

APPROACHES TO REMOTE LEARNING DURING COVID-19 IN THE SCHOOL OF INDUSTRIAL AND WELFARE ENGINEERING, TOKAI UNIVERSITY

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ABSTRACT. *Due to the spread of COVID-19, the daily lives of most people have changed drastically. The educational environment was certainly no exception. Most universities in Japan restricted access to their campuses and had to provide students with remote lectures. In our university, most lectures were provided remotely during the spring semester, 2020. Our school decided to give all lectures using Microsoft Teams and made videos on how to take the remote lectures using Microsoft Teams; thus we were able to start giving remote lectures smoothly. We report on the approaches which helped us to create a successful environment for providing remote lectures in our school. In this paper, we also report the effects of on-line flipped lectures, which we conducted on a trial basis.*

Keywords: COVID-19, Microsoft Teams, Remote lectures, On-line flipped lectures

1. **Introduction.** In 2020, to prevent the spread of COVID-19, most universities in Japan restricted the students from entering the premises and provided remote lectures [1-3]. On April 2nd, 2020, Tokai University decided to provide remote lectures beginning from May 11th, 2020, and faculty members were instructed to prepare remote lectures. Course Power, as a learning support system, Zoom, as a video conference system and Microsoft Teams for education were all available for use by our university staff. Our school had originally planned to use Course Power for on-demand distance classes, while using Zoom for interactive distance classes and finally using Course Power for submission of assignments. Unfortunately, on April 28th, 2020, it was discovered that only 1,300 people would have been able to use Course Power concurrently, and we received notification that usage restrictions would have to be put into place on the system in order to prevent access overload. Therefore, our school had an emergency meeting and decided to use only Microsoft Teams for remote lectures. It was felt that having a unified system for remote lectures would be the biggest factor in allowing us to conduct remote lectures smoothly. In addition, we decided to conduct on-line flipped lectures on a trial basis.

It is said that the idea of flipped lectures originated with Baker's "Classroom Flip" [4]. He used on-line access to university lecture materials before class, a bulletin board for students to ask questions and have discussions with each other, on-line check tests, and he employed active learning to confirm, extend, and apply the knowledge learned on-line in the classroom. Later, Bergmann and Sams coined the term "Flipped Classroom", and created a more formulaic model [5]. The term became generally known when their practice

was covered by the mass media. Also, the existence of the Khan Academy can be cited as a background for the spread of flipped lectures. The Khan Academy is a website that provides free access to instructional videos and check tests on a variety of subjects. The service was originally designed for learners to study on-line after school. However, with the spread of flipped lectures, school teachers are now using the service in their classes.

In recent years, flipped lectures have been adopted by many universities as well. In particular, during the COVID-19 epidemic, various universities have attempted to conduct flipped lectures completely on-line, where discussions and exercises are conducted in place of in-person lectures. For example, Inoue conducted on-line flipped lectures in an English course for first-year university students [6]. As a result, while the flipped lectures increased students' motivation to learn, it was found to be insufficient in dealing with variations in proficiency levels. Okuda also conducted an on-line flipped lectures in an English course for first-year university students [7]. As a result, it was confirmed that the learning effect was higher in terms of knowledge acquisition compared to in-person classes. On the other hand, it was found that the students did not feel a sense of accomplishment, satisfaction, and an atmosphere of learning.

Most of the previous studies on flipped lectures have included in-person lectures. Also, the number of cases of on-line flipped lectures, especially in engineering courses, is still limited. As the end to the epidemic is not sight, further research on on-line flipped lectures is required. This paper describes the preparation for remote lectures and on-line flipped lectures and methods of conducting these lectures, our results and conclusions. Though we started remote lectures due to the necessity of limiting the spread of COVID-19, we found we were able to improve the educational effectiveness of our on-line flipped lectures above and beyond that of normal in-person lectures; thus we report those results here as well.

The construction of remaining sections is as follows. In Section 2, we describe preparation for remote learning, especially our video teaching materials. In Section 3, we describe the remote learning policy in our school. In Section 4, the details of the on-line flipped lectures which we conducted, and our result are explained, respectively. In Section 5, we discuss the results of questionnaires about remote lectures. Section 6 is devoted to our conclusions and future research goals.

2. Preparing for Remote Lectures. At Tokai University, Microsoft Teams was originally only used by the faculty members for meetings. Access to Microsoft Teams was provided to students beginning from April 2020, so up until that point no students had ever taken distance lectures using Microsoft Teams. Therefore, we felt it would be necessary to provide instruction to the students on how to use Microsoft Teams in advance. In order to do this, we created videos on how to use Microsoft Teams for our students and uploaded them to YouTube. The reason we uploaded videos to YouTube is that it would be easy for the students to access the videos because videos on YouTube can be seen without authentication. In addition, students often watch videos on YouTube, so they are familiar with the platform which, additionally, allows them to watch the videos anytime and anywhere. Table 1 shows the video materials which we made and the total number of views. In the first video uploaded on May 1st, we explained how to take remote lectures using smartphones and on a web browser. We anticipated students would be able to take remote lectures merely from watching this one video. However, the web version of Microsoft Teams is limited, and does not support remote control of shared screens. Some faculty members wanted to use this function, so we ended up making two more videos. In the second video, we explained how to install Microsoft Teams on PCs. In the third video, we explained how to take remote lectures using PCs with Microsoft Teams. We uploaded these videos on May 6th. The videos were made using Power Point 2019 and the Power Point presentations with audio were exported to the MP4 file format.

TABLE 1. Video teaching materials

No.	Contents	Length	The total number of views (May 2020)
1	How to take remote lectures using Microsoft Teams (on smartphone and web browser)	6m 10s	2231
2	How to install Microsoft Teams on PCs	1m 58s	849
3	How to take remote lectures on PCs (on application for PCs)	3m 25s	1422

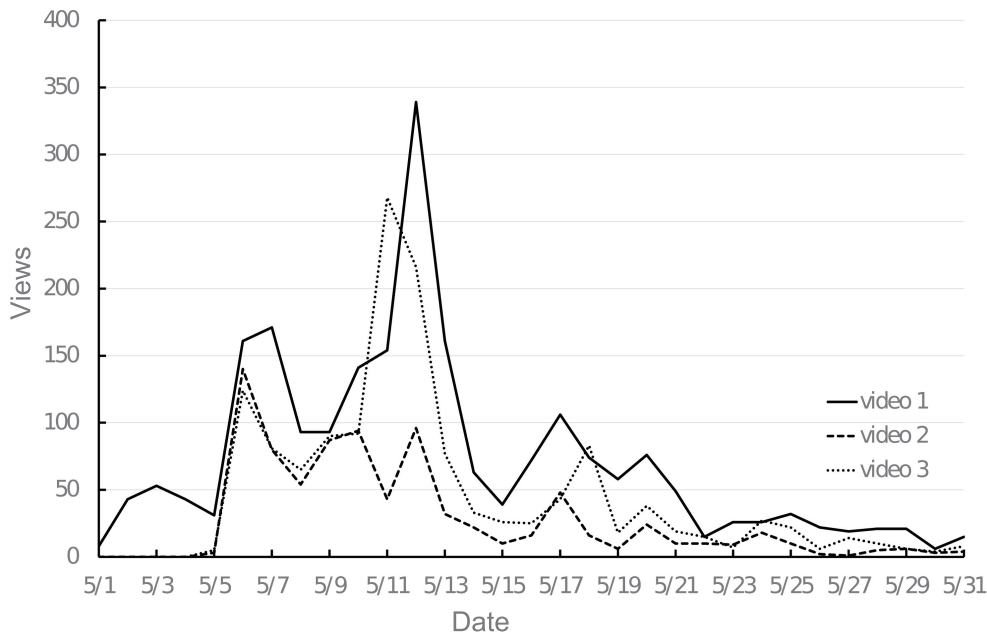


FIGURE 1. The views of each video per day

Figure 1 shows the views of each video per day in May 2020. The first video was viewed the most on May 12th, 2020, at 339 times that day. The second video, for installing Microsoft Teams, was viewed the most on May 6th, 2020, at 140 times. The third video was viewed the most on May 11th, at 268 times.

Figure 2 shows the total number of views of each video. By the beginning of the spring semester, the second video was watched at the same pace as the third, by students. This result confirms that students watched both the video about how to install Microsoft Teams on PCs and the video on how to take remote lectures for PCs at the same time. Moreover, the School of Industrial and Welfare Engineering had 404 students, and the total number of views of each video was over 400. This result confirms that most of the students watched these videos, while some had watched them more than once. Thus, we can see that we were successfully able to encourage students to watch the videos about using Microsoft Teams. We used e-mail and the Tokai University’s website to instruct the students to watch the videos.

3. Remote Lectures. Our school had decided on the policy for distance learning as shown in Table 2. In the case of on-demand distance lectures, lecturers not only uploaded on-demand materials on Microsoft Teams but also answered questions with using video conference function on Microsoft Teams during the class hour on the timetable. In the case of interactive distance lectures, lecturers conducted remote lectures in real time and recorded them using Microsoft Teams as on-demand materials for students who could not

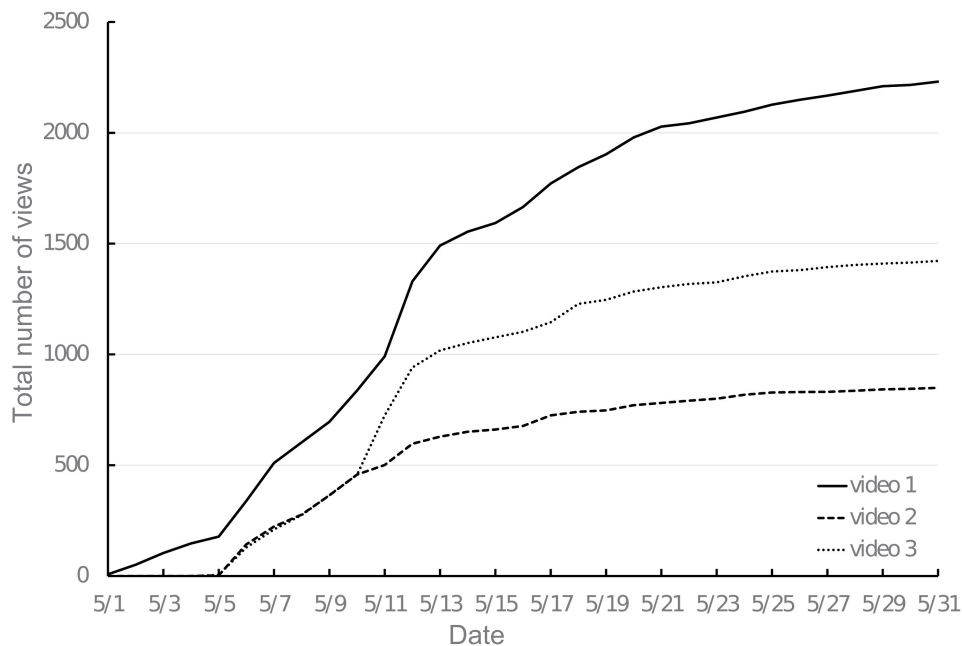


FIGURE 2. The total number of views of each video

TABLE 2. Distance learning policy in our school

Distance lecture type	Class hour on the timetable	On-demand materials	Checking attendance
On-demand	Answer the questions with using video conference function of Microsoft Teams.	Upload before class hour on timetable.	By usage of reports and the mini examinations.
Interactive	Lecture with using video conference function of Microsoft Teams.	Record and upload the real-time lecture.	

attend the lectures due to network failures. In both cases, we checked attendance using reports and mini examinations.

4. On-line Flipped Lecture. Flipped lectures are based on a pedagogical model in which students study by themselves using lecture materials before class at home, and then they discuss and do problem exercises in the actual class. This style of lecture began in America in the 2000s, and it has been used in Japan since then from primary school to the university level. It has four main advantages as follows [8-12].

- a) Learners have basic knowledge gained through previous learning which lecturers can confirm before moving on to advanced tasks and problems in class.
- b) Learners can learn cooperatively and deepen their understanding through discussion, allowing them to acquire problem-solving skills.
- c) Lecturers can check the knowledge acquired in previous learning, so it is easy to grasp students' levels.
- d) Learners can learn at their own pace. This can enhance their understanding and help them retain the knowledge.

There are, however, disadvantages to flipped lectures as well, for example, it can be difficult for the lecturer to grasp the students' levels of prior learning, so the lecturer needs to establish a support system for underachievers. Additionally, it takes time to get used to the flipped lecture because students have to study on their own. Though the flipped lecture has some disadvantages, their teaching effectiveness has been highly evaluated

[13]. At first, we had to conduct remote lectures to prevent the spread of COVID-19, but in anticipation of being able to increase students' motivation to learn and improve their academic performance, we conducted on-line flipped lectures in the three courses of Table 3.

TABLE 3. Subjects for which we conducted on-demand flipped lectures

Course title	Department	Years	The numbers of participants
Data processing theory	Business Administration	2nd years	158 (77)
AC electrical circuit	Medical Care and Welfare Engineering	2nd years	38 (56)
General remarks on electrical and electronic engineering	Medical Care and Welfare Engineering	1st years	55 (51)

(The figures in parentheses indicate the number of participants in 2021.)

Table 4 shows the on-line flipped lecture cycle. The lecturer uploads on-demand materials one week prior to the on-line interactive lecture. Students study using on-demand materials and make summary notes. They take pictures of the notes and submit them at least two days before the on-line interactive lectures. By using these, the lecturer can grasp students' level of comprehension of prior learning, circumventing one of the disadvantages of the common flipped learning. At the same time, students submit the parts which they did not understand and for which they wanted to know more about with Microsoft Teams chat function.

TABLE 4. The on-line flipped lectures cycle

	The lecturer	Students
	Prepare for on-demand materials	
One week before	Upload on-demand materials	Study with using on-demand materials and submit summary notes (Everyone) Comments and opinions for on-demand materials (Voluntary)
Two days before	Prepare for on-line interactive lecture	
During the class	Conduct on-line interactive flipped lecture 1) Answer the questions and comment on opinions which had been submitted 2) Lesson for review 3) Question and answer session about lesson for review 4) Problem exercises (Everyone)	
After the class	Answer the question Follow up for low understanding students	Question

During the class on the timetable, the lecturers conducted on-line flipped lecture using the video conference function of Microsoft Teams. At the beginning of the lecture, the lecturers answered the questions and commented on the opinions which had been submitted from students. This was one of the approaches employed to motivate students in participating in class. Next, the lecturers conducted reviews and had question-and-answer sessions about the reviews. The lecturers took questions from students using not only the

video conference function but also the chat function on Microsoft Teams. This was a consideration made for students who were too shy to speak up during the video conference. After that, the lecturers did the problem exercises. The lecturers had the students submit their answers through pictures taken with their smartphones or scanned, as in the case of submitting summary notes.

We conducted on-line flipped lectures in the 2020 spring semester. In the first half of the spring 2021 semester, we conducted in-person lectures because of decreasing levels of COVID infection numbers. However, in the latter half of the spring semester, we went back to wholly remote lectures again because of increasing infection numbers, and we offered only on-line flipped lectures. We will compare these three types of lectures.

Figure 3 shows the average number of characters (Japanese words) of comments in each type of lecture. In the case of flipped lectures, students wrote more than twice as many characters as in-person lectures and on-line lectures, and we find this to be an improvement compared to regular classes. In terms of the contents of comments, we found that students asked more specific questions in flipped lectures than in-person lectures and on-line lectures.

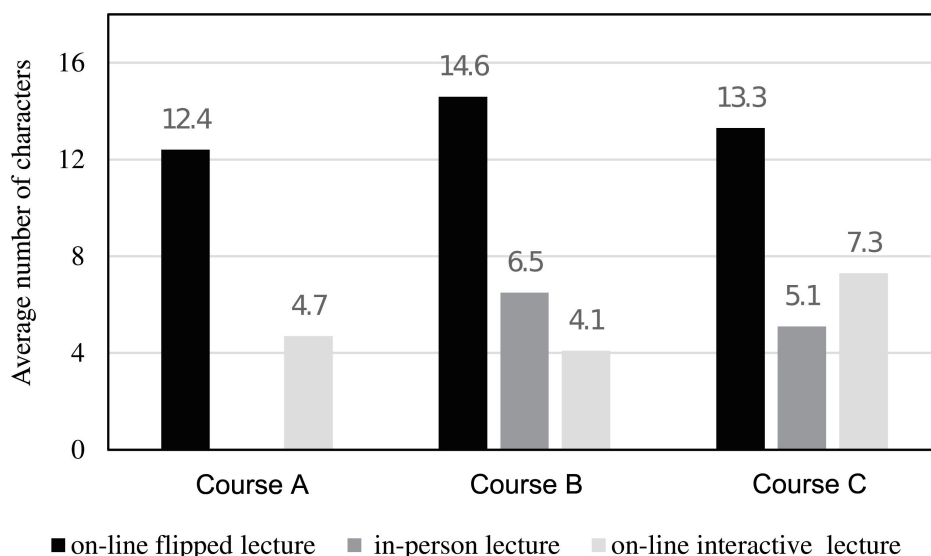


FIGURE 3. The average number of characters (words) of comments

Figure 4 shows the percentage of students who sent comments or questions in each type of lecture. In the case of the flipped lecture, it shows a much higher value than in-person lectures and on-line lectures, we found that an increasing number of students had higher motivation for participating in class. Furthermore, there were comments saying that it was easy to ask questions. Because of active use of the chat function, we could provide the students who were familiar with SNS with an environment in which it was easy to ask questions. We saw the effectiveness of the chat function on the flipped lectures.

5. The Results of Questionnaires about Remote Lectures. At the end of the spring semester, our university gave questionnaires about remote lectures to all students. Table 5 shows our school students' results of questionnaires about satisfaction with remote lectures. Among Tokai University's 20 schools, both the rate of our school's students who answered "sufficient" and "so-so" was the second highest. In addition, the percentages of both "not at all" and "not enough" were the lowest among them.

6. Conclusion. Due to the spread of COVID-19, our university had to conduct remote lectures in a hurry as was the case at other universities. Our school decided to only use Microsoft Teams for remote lectures and made videos about how to use it for students.

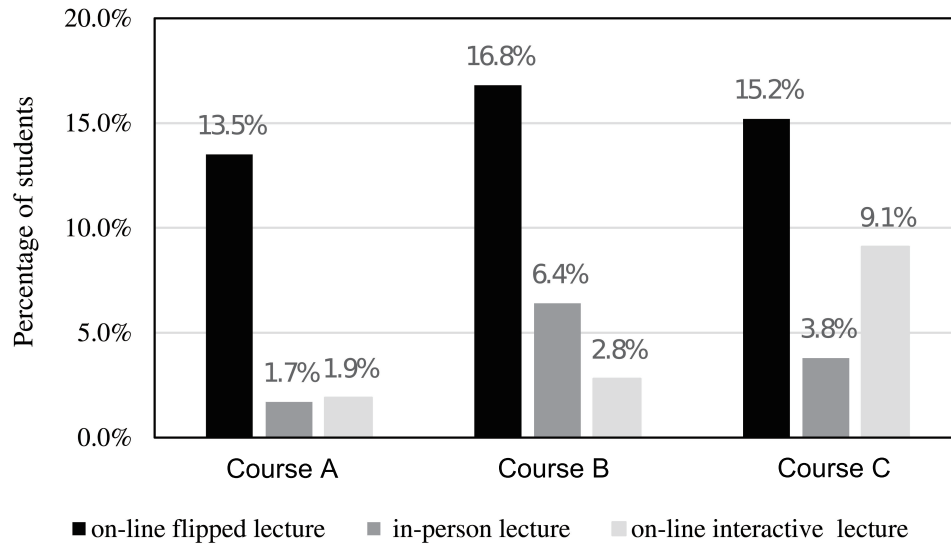


FIGURE 4. The percentage of students who sent comments or questions

TABLE 5. Our school students’ results of questionnaires about satisfaction with remote lectures

Sufficient	So-so	Undecided	Not enough	Not at all
8.1%	35.0%	31.6%	22.0%	3.3%

This enabled us to conduct remote lectures smoothly. Also, we conducted on-line flipped lectures which take advantage of characteristics of remote lectures in some courses on a trial basis. We found the possibility that they could improve the educational effect as compared to in-person lectures. Remote lectures were conducted due to the spread of COVID-19, and we found that remote lectures had a profound effect. This was an opportunity which reformed academic education. Tokai University decided to give remote lectures which were also suitable for use when things return to normal, we will continue to conduct research examining the educational effects of on-line flipped lectures.

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