

# Tiny approaches to the interactive online lectures under the COVID-19 pandemic

Eiji Hiraki, Masataka Ishihara, and Kazuhiro Umetani  
Graduate school of natural science and technology,  
Okayama University,  
Okayama, Japan

Published in: IECON 2021 – 47th Annual Conference of the IEEE Industrial Electronics Society

© 2021 IEEE. Personal use of this material is permitted. Permission from IEEE must be obtained for all other uses, in any current or future media, including reprinting/republishing this material for advertising or promotional purposes, creating new collective works, for resale or redistribution to servers or lists, or reuse of any copyrighted component of this work in other works.

DOI: 10.1109/IECON48115.2021.9589676

# Tiny Approaches to the Interactive Online Lectures Under the COVID-19 Pandemic

Eiji Hiraki  
Graduate school of natural science and  
technology  
Okayama University  
Okayama, Japan  
hiraki@okayama-u.ac.jp

Masataka Ishihara  
Graduate school of natural science and  
technology  
Okayama University  
Okayama, Japan  
masataka.ishihara@okayama-u.ac.jp

Kazuhiro Umetani  
Graduate school of natural science and  
technology  
Okayama University  
Okayama, Japan  
umetani@okayama-u.ac.jp

**Abstract**—Due to COVID-19, Okayama University, one of the national universities in Japan, has been unable to enter the campus since March 2020. Therefore, all classes, meetings, and even graduation ceremonies were held online. Even now that large-scale vaccination is in progress, most of the lectures are still online except for some small-scale classes that can secure the social distance. This paper introduces small attempts to effectively conduct the interactive online lectures of undergraduate and graduate schools.

**Keywords**—covid-19, real-time online type lecture, on demand type lecture, interactive,

## I. INTRODUCTION (HEADING 1)

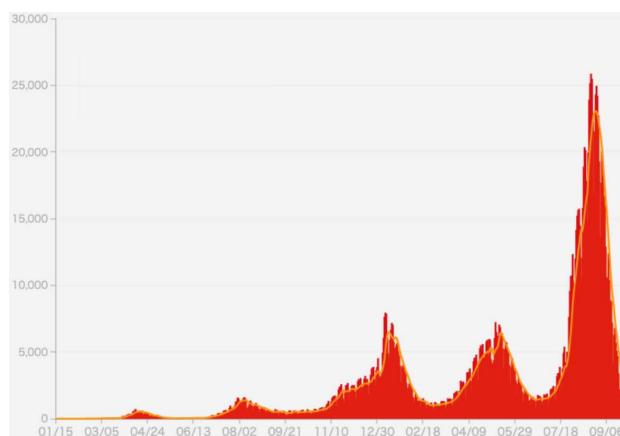
After an outbreak of pneumonia of unknown cause in Wuhan, China, in December 2019, the new coronavirus pandemic has spread rapidly around the world. In Japan, covid-19 was designated as a designated infectious disease by the government in February 2020, and then, public institutions, including universities, began to consider how to respond to the covid-19. In addition, the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) has requested the temporary closure of schools. Due partly to this, many universities canceled or reduced graduation ceremonies in March and postponed the start of lectures from April 2020 [1]. Since then, many educational institutions have started to improve their environment for online lectures, and the new semester has been created one after another from the university where the preparation for conducting online lectures has been completed.

Okayama University, one of the national universities in Japan, rapidly developed the Microsoft Teams environment in addition to Moodle, which had been in place before the pandemic, and began offering online lectures in mid-May. However, the implementation method of the online lectures was practically entrusted to each educator. Therefore, both educators and students were perplexed.

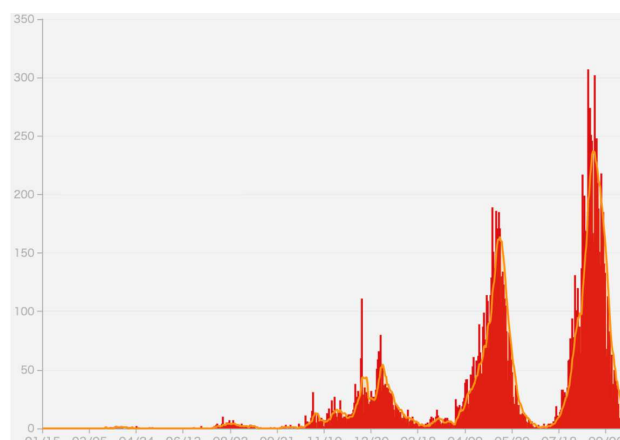
After September 2020, when the pandemic had temporarily subsided, face-to-face lectures were resumed in small-scale classes that the social distance could be secured (the capacity of lecture rooms was limited 50% of the normal level [2]). However, due to the re-emergence of the pandemic as shown in fig.1 and the state of emergency announced by the government to cope with, the expansion of face-to-face lectures has repeated ups and downs in lower levels. The vaccination program has started at the beginning of 2021, and Okayama University plans to have all students vaccinated for the second time by the end of October 2021 [3]. Needless to say, vaccination is not compulsory and is only for those who

wish it. However, it is unclear when the vaccination effects will become apparent. Therefore, for the time being, it is unavoidable that online lectures will be the mainstream of lectures in the with-pandemic environment.

As for online lectures, various methods have been tried [4]– [11], such as on-demand type (video or lecture notes) and real-time type. In contrast to the former, which tends to be a one-way lecture format from the educator to the students, the latter is recognized as effective to make lectures interactive. However, it may be difficult to practice effective interactive lectures in online lectures under a relatively weak communication environment, even in real-time type lectures.



(a) Japan



(b) Okayama

Fig.1. The number of covid-19 active cases from 15<sup>th</sup> Jan 2020. per day (red-bar) and its 7 days average (Orange-line)

The author conducted the both on-demand type and real-time type lectures on electrical and electronic fields for undergraduate and graduate students. In this paper, the situation of small trial and error to be the lectures effectively interactive in the 1<sup>st</sup> semester of 2020 and 2021 are reported.

## II. ON DEMAND TYPE LECTURES IN 1<sup>ST</sup> SEM. 2020

### A. Conducted Subjects

The author conducted two subjects in the 1st semester of 2020 under the pandemic situation. Due to the short preparation time and the fact that neither the educator (author) nor the students were familiar with the MS Teams environment provided by the university, both courses were conducted as on-demand type lectures using Moodle, which I have been using for several years.

The first was “Circuit Theory B” for 120 second-year students in the Department of Electrical and Communication Engineering [12]. Normally, one course consists of 16 lectures in 8 weeks, including exams. However, in 2020, the duration was shortened due to the pandemic, so the contents of the course were carefully re-selected. The main contents of “Circuit Theory B” are as follows;

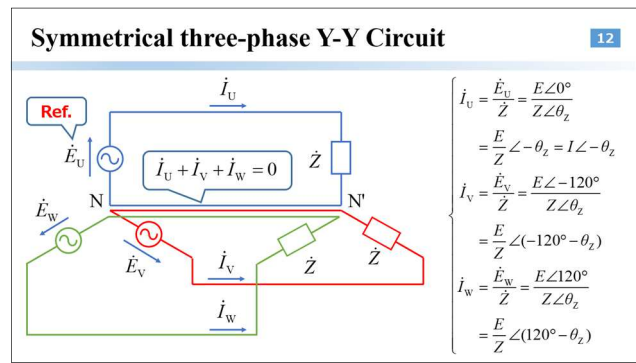
- ✓ Thevenin's theorem and superposition theorem etc. in AC circuits
- ✓ Four-terminal circuit
- ✓ Mutual induction circuit
- ✓ Three-phase circuit
- ✓ Non-sinusoidal AC.

For each lecture, 10-12 pages of slides based on the author’s lecture notes and a few exercises were uploaded to Moodle. Students uploaded their assignments to Moodle before the following lecture (3-4 days apart). This lecture was repeated 12 times. Questions related to the content of the lectures were dealt with on a one-to-one basis between the educator and the students using the Moodle communication system or email.

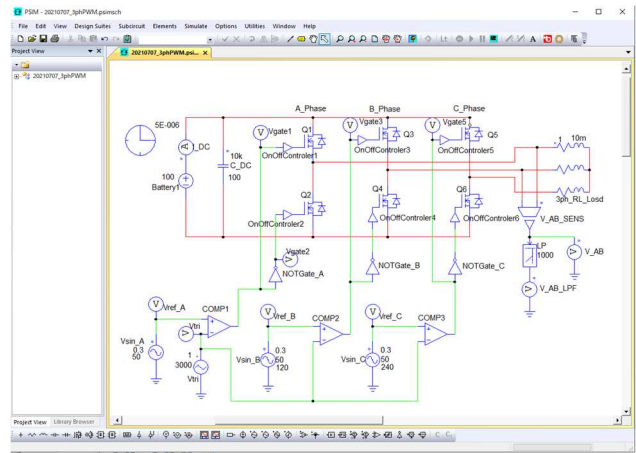
The other was “Switched Power Conversion Circuits” targeting first-year students of the Electrical and Electronic Engineering course at the Graduate School of Natural Sciences [13]. Among 45 course students, the number of participants is usually about 30. The main contents of “Switched Power Conversion Circuits” are as follows:

- ✓ Diode rectifier
- ✓ Non-isolated boost and buck chopper circuits
- ✓ Sinusoidal PWM inverter
- ✓ High frequency inverter
- ✓ Isolated DC-DC converter.

For each lecture, 5-10 pages of slides with PSIM basic circuit file as well as a few exercises were uploaded to Moodle. Students have solved exercises using the power electronics simulator PSIM “demo version” and upload their answers to Moodle before the following lecture. This lecture was repeated 12 times. The procedure for interacting with students regarding the contents of the lecture was similar to “Circuit Theory B”.



(a) Lecture slide example of the subject “Circuit Theory B.”



(b) Basic circuit file example of the subject “Switched Power Conversion Circuits”

Fig.2. Materials shared with students using Moodle.

### B. Appeared problems in on-demand type lectures

In the process of implementing on-demand lectures for the first time, the author felt several problems.

First, it is virtually impossible to objectively judge the level of achievement of students. Nowadays, students are familiar with social networking sites, but they are not in the habit of using e-mail. Therefore, even if they have questions about the lecture, there is almost no response except for a few students. To make matters worse, it is not possible to conduct objective examinations for assignments.

The second problem is that students tend to fall into the hell of report writing. Since educators have no way to objectively measure the level of achievement of their students, they tend to assign a large amount of work to their students. Moreover, this applies to all lectures in which each student participates. For students, it tends to be more important to prepare "answers to assignments for submission" than to understand the content of the lecture.

Another serious problem is that students tend to move ahead in their studies without understanding the relationship with the previous and following lectures. Although the instructor constructs the lectures systematically and give meaning to the order of learning, it is difficult to convey their intentions. As a result, students tend to lose their proficiency.

In particular, these problems were felt strongly in “Circuit Theory B” which was designed for second-year undergraduate students. We believe that the causes of this result are as

follows: one is the difference in the knowledge and experience that undergraduate and graduate students have built up, respectively, and the other is the difference in the frequency of communication among students. In particular, second-year undergraduates, who have little experience at the university, may not have sufficiently established a community among students. This situation could be a critical issue for second-year undergraduate students in 2021 who have not had face-to-face experience with their classmates because they have not been able to enter the campus for a long period immediately after entering university.

### III. APPROACH TO MAKE LECTURES INTERACTIVE IN 2021

#### A. Improved points

In order to solve the problems described in the preceding chapter, the lecture style of "Circuit theory B" for 2<sup>nd</sup> graders was modified in 2021. In particular, we tried to strengthen the following two points. (a) To activate communication not only between educators and students but also between students and students; (b) To raise awareness of systematization of relationships with lectures before and after lectures. As shown in fig. 3, the main improved points are as follows:

- ✓ Online real-time lecture with Teams in addition to the document-based communication by Moodle
- ✓ Self-assessment of submitted work and re-uploading of self-assessment results

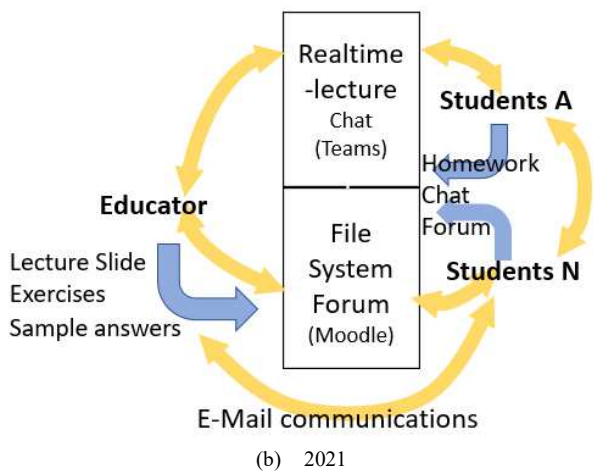
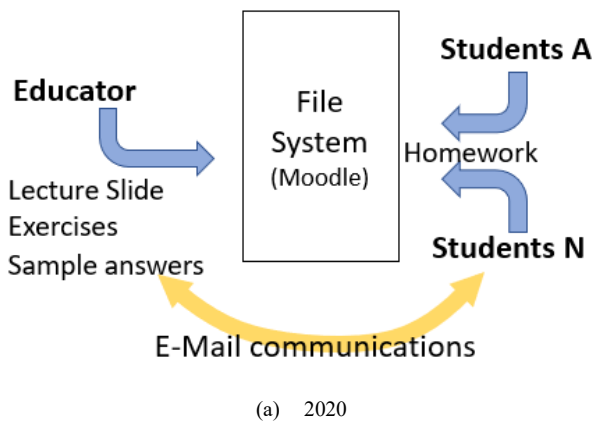


Fig.3. Lecture style and the communication passes.  
(Blue: file pass, Orange: communications pass)

- ✓ Development of SNS communication using Teams chat (mainly during lectures: Available for reading and writing by educator and all students)
- ✓ Development of open-forum with Moodle (mainly after-hours: Available for reading and writing by educator and all students)
- ✓ Addition of the auxiliary pages of summaries of the previous and current lectures to the lecture slides.

At first, the interactive effect by online real-time and chat by MS Teams environment was expected. However, the activation of the communication was not as much as expected. This may be because (a) students have to turn off the video function of the MS Teams because of the poor network environment, (b) many students were relatively shy, so they tend to hesitate to speak with a microphone. Then, the open forum of Moodle was newly opened. As a result, it seemed that open forum became a trigger of the communication activation not only between educator and students but also between students.

Based on the results, the author decided to open Moodle forum for the "Semiconductor Power Conversion Engineering." There seemed certainly a slight tendency of increased communication. On the other hand, the real-time online lecture by MS-Teams was not introduced in this lecture. This is because the author believes that graduate students should not rely on the lectures but should learn by themselves.

#### B. Effect of interactive lectures

The effectiveness of the interactive approach is discussed based on the results of the student survey and final grades of "Circuit Theory B" in 2020 and 2021. However, although the final term-examination was carried out, it had to administer by online. In order to keep fair condition, chatting, e-mailing, and other communication forms were prohibited during the examinations. Though, the actual situation was unmanageable despite the using video function as shown in fig.4. Therefore, the test scores were treated as one of the reference information. Consequently, it should be noted that the final grades were not wholly objective.

Figure 5 shows the results of the student survey obtained immediately after the final term examination. Compared to the results of 2020, not focused on interactivity, students' evaluations in 2021 were generally positive. In particular, the evaluation of the lecture materials and FAQ system were relatively high.



Fig.4. Online final examination of the subject "Circuit Theory B."

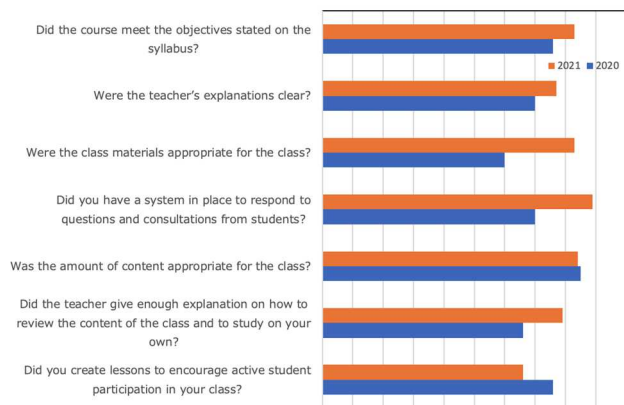


Fig.5. Results of the student surveys. (Blue:2020, Orange:2021)

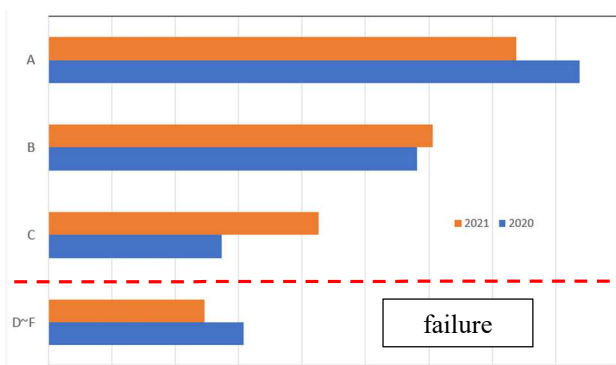


Fig.6. Final grades. (Blue:2020, Orange:2021)

The distribution of the final grades is shown in fig. 6. Unfortunately, no apparent interactive effect has been confirmed at this time. One of the reasons for this is that the method for calculating grades in online lectures has not been established. Unfortunately, the author does not have a method to fairly judge the students' proficiency level in a fully online situation. However, the practice and the accumulation of know-how of interactive online lectures may invite educators to an attractive environment after-pandemic because the location and time constraints for classes may be drastically reduced.

#### IV. SUMMARY

The Covid-19 pandemic tends to spread rapidly around the world. On the other hand, calming of the pandemic by the extension of the vaccination is expected. However, it isn't easy to be optimistic due to the emergence of New variant of coronavirus. This paper introduced a case study for approaching interactive online lectures under pandemic situations. Indeed, not enough educational effects have appeared at present. Though, this kind of effort will contribute to reducing the burden on educators after-pandemic.

#### REFERENCES

- [1] [https://www.mext.go.jp/en/mext\\_00006.html](https://www.mext.go.jp/en/mext_00006.html).
- [2] [https://www.mext.go.jp/a\\_menu/coronavirus/mext\\_00039.html](https://www.mext.go.jp/a_menu/coronavirus/mext_00039.html).
- [3] <https://www.okayama-u.ac.jp/user/hokekan/covidvaccination.html> (in japanese)
- [4] Yajuan LIU *et al.*, "The Emotional Tendency Analysis of Social Network Evaluation on Online Education during the COVID-19 Pandemic," *IEEE/WIC/ACM International Joint Conference on Web Intelligence and Intelligent Agent Technology*, 2020.
- [5] Triyo Supriyatno and Facrul Kurniawan, "E A New Pedagogy and Online Learning System on Pandemic COVID 19 Era at Islamic Higher Education," *6th International Conference on Education and Technology*, 2020.
- [6] Zhen Liu and F Ziyi Han, "Exploring Trends of Potential User Experience of Online Classroom on Virtual Platform for Higher Education during COVID-19 Epidemic: A Case in China," *IEEE International Conference on Teaching, Assessment, and Learning for Engineering*, 2020.
- [7] Liu Kexin *et al.*, "Future Education Trend Learned From the Covid-19 Pandemic: Take « Artificial Intelligence » Online Course As an Example," *International Conference on Artificial Intelligence and Education*, 2020.
- [8] Mireille Boutin and oanne Lax, "Engaging graduate students through online lecture creation," *IEEE Frontiers in Education Conference*, 2015
- [9] Siddharth Srivastava, Shalini Lamba, and T.V. Prabhakar, "Lecture Breakup- A Strategy for Designing Pedagogically Effective Lectures for Online Education Systems," *IEEE 20th International Conference on Advanced Learning Technologies*, 2020.
- [10] H. Zainol Abidin *et al.*, "Online video lecture series for digital logic fundamental courses blended learning," *IEEE 9th International Conference on Engineering Education*, 2017.
- [11] Maxime Pedrotti and Nicolae Nistor, "Online Lecture Videos in Higher Education: Acceptance and Motivation Effects on Students' System Use," *IEEE 14th International Conference on Advanced Learning Technologies*, 2014.
- [12] [https://kyomu.adm.okayama-u.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct\\_year=2021&lct\\_cd=2021092211&je\\_cd=2](https://kyomu.adm.okayama-u.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2021&lct_cd=2021092211&je_cd=2)
- [13] [https://kyomu.adm.okayama-u.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct\\_year=2021&lct\\_cd=2021432002&je\\_cd=2](https://kyomu.adm.okayama-u.ac.jp/Portal/Public/Syllabus/DetailMain.aspx?lct_year=2021&lct_cd=2021432002&je_cd=2).