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Has the Experience of Online Study under COVID-19 Improved Outcomes of Study in Universities?

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Abstract
This article examines the learning outcomes of after COVID-19 in universities. Now, almost all students experienced online learning instead of face-to-face during the pandemic period. The students surveyed after COVID-19 are now taking face-to-face classes after a year or two of online-based learning experience. This study compares their learning outcomes to those of students who previously only had face-to-face classes. Owing to the statistical analyses, some points are clear. Final results after COVID-19 clearly show that student outcomes dropped. Attendance and quiz scores also drop slightly and lead to reduced scores in the final results. It can be inferred that students have lost their attitude to take on challenges without giving up as a whole. Moreover, report scores dropped significantly. The rate of decline is larger than attendance and quiz scores. The reports in the surveyed classes do not rely on a shallow understanding or investigation, so the decreasing may be serious. Losing opportunities to attend and participate in classes reduce self-management ability and opportunities for communication. Online classes do not provide sufficient opportunities to be exposed to different ideas, objectively reexamine their own ideas, and create new ideas of their own. These skills may have suffered serious decline. Ultimately, it all comes down to encouraging students to be spontaneous. Even if the results are not so good, teaching too much should not be a hindrance to voluntary learning. One way to solve this seems to be a flipped classroom.

Keywords: COVID-19, Face-to-Face, Flipped Classroom, Online, Outcome

1. Introduction

COVID-19 has impacted education all over the world and higher education such as universities and colleges are not exceptions. In schools, including most higher education, students had to learn online instead of face-to-face. Nearly three years had passed from the onset of COVID-19, however, “normal classes” that are conducted with the same methods employed before COVID-19 have restarted. This study examines the learning outcomes of classes to determine whether they have improved or not compared to the pre-pandemic period.

Many studies focusing on online learning instead of face-to-face have been presented after the onset of COVID-19, and almost all of them indicate that learning outcomes have not changed significantly, while some show the

outcomes have improved. Surely, However, it would be doubtful in some cases that online learning would promote learning outcomes without any exceptions.

Surely, some studies indicate that there is no difference in the results when comparing online and face-to-face classes. Many schools and teachers have made sincere efforts not to degrade the quality of education, and there is little doubt that their efforts have yielded fruitful results. There are probably many cases in which learning among students and communication between students and teachers were not impaired through the skillful usage of ICT (Information, Communication, and Technology). It has also been pointed out that the one-sided class with a large number of students is no longer one-sided due to the usage of online functions. However, if the one-way class format was originally undesirable, it seems that a two-way class format should have been introduced at that stage. Certainly, when comparing face-to-face classes, which were one-way classes from teachers to students, and online classes that involve interaction between teachers and students, or between students, it is conceivable that the latter class will be more effective. In that sense, the role played by online classes may be significant. However, this issue has not been resolved because all the classes surveyed in this article have been conducted two-way.

Moreover, in the classes that this article references, flipped classes have been performed with the exception of cases from the era of COVID-19. What is a flipped classroom? In a traditional class, students learn the basic contents in class and then review or study further after class. However, it may not be possible to achieve independent and subjective learning. In the flipped classroom, on the other hand, students learn the basics in advance through videos and textbooks, and then learn more by problem-solving learning, discussion or debates in class with other students. In this classroom, teachers can be thought of as instructors instead of teachers and students can be thought of as learners instead of students (see, Kurihara, 2018, for example).

Flipped classroom is usually related to active learning. In classes where active learning is employed, paired work, group work, and cooperative student activities are utilized; however, the classroom includes activities such as brainstorming, cooperative learning, case-based instruction, role-playing, program/project-based learning, and peer teaching. Teaching others is sometimes an effective method to learn deeply. Davenport (2018) showed that flipped classrooms increase critical thinking skills. However, there are some pros and cons. For example, in flipped classrooms, mandated study is emphasized over spontaneous study so it seems risky to rely heavily on a flipped classroom.

Although the number of people who are infected with COVID-19 has not decreased significantly, the rate of severe cases have deceased, and many universities have resumed normal face-to-face classes. The classes this study references are resumed flipped classrooms that are the same as before the onset of COVID-19.

It can be possible to compare my classes before COVID-19 with the classes after COVID-19 because both of the classes were (are) conducted as flipped classes. This study examines whether learning outcomes have improved or not after COVID-19 disaster.

This study is structured as follows. Section 2 reviews related studies. Section 3 indicates empirical methods to verify whether learning outcomes have empirically improved or not. Section 4 shows the empirical results and analysis. Finally, a summary is presented.

2. Previous research related to online learning

The coronavirus has forced universities to conduct classes online. However, regardless of their first experiences, each university seems to have succeeded in conducting classes smoothly. It seems that the efforts of each university, teachers, and stuff should be evaluated highly.

Rather, students tended to welcome online learning rather than face-to-face. Of course, there is also the merit of not having to physically go to their universities, but one of the reasons was that there was not so much difference between face-to-face and online. Boca (2021) provided that students think online education is beneficial. Iqbal et

al. (2022) suggested that most students would not like online, however, most students had welcomed online because they didn't need to physically go to universities.

Some students seemed to have doubts about the evaluations. Hasan (2022) showed that students had doubts about measurement, evaluation, and teacher assessment in the pandemic era. On the other hand, we cannot deny the possibility that the grade evaluation has become lenient.

Online learning should be considered to have achieved certain results, but there are also disadvantages. Assunção et al. (2022) indicated that individual self-regulation and socio-emotional competences are essential for online learning. Budur, et al. (2021) stated that there is a lack of study for promoting online class.

In conclusion, we need a new education strategy that incorporates the advantages of both online and face-to-face education. Stoian et al. (2022) indicated an adjustment between face-to-face and online to result in a sustainable education. However, after the Covid-19 pandemic, there are sufficient research results to compare pre-corona and post-corona, what kind of skills students have gained, and what kind of skills they have lost. This study focuses on these points.

3. Empirical methods

Taking into account the above section, one of my classes is performed as follows according to the following syllabus:

Subject: Monetary and Financial Economics (2 units)
Theme: Monetary and Financial Economics: Theory and Reality
General explanation: Finance has become an integral part of our lives. The need to utilize accurate financial knowledge is increasing. In this class, we will cover the role of finance, financial markets, financial institutions, financial products, and monetary policy. It should also be useful for understanding recent trends in the Japanese economy and the world economy. Some will work for financial institutions.
Goal: Understanding basic theories of monetary and financial economics and the real conditions of financial markets

Method of class: Blended class that uses a flipped classroom and lectures. Lectures include peer review, group work, practice by doing group discussion and demonstration, and teaching others. Class will become the place to solve problems, advance concepts, and engage in collaborative learning. Of course, you have to ask and answer many questions in this class every time. Traditional lectures are provided using Socratic discussion.

Content and schedule:
1. Currencies, Interest Rates, Crypto Assets
2. Financial Markets
3. Financial Institutions (1) Central Banks, Banks
4. Financial Institutions (2) Banks and Credit Creation Functions, Prudence Policy
5. Financial Institutions (3) Securities companies, insurance companies, other financial institutions
6. Financial Instruments (1) Financial Instruments Included in Indirect Financing (Bank Deposits, etc.)
7. Financial Instruments (2) Financial Instruments Included in Direct Financing (Bonds, Stocks, Investment Trusts, etc.)
8. Financial Instruments (3) Bonds
9. Financial Instruments (4) Stocks, Derivatives
10. Quiz, quiz commentary, review so far, topics related to the financial industry
11. Monetary Policy and Fiscal Policy (1) Monetary Policy and Fiscal Policy Measures
12. Monetary Policy and Fiscal Policy (2) Explanation of IS/LM Analysis and Report Issues
13. Monetary Policy and Fiscal Policy (3) Effects of Monetary Policy and Fiscal Policy Using IS/LM Analysis
14. Exchange rate (online; conducted on demand)
15. Test and commentary, report assignment commentary, reflection of the whole class

Pre-study and after study: Pre-study is to watch the video and read textbooks. After study is to study materials presented during the class.
Evaluation: Examination: 65%; Quiz: 15%; Report: 10%; Class activity: 10%.
To students: If you are not good at communication skills with each other, don't mind it too much. Such skills are not linked directly with evaluation. Class activity (10%) is not equal to the number of attendance. It is evaluated by the Rubric. The standards of evaluation are explained in the class.

The sample data of before COVID-19 and after COVID-19 are used for estimations. The numbers of the samples are 112 and 78 respectively. Four universities in Japan provided data that was used for estimations.

The equation is following.

$$\text{Final result} = \alpha + \beta\text{Attendance} + \gamma\text{Quiz} + \varepsilon$$

Final result is scored from 0 to 100. Attendance and Quiz are scored from 0 to 15 respectively. Ordinary Least Squares (OLS) is used for estimations and also Robust estimation is employed. In this method, M-estimation is used. M-estimation is a robust estimation method utilized in the field of econometrics/statistics. There is an error between the sample data and the estimated value. The ordinary least squares (OLS) treat all errors with the same weight, so a large exception data will have a large impact on the estimations. On the other hand, in M-estimation, the errors are calculated to result in a small impact.

4. Empirical results

Before conducting regression analyses, descriptive statistics are shown in Table 1 and Table 2. Table 1 is the case of before COVID-19 and Table 2 is the case of after.

Table 1: Descriptive Statistics for the case of before COVID-19

	Final result (0-100)	Present (0-15)	Report (0-10)	Small test (0-15)	Exam at the end of the semester (0-65)
Mean	80.75	13.93	8.81	9.12	53.75
Median	83.00	15.00	9.00	10.00	57.50
Maximum	100.00	15.00	14.00	15.00	64.00
Minimum	7.00	12.00	7.00	4.00	25.00
Std.Dev.	17.87	1.43	1.32	3.50	14.92
Skewness	-0.67	-0.58	0.53	-0.16	-0.69
Kurtosis	2.41	1.40	1.55	1.49	2.40
Jarque-Bera	1.45	2.61	2.14	1.59	1.50
Probability	0.48	0.27	0.34	0.45	0.47

Table 2: Descriptive Statistics of after COVID-19

	Final result (0-100)	Present (0-15)	Report (0-10)	Small test (0-15)	Exam at the end of the semester (0-65)
Mean	77.31	13.30	7.25	8.35	48.76
Median	75.00	14.50	7.00	9.00	48.00
Maximum	100.00	15.00	10.00	15.00	65.00
Minimum	38.00	7.00	2.00	2.00	20.00
Std.Dev.	14.18	2.20	-0.12	2.02	2.02
Skewness	-0.02	-0.21	-0.12	-0.19	-0.19
Kurtosis	2.32	2.64	2.80	2.29	2.29
Jarque-Bera	1.55	1.00	14.08	2.13	2.13
Probability	0.46	0.61	0.00	0.34	0.34

A precise comparison between before COVID-19 and after is difficult or impossible because the content of the course and the questions on the exam are slightly different. However, some points are clear. One is that final result score decreases after COVID-19. Attendance and quiz scores also dropped. The content of the quiz is for comprehension checks of class material, and includes questions that do not require deep thinking so much as they are conducted for ensuring understanding and promoting face-to-face class activities. Therefore, it can be inferred that students have lost their tenacity and will to take on challenges without giving up.

The most shocking and serious thing is the drop in report scores. They exhibited a significant decrease. The report is targeting content that cannot be passed by memorization or shallow understanding of the subject material, so the decrease may be serious.

Table 3 and Table 4 are regression results listed in the previous section. Final result is regressed by attendance and quiz.

Table 3: Regression analysis of before COVID-19

Method	LS	Robust squared estimation	LS	Robust squared estimation
C	-19.993 (-0.488)	-28.714 (-0.601	-29.198 (-1.011)	-29.322 (-0.845)
Present	6.997** (2.24)	7.628** (2.095)	6.378*** (2.807)	6.430*** (2.555)
Small test	-	-	1.751** (2.195)	1.800* (1.878)
Adj.2/adj.Rw2	0.260	0.445	0.590	0.704
F-statistic/Rn-squared statistic	3.462	5.826	8.214	17.285
Pob(F-statistic/ Rn-squared statistic)	0.064	0.054	0.003	0.0006
D.W.	1.220	-	1.467	-

Note. Parentheses are t-value (LS) and z-value (robust squared estimation). ***, **, * denotes significant at 1%, 5%, 10% respectively.

Table 4: Regression analysis of after COVID-19

Method	LS	Robust squared estimation	LS	Robust squared estimation
C	48.041***	46.761***	30.081***	23.377**
	(5.200)	(4.867)	(2.930)	(2.354)
Present	2.201***	2.333***	1.823***	2.056***
	(3.211)	(3.274)	(2.754)	(3.240)
Small test	-	-	2.754***	3.309***
			(3.298)	(4.097)
Adj.2/adj.Rw2	0.105	0.151	0.206	0.365
F-statistic/Rn-squared statistic	10.312	10.717	11.248	32.932
Pob(F-statistic/ Rn-squared statistic)	0.002	0.001	0.000	0.000
D.W.	2.134	-	2.198	-

Note. Parentheses are t-value (LS) and z-value (robust squared estimation). ***, **, * denotes significant at 1%, 5%, 10% respectively.

Why are students failing to achieve high outcomes? What can be understood from the estimation results is that class attendance and high scores on quizzes had a strong impact on obtaining higher outcomes prior to COVID-19. Reduced opportunities to attend and participate in classes reduce self-management ability and opportunities for communication, and also reduce opportunities to come into contact with different ideas, objectively reexamine their own ideas, and create new ideas. Khaldoun et al. (2021) indicated that self-regulation is important to study. Also, kavakoğlu et al. (2022) stated that communication between instructor and student and between student and student has been a problem in the case of online lessons.

So how should we go about solving this? Teachers may be able to change the content of classes to something that students are interested in, or increase opportunities for group work. However, this does not necessarily lead to better learning outcomes. Ultimately, it all comes down to encouraging students to be spontaneous. Even if the results are not good, teaching too much should not be a hindrance to voluntary learning. One way to do this seems to be a flipped classroom.

Flipped class is sometimes treated as ‘active learning’. The phrase ‘active learning’ has attracted a lot of attention, and its introduction is sometimes regarded as an ideal teaching method. Educators are surely struggling to enable learners to promote the effectiveness and incentives to study and break away from knowledge-based learning. However, there seems to be a lot of cases where lecture-based classes produce active learning more than classes in which educators say ‘my classes introduce active learning.’

Garrison & Kanuka (2004) proposed a blended class that performs work under face-to-face and educational contents from teachers online. Van Wyk (2018) stated that a flipped classroom with online is an effective way to improve performance of students.

Using videos online and related ICT resources/instruments effectively before attending face-to-face class promotes deep learning face-to-face and enables students to use the concepts and theories for case studies and to solve problems in mind or in reality.

The author's classes have adopted the flipped classroom both before and after coronavirus. However, the learning outcomes of the lessons fell. This may be a lesson design issue rather than a flipped classroom issue. I think it is necessary to correctly understand the special mention of students who have studied in a special and harsh environment due to the corona crisis, and to design classes with that in mind. Also, in addition to the equipment used in online classes, knowledge obtained from them should be made use of in the future.

5. Conclusions

This study analyzed the learning outcomes of after COVID-19 in universities compared with before COVID-19. Almost all of the after the COVID-19 students surveyed in this study had experienced online learnings instead of face-to-face during the pandemic period. The students are taking face-to-face classes now after a year or two of online learning experience. This study compared their learning outcomes to those of students who had only face-to-face classes. From the results of statistical analyses, some points were cleared. Final results of after COVID-19 showed that students had a drop in scores. Attendance in classes and quiz scores also dropped and lead to a drop in of final results scores. It can be considered that students have decreased their learning attitude to continue challenges without giving up. Moreover, report scores dropped significantly. The rate of decrease is much larger than attendance and quiz scores. The reports from these surveyed classes do not rely on a shallow understanding of the material or insufficient investigation, instead it it requires thorough analyses and thinking deeply, so the reduction of scores shows a serious decline in students' grasp of the fundamentals. Losing opportunities to attend and participate in classes may reduce self-management skills and opportunities for communication. Online lessons surely have contributed to maintaining the quality of learning in some parts, however, there exists a possibility that it does not provide opportunities sufficiently to know different ideas, objectively reexamine their own ideas, and the ability to create new ideas of their own may have declined. Ultimately, it all comes down to encouraging students to be spontaneous. Even if the results are not ideal, teaching too much should not be a hindrance to voluntary learning. One of the key ways to solve this seems to be a flipped classroom.

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