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Types and Characteristics of Remote Classes at a University during the COVID-19 Pandemic

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ABSTRACT

Since 2020, novel coronavirus infection (COVID-19) has greatly affected Japanese university education. Many universities have temporarily canceled classes or closed schools. Currently, several methods exist for conducting face-to-face classes with a limited number of students to be physically present in classrooms, remote classes using electronic devices such as Personal Computers (PCs), or a combination of both. Consequently, educational activities are being maintained. Meanwhile, many university teachers, including us, have not introduced remote classes until now. This appears to be true not only in a university, where we work but also in classes at many universities in Japan. In this paper, we will summarize and demonstrate how remote classes affect teachers or students in their preparation and execution compared to conventional face-to-face classes. This is only applicable within the scope of the lessons conducted by us, and the software is limited to using Zoom, PowerPoint, and Moodle. Further, the terminal is predominantly limited to using a PC or an attached Web camera.

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INTRODUCTION

The new coronavirus disease (COVID-19), which has affected the whole world since the end of 2019, continues to have a major impact on university education in Japan[1)]. At the beginning of 2020, it was expected that only the urban areas around Tokyo and Osaka prefectures would be affected, but the impact could be observed in the local cities too. The graduation ceremony at the university where one of the authors is associated, which was to be held in March 2020, was canceled and held virtually instead. The classes from the beginning of April also had to be canceled[2)]. Remote teaching in our university began at the end of April because most of the teachers were able to switch to the online mode, and there were not that many infected people in the prefecture. Subsequently, depending on the situation of infections in the region, face-to-face classes were resumed. The educational activities were conducted either in face-to-face or remote modes based on the subject and to limit the number of students attending the class at a particular time.

Many teachers, including us, had no experience with remote classes until then. This seemed to be the case not only in our university but also in many universities in Japan. As a matter of course, before the pandemic, we delivered face-to-face lectures in the lecture room or provided experimental guidance in the training room. There are also some components of the course that cannot be conducted through remote correspondence. This paper summarizes how the preparation and implementation of remote classes affected the teachers and the students, in contrast to traditional face-to-face classes. Other universities may be implementing other methods, and even if they are similar, they may be using different online platforms and software having different usability[3)]. Since Kochi City, where our university is located, is a local city, there may be problems peculiar to it. In addition, this article contains the personal views of the authors that may be biased. It seems that there are cases where we are thinking of introducing new remote classes or are currently exploring choices, and we think that there is content that can provide information to such people.

Basic learning method and learning support system until 2019

For comparison, we will describe the learning method that we have been adopting previously based on our experience. The lecture rooms are usually equipped with a whiteboard, blackboard,

and a microphone. They also have screens, data projectors, and personal computers (PCs). This is the typical setup of a lecture room, and the teaching method involved the projection of the content or the data and charts using a PC and providing an explanation to the students, without writing on the board. Students use their textbooks and notebooks, receive notes or assignments on paper, and participate in the class discussion. At that time, during the lectures, only a portion of the textbook was quoted or read, and some figures and tables were projected on the screen for an explanation. The students tried to understand the content while listening to the teacher's explanations. They took notes in their notebooks, textbooks, and other materials that contained what was explained by the teacher and the key points. The general-purpose software used for presentation in the classes was Microsoft PowerPoint. In the past, no classes were held in which only a PC was used and where the teacher hardly wrote on the board. The lessons were developed mainly using textbooks without using PCs or projectors, and the students were able to take sufficient notes. However, at present, the students are not able to do this, and the content that they can note down is substantially less. Some researchers have linked this to poor memory[4]. On the contrary, some studies have also reported that the speed of taking notes by the students is very slow. Currently, the teachers are unable to make the students take down sufficient notes during the classes.

Although our university had previously introduced a learning support software called Moodle, we had not used it until the COVID-19 pandemic. With this software, the students can download and watch the pre-recorded lessons or lectures, and materials and resources about the subject can be distributed for the students to study on their own. It is a system wherein teachers can upload the resources in advance and allows the administration of survey questionnaires and maintenance of records of student attendance.

Face-to-face learning method after 2020

In this section, we will briefly describe the differences between the conventional face-to-face classes before and after the COVID-19 pandemic. The classes were conducted similarly in both periods and the teachers used PowerPoint presentations during the classes. However, the use of the lecture rooms changed significantly. With the pandemic, the Ministry of Health, Labor, and Welfare has called for avoiding rooms that are closed, dense, and sealed. Thus, it is necessary to

follow the rules for conducting classes. The students are supposed to fill in their health check sheets for COVID-19 symptoms before coming to the university. In the case of an unlikely event such as an increase in body temperature or presence of fever, the teacher and clerical staff are contacted by e-mail and the student may voluntarily skip school on that day. The university treats this as a special absence. This is treated in the same way as a public holiday in so-called job hunting and club activities. In the case of normal conditions, the students go to school. However, before the class starts, the students have to disinfect the chairs and desks that they are to use with a disinfectant solution. The students are also required to maintain a specific distance while sitting, as instructed, and wear masks while attending classes. Disinfected sheets and writing tools for whiteboards are provided to the teachers, as cases of infections have been reported due to the shared use of teaching resources. The teachers are also supposed to wear masks like the students. In addition, the teachers also wipe the common devices, such as microphones and PCs, with a disinfectant cloth before and after use. In the lecture room, the windows and doors are kept open to allow proper ventilation, and the lessons are delivered in a properly ventilated and air-conditioned room. Before beginning with the teaching, the teacher takes time to turn on the fan and to open the window or to encourage the students to open it. It has been found that while ensuring sufficient ventilation in the lecture room, the effect of air-conditioning is greatly diminished, and hence we can hardly expect to obtain comfort from it[5]. Since it seems that the content in this article is not direct, we omit the details.

Types of remote learning methods

A) Uploading a PowerPoint file with audio on the Moodle

Table 1 outlines the types and characteristics of remote classes. The ones that are currently being used can be categorized into five types (**A**–**E**). Currently, the most commonly used method is to upload a Powerpoint slideshow with audio on Moodle that is downloadable by the students for listening. As we were accustomed to teaching using Powerpoint, we believe that this method is the easiest to follow[6]. Initially, while preparing the presentations, we used to get nervous when our audio recording was interrupted due to telephone calls. We had to re-record every time in such instances and this took a lot of time and effort, and it seemed to be never-ending. Therefore, we tried not to think about such details. In the past, it took about one hour of deskwork for

modifying the previous materials only and about 1.5 hours to prepare the recording for a 1.5-hours class. However, it usually took approximately 2 hours to record audio after preparing the material that took approximately 1 hour. Additionally, there were instances that students could not go through the uploaded lessons properly, which increased their burden. Students from other universities have appeared in the news recently, asking for reductions in their tuition fees if only remote classes are conducted; we expect that the students from our university may likewise ask for the same[2]. From the teacher's perspective, preparation for remote classes is more burdensome than for face-to-face classes.

The students access Moodle, download the file, and go through it, which is also burdensome[3]. In our experience, it is approximately 1 MB/min, and one class is equivalent to a file of approximately 100 MB. The internet speed in the university is fast and the file can usually be downloaded in less than a minute. However, when the students download the file at home or while traveling, the download can take several hours due to poor internet speed. Additionally, the student is burdened with extra expenses for communication[6]. In the case of our university, although there are restrictions concerning attendance in face-to-face classes, the information practice room (PC room) can be used without any restrictions. If there is a lack of availability of proper internet connectivity or the student does not own a PC, he/she is allowed to go to the university to attend classes. The use of school-owned PCs and tablet terminals began this year and the facility was extended to economically deprived and international students[3),7)]. Finally, a PowerPoint presentation contains several slides. Therefore, in the Moodle available at our university portal, we can upload both the original file and divide the content into multiple smaller files (each of 20 MB size). This way, the students can download them easily. A motivated student is likely to listen to the files repeatedly for a thorough understanding, but a student lacking in motivation is likely to play it for a short period. This can lead to a big difference in learning outcomes.

B) Uploading a file on Moodle that has been recorded on Zoom

This is similar to **A**. The process of uploading the file containing audio and video to Moodle is the same. The only difference is that the recording was done using Zoom instead of MS Powerpoint. The size of the created file is also larger. It is easier to use the software that teachers

are accustomed to (i.e., using Powerpoint with voice addition feature). Since the division of the files is not possible (at least with our skills), the students need to download large files for them to listen to. Zoom is currently being used extensively in online conferences in various fields and it is possible to save the files on the cloud platform and refer to them whenever needed, even if it is not available on Moodle. Another feature of the Zoom platform is that the files can be easily viewed on devices other than PCs; hence, the meetings can be attended even on smartphones and tablets. Owing to the progress of the current communication technology, smartphones and tablets tend to have faster internet connectivity as compared to PCs and it is easy to download files on these devices. Depending on the size of the screen, the characters may be small and difficult to see, so we must consider whether to limit the types of terminals that students use in the future[7].

C) Uploading the files recorded on Zoom along with materials on Moodle

This method solves the problem about the size of files, which arose during the adoption of methods **A** and **B**. This allows for the download of small files only during remote teaching. The Zoom platform can be used to create a file with audio recording only. The creation of files having both audio and video is also possible. This is a method that uses only the former. Since the audio-only file size is approximately only 60% of the original audio with a video file, it is slightly easier to download. However, if the internet connectivity is very poor, the time required for downloading does not change significantly. Additionally, as in the case of methods **A** and **B**, the image and sound are not embedded in the files, so unless the student has some understanding of the content or listens to it carefully, it could be difficult to ascertain whether the images and the audio pertain to the same topic of discussion.

It can be said that it is easy for the teachers to prepare their lectures using this method. However, this method can also be associated with a higher risk of yielding lower levels of student understanding. Thus, there is a need to devise ways to make up for this shortcoming (for example, by creating materials that are easy to understand even if they are different from the conventional ones and that induce the students' interest). The degree of competence of the teachers is the challenge that is likely to be encountered[8].

D) Using Zoom in real-time

This method is applicable only during real-time classes and the lectures are not available on-demand to be listened to whenever needed. The teachers require the same kind of preparation as in the case of face-to-face classes, and the teachers can create a traditional class (face-to-face class) environment by imagining that the students are sitting in front of them. Other methods are also on-demand because the teachers can prepare for the lectures at night and carry out other activities, such as attending meetings during the day. However, this method can only be employed at the same time the class is going on like in the case of a conventional face-to-face class. The teachers are quite familiar with this method but are associated with challenges such as time constraints. The students do not have to download large files if they can secure a Zoom viewing environment. In case they are unable to secure such an environment, then they can use the internet connectivity provided within the university campus or some other high-speed public Wi-Fi. If there are supplementary teaching materials to be used, it is necessary to prepare them separately in advance—such as downloading and printing them. The major challenge associated with this method is that if the internet connectivity is unstable or gets disconnected, it is not possible to attend the lecture later. This method is also entirely dependent on the software. Since the number of people who can connect at one time may be limited, there is a risk that some students will not be able to connect, unless they check in advance and limit the number of attendees to within that range. Currently, we are using this method in combination with the recordings done on Zoom as described in **B**. The lessons are delivered in real-time, but if any student reports that the internet connectivity was lost, then the pre-recorded file is uploaded on Moodle for the student to view later. If the students need to connect immediately, such as for confirming attendance, they may have to exert extra effort to find a place with good internet connectivity or visit the university for that purpose. We do not know if this is the same at other universities but in our university, if it is a class of about 80, the students do not face any connectivity problems. However, if the number of people who attend the Zoom class exceeds 100, the connection may be cut off for some students.

E) Uploading teaching materials on Moodle

Many people seem to take such measures. If a sudden decision to start remote classes in the university is taken due to changes in the COVID-19 situation in the prefecture, the file of the material that was to be distributed may be uploaded to Moodle. This method is usually adopted if the Zoom link (URL) for the meeting is not available in time or there is not enough time to record a video. It seems that while using this method, a strong relationship of trust is required between the teachers and the students. The teacher may take it for granted that the students can read and understand the materials, but if the materials were used as auxiliary materials during face-to-face classes, it would be difficult for students to fully understand the content[8)]. If the students are familiar with the teacher's learning policy and know how to proceed, browsing the material and textbooks together may significantly increase their level of comprehension. Unfortunately, it is not possible to only consider such students, so the teachers must provide supplementary explanations on another occasion. Although we do not do this, some teachers supplement the materials used in regular face-to-face classes with many explanations. However, we are not sure to what extent students' comprehension can be improved.

Comparison of remote classes and face-to-face classes

We will compare the current and conventional face-to-face classes with the real-time viewing method using Zoom, which we consider the best among the remote learning methods. The outline of this is presented in Table 2. Comparing the conventional and current face-to-face classes, it was observed that the teachers take more time to prepare for the lessons as a whole, compared to the time spent on lessons to be delivered in the online mode. Therefore, we believe that the learning outcome is decreasing. Although it may be unavoidable, it may also be troublesome for the students to take time for sanitization and observation of health protocols before and after classes as part of COVID-19 preventive measures. Such actions reduce the class time available for learning and reduce the quantity and quality of the learning content. As compared to attending remote classes, it is easier to go through a file supported by audio. Unfortunately, it seems that it is difficult for the students to judge the information being provided concerning the points emphasized by the teacher during remote classes from his/her voice and inflection while explaining, unlike in the case of conventional face-to-face classes[8)]. This may be

because teachers may lack familiarity with the online tools used for the remote classes. In addition, it is believed that the students feel less tense if they watch the lectures at home, and in some cases, the degree of understanding is reduced when they do more than two different things at a time[9]. I feel that the students' exam grades tend to be lower in remote classes. However, it is essential to conduct remote classes during the COVID-19 pandemic. It is thus necessary for teachers to improve their teaching methods so that they can evaluate the proficiency level of the students and take relevant measures to improve their academic performance. Although it depends on the field of study that is being pursued, sometimes it is necessary to operate the equipment and be in contact with people, as experimental training is required in the learning content in the field. This cannot always be supplemented by remote correspondence. Not all the contents are the same for each subject, so it seems that the instructor's ingenuity will be important in the future, such as conducting some classes face-to-face and utilizing video footage of the procedure.

CONCLUSION

In this paper, we have summarized the differences in teaching methods being adopted at different universities facing the COVID-19 epidemic, based on our teaching experience at the universities in Kochi. Unfortunately, it was found that remote classes have some drawbacks as compared to face-to-face classes. The main drawback is that it is difficult to develop the lessons while observing the students' reactions. Further, after the class has been conducted, the student's proficiency needs to be ascertained and followed up on the points that they could not understand[10]. One way is to involve the senior students as teaching assistants who can help in reviewing the material prepared for a small group of students[11]. It is also necessary to consider the extent to which the experimental component of the curriculum can be communicated through the online mode. This paper is based on our idea that the teachers and students are not accustomed to remote learning yet, and that the way of thinking is likely to change as they become more accustomed to it. Because the communication environment has been improved by on-campus construction last summer, and the information provided in this paper is based on the situation that persisted until July 2021, the disadvantages are expected to decrease in the future. However, we believe that this article will be helpful for those who are currently exploring or planning to introduce remote classes in the future.

Since this conclusion has many sensitive parts, it may be necessary to support this with relevant data, such as grades, so that an objective evaluation may be made in the future. Another method that can be used involves recording or delivering the lectures in real-time, with the teacher conducting the class with the help of a digital camera and a whiteboard; although, we have never done this[8)]. Since it is believed that remote classes can be conducted in many ways, it may be a future task to identify the characteristic features of the methods that can be adopted, and some effective methods of teaching can be introduced[12)].

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Table 1. Types and characteristics of remote classes

Type	Real time with Zoom **(D)**	Record with Zoom and upload on Moodle (**B**)	Record with Zoom and upload along with materials such as PowerPoint (**C**)	Upload the file recorded in PowerPoint to Moodle (**A**)	Only materials such as PowerPoint are uploaded on Moodle (**E**)
Ease of teaching for teachers	Talking in front of a monitor takes time to get used to, but once you get used to it, you can do it just like in the case of face-to-face classes.	Until you get used to it, you cannot finish it easily because you are concerned about the surrounding sounds, but once you get used to it, you can do it in a form close to face-to-face teaching.	There is almost no difference from the case of recording with Zoom (**B**) on the teacher side.	There is not much difference from recording with Zoom (**B**). If you are very familiar with PowerPoint, this should be easier to do.	Similar to part of a face-to-face class.
Ease of preparati	Preparations are almost the	The part where you	It is almost the same as	There is no difference	Easier than preparing

on of teaching materials	same as in the case of face-to-face teaching.	cannot see your face is considered easy, but this kind of content is the newest and most important part, and it takes time and nerves.	recording with Zoom (**B**).	from recording with Zoom (**B**).	for face-to-face classes.
What teachers may see as a problem	It is hard to write small things on the board, and you need to cover everything in a file.	Since it is possible to retake the picture, it takes a lot of preparation time depending on how elaborate it is.	Same as recording with Zoom (**B**).	Same as recording with Zoom (**B**).	Students will find it difficult to understand unless the materials are created considering the progress of the lesson.
Ease in student participation	You can participate in the same way as in face-to-face classes. If you think you can participate	From the perspective of the university, it is easy to participate in learning, as	Same as recording with Zoom (**B**).	Similar to recording with Zoom (**B**). Zoom is considered easier to use	Participation itself is extremely easy. Even if the material is a file, it is usually not

	at home, it is better than face-to-face. It takes time and effort to obtain multiple files from Moodle.	much time is available, for watching the lectures during the day. However, the students have the freedom to listen to the lectures whenever they want, for example, listening while driving.		on mobile phones, etc., and you can access it through many types of devices.	very large and is easy to download.
Factors related to student comprehension	It can be said that audibility is ensured it is not dependent on the seating position in the classroom. However, there may be an environment in which it is more difficult	Highly motivated students can playback what they have recorded many times, which can increase their learning effectiveness	Since the audio and the material are separated and independent, if a situation occurs in which the consistency is not properly	Same as recording with Zoom (**B**).	It seems that few students can really understand as expected by the teachers. Efforts to measure proficiency (confirmation test, etc.)

	to ask questions, and the faculty must devise (such as being able to consult by e-mail).	.	obtained, the degree of understanding will be slightly lowered.		may be required separately.
Other problems for the students	In case of poor connectivity, the screen sometimes freezes or the video is interrupted. This can be attributed to both the sender and the receiver environment. If the connection environment to Moodle is weak, it becomes necessary to visit the university to get the printed materials.	The recording capacity is very large at 1MB / min. There is no problem with uploading at the university side, but the students are likely to face the burden of seeking better specifications for their PCs.	The size of the downloaded file is small as compared to the recording.	Same as recording with Zoom (**B**).	There is a risk that there will be a certain number of students who cannot understand the content at all. Since the follow-up is not possible face-to-face, it is necessary to consider whether to take special measures or select the method.

Relative evaluation	○ Among the remote learning methods, it is thought that the most conventional learning outcome can be obtained by the same method as before.	△ Both the preparation and method of delivery require an altogether new approach, and the learning effect is still unknown. However, depending on how the materials are developed and implemented, learning outcomes may be higher than with the materials alone.	△ Both the preparation and method of the lesson are new methods, and the learning effect is unknown. However, depending on how the materials are created and followed, the learning outcome may be higher than with the materials alone.	△ Both the preparation and method of the lesson are new methods, and the learning effect is unknown. However, depending on how the materials are created and followed, the learning outcome may be higher than with the materials alone.	× Preparation for the lessons is easy, but the learning effect is yet to be ascertained because it depends on the students.

The Zoom class shown here is a way to share the PowerPoint screen with the students and deliver the audio (not the scenery of the lecture room or the face of the teacher).

The symbols (**A**-**E**) in the table correspond to the remote learning methods in the text.

Table 2. Overview of the comparison between face-to-face and remote classes

Type	Traditional face-to-face classes	Current face-to-face classes	Remote classes (real-time with Zoom, **D**)
Time required for preparation	Standard (usually less than 1 hour)	Same as conventional	It takes more time as compared to face-to-face classes (more than 2 hours).
Efforts required from the teachers apart from time	Standard	Same as conventional	It is necessary to be careful not to need to write on the board.
Time is taken by the teachers	Standard (1.5 hours)	Shorter than the standard (preferably within 1 hour) Securing operation time such as an explanation of precautions and disinfection	It may be the same.
Efforts made by the teachers other than the time devoted to taking	Criteria (implementing grasp of attendance status by memo paper)	Almost the same as conventional classes Explanation with regard to ventilation (opening the windows, switching on the ventilation fan,	Keep in mind that the connectivity is dependent on the student's internet connection, which may become unstable and may cause interruptions (provided it is not too long).

classes		measures of prevention of COVID-19)	Sufficient time should be devoted to taking attendance.
Other contents that teachers suffer	Nothing in particular	Larger classrooms are needed to maintain distance between the students (in case of non-availability, multiple smaller rooms need to be prepared to share images and audio recordings)	Since electronic files are to be distributed to the students, there is a concern that students will be able to separate and divert the charts in them without permission and that secondary use will be a problem.
Time and preparation for students	Criteria (preparation for the class and review)	Almost the same as the standard sterilization work before and after class, health observation before going to school	Pre-printing of materials, preparation for class listening terminals, understanding of communication environment, maintaining connectivity (Wi-Fi)
Comprehensive evaluation	As a reference	○ The time taken is nearly the same and is acceptable.	○ or △? If you want to follow individual students properly, it will take more time than before, but efforts should be made to maintain the effectiveness of teaching. However, it is essential to understand the communication environment of each student, procure information with regard

			to availability of the electronic devices like PCs, tablets, etc., and in some cases lending PCs and providing help in meeting the purchase expenses.

Comprehensive evaluation is a method that is better as compared to the conventional face-to-face classes.

The symbols in the type section correspond to the remote learning methods in the text.