

# Comparisons of three types of flipped classrooms under COVID-19: The case of Economics

Yutaka Kurihara

Department of Economics, Aichi University

Aichi, Japan

kurihara@vega.aichi-u.ac.jp

**Abstract**— Recently, flipped classroom has been acknowledged as it might promote learning effectiveness and increase learning outcomes in universities and colleges education as well as in elementary, secondary education, and business persons' education. As COVID-19 prevails, many universities and colleges have been obliged to conduct classes online. In the author's classes on economics, 1) a blended class which consists of a flipped classroom and lecture (face to face), 2) a blended class which consists of a flipped classroom and lecture (online; on demand), and 3) a blended class which consists of a flipped classroom and lecture (face to face and online), and 4) which consists of a flipped classroom and lecture (online; live) have been conducted. In these (1), (2), and (3) classes, outcome data, studying process data, and questionnaire data were collected to analyze learners' studies. The results show that that most of the collected data does not differ much from face-to-face class, and quiz type test scores conducted in online learning are high, however, the quality of reports (writing) has declined significantly. There is some possibility that acquisition of surface knowledge improved by introducing online learning, but in-depth learning stemmed from thinking or discussing with other learners and faculty are not realized sufficiently. In such a situation, flipped classrooms can be a starting point for solving problems that cannot be solved online.

**Keywords**—COVID-19; economics; flipped classroom

## I. INTRODUCTION

Flipped classrooms have been introduced and spread gradually. Under COVID-19, flipped classrooms have received much attention. It is a reversed way of traditional teaching which learners use materials outside of classes, such as at home, usually in the form of videos or books, then perform their additional work such as problem-solving, discussion, or debates, in the classrooms (see, for example, [1]). [2] indicated that the most positive impacts of learning are interaction in class discussions, group problems, and other types of active learning. Teaching each other can be an effective way to improve the quality of learning in such activities.

In the author's classes on economics (international economics and international financial markets), 1) a blended class which consists of a flipped classroom and lecture (face to face), 2) a blended class which consists of a flipped classroom and lecture (online; on demand), and 3) a blended class which consists of a flipped classroom and lecture (face to face and online), and 4) which consists of a flipped classroom and lecture (online; live) have been conducted. In these (1), (2), and (3) classes, questionnaires, studying data, and outcome data were collected to evaluate learners' studies.

This study examines the results and analyzed them. Analyzing not only the flipped classroom, but also other types of classrooms, is necessary. COVID-19 has imposed various strict restrictions on education activities. However, under the prevalence of COVID-19, it is the university's duty to provide at least the same quality of lessons as regular face-to-face lessons, even in situations where only online lessons are possible. A flipped classroom is one of the effective ways to accomplish high quality education, however, it is not the exception.

This study is structured as follows. Section 2, existing studies are reviewed. There has been a lot of examples reported on flipped classrooms. Section 3 reports my classes of international economics and international financial markets. Following these sections, statistical analyzes based on students' evaluations are conducted. Finally, a brief summary is presented.

## II. EXISTING STUDIES

The most important elements to facilitate flipped classroom were IT or recently DX improvements and Learning Management System (LMS) have enabled schools to produce high quality online contents, so classroom time can be intensively used to engage in further learning based on basic knowledge and group work. The use of IT could have provided lectures to be recorded easily and made them available to all learners outside of the classroom [3]. Massive Open Online Courses (MOOCs) started and have been prevailing globally. Some obstacles of time, place, distance, which have prevented from spread, have been decreasing in education.

Recently, new technologies have been invented to improve the quality of online learning and it has helped to promote the flipped classrooms more

effectively and fruitfully. Many studies show that learners in the flipped virtual classroom could, for example, engage in the course material or assigned topic to teach it to the class or collaborate in a small group in the Breakout Room. Such function is inevitable for group working assignments if the class was conducted without face-to-face lessons. As such, new technology improvements will occur and stuff should follow the trend if the introducing will improve the quality of the classes.

Since then, flipped classrooms have obtained a positive reputation and they have been spreading gradually. In 2020, COVID-19 occurred and many schools, including universities, had no choice but to introduce online learning. Flipped classrooms have again started to get attention.

Flipped classrooms have recently been discussed and a lot of studies have been presented. [4] showed that the flipped classroom improved outcome by 0.2 to 0.7 standardized deviations. [5] showed that introducing a flipped classroom increased scores on the medium-term, high-stakes assessment by 0.16 standard deviation, with similar long-term effects for high-performing students.

According to [6], active learning is an umbrella for pedagogies that emphasize learners' activity and student engagement in the learning process. [7] indicated that lecturers must change from memorization of facts and knowledge, known as surface learning, to deep learning in which understanding is emphasized and promoted from active and constructive processes. [8] found that a flipped class with team-based learning activities promoted outcomes. [9] showed that 92.3% of learners evaluated that problem-solving in flipped classroom is effective.

[10] showed that learners are able to study at their own pace using videos. Also, on demand classes can enable students to study repeatedly. Under COVID-19, many universities have introduced online lessons. Also, under COVID-19, some learners feel better when they do not need to ride crowded trains or buses to go to universities and colleges.

[11] Goodwin and Miller (2013) indicated that most educators find it useful for special needs and advanced levels. [12] revealed that learning promotes self-learners. [13] indicated that underlying some factors of self-determination theory, the sense of competence, relatedness, and extrinsic motivation, increase the performance of learners in flipped learning.

On the other hand, cons have also been presented for flipped classrooms. [14] showed that there were no significant differences of learners' satisfaction between the online and face-to-face class. [15] found also there was no evidence that learners increased their learning time by introducing a flipped classroom. [16] showed that learners who participate in flipped classrooms were less satisfied than traditional classroom as they felt uncomfortable with team-based active learning that cultivates autonomy, which has a positive relationship with learners' perceptions of

outcomes and traditional pedagogy. [17] showed that the flipped classroom may promote productivity of learning and result in lower attendance for similar grades. [18] indicated that flipped learning needs pedagogical elements more than face-to-face learning, for example, integrated institutional design and adaptive content delivery, to achieve effective instructions. [19] indicated that the flipped classroom approach has been realized beyond the already existing implementations, mostly performed by enthusiastic teaching staff.

As these studies show, the flipped classroom has been highly reputed, however, pros and cons still exist in many cases. Moreover, flipped classroom with online learning have not been analyzed so much. It can be said that there has been little study for such analyses. This study focuses on this issue.

### III. PREPARE YOUR PAPER BEFORE STYLING

Among all of the classes which the author takes, one example is presented (Example 1). This is 'International Financial Markets'. It consists of two units. The class is held 15 times in one semester. This class was held in 2019 and all of the classes were face-to-face.

Example 1 (face-to-face)

Subject: International Financial Markets

Theme: International Financial Markets: Theory and Reality

General explanation: International finance includes exchange rates, international balances of payment, monetary and fiscal policies under the global economy, and so on. This class focuses on markets in the field of international finance. Theories of international financial markets are the main topic of this class; however, realistic aspects related to these theories are also examined. In every class, real phenomena are checked and discussed.

Goal: Understanding basic theories of international financial and the real conditions of international 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 of 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.

Content and schedule:

1. Introduction, guidance
2. Foreign exchange markets: Nominal exchange rate, real exchange rate, foreign exchange markets all over the world, trade volume, globalization of the yen
3. Financial markets: Japanese financial markets, international financial markets, capital flows, commodity markets, theory of intertemporal money allocation

4. Financial institutions 1: Japanese financial institutions, US financial institutions, central bonds and stocks, credit creation  
 5. Financial institutions 2: Bonds and stocks, price and yield, portfolio theory  
 6. Exchange rate determination 1: Purchasing power parity theorem, monetary approach  
 7. Exchange rate determination 2: Uncovered interest parity, covered interest parity, portfolio approach, quiz  
 8. Monetary system and intervention: History, monetary systems around the world, intervention  
 9. Financial crisis: Theory of financial crisis, Asian financial crisis, Lehman shock, role of the IMF  
 10. International balance of payments 1: What is international balance of payments, elasticity approach, J-curve effect  
 11. International balance of payments 2: Absorption approach, saving-investment approach, quiz  
 12. Open macroeconomics 1: Financial and fiscal policy, financial and fiscal policy under open macro economy  
 13. Open macroeconomics 2: IS-LM analysis  
 14. Financial derivatives 1: forward/future, option  
 15. Financial derivatives 2: swap, quiz.

Pre-study and after study: Pre-study is to listen to the video and read text books. After study is to study materials presented during the class.  
 Evaluation: final examination: 65%; Quiz: 15%; Report: 10%; class activity: 10%.  
 Message: (1) If you are not competent in communication skills, never mind. Such skill is not related directly to evaluation. (2) There is some possibility for using a clicker (or your smart device); however, your private information is not necessary to enroll. The sample size is 182.

The second example (Example 2) is 'International Economics'. This class was held online in 2020. Only the evaluation is listed. The sample size is 51.

Example 2 (online)

Evaluation: examinations (4 times): 60%; Quiz: 10%; Report: 20%; class activity: 10%.

The last one (Example 3) is 'International Economics'. This class was held at first face-to-face, however, it changed to online because the situation of COVID-19 became serious. Only the evaluation is listed.

Example 3 (face-to-face and online)

Evaluation: final examination: 48%; examinations (two times): 20%; Quiz: 10%; Report: 12%; class activity: 10%. The sample size is 17.

In all of the examples, 'class activity' is evaluated by Rubric. A flipped classroom is introduced into all of the classes as example 1, example 2, and example 3. My classes include a flipped classroom, active learning, and lecture. Learning includes some important step processes, including transfer of information, making sense of that information by connecting it to learners' own experiences and organizing the information in the

mind, and inspiring continuous (lifelong) learning. Via active leaning and lecture, learners are able to improve problem-solving and skill development and may gain more understanding of the subjects [7].

#### IV. OUTCOMES OF THE LERNERS USING THE TEMPLATE

In all of the classes, flipped classroom have been employed. This section lists the outcomes of learners and analyzes them.

Table 1a is the mean of each class type (face-to-face, online, and face-to-face and online). Table 1b lists the statistical descriptions.

Table 1a Mean of each class type

	Final result (0-100)	Present (0-15)	Times of seeing the video (0-)	Report (0-10)	Small test (0-15)	Exams of the end of the semester (0-65)
Face-to-face	80.7512	13.9302	38.1828	8.8166	11.1254	54.4050
Online	76.1404	14.7544	105.5439	3.7543	13.7421	53.7532
Face-to-face and online	83.9204	13.6529	103.8235	5.9117	12.1764	54.1176

Table 1b Statistical descriptions (face-to-face and online case)

	Final result (0-100)	Present (0-15)	Times of seeing the video (0-)	Report (0-10)	Small test (0-15)	Exams of the end of the semester (0-65)
Mean	83.9219	13.3529	103.8235	5.1911	12.1764	54.1176
Median	91.70000	15.0000	88.0000	5.0000	14.0000	60.0000
Maximum	96.9000	15.0000	219.0000	10.0000	15.0000	65.0000
Minimum	0.0000	0.0000	20.0000	0.0000	0.0000	0.0000
Std. Dev	22.7141	3.7071	52.3942	2.5139	3.6440	17.0692
Skewness	-3.1940	2.9964	0.5049	-0.2517	-2.2866	-2.0696
Kurtosis	12.41109	11.2512	2.5233	3.1501	8.4208	6.9375
Jarque-Bera	0.1956	73.6650	0.8833	0.1956	35.6291	23.1191
Probability	0.9068	0.0000	0.6429	0.9068	0.0000	0.0000

The results seem to be clear. Face-to-face is sometimes important to improve the achievements of the learners. It should be noted that the score of reports declines largely on the case of employing online. Writing ability seems not to be increased recently. However, the reason may be that face-to-face peer review was not performed in online class, so the scores may be low. On the other hand, the scores of small tests are high. The tests were conducted by multiple-choice. There is some fear that surface learning instead of deep learning has been promoted. Student familiarity in online learning may fill the shortcomings of online learning, but there is currently a gap between online and face-to-face learning. However, if the flipped classroom was not introduced, the problem would be much more serious. Group work is a typical example. On the other hand, online leaning has some merits surely. It seems that questions increased on average, and learners who seemed to be not good at group work actively participated. There would be some possibility that learners who are not good at face-to-face class may have asked questions while learners who are good at face-to-face class may not have asked questions. There are of course pros and cons in online learning, however, it seems natural

that flipped classroom would be beneficial and sometimes inevitable in the case of online classroom. Regression analyses are performed for the final scores (independent variables in the equations). Dependent variable are present, times (seeing the video), and small tests. Ordinary Least Squares and Robust Least Squares are empirical methods employed in this study. Robust estimation is unlike maximum likelihood estimation and is often used for the case of the shortages of the samples. OLS estimates for regression are sensitive to observations that do not follow the pattern of other observations. This is not a problem if the outlier is an extreme observation from the tail of a normal distribution. On the other hand, if the outlier is from non-normal measurement error or some other violation of ordinary OLS, it is able to compromise the validity of the regression results. The results of the regressions are in Table 2.

Table 2. Regression analyses for final score

Method	Face-to-face and online		Face-to-face	
	Ordinary Least Squares	Robust Least Squares	Ordinary Least Squares	Robust Least Squares
C	4.4615 (1.0195)	-0.1642 (-0.1331)	-40.2426** (-2.3701)	-39.9641** (-2.2284)
Present	4.1474*** (4.1119)	4.2178*** (14.8347)	4.7584*** (2.9204)	4.8286*** (2.8057)
Times	-0.0077 (-0.0298)	0.0077 (0.9142)	0.0542 (1.6697)	0.0534 (1.5587)
Small test	2.0442* (1.8499)	2.0925*** (6.7178)	2.4460*** (3.1757)	2.3518*** (2.8908)
Adjusted R-squared	0.9574		0.6547	
Adjusted R-squared		0.9985		0.7015
F-statistic	121.1400		36.3951	
Prob(F-statistic)	0.0000		0.0000	
Rn-squared statistic		4959.706		95.2412
Prob(Rn-squared statistic)		0.0000		0.0000

Note) Parentheses are t statistics. \*\*\*, \*\*, and \* denote significant at 1, 5, and 10%, respectively.

The results show that learners were able to obtain final good scores by getting a high score on small tests. The number of times viewing the videos are related positively with the final score in some cases, however, the relationship is not so robust.

There would be a possibility that the method of learning has damaged some aspects. Spontaneous and progressive learning which should be emphasized may be hindered. For this issue, further analyses are performed in the following section.

#### V. Questionnaires for the learners

Finally, three questionnaires are conducted:

Q1: Did it (video material) help your understanding?

Q2: Did it make you spontaneous study?

Q3: Did you feel growth as a learner?

The results are in Table 3a and 3b.

Table 3a. Questionnaires

	Q1	Q2	Q3
Face-to-face	4.1521	4.2018	4.1355
Online	4.0833	3.4583	3.9166
Face-to-face and online	4.2500	4.3334	4.0838

Note) Parentheses are "mean" and compared with face-to-face class (last year).

Table 3b. Statistical descriptions (face-to-face and online case)

	Q1	Q2	Q3
Mean	4.250	4.333	4.083
Median	4.500	5.000	4.000
Maximum	5.000	5.000	5.000
Minimum	3.000	3.000	3.000
Std. Dev	0.866	0.887	0.668
Skewness	-0.493	-0.693	-0.075
Kurtosis	1.628	1.739	2.419
Jarque-Bera	1.427	1.757	0.179
Probability	0.489	0.415	0.913

Achieving positive effects by introducing a flipped classroom and active learning at the same time seems to be difficult, however, it would not be impossible. A blended class that combines the flipped classroom and face-to-face class can be one key point or sometimes a solution with or after the COVID-19 crisis. Apart from the effectiveness of classes, COVID-19 makes face-to-face impossible. It is needless to say that flipped classrooms and online classes are not goals for themselves. Too much dependence on online learning could cause serious problems. Pursuing too much clarity by reducing the level of the class would hinder learning, spontaneous learning which should be emphasized. Clarity and short-circuiting sometimes hinder student growth although learners on online learning are prompted to pursue.

The key issues are the results of reports and multiple-choice tasks. Learners would like to learn under this severe condition. However, communicating with other learners, much more feedback is given from faculty to learners, and tasks which are related with the real-world would be a solution. Moreover, learners are under too much stress and worry about tasks, so some faculty, including myself, did not give learners many tasks. Faculty may have to adjust the amount and number of tasks with other faculty. While considering such things, the contents of the tasks should be also considered. On the other hand, too much consideration on this issue causes 'sweet credit' and leads to quality degradation.

#### VI. Conclusions

As the COVID-19 pandemic hit all over the world, many schools including universities and colleges were not able to perform face-to-face classes, and instead performed online classes. Fortunately, online learning has merits and has been evaluated highly by learners and university faculties. Learners accept this type of study. However, whether or not the learning quality of online learning improves or maintains the face-to-face



levels, should be evaluated much more. Furthermore, online learning without being face-to-face is different from a flipped classroom. This study empirically analyzed how the quality of online learning changed. The empirical results showed that most of the outcomes were not different from face-to-face classes, and online quiz type test scores are quite high. However, the quality of reports (writing) has declined significantly. There is some possibility that surface knowledge improved or was accelerated by online learning, but in-depth learning by thinking or discussing with other learners and faculty were not realized fully.

Flipped classrooms are effective, however, it is difficult to facilitate spontaneous incentives. In some cases, it seems dangerous that mandated study is emphasized too much over spontaneous study. Flipped classrooms sometimes make instructors guide learners to one answer if the methods were introduced incorrectly. Classroom planning and much more investigation is necessary and important. There is room for further studies.

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