and characteristics of the university (Sense of belonging)
Q3	Logically expressing one's opinions (Expressing one's opinions)
Q4	Listening to other people with respect and interest (Listening closely)
Q5	Avoiding being absent from or late to lessons without permission (Discipline)
Q6	Small-class education is useful (Small-class education)
Q7	Interaction with students of other faculties/departments (Interacting with other people who have different ideas)
Q8	Group learning activities were helpful (Group learning)
Q9	Understanding the subject in depth by submitting assignments and receiving comments from teachers (In-depth understanding)

We also administered out a questionnaire survey for teachers (N = 41) upon beginning the Zoom lessons and following their completion.

Data Analysis

Descriptive statistics were calculated for all questionnaire responses. To assess whether the difference in the mean values of the of questionnaire responses completed following the face-to-face lessons conducted in the 2019–20 school year and the online lessons conducted in the 2020–21 school year was statistically significant, we conducted a student's two-sided t-test at a level of significance of 5% for each question item. However, we used Welch's method for several questions (Question Items 1,

2, 3, 5, and 7) for which equal variance could not be confirmed between populations using Levene's test for homoscedasticity.

Next, we compared the evaluations of the online lessons provided in the 2020–21 and 2021–22 school years, using the course evaluation questionnaires that were given to the students at the end of the course on the LMS. We conducted a student's two-sided *t*-test at a level of significance of 5% for each question.

All statistical analyses were conducted using SPSS, version 20.

RESULTS

Results of Student Course Evaluation Questionnaires

The comparison of questionnaire results showed a significant difference in the mean values for the 2019–20 and 2020–21 school years for all items (Table 5). The comparison between the 2020–21 and 2021–22 school years found no significant difference in any responses (Table 6).

Statistical analysis showed that significantly preferred elements of face-to-face lessons were small-class sizes make this active voice and not passive, as it is written here (Q6: small-class education); interaction with students from other other parts of campus (Q7: interaction with other people who have different ideas); and group learning activities (Q8). Conversely, online lessons were preferred for enhancing student' understanding of what you should do as a student (Q1: student life), knowing the history and characteristics of the university (Q2: sense of belonging), logically expressing one's opinions (Q3), listening to other people with respect and interest (Q4 listening closely), avoiding being absent from or late to lessons without permission (Q5: self-regulation/discipline), and gaining an in-depth understanding of the subject as a result of submitting assignments and receiving comments from teachers (Q9: in-depth understanding).

Open-Ended Response Results

A total of 2,102 open-ended responses were received. Below are some examples of the students' open-ended responses regarding items 6 (small-class education), 7 (interaction), and 8 (Group learning). Of the 978 responses related to these items, 209 (21.4%) expressed positive opinions on face-to-face

Table 5. Comparison between course evaluations of face-to-face lessons in the 2019–20 school year and online lessons in the 2020–21 school year

Q	Online (2020)		Face-to-face (2019)		t	Df	P
	N	$\bar{x}$	N	$\bar{x}$			
1	1,996	1.80	1,960	2.00	10.03	3,848	.00**
2	2,001	2.67	1,957	3.00	15.05	3,889	.00**
3	2,001	2.44	1,960	2.54	4.57	3,910	.00**
4	2,001	1.59	1,961	1.74	8.08	3,960	.00**
5	1,995	1.51	1,932	1.57	3.17	3,898	.00**
6	1,505	1.70	1,691	1.58	5.00	3,184	.00**
7	1,505	1.67	1,691	1.47	8.08	3,194	.00**
8	1,505	1.80	1,693	1.51	11.93	3,196	.00**
9	1,504	1.72	1,684	1.87	6.03	3,194	.00**

#Items for which equal variance cannot be confirmed
** $p < .01$

Table 6. Comparison between course evaluations of online lessons in the 2020–21 and 2021–22 school years

Q	Online (2021)		Online (2020)		t	Df	P
	N	$\overline{x}$	N	$\overline{x}$			
1	1,307	1.66	1,996	1.80	.79	1,238	.43
2	1,307	2.14	2,001	2.67	.73	933	.47
3	1,307	2.07	2,001	2.44	.74	861	.46
4	1,307	1.50	2,001	1.59	.18	1,126	.86
5	1,307	1.69	1,995	1.51	.80	1,193	.43
6	1,307	1.42	1,505	1.70	.12	1,165	.91
7	1,307	1.34	1,505	1.67	.04	1,143	.97
8	1,307	1.41	1,505	1.80	.46	1,123	.65
9	1,307	1.73	1,504	1.72	1.49	1,189	.14

classes, including 115 (11.8%) that emphasized interactions between students. Students specified that online lessons hindered their ability to communicate with and interact with their classmates:

If they had been face-to-face lessons, they would have been the most interesting lessons for me, and I would have interacted with students from other departments.
I would have been able to get on well with my classmates had I been in the face-to-face classes. I did not feel that I was communicating with them in online meetings.
I was disappointed not to have direct communication with other students and teachers, not only in lessons but also on other occasions.
I wanted to interact with many students. It's really unfortunate that the course ended without my actually meeting my classmates.

Students expressed the perception that their reduced ability to communicate with instructors and classmates had negative impacts on their understanding of course materials and ability to exchange viewpoints:

Although it was inevitable in this difficult situation, if I had been able to communicate directly with other students, I could have improved my understanding in the study.
If the course had been provided in face-to-face form, we could have expressed and exchanged our opinions more freely with teachers and classmates.

Below are examples of what students wrote regarding the evaluation of items 1 (student life), 2 (sense of belonging), 3 (expressing one's opinions), 4 (listening closely), 5 (discipline), and 9 (in-depth understanding). Multiple students expressed a preference for conducting lessons using Zoom and suggested that it be used earlier during the course. Students highlighted the enhanced student-student and student-instructor interactions using Zoom:

I would have preferred a greater number of Zoom lessons to allow interaction with other students, since we could not attend any face-to-face lessons.
I think we would have been able to communicate with students from other faculties had we started to use Zoom earlier.

I wanted to communicate more with teachers and students in the same year over Zoom.
Although we had no choice about lessons being provided online, I wanted to have more communication
with other people by using Zoom and a message board.

In total, 234 cases (23.9%) explicitly highlighted the benefits of Zoom in improving communication and interaction.

Instructor Questionnaire Results

The results of the teachers' questionnaire showed that more than 60% of teachers had used Zoom to provide lessons and interact with students; however, fewer than 30% had used the breakout rooms feature (Table 7). Moreover, as many as 76% of teachers expressed positive views about using Zoom in future lessons, including those who answered, "I use it as part of a rough lesson plan" and "I would like to use it if I could" (Table 8).

DISCUSSION AND CONCLUSION

The research question in this study was student satisfaction with active learning group work courses featuring interaction between students and between teachers and students before and after the COVID-19 epidemic that prompted the shift from face-to-face lessons to online. It is to clarify whether there is a difference in degree.

This study used a mixed structured and open-ended questionnaire to compare students' satisfaction with face-to-face and online synchronous lessons entailing two-way interaction between classmates as well as between teachers and students. The results show that the online lessons were significantly more highly evaluated than face-to-face lessons in terms of enhancing students' understanding of student life, sense of belonging, expressing one's opinions and listening to those of others, self-regulation of attendance and gaining an in-depth understanding of the course material. However, face-to-face lessons were preferred for smaller class sizes, interactions with students who have different ideas, and group learning activities.

Table 7. Current use of Zoom (N = 41)

Item	Yes (%)	No (%)	N/A (%)
1. I use Zoom.	65.9	31.7	2.4
2. I engage in interactive exchange using Zoom.	63.4	34.1	2.4
3. I have used the Breakout Rooms feature.	29.3	68.3	2.4

Table 8. Future use of Zoom (N = 41)

Item	%
1. I want to use it (I will figure out how to use it by myself).	-
2. I want to use it (I use it as part of a rough lesson plan).	22.0
3. I'd like to use it if I can.	53.7
4. It is difficult to use.	9.8
5. Others	12.2
N/A	2.5

These findings are largely consistent with those of other studies of students' satisfaction with online learning since the COVID-19 pandemic. Research has highlighted students' references to ease of communication, convenience, and flexibility as major benefits of online learning (Chandrasiri & Weerakoon, 2022; Elshami et al., 2021; Landrum et al., 2021). Similarly, participants in this study cited "listening to others," the ability to clearly and logically express opinions, and "receiving comments from teachers" as factors that increased their subject understanding, and they identified the online format as contributing to higher class attendance and reduced tardiness.

A number of studies have highlighted challenges with student-student and student-teacher interactions as a substantial factor reducing satisfaction with online learning formats (AlHamad et al., 2014; Almahasees et al., 2021; Giray, 2021; Landrum et al., 2021; Simonson et al., 2019). The structured survey and open-ended responses obtained in this study clearly indicate that students keenly felt a lack of sufficient interaction both with their peers and instructors, which hindered their psycho-social experiences as well as their perception of understanding the course material. Despite our efforts to provide the course in an online format, unlike with conventional face-to-face lessons, we were unable to offer a study environment that could realize the final goal of "interaction with other people." Landrum et al. (2021) found that students viewed interactions with classmates to be beneficial when they were perceived to offer additional insight, new perspectives, and meaningful questions; however, such experiences are seen as distracting when classmates are viewed as hindering students' progress in the realization their learning goals. The findings of the current study indicate that students valued interactions with their classmates for the opportunities they provided to both socialize and increase their understanding of the course material. However, the results from the students' course evaluation questionnaires suggest considerable potential for providing group-learning activities that enable teachers and students to flexibly interact and freely exchange opinions in a manner similar to face-to-face lessons. Open-ended responses indicated that conducting online classes via Zoom improved students' perceptions of group learning and interaction in this setting. This result is consistent with Lin's (2022) study, which found that using Zoom for online lessons substantially reduced the gap between students' satisfaction in online vs. face-to-face learning formats.

When designing Zoom lessons, there was a concern that students' satisfaction with lessons would be markedly lower than with face-to-face lessons. However, the results showed that this was not the case—rather, their satisfaction levels tended to be higher when using Zoom lessons. We can prepare a quasi-face-to-face study environment while using online lessons over Zoom from the beginning of the university year. In addition, we can adequately utilize the breakout rooms feature such that it is possible to interact with other people in a small group.

It seems that online lessons were not a major challenge for students. Although we engaged in the practice of active learning using online lessons as a temporary and emergency measure to respond to the current social conditions, the results show that it might be possible to use this method even under conditions in which face-to-face lessons are feasible. However, some teachers who are anxious about online lessons may experience difficulties in using the online lesson environment. For example, they may provide one-sided lessons, may not facilitate students' discussions using the breakout rooms feature in Zoom, or may not use online whiteboards effectively.

In summary, all these conclusions suggest the potential to develop online lessons with a quality comparable to those of face-to-face lessons, provided that we can successfully use online meeting tools together with a range of teaching materials such as printed textbooks, an LMS, and digital whiteboards. A hybrid format could include various lesson styles with a mixed ratio of lectures and interactions.

This study has several limitations. First, it relied on students' and teachers' self-reported responses and did not include any objective measures that could provide indications of students' interaction levels and academic performance. Future studies could include data correlating students' responses to grades and digital records of student-student and student-teacher interactions. In addition, future studies could assess students' satisfaction across courses, including both required classes and electives related to students' interests or focus of study.

CONFLICT OF INTEREST

The authors have no conflicts of interest directly relevant to the content of this article to declare.

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