

Teaching Advanced Economics using a Flipped Classroom approach

Docencia en Economía Avanzada con el método del Aula Invertida

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Abstract- This paper analyzes the impact on academic achievement of implementing a flipped classroom methodology in an undergraduate advanced course of Economics. The performance on the midterm exam of two sections with partially flipped lectures is compared to a control group following traditional lecturing. The results reveal a negative effect of the flipped classroom design, suggesting that the effectiveness of this active learning methodology in advanced courses may be different compared to introductory courses. The size of this effect depends on the extension of the flipped classroom format, being less important when the course is flipped to a higher extent. We also find that women perform better, both the students' GPA and their grade goal for the course are positively associated with the midterm grade, while working has a negative effect on academic performance. Further work is needed to reach more robust conclusions.

Keywords: *flipped classroom; higher education; teaching; active learning.*

Resumen- En este trabajo se analiza el impacto de la metodología del aula invertida sobre el rendimiento académico de los estudiantes de un curso avanzado del grado en Economía. Se comparan los resultados del examen parcial en dos grupos donde se ha aplicado este método con los de un grupo de control que ha seguido una metodología tradicional basada en clases magistrales. Encontramos que hay un efecto negativo del aula invertida sobre la nota del parcial, cosa que sugiere que la efectividad de este método puede ser distinta en cursos de nivel avanzado. Sin embargo, cuanto más extensa es la parte de aula invertida en el curso, menor es el efecto negativo sobre el rendimiento académico. Ser mujer, tener un mejor expediente académico y una mayor nota objetivo del curso están asociados a una mayor nota, mientras que ocurre lo contrario si se compaginan los estudios con un trabajo.

Palabras clave: *aula invertida; educación superior; enseñanza; aprendizaje activo.*

1. INTRODUCTION

Teaching methods in higher education need to adapt to the challenges the societies are currently facing. These include, among others, the new generations of students who are less prone to engage in the traditional chalk and talk lectures (where they are just passive learners) and the rapid emergence and increased use of technology-enhanced learning resources. To improve student class attendance, increase their motivation and

promote their active participation (prerequisites for academic success) the teaching strategies need to shift the focus from the instructor (knowledge transmission) to the learners (knowledge construction).

Among the different active learning methodologies that have emerged to adapt to the new circumstances of more technologically sophisticated students, the Flipped Classroom (FC) format has gained much popularity in practically all fields of education in the last two decades. With this approach, the main part of content delivery is moved outside the classroom and left to autonomous learning (often using online resources), while several collaborative and team-based activities are used to promote students' engagement inside the classroom.

Published research on FC experiences in economics provide mixed results. Some report improvements in students' academic achievement when active learning is adopted (Balaban et al., 2016; Caviglia-Harris, 2016; Singh, 2020), which is in line with results found in other areas of education. However, there are also studies that find either a negative or no effect of flipping the classroom on performance (Joyce et al., 2015; Mikek, 2023).

Moreover, in the field of economics, the majority of studies have been done in introductory courses, while a few describe experiences in intermediate courses. To our knowledge, there is no evidence of the effects of flipping the classroom in advanced economics courses.

This paper aims to assess the use of FC methodologies in an advanced Macroeconomics course taught at undergraduate level in a large public university. Poor class attendance and low academic results when using the traditional lecture format motivated the change in the teaching method. In addition, this active learning format has been previously successfully applied in few sections of students retaking a course of principles of economics or intermediate microeconomics at the same university. Contrary to what was found by Abio et al. (2019), our main result suggests that flipping the classroom in an advanced course does not translate into better academic performance (i.e., higher grades).

Our work is similar to Lombardini et al. (2018), who compare a partially and a fully-flipped classroom to a non-

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flipped format (in a principles of microeconomics course). Focusing on the final exam, they find a positive effect on learning outcomes only for the partial flip, while there is no statistically significant difference between the full flip and the non-flipped course.

2. CONTEXT & DESCRIPTION

A. Course design

Macroeconomics IV is scheduled in the last semester of the bachelor degree in Economics (4th year, 2nd semester). It is the last compulsory subject of the degree and it requires a solid background of mathematics and intermediate economics.

The teaching strategy generally used in this (and most) compulsory courses at the University of Barcelona was the traditional (non-flipped) lecture format. However, following this method was related to poor class attendance and low academic performance. The introduction of a continuous evaluation (CE), consisting of a midterm exam accounting for 25% of the final grade; completion of other learning activities during the course (weighted 20% of the final grade) and a final exam representing 55% of the final grade, was not enough to improve course participation and academic performance. In fact, the significant weight of the final exam and the possibility to opt out of the continuous assessment usually resulted in lower participation (less than half of the students) in the CE.

In spring 2022 and 2023, a FC methodology was developed and applied in two sections of Macroeconomics IV. The aim was to improve students' engagement in the CE and enhance academic outcomes. The standard FC method was adapted for this advanced course by introducing an initial master class in which the basic model of each topic was explained by the lecturer using the blackboard. After that lecture, students were asked to read and study part of a textbook as preparatory work prior to the next face-to-face session. That session would start with a short multiple-choice quiz designed to assess the comprehension of the proposed reading and to encourage students' preparation. During the rest of the session, students were grouped in teams of 3 or 4 and had to solve a problem set. To do that, they were allowed to use a one-page summary of their notes that they were encouraged to have prepared prior to the session. They could also ask questions to the instructor, who supervised and guided, if required, the team work. Each team had to hand in the answers at the end of the class. In the following session, the problem set solution was discussed and the instructor clarified any remaining doubts and introduced the next topic with a short lecture.

The FC format was introduced in the first part of the course with a different extension in 2022 and 2023. In Spring 2002, it lasted for around one third of the semester. Assessment of the CE for this part of the course included both quizzes and the team work, which together accounted for 10% of the final grade, and another 5% came from two exercises that had to be solved online at home. In 2023, the FC part was extended to half of the semester, and the corresponding CE activities (quizzes and team work) represented 20% of the final grade. In both academic years, there was a midterm exam (in the middle of the semester) accounting for 30% of the final grade.

In the second part of the semester, the instructor switched to the traditional lecture method and delivered master classes, including practical sessions where problem sets were solved on

the blackboard. At the end of the semester students had to sit for a final exam, which differed for those following CE and those choosing unique evaluation (a final exam representing 100% of the course final grade).

B. Data

The total number of students enrolled in the two sections of Macroeconomics IV where the FC methodology was implemented was 137 and 113 in 2022 and 2023, respectively. For 2023, our analysis includes as a control group data on another section of Macroeconomics IV where the FC method was not applied, with 92 students enrolled. The CE activities in this group differed from those used in the section that followed a more active learning method. They consisted of two individual online tasks that could be solved at home. The weight of these tasks in the final course grade was 20%, i.e., the same as the weight of the quizzes and team work in the other two sections.

At the time of writing this paper, the 2023 Macroeconomics IV final exam has not taken place yet, so we cannot compare the academic results for the whole course with respect to the previous year. However, we have data on the midterm exams for all the courses. Midterms are important as they allow to develop understanding of half of the material covered in the course, which makes it easier to succeed in the class and increases the chances of better performance in the final exam. Midterms also help to establish good study habits, that are undoubtedly relevant for successfully passing the course. There is evidence that midterm grades are highly correlated to final grades and are good predictors of overall course performance (Jensen et al., 2014). Thus, in this paper, we focus on performance on midterms to assess the impact of the extension of FC on academic achievement.

We collected data on demographic, academic and socio-economic characteristics of the students through two online surveys. These surveys contained several questions about different aspects of the two methodologies and about the students' perception of the FC method. All enrolled students were invited to participate in the first survey, which took place at the time of the change in the methodology (from FC to traditional lecture format) and the second one at the end of the teaching period. Those who answered both surveys were awarded 0.5 points of the final grade as extra credit to encourage their participation. The number of students who took the survey was 63 in 2022 and 118 in 2023, of which 43 were enrolled in the control group.

C. Statistical methods

We used linear regression analysis to estimate the effect of the teaching methodology on academic achievement (measured by the midterm exam grade). The model was specified using the following expression:

$$MIDGRADE_i = \beta_0 + \beta_1 PFC_i + \beta_2 EFC_i + \gamma' D_i + u_i,$$

where PFC_i and EFC_i are two dummy variables equal to 1 if the student was enrolled in the partially flipped classroom course in Spring 2022 and in the extended flipped classroom course in Spring 2023, respectively. D_i is a vector of demographic and academic covariates including gender, age, the GPA in the student's academic records at the time of the survey, the grade goal that the student had at the beginning of the course ranging from 5 (minimum pass grade) to 10 (honours), and the student's

labour status situation (not working, working more than 20 hours/week, working less than 20 hours/week, working occasionally).

All the statistical analyses are done with Stata 17.

3. RESULTS

Table 1 contains a summary of students' characteristics in each of the three sections that followed different teaching methodologies. A chi-squared test showed no statistically significant differences by gender ($\chi^2(2) = 2.71, p = 0.258$) between the three groups. The Kruskal-Wallis test revealed that the students' subsamples significantly differed by age distribution ($KW = 15.80, p = 0.000$). That is due to the higher age of students enrolled in the control group (based on results from post-hoc Wilcox tests for each pair of sections, not shown here). Regarding average (GPA) and desired (Grade goal) performance, the GPA was the same across the three groups ($KW = 1.55, p = 0.460$), while the students enrolled in each group reported significantly different goals in terms of the course grade ($KW = 10.37, p = 0.006$). Again, the dissimilarities are mainly driven by the control group (pairwise Wilcox test results, not shown here). Finally, the work-study patterns depict singularities across groups ($\chi^2(2) = 39.84, p = 0.000$). One third of those enrolled in sections that applied FC do not work compared to only 6.9% of those in the control group. On the contrary, 80% of the students following the traditional format work more than 20 hours per week or are employed full-time, while the share of intensively working students in the other two sections is around 28%.

Table 1. Students' characteristics in the three sections.

	2022 Partial FC	2023 Extended FC	2023 Lecture format	p- value
N	63	75	43	
Females	33.3%	25.3%	39.5%	0.258
Age (mean)	22.8	22.9	24.9	0.000
GPA	6.5	6.6	6.4	0.460
Grade goal (mean)	7.8	7.4	6.8	0.006
Work status				
Not working	31.8%	30.7%	6.9%	
Working >20h/week	28.2	28.0	79.1	0.000
Working <20h/week	20.6	30.7	4.7	
Working occasionally	19.1	10.7	9.3	

The estimation results from the model outlined in section 2.C are shown in Table 2. Our results reveal a negative impact of the use of FC on academic performance, although the effect is not monotonic. The adverse impact seems to be higher when FC is partially applied (Spring 2022), which lowers the grade

by 1.8 percentage points, than when the use of FC is extended (Spring 2023), which reduces the grade by 1.4 percentage points.

Regarding the rest of the covariates, women perform significantly better on the midterm than men. Age exerts a negative impact on the midterm grade; however, the result is not statistically significant. As expected, students with higher GPAs obtain better results on the Macroeconomics IV exams. Ambitious and hard-working students, as captured by the grade goal variable, also perform significantly better on the midterm. Lastly, working while studying hampers academic achievement. The more intensively a student works, the larger the negative impact on the midterm grade.

Table 2. OLS estimation of the impact of flipped classroom on academic performance on the midterm exam (all three groups).

Covariates	Coef.	Std. Error	p-value
Partial FC	-1.7683***	0.3915	0.000
Extended FC	-1.4217***	0.3793	0.000
Female	0.6900**	0.2752	0.013
Age	-0.0289	0.0575	0.616
GPA	1.4944***	0.2135	0.000
Grade goal	0.5074***	0.1055	0.000
Work status			
Working >20h/week	-0.9118***	0.3455	0.009
Working <20h/week	-0.9284**	0.3769	0.015
Working occasionally	-0.8006*	0.4347	0.067
Number of observations		181	
R-squared		0.4778	

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4. CONCLUSIONS

The present research contributes to the existing literature assessing the impact of flipping the classroom on academic achievement, which finds mixed results. To our knowledge, this is the first study to analyze the impact of two different designs of the FC methodology on academic performance in an advanced Macroeconomics course. Using data from a large public Spanish university, we find that flipping the classroom adversely affects midterm grades, when controlling for a set of relevant covariates. Nevertheless, the negative effect is relatively small. Our result is in line with previous studies (Joyce et al., 2015; Mikek, 2023). Moreover, the intensity of the use of FC plays a role; the more extended the use of the active learning methodology is, the lower the decrease in terms of grade.

The finding that the degree to which the course is flipped makes a difference in the results is consistent with empirical evidence showing that there is a negative adjustment period associated with the flipped classroom format and suggesting

that gains in learning outcomes become evident and larger after this period (Wozny et al., 2018).

We observe that students' effort is an important determinant of academic achievement. Those who continuously perform better (higher GPAs) and are also more ambitious (higher grade goal) tend to benefit more from the active learning environment. This result is similar to Wozny et al. (2018), but contrasts with Lombardini et al. (2018), who obtain better achievement for weaker students.

In the last year of the degree, many students combine work and studies. We find that working negatively affects performance, which may be explained by that fact that working impedes regular attendance. Although we have not been able to include class absenteeism in our regressions due to the lack of data, the lecturers that implemented the partial FC methodology reported the perception of a significant increase in the number of students attending the sessions when the classroom was flipped. Previous research has shown that attendance is highly correlated with academic success (Credé et al., 2010). Attending class sessions provides students not only with access to content-oriented information, but also to resources and social interactions that can positively impact knowledge and academic results.

This last finding may be interpreted from a different perspective also. Working, and the associated absenteeism and lower grades, may increase social inequality among students. Most students who work while enrolled in a full-time programme do so as they need the work to be able to pay for their studies. In these cases, introducing active learning methodologies requiring regular attendance may punish disadvantaged students more and thus, increase inequalities.

Lastly, we should note that our results are preliminary, as they are based on the performance on the midterm exam. Extending them to the final exam will allow us to provide more robust conclusions on the impact of flipping the classroom on academic achievement. In addition, further research is needed to assess other potential benefits of the FC methodology such as increased attendance, class participation, exam show-up rates, as well as students' motivation and perceptions of the learning process.

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