

Exploring the Effectiveness of a Flipped Classroom with Student Teaching

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Abstract

*Student-centered pedagogical methods have gained popularity in recent years. Various active learning strategies are being used at schools of all levels. This study describes a flipped classroom with student teaching strategy employed in an international business course and evaluates its effectiveness on student learning. With primary data of 152 students covering two semesters before and two semesters after the implementation of the new strategy from 2016 to 2018, preliminary evidence shows that the flipped classroom with student teaching improves student attendance, performance, and the overall satisfaction of students with the course. By controlling for the other factors that could contribute to the improved student performance, a regression analysis with year fixed effects further confirms the preliminary evidence that flipping the classroom with **student teaching improves students' learning and performance**, which corroborates the **theory of "learning by teaching" by Dr. Jean-Pol Martin**. This research benefits the professors who are thinking of incorporating more student-centered active learning activities in their teaching.*

Key words: Student-centered pedagogy; flipped classroom; active learning; student learning.

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Introduction

Teaching innovations have been found to improve **students' satisfaction** and learning outcomes (e.g., Hu and Hui, 2012). In recent years, student-centered pedagogical methods have gradually replaced the traditional teacher-centered instruction and become popular. Educators from primary schools to colleges have experimented various active learning strategies to engage students in the learning process. By definition, **student-centered instruction refers "a form of active learning where students are engaged and involved in what they are studying" (Brown, 2008)**. It is based on the idea of constructivism, which states that students learn more by doing and experiencing than by observing (Dewey, 1963). In the literature, there have been numerous studies investigating the effectiveness of student-centered activities. These activities include but are not limited to involving students in simulations and role-plays, giving students autonomy in choosing their own topics and reading materials, letting students lead discussions, using cooperative learning strategies etc. (e.g., Brisk and Harrington, 2000; Felder and Brent, 1996; Pardon et al., 2002). As is argued by McCombs and Whisler (1997), learning is more meaningful if the subjects covered **match students' interest and need and/or are applicable to students' life**. Therefore, the student-centered active learning strategies increase the relevance of the subjects, **make students be more responsible for their learning and consequently enhance students' motivation to learn**. In addition, studies have shown that student-centered instructions can help students in engagement, knowledge retention, depth of understanding and the appreciation of the subject being taught (e.g., Bonwell and Eison, 1991; Meyers and Jones, 1993; Talbert et al., 2019).

Flipped classroom is one of the student-centered teaching strategies that has gained popularity in the most recent decade. It is based on the idea of changing the **role of the instructor from "sage on the stage" to "guide on the side" as is advocated by King (1993)**. In the "sage on the stage" model, instructor is the center and tries to transmit knowledge to the brains of students by passive teaching method such as **lecturing**. Whereas with the "guide on the side" approach, **instructors share the control** of the classroom with students and assist students in the exploration of contents either independently or within a group. The benefits and the implementation of this active learning strategy in various disciplines have been examined in the literature recently. For example, Gilboy et al. (2015) show that students have a strong preference for the flipped method compared with the traditional pedagogical strategies. Mok (2014) finds **that students' feedback on the flipped classroom strategy is generally positive, and** students are more engaged and empowered to take on more ownership for their learning. However, some other evidence shows otherwise. Four professors at Harvey Mudd College in Claremont, California study the effectiveness of a flipped classroom, and the preliminary evidence shows that the flipped classroom does not make any difference in improving students learning (Atteberry, 2013).

The increased popularity and the mixed evidence on the effectiveness of the flipped classroom strategy warrants further research on the issue. The purpose of this study is to illustrate the implementation of the flipped classroom in an introductory international business (IB) class and evaluate its effectiveness. The rest of the paper is organized as follows. Section 2 describes the employment of the flipped classroom approach in an introductory IB class; section 3 details the data and methodology; section 4 presents the results; and section 5 concludes.

Flipped Classroom in an Introductory IB Class

Background

With the booming of cross border transactions, international business becomes an important part of the business school curriculum. Most business schools, if not all, offer at least one introductory international business course as a required core course that covers the different aspects of international business. I have been teaching such a course over years in different institutions, and realized that it could be more challenging to engage students of smaller regional colleges where most of the students are from the region with limited exposure to international business. The lack of relevance of the subjects to the lives of the locally oriented students results in little interest in the IB topics. To help students learn, I diversified my teaching methods and materials to accommodate students with different learning preferences. Besides the traditional lecture, I adopted some active learning activities such as class discussions, case studies, and simulations & role-plays. With that being said, lecturing was still an important part in the classroom. However, the Student Evaluation of Teaching (SET) data showed that delivering lectures with PowerPoint presentation might not be an ideal way to engage students. Some students complained about the lecture being boring and less engaging. Research suggests that audience attention in lectures starts to wane every 10-20 minutes. To address the issue, in spring 2018, for the first time, I flipped the classroom and let students be involved in the teaching. Specifically, I kept the other active learning activities (e.g., class discussions, case studies and simulations), but changed my lecture to student presentations. This change is based on Dr. Jean-Pol Martin's theory of *Lernen durch Lehren* (learning by teaching). A two-year pilot study by Aslan (2015) indicates that learning by teaching within the context of science is an effective method.

Implementation

In order to flip the classroom, the contents were moved out of the classroom, which left most of the class time to students. The lectures were recorded and posted on the course management system (Canvas) for students to read and listen before class. In addition, students were required to read the relevant chapters from the Smart Book offered by McGraw Hill Connect and do the practice problems before class in order to earn credit for the reading assignments (5%). This incentivized students to complete the readings and get prepared for class.

The class was divided into groups with each choosing a chapter or topic to teach as a group. I kept for myself the chapters (topics) on which students hold little or no prior knowledge and/or those that are most difficult for students to understand. In preparation for the teaching presentation, students needed to expand their teaching materials out of the textbook and do independent research for the topic. I allowed students the freedom to compile the teaching materials from multiple sources, such as books, journals, newspapers, internet, and/or other public media. In order to teach their peers in the class, the presenting students had to teach themselves first. Usually they listened to my recorded lectures posted to Canvas and asked me questions for clarifications if there was any. Group members also needed to meet several times to work together and make sure everyone in the group had a good understanding of the **teaching materials. To ensure the quality of students' teaching, I required students to send me their teaching plan and materials for approval at latest two days before their scheduled teaching day.**

The role of the instructor was to assist the students to get prepared to teach and be a moderator during class. When the presenting students encountered difficulties in explaining some topics or could not answer a question from the class, I stepped in and

helped with more explanations or examples. I noticed that students were more attentive when their peers were teaching and more willing to join the discussions. The class was in general more relaxed and interactive.

To assess the quality of students' teaching, I incorporated peer feedback with rubric. I made it clear at the beginning of the semester how the teaching presentation would be evaluated, so that students prepared their presentation accordingly. I distributed an evaluation sheet with rubric to the class for the evaluation of the **presenting students' teaching. This practice incentivized students to prepare carefully for the teaching. In addition, to ensure the class's comprehension of concepts after** student teaching, I tested students with interactive classroom technologies (e.g., Kahoot!). By doing this, I identified the area that were not sufficiently addressed so that I would provide more explanations accordingly.

The flipped classroom can benefit students in several ways. First, from the teaching preparation and presentation, the presenting students learn much more than just reading the textbook and passively listen to my lecture. They do independent research and collect raw materials from multiple sources besides the textbook, which are then organized in a presentable way, synthesize ideas, develop arguments, and present to the class. This process involves multiple levels of learning in the **Bloom's** taxonomy: knowledge, comprehension, application, analysis, synthesis, and evaluation (Bloom and Krathwohl, 1956). Secondly, by collaborating on the teaching presentation, **group members interact and learn from each other. Vygotsky (1978)'s "Zone of Proximal Development"** argues that learners understand new ideas or concepts and acquire knowledge when they receive help or feedback from a teacher or a peer. Therefore, peer interactions with group work facilitate cognitive growth and knowledge acquisition (Ku et al., 2013). Thirdly, the rest of the students in class also benefit from participating in the discussions and the presentations that cover more information than the textbook. Fourthly, the flipped classroom helps engage students in the learning process. By flipping the classroom, the instructor shares the ownership of the class with students, and gives students autonomy in deciding the presentation materials and the way of presentation, which makes students be more responsible for their learning. Similarly, the students sitting in the classroom are also better engaged as they need to be attentive and evaluate **the presenting students' performance**. I find that students can be very creative in managing the class and making the class more fun. For example, some groups design role-play games and some bring candies or other small gifts to motivate the class to participate. With the above arguments and for the purpose of empirical testing, the following hypotheses are developed:

Hypothesis 1 (H1):

Flipped classroom with student teaching increases student participation and engagement.

Null-Hypothesis 1 (H01):

Flipped classroom with student teaching will not increase student participation and engagement.

Hypothesis 2 (H2):

Flipped classroom with student teaching enhances students learning and performance.

Null-Hypothesis 2 (H02):

Flipped classroom with student teaching will not enhance students learning and performance.

Hypothesis 3 (H3):

Flipped classroom with student teaching improves the overall satisfaction of students.

Null- Hypothesis 3 (H03):

Flipped classroom with student teaching will not improve the overall satisfaction of students.

Method

The effect of flipping the classroom on student learning is examined with pooled OLS regressions on an unbalanced panel data with year fixed effect. The model is illustrated as follows:

$$\text{exam score}_i = \alpha + \beta \cdot \text{flip} + \gamma \cdot \text{attendance}_i + \delta \cdot \text{senior}_i + \theta \cdot \text{collaboration}_i + \text{year dummies} + \epsilon_i \quad (1)$$

where the dependent variable *exam score* measures students learning and performance. Variable *flip* is a dummy variable that takes on the value of 1 if the flipped classroom strategy is implemented in the class, and 0 otherwise. β , the coefficient of interest, is expected to be greater than 0 if flipping the classroom helps students learn. In the regressions, I also control for the other factors that could influence student performance, i.e. attendance, student status, and collaboration. Variable *attendance* measures student attendance to class and is expected to be positively associated with student performance. The attendance score for being “present”, “late” and “absent” are 100, 80, and 0, respectively. Student status can also play a role in student performance. When senior students are approaching to their graduation, they may be more motivated to study hard to pass the course as failing the course could delay their graduation. I use a dummy variable *senior* to account for the potential difference in performance attributable to student status. It takes on the value of 1 for senior students, and 0 otherwise. In addition, more effective collaboration with group members could also improve student performance. The variable *collaboration* measures the effectiveness of collaboration and is measured with the peer evaluation score that a student receives from his/her group peers. I adopt multiple group projects in the course, and students are required to evaluate the participation in and contribution to the project of their group peers. That is, students receive several evaluation scores from their group members for every group project, and the average score the student receives from their peers is the peer evaluation score. A higher peer evaluation score indicates more effective collaboration among group members, which consequently could improve student performance. Furthermore, to take into consideration the impact of the unobserved variables on student performance, I include *year dummies* in the regression.

Collection of the data for four classes was done with two before the implement of the flipped classroom strategy and two after. The dataset covers 152 students in total from fall 2016 to fall 2018. These four classes are taught in the same way except the new flipping-the-classroom experiment in the latest two classes, i.e. the assignments, case studies, exams, simulations, and other class activities are all the same except that I let students teach instead of passively listening to my lecture since spring 2018. There are 50 seniors, 97 juniors, 4 sophomores, and 1 non-degree undergraduate students in the sample. Table 1 below shows the summary statistics of the variables included in model (1).

Table 1:
Summary Statistics

Variables	No. of Observations	Mean	Standard Deviation	Minimum	Maximum
Exam Score	152	81.21	12.41	22.67	99.33
Flipped Classroom	152	0.51	0.50	0	1
Attendance	152	85.87	14.84	11	100
Senior	152	0.33	0.47	0	1
Collaboration	152	92.00	14.04	13.33	100

Notes: This table displays the summary statistics of the variables used in this study. The dependent variable Exam score measures student performance, flipped classroom dummy takes on the value of 1 if the flipping-the-classroom strategy is implemented in the class and 0 otherwise. Control variable attendance is the class attendance of the student for the semester, senior is a dummy variable that equals 1 for the senior students and 0 otherwise, and collaboration measures the effectiveness of collaboration in the group projects and is measured with peer evaluation score. All variables are in percentage except for the dummy variables (e.g., flipped classroom dummy and senior dummy).

In order to look into the potential change of variables, I organize the courses in the order of time when these courses were offered and calculate the mean value of the variables by course. The results are displayed in Table 2. It shows that along with the implementation of flipping the classroom in spring 2018, there was an increase in both performance (measured with exam score) and attendance, which are consistent to *hypothesis 1 (H1)* and *hypothesis 2 (H2)* that flipped classroom with student teaching increases student participation and enhances students learning and performance. The exam score increases from C+ to B from before to after the new strategy, and attendance increases from 85.35 before and 86.38 after, which is a 1.03% increase. Table 2 shows a slight increase in collaboration but no change in student status.

Table 2:
Mean Variables by Course

	Course	Exam Score	Flipped Classroom	Attendance	Senior	Collaboration
Before	Fall 2016	77.77	0	85.21	0.38	91.67
	Spring 2017	77.67	0	85.50	0.28	91.57
	Average	77.72	0	85.35	0.33	91.62
After	Spring 2018	85.18	1	86.18	0.30	93.24
	Fall 2018	84.00	1	86.59	0.35	91.42
	Average	84.59	1	86.38	0.33	92.33

Notes: This table shows the class average of the variables before and after the experiment. The two-course average of the variables before and after the flipped method was adopted is displayed in bold. All variables are in percentage except for the dummy variables (e.g., flipped classroom and senior).

The correlation matrix of the variables is displayed in Table 3. It shows that all three independent variables in model (1) are positively correlated with student performance as measured with exam score. Specifically, flipped classroom is associated with higher exam score, implying that flipped learning is an effective way to improve student performance. It is not surprising that better attendance leads to higher exam score. Although attendance is not equivalent to engagement, at least attending class regularly **shows a student's commitment to study**. The senior dummy is correlated with exam score at 10% level, providing evidence that senior students on average have higher exam score than the other students. The independent variables are not significantly correlated to each other.

Table 3:
Correlation Matrix of Variables

	Exam Score	Flipped Classroom	Attendance	Senior
Exam Score	1			
Flipped Classroom	0.2787* <i>0.0005</i>	1		
Attendance	0.3717* <i>0</i>	0.0348 <i>0.6704</i>	1	
Senior	0.1555* <i>0.0557</i>	-0.0092 <i>0.9103</i>	0.0696 <i>0.394</i>	1

Notes: * indicates significance at 10% level at least. P value in italic.

Results

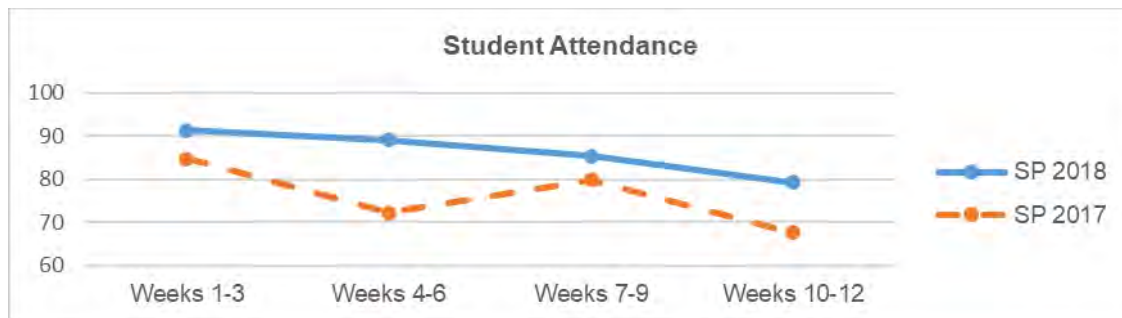
Preliminary Evidence

The inverted teaching by flipping the classroom with student teaching turned out to be great active learning activities that provided students with opportunities to think, talk, and process course materials proactively. The group work involved in these activities allowed students to practice important skills (e.g., collaboration) and created a sense of community in the classroom through increased student-student and instructor-student interactions. Students seemed to enjoy learning by teaching, and some of them indicated that it was more interesting to lecture than to listen to a lecture.

With the flipped classroom, there was significant improvement in student attendance, exam grades, and the overall satisfaction of students with the course. Figure 1 below compares student attendance in two semesters, one immediately before and the other immediately after the classroom was flipped (i.e. spring 2017 vs. spring 2018). The student attendance score in Figure 1 is the average attendance score of all students in the class. The chart shows significant improvement in attendance with the new strategy, which is supportive to *hypothesis 1 (H1)* that flipped classroom with student teaching increases student participation and engagement.¹

¹ Since the last three weeks of the semester were used for a simulation game, attendance was evaluated separately and thus not included in the chart.

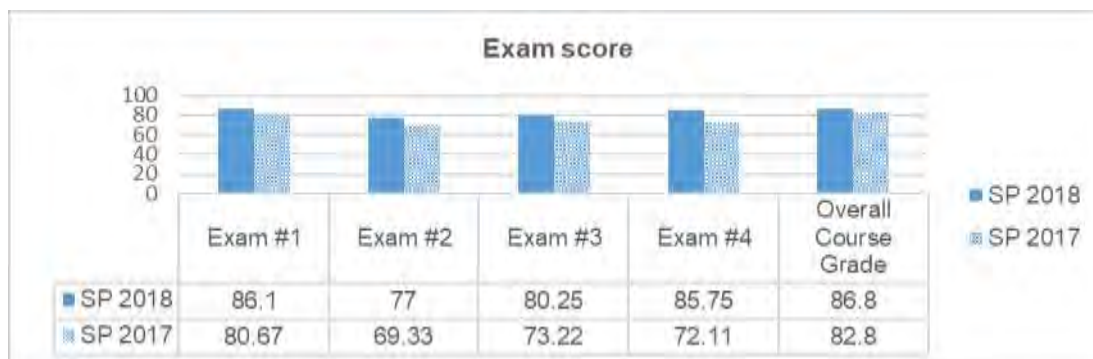
Figure 1:
Student Attendance



Notes: This chart displays student attendance score for two semesters, one immediately before and the other immediately after the classroom was flipped with student teaching. The solid line shows student attendance after and the dotted line before the new strategy was implemented.

Along with the increased attendance were the improved student performance and course evaluations. The class performance was improved significantly from the semester before to that after the new strategy. As is indicated in Figure 2, the grade for all four exams increased, and the overall course grade increased from 82.8 to 86.8 (B- to B), which provides preliminary evidence for *hypothesis 2 (H2)* that student teaching enhances students learning and performance.

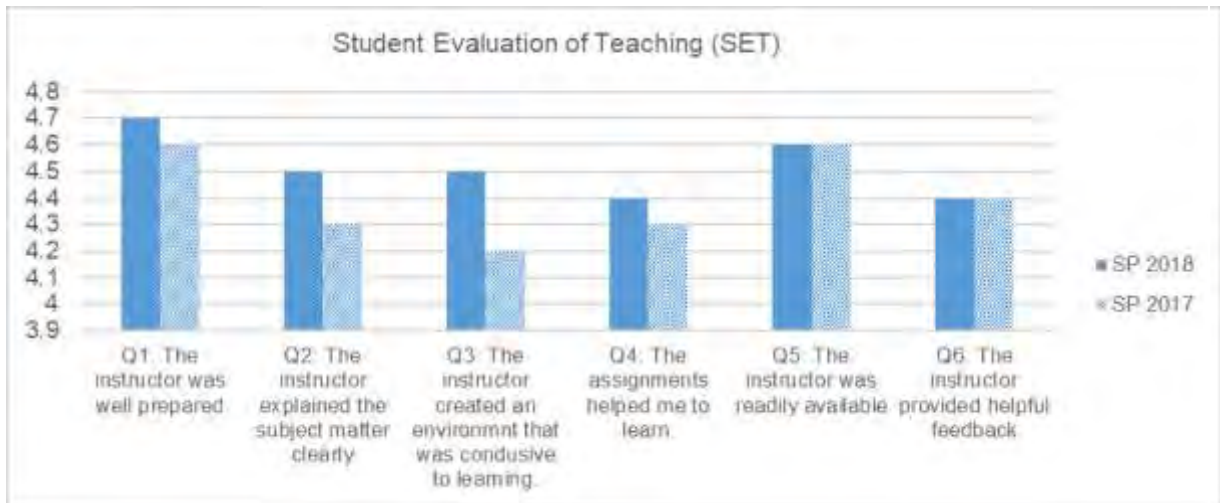
Figure 2:
Student Performance



Notes: This chart shows the student performance as measured with exam score for two semesters, one immediately before and the other immediately after the classroom was flipped with student teaching. Overall course grade includes not only exams, but other grade categories such as reading assignments, case studies, simulations, attendance etc. The solid bar represents student performance after and the dotted bar before the new strategy was implemented.

The student evaluation of teaching (SET) data also indicate an improvement for all the questions in the course evaluations in spring 2018 from spring 2017. The most pronounced improvement is with question Q3 “the instructor created an environment that was conducive to learning”, which benefits mostly from the flipped learning. The improved score for student evaluation of teaching provides supportive evidence for *hypothesis 3 (H3)* that flipped classroom with student teaching improves the overall satisfaction of students with the class.

Figure 3:
Student Evaluation of Teaching



Notes: This chart compares the course evaluations for two semesters, one immediately before and the other immediately after the classroom was flipped with student teaching. The evaluation is based on a scale of 1-5, where 5 represents "strongly agree" and 1 "strongly disagree".

Statistical Analysis

Although the evidence presented above indicates that student attendance, performance and the overall satisfaction with the course are all improved after the new flipped classroom strategy was implemented, which are consistent with hypotheses proposed (i.e. H1, H2, and H3), the results are only preliminary without a formal statistical test. Since the focus of this study is to examine whether flipped classroom helps improve students learning, I first test whether the improvement in exam score is statistically significant with a two-sample t test. The test results are reported in Table 4. Flipped classroom dummy equals 0 for the two semesters before and 1 for the two semesters after the classroom was flipped. The t test shows that students' exam scores are significantly higher after the flipped classroom strategy was implemented, which is in line with hypothesis 2 (H2).

Table 4:
Two-Sample t Test on Student Performance

Flipped Classroom	No. of Observations	Mean	Standard Error	Standard Deviation	95% Confidence Interval	
0	75	77.72	1.43	12.38	74.87	80.57
1	77	84.61	1.31	11.53	82.00	87.23
Combined	152	81.21	1.01	12.41	79.22	83.20
Difference		-6.89	1.94		-10.73	-3.06

Difference = mean(0) - mean(1) t = -3.55
 Degree of freedom = 150

Ho: Difference=0

Ha: Difference < 0

Pr(T < t) = 0.0003

Notes: This table shows the results of a two-sample t test on student performance for the two semesters immediately before (flipped classroom = 0) and the two semesters immediately after (flipped classroom = 1) the flipped-classroom strategy was adopted in the class.

However, other factors could contribute to the improved performance of students. For example, better performance could be attributable to the increased attendance instead of the flipped classroom. Student status and other unobserved factors can also affect student performance. Therefore, I further look into the effect of the flipped-class approach on student performance with a multifactor model that controls for attendance, student status and year fixed effect as is specified in model (1). For robustness check purpose, I add the control variables one by one to the regressions and the results are reported in Table 5.

Table 5:
The Effect of Flipped Classroom on Student Learning

	(1)	(2)	(3)
Dependent Variable: Exam score			
Flipped Classroom	7.0963*** (2.3366)	6.7111*** (2.1782)	6.6336*** (2.0784)
Senior	4.1824** (2.0562)	3.5229* (1.9204)	2.5350 (1.8494)
Attendance		0.2951*** (0.0608)	0.1321* (0.0713)
Collaboration			0.2993*** (0.0761)
N	152	152	152
R-sq	0.103	0.227	0.301
Adjusted R-sq	0.085	0.206	0.277
Year Fixed Effect?	Yes	Yes	Yes

Notes: This table displays the regression results of student performance as measured with exam scores on flipped classroom dummy and other control variables. All variables are in percentage except for the dummy variables (i.e. flipped classroom and senior). The estimates for the year dummy are not reported for brevity. Standard errors in parentheses, *, ** and *** denote significance at 10, 5 and 1 percent, respectively.

Table 5 shows that the coefficients for the flipped classroom dummy are statistically significant at 1% level with all specifications, providing strong evidence that flipping the classroom improves student learning. With all control variables included in column (3), estimates show that after flipping the classroom and letting students take charge of the classroom, the average exam score increases by 6.63%, an increase of

course grade by two categories. This is consistent with the evidence presented in Table 2 that average student exam score increases from C+ to B with the flip-the-classroom experiment. Again, the hypothesis that flipped classroom with student teaching enhances student learning and performance (H_2) is supported.

In addition, as expected, Table 5 also provides evidence that senior students perform better than the non-senior students do. This could be attributable to the fact that senior students are more motivated to work hard because failing the course can delay their graduation, as the course is a required core course. Another plausible explanation could be that senior students tend to have a more solid knowledge base and be better prepared for the course than the lower-level students.

Furthermore, Table 3 shows that regular attendance in class and more effective collaboration are both associated with better performance. Attending class is the minimal requirement for a responsible student. Although it is not a perfect measure of student engagement, students who attend class regularly at least show their commitment to study, therefore, it is not surprising to see student attendance is positively linked to performance. Collaborative group work gives students a chance to learn from each other, and effective collaboration among group members facilitates cognitive growth and knowledge acquisition, and consequently leads to better performance.

Conclusions and Discussions

Summary

This study describes a student-centered active learning strategy – flipped classroom with student teaching employed in an introductory international business course, and examines its effectiveness on student learning. Preliminary evidence shows that student attendance, performance, and overall satisfaction with the course all increase with the adoption of the new strategy. With an unbalanced panel data of 152 students covering two classes before and two classes after the experiment, a further regression analysis with year fixed effect renders strong evidence that flipping the classroom with student teaching is an effective strategy to better engage students and improve student learning. The findings corroborate Jean-Pol Martin's theory of "**Lernen durch Lehren**" (**learning by teaching**). **In addition, it is also observed that student status matters and senior students outperform other students; better attendance and effective collaboration both lead to better performance.**

Implications

Interactive teaching techniques have been shown to enhance learning (Crouch and Mazur, 2001; Deslauriers et al., 2011), and the student-centered active learning strategies such as the flipped classroom approach have gained popularity in recent years. At the same time, the traditional pedagogical method such as lecture has been criticized for not being engaging and effective. This study finds support for active learning. However, directed instruction like lecture is still necessary in some situations. There are topics that are difficult for students to comprehend by themselves and some skills that must be taught. Therefore, a mixed strategy that incorporates both active learning and traditional lecture is more reasonable, and the balance between the two methods depends on the topics and subjects covered. For example, I only let students research on the topics and teach the chapters that I believe students are able to comprehend mostly by themselves. In many occasions, I still need to help them with more explanations and clarifications. For the chapters that students have no prior knowledge or involve complicated theory derivation, I still need to lecture in the class. With that being said, the flipped classroom practice described in this study actually

involves instructor and students teaching together and students learning from teaching. Student teaching could be more applicable to some courses in business school and some other fields of social science, but traditional method of instruction should continue to prevail in some fields of STEM. Moreover, the different learning styles of students also necessitate a balanced teaching strategy to accommodate different needs of students. Active learning practices are effective and welcomed by most students, but not for all. For example, Chavan (2011) finds that although most students in the survey like to participate in the experiential learning activities, Asian students think otherwise. The purpose of this study is to provide a sample active learning strategy that can be used in different disciplines, and the findings will benefit the professors who are thinking of including more active learning strategies in their class.

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