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## **Endowment effect in student performance in classes**

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## Introduction

Student performance in classroom is one of the main subjects with the most studies in education, where motives are sought to explain how students can increase their performance and therefore improve their learning. Most studies (especially in the area of Economics) are focused on external factors to explain student performance; for example, Haahr, Nielsen, Jakobsen, and Hansen (2005) and Ali, Haider, Munir, Khan, and Ahmed (2013) use factors such as place of residence, family income, type of school, among others to be able to measure performance by studies. While other studies focus on intrinsic factors of classes and students to be able to demonstrate the efficiency of the student performance: the gender of the individual, the grading system, the GPA, among others to be able to explain the performance (Lewine et al, 2011; Cherry and Elis, 2005).

Currently there are scarce studies that focus on the effects of behavioral factors that can affect student performance in class. Raza, Qazi, and Yousufi, (2020) and Rasul, and Bukhsh (2011) focus on psychological, behavioral, and personal factors that affect performance, where students' perception is the main reason for their effort within classes. But now, there is little information from studies that seek to use mechanisms focused on the grading system to improve the performance of students in classes.

In education, the use of different methodologies inside and out of classes to improve student learning has increased. All focused on creating strategies that allow individuals to have new practices, focusing on skills and improving individual performance. These methodologies are focused for use in the first and second level education system while the higher education system (colleges and universities) maintains a constant education methodology, where learning options are reduced. This study will use the methodology based on the study of Smith, Shrader, White, Wooten, Dogbey, Nath, O`Hara, Xu, Roseman, (2019) focused on the evaluation system where the use of the endowment effect will be implemented as a behavioral factor to improve the performance of university students within classes, where it is shown

that a grade deduction system had a direct effect of increasing individuals final grade by half a letter. This model has no direct intervention with the class curriculum and creates appropriation of learning to students.

**Question of study:** How does the endowment effect on a score elimination system affect class performance in college students?

This paper focused on the empowerment effect on student performance is divided into three parts: the first, focused on the contribution of new educational strategies that do not affect the teaching processes within the curriculum of courses taught in the university environment and to implement new practices in the educational system; secondly, focused in how to intervene in the educational process of students in universities, where the appropriation of grades would allow an increase in the performance of individuals within classes and in the tasks they have to perform; and thirdly and last, how this contribution would allow to implement effects and studies used in the area of economic behavior to other branches of study where new strategies for the continuous improvement of cases can be studied, understood and implemented. The following work will be divided into the next sections: section 2 with the literature review, section 3 with experiment and methodology, section 4 results and section 5 conclusions and recommendations.

## Literature review

### Previous studies

Economic studies focused on education can be split into two: the first branch, that is focused on the macroeconomic view, that explains the effects of education on society as the cost of investment in education and how it is affected in economic growth and inequality (Benabou,1996); and the benefits of education and its effects on productivity as the study of Psacharopoulos (2010). And the second branch is focused on microeconomics and education, where they concentrate on in-class outcomes such as the study by Rivkin, Hanushek and Kain (2005) which demonstrates the effect of qualities on student performance or the effect of the number of children per family on school performance presented by Hanushek (1992).

One of these economic and educational studies is that of performance within classes where academics such as Raimondo, Esposito, & Gershensberg (1990), Brown (2020), Senko and Miles (2008), among others, have contributed with theories, methodologies and results that allow us to understand the variables that can help students improve their school performance. One study is that of Smith et al (2019), where they study the loss aversion effect on student performance based on four educational pillars that are related to the education received by students and their activity within the class.

As Shrader et al (2016) explain in their first draft of their experiment, the four components related to performance within classes are: peers, class size, teacher quality, and evaluation methodology. This study will be focused on the evaluation methodology based on economic theory. Based on this study it can be shown that a change in the grading system methodology can affect positively in the students' performance, where an elimination score system can motivate students to improve their actions in class. While in the study presented in Smith et al (2019) it was found that there is a direct relationship in the type of evaluation presented to the students and the grades they obtained, as they explained "*... we found*

*that an inverted grading system scheme where students are endowed with all the potential points at the start of the semester might result in increased student performance”* and their results showed that, in average, students who participated in the elimination point scheme had half a letter (in their grading system) higher than those student who had the traditional grading scheme. Although this study did not measure the perception of students towards the class, since there may be other variables that end up affecting the final grade.

## Grading system

Student learning assessment is the most effective way to authenticate the goals of the curriculum that have been met by each individual. Most of these are based on a grading system, from lowest to highest, where a minimum requirement must be met in order to follow the next level and/or complete the course. This type of evaluation allows to assess and measure the knowledge acquired by the students, being the final grade in each job or task the representation of their performance within classes (Tippin, Lafreniere, & Page, 2012). There are several types of grading, but the most common ones are: the letter-based system (Ornstein, 1994; Morgan, Tallman, and Williams, 2006) and number scale system (from 0 to the maximum score).

In the university educational environment, the standardized measurement evaluation system is generally used, which aims to visualize students' academic results (Ravela et al, 2008). This type of system has a score-based scheme where students need to achieve specific requirements to gain grades and pass the minimum requisite to achieve the class minimum grade. Students usually associate effort with their scores (Tippin, Lafreniere, & Page, 2012), this being the result of the hours they used to study, research, perform, and work on every specific task.

## Students' performance

In-class student performance is one of the most studied topics in the education branch. Where socioeconomic factors (Hijazi & Naqvi, 2006), psychological factors (Rasul, & Bukhsh, 2011), intelligence (Cascón, 2000), behavioral aptitudes (Kassarnig, et al, 2018) have allowed to understand the aspects involved in the within and overall performance of students. From this category of studies, policies have been created to be able to counteract and optimize each factor of previous studies and created methodologies that can increase the efficiency in the functioning of classes such as: differentiation in class, case studies, among others. All focused on the development inside classes and having the students as the main objective inside the education environment.

In the university environment, each student's performance is related to the independence and skills of each individual, where each task presented to him/her must be managed by each one so that the student can acquire knowledge while developing skills preparing them for their future. In this type of educational environment, students are handled by two types of approaches: deep and superficial. Where each student must define their personal and external motivations to define their meaning in studying it and creating knowledge (Lamas, 2015) and increase performance in the classrooms. Another factor within classes that allows teachers to understand student performance are the mix of students' personality traits and cognitive abilities, as Barchard (2003) explains.

## Endowment and loss aversion effect

The endowment effect is the tendency where the appreciation of an object is greater for a person who owns it compared to one who does not (Morewedge and Giblin, 2015). This effect has been evaluated in several studies. Ariely, Huber and Wertenbroch (2005) showed that individuals have an emotional connection to an object when it has been given to them unlike an individual who did not own the object (being the same object). Other studies such as Kahneman's, Knetsch and Thaler (1990) showed that an

initial endowment to individuals in a buy-and-sell experiment created a gap between the willingness to pay (WTP) and willingness to accept (WTA) between the participants, noting that the owners of the objects increased the personal valuation of the object unlike buyers. With such conclusions it can be intuited that the granting of objects (whether tangible or intangible) to people creates a personal link which increases the appreciation towards it.

The greatest explanation for the endowment effect comes from aversion to loss. This aversion first presented in the Study Theory study written by Kahneman and Tversky (1981) demonstrates how losses have greater weight than profits. Other studies have shown that not only are losses subject to objects but can be presented in salaries and attitudes as Fryer, Levitt, List and Sadoff (2012) do, where they may find that teachers increased the efficiency of their teachings when students did not reach a required minimum. Teachers who could be sanctioned showed an increase in students' grades while those who could not be sanctioned maintained the results.

By understanding how the evaluation system works at the university level, the personal incentives that affect student performance and how the endowment effect and loss aversion affect individuals may be used in various scenarios. We can replicate the experiment conducted by Shrader, Wooten, Rosenman, Smith, & White (n.d.) where it is sought to see the performance in classes of students when they are given an endowment at the beginning of the course, taking the following hypothesis:

**H1:** A grading system based on a score elimination scheme with an initial endowment would have a positive effect on the performance (grades) of students.



## Methodology

To carry out this study, a different model was created than that of Shrader et al (2016), which was able to obtain a greater number of observations in a longer period of time. In this study, due to the limitations of time and the number of periods that can be performed to obtain the same number of observations, an experiment was performed that resembles a school environment where students must complete tasks or subjects in order to pass the classes.

### Experimental design

The experiment consists of two parts: the first part is focused on introducing the experiment to the subjects, obtaining personal information (which will be used as control variables in the study) and at the end of this stage of the experiment subjects are divided into the control group and the treatment group, where each subject have an introductory template notifying them how they will be graded and finally having three validation questions where the subjects have to answer all the questions correctly to follow the second stage.

The second part of the experiment is focused on completing three lessons in three different periods, each lesson is divided into ten questions and distributed into three types of questions: true and false questions, multiple choice questions and short answer questions that must be filled out. The questions used for this experiment are from the Introductory Economics class and two university professors who direct these courses validated the questions before being presented to the subjects of the experiment. In the first two periods the same amount of type of questions were used, while in the third and last period a true and false question was removed and replaced with an additional short answer question.

The first group (of control) will maintain the scoring system of obtaining points and will start their score from 0, where they will manage the system of rubrics where the students can obtain a correct question will earn points, while the second group (treatment) will manage the system of qualification of elimination of points where they will be given an initial endowment (the maximum percentage of the lesson is 10 points) and will manage the system of rubrics of elimination of points, where each incorrect question will have an elimination penalty of one point. At the end of each period, each subject will be informed of the grade they obtained where the control group will be told the total score they have won from the maximum score, while the treatment group will be told the total points they lost on the highest possible score.

## Model

This study will measure the effect of the points elimination system through the endowment effect on student performance. As explained in the experimental design, this will be done in several periods so the data to be obtained will be transformed into panel data. And for this experiment, it will be divided into three models, to be able to check if the type of evaluation affects the final grade of the subjects.

The first model will be presented considering the study by Shrader et al (2016)<sup>1</sup>, where there is a mixture of exogenous and endogenous variables to the subjects and the model is as follows:

$$\mathbf{Grade} = \beta_0 + \beta_1 \mathbf{Group} + \beta_2 \mathbf{Studl} + \beta_3 \mathbf{Classb} + \beta_4 \mathbf{Friend} + \beta_5 \mathbf{Known} + \beta_6 \mathbf{Daded} + \beta_7 \mathbf{Momed}$$

Where *Grade* is our study variable, *Group* is our independent variable where it can take the value 0 if it is the control group and the value 1 if it is the treatment group. And the control variables where *Studl* is the number of hours the subject spends studying per week, *Classb* is if the subjects have taken an economics class before, *friend* equals whether the subjects are taking a class with a friend, *Known* if

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<sup>1</sup> Some variables presented in Shrader et al (2016) study, were not used in this model since these could not be obtained due to the differences between the experiments done.

the subjects know a person who has taken the class before, *Daded* if the subject's dad has a third-level degree or higher, and *Momed* if the subject's mom has a third-level degree or higher.

The second model that will be carried out in this study is focused on using only variables endogenous to the subject, also shown in the study of Smith et al (2019), since we want to observe if the type of qualification is linked to the innate characteristics of the subjects and there is no interference of exogenous variables to the subject and the model is as follows

$$\mathbf{Grade} = \beta_0 + \beta_1 \mathbf{Group} + \beta_2 \mathbf{Studl} + \beta_3 \mathbf{Classb} + \beta_4 \mathbf{Age} + \beta_5 \mathbf{Year} + \beta_6 \mathbf{GPA} + \beta_7 \mathbf{Gender}$$

Where we have the same as the previous model to Grade as a dependent variable, group is the independent variable, Studl is the number of hours that the subject uses to study the subject, Classb is the variable to see if the subject has taken an economics class before, Age which is the age of the subject, Year is the year in which he is in college, GPA is the grade point average of each subject and Gender.

The last two models will be focused on introducing two more variables to equation two, which are mainly focused to see if there is any difference in the difficulty between the questions that were presented in the experiment (variable *Period*) and a model with an interaction between the GPA and the treatment subjects participated in the experiments, and the models would be as follows:

$$\mathbf{Grade} = \beta_0 + \beta_1 \mathbf{Group} + \beta_2 \mathbf{Studl} + \beta_3 \mathbf{Classb} + \beta_4 \mathbf{Age} + \beta_5 \mathbf{Year} + \beta_6 \mathbf{GPA} + \beta_7 \mathbf{Gender} + \beta_8 \mathbf{Period}$$

$$\mathbf{Grade} = \beta_0 + \beta_1 \mathbf{Group} + \beta_2 \mathbf{Studl} + \beta_3 \mathbf{Classb} + \beta_4 \mathbf{Age} + \beta_5 \mathbf{Year} + \beta_6 \mathbf{GPA} + \beta_7 \mathbf{Gender} + \beta_8 \mathbf{Period} + \beta_9 \mathbf{GPA} * \mathbf{Group}$$

# Results

## Data

The data obtained for this experiment was collected from 4 classes of Introductory Economics Course of two different universities in the city of Quito-Ecuador, a total of 72 individuals of different major programs participated in a three periods length experiment that was taken in classes and not as an extracurricular activity via the program Qualtrics while being in a zoom session, which gave a total of 216 observations. From this entire data, 15 observations had to be eliminated, as 5 subjects chose not to finish the experiment, leaving a total of 201 observations (67 subjects). In models 2 and 3, a total of 180 observations (a total of 60 subjects) were used since some data was not completed in the question that referred to the GPA which interfered with the results of the regressions.

## Descriptive evidence

In figure 1 and table 1 it can be seen the results of the average grade that the control group and the treatment group presented. It is shown that in all the three periods the average grade of the treatment group is higher than the control group; being 5.91 average points in the first period, 4.94 average points in the second period and 5.44 average points in the third period, while the general evaluation group (control group) had an average of 5.49 points in the first period, 4.80 points in the second period and 5.2 points in the third period.

It can also be seen in Table 1 the variations between the average grade points between period 1 and 2, and between period 2 and 3, where both groups presented the same effects by period but had a difference in the magnitude. The control group had a minor change in the second period with a negative variation of 12.57% (0.69 points) while the treatment group suffered a negative variation of 16.41% (0.97 points); but in the third period, it can be seen that the treatment group had a positive variation of 10.12%

(0.50 points) which was greater than that of the control group which was a positive variation of 8.33% (0.40 points).

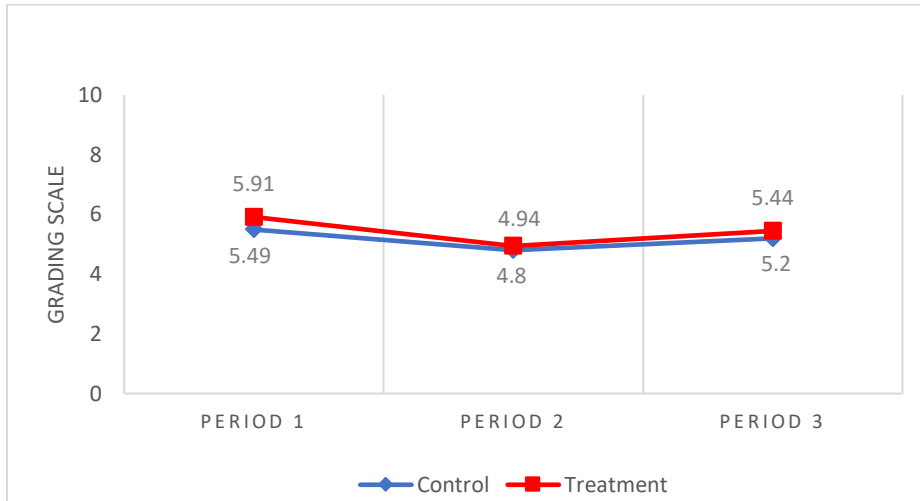


Figure 1 Average grades of control and treatment group between periods

	Control Group	Treatment Group
<b>Average grades</b>		
Period 1	5.49	5.91
Period 2	4.80	4.94
Period 3	5.20	5.44
<b>Variation between periods</b>		
Period 2	-12.57%	-16.41%
Period 3	8.33%	10.12%

Table 1 Average grades and variation between period control and treatment group

Based on these results obtained in this first part, it was proceeded to perform the regressions mentioned above in section 3, to verify the effect of the variables on the grades obtained by the subjects.

## Regressions

Table 2<sup>2</sup> presents the estimates of the Pooled OLS model for three regressions made from the first equation presented in section 3. The coefficient estimates of being in the treatment group for the Pooled

<sup>2</sup> Due to the small number of groups used in the experiment, it was decided to use robust errors and not cluster robust errors.

OLS model in column 1 is positive, showing an increase in the grade per period of 0.265 points compared to the control group, even though this variable is not statistically significant.

In column 2 and 3 it can be seen the regression of the equation 1 that were presented on section 3 based on the study of Shrader et al (2016), where it shows the following: in column 2 the variable of belonging to the treatment group has a positive effect of 0.225 points to the final grade per period compared to a subject who has participated in the control group, this variable being statistically insignificant; in the variable of the number of hours studied per week we can see that studying more than 5 hours per week has a negative effect of 0.870 points to the final grade per period compared to a student who studied between 1 and 5 hours a week this variable is statistically significant in 1%, while studying less than 1 hour per week has a negative effect of -0.983 points compared to subjects that studied between 1 and 5 hours a week, this variable is not statistically significant; having an economics class before participating in the Introductory Economics classes has a positive effect of 1,043 points on the final grade per period compared to subjects who did not have economics classes before taking the Introductory Economics class, this variable being statistically significant at 1%; entering the class with a friend has a negative effect of 0.243 points to the final grade per period and knowing a person who had taken the same class before also has a negative effect of 0.316 points to the final grade per period compared to a subject who does not know a person who has taken the class before, both variables are not statistically significant.

In column 3 two variables were added, the father's education and mother's education and the results were as follows: staying in the treatment group has a negative effect of 0.029 points to the final grade per period compared to the control group, this variable is economically and statistically insignificant; studying more than 5 hours a week and less than 1 hours a week have a negative effect of 0.84 and 1.307 points respectively compared to individuals who study between 1 and 5 hours per week these two variables are statistically significant at 5%; taking an economics class in the past has a positive

effect of 1,345 points to the final grade per period compared to subjects who did not have economics classes, this variable is statistically significant at 1%; having a friend in class has a negative effect of 0.229 points to the final grade per period compared if the subject took the class alone, this variable is not statistically significant; knowing a person who has already taken the class previously has a positive effect of 0.459 points to the final grade per period compared if the subject does not know anyone who has taken the class, this is statistically significant by 5%; if the subject's father has a third education degree or higher, this has a positive effect of 1,058 points to the final grade per period while if the individual does not know if his or her father has a third educational degree or higher has a negative effect of 3.45 points to the final grade per period, compared to individuals that know that his or her father does not have a third education degree the, both variables are statistically significant at 1%; finally if the mother has a third level degree or higher it has a positive effect of 0.115 points to the final grade per period, compared to the subject who has a mother that has not obtained a title of third level or higher and this variable is not statistically significant.

	(1)	(2)	(3)
DV	Grade		
VARIABLES			
Group	0.265 [0.302]	0.225 [0.280]	-0.029 [0.273]
Study Level			
Low		-0.983 [0.617]	-1.307** [0.513]
Medium		0.00 [0.00]	0.00 [0.00]
High		-0.870*** [0.300]	-0.840*** [0.315]
Class Before		1.043*** [0.307]	1.345*** [0.279]
Friend		-0.243 [0.299]	-0.229 [0.279]
Known Person		0.316 [0.198]	0.459** [0.189]
Dad Educ			
Yes			1.058*** [0.336]
Maybe			-3.450*** [0.576]
Mom Educ			0.115 [0.429]
Constant	5.16 [0.201]	3.759 [0.756]	2.277 [0.857]
Observations	201	201	201
R-squared	0.003	0.161	0.205
Standard errors in brackets			
*** p<0.01, ** p<0.05, * p<0.1			
Standard errors clustered at the firm-region level are reported in parentheses.			

Table 2 First equation model regressions

In table 3 we can see the interaction of the endogenous variables of the individuals and their effect on the final note of the period. In column 4, 5, 6 and 7 we can see how the different interactions of these variables give different effects to the final grade by period. Column 4 shows how having one additional year of age has a negative effect of -0.224 points to the final grade and having a GPA greater than 3.50 has a positive effect of 1.104 points to the final grade per period compared to a subject who has a GPA between 3.00 and 3.50, both are statistically significant in 1%; while being one more year in



college has a positive effect of 0.352 points to the final grade per period, having a GPA between 2.00 and 3.00 has a negative effect of 0.643 points to the final grade per period compared to people who have a GPA between 3.00 and 3.50, and being male has a positive effect of 0.273 points to the final grade compared to being female, all of these variables are not statistically significant.

Column 5 shows that one additional year of age has a negative effect of 0.20 points to the final note per period, while having a GPA greater than 3.50 compared to having a GPA between 3.00 and 3.50 have a positive effect of 1.093 points to the final note per period, and these two variables are statistically significant in 1%; studying more than 5 hours per week has a negative effect of 0.6 points to the final grade per period compared to a person who studies between 1 to 5 hours per week, and this is statistically significant in 10%; belonging to the treatment group has a positive effect of 0.09 points to the final grade per period compared to belonging to the control group, but this is not statistically significant. And the other control variables are not statistically significant.

Column 6 shows that having had economics classes before has a positive effect of 0.917 points to the final grade per comparative period of not having had an economics class, one additional year of age has a negative effect of 0.24 points to the final grade per period and having a GPA less than 3.00 has a negative effect of 0.96 points to the final grade per comparative period of subjects who have a GPA between 3.00 and 3.50, all these variables are statistically significant at 1%; having a GPA greater than 3.50 has a positive effect of 0.712 points to the final grade per period compared to subjects who have a GPA between 3.00 and 3.50, being this statistically significant in 10%; belonging to the treatment group has a negative effect of 0.11 points to the final grade per period to comparison of belonging to the control group, and this is not statistically significant; and the other control variables are statistically non-significant.

Column 7 shows that taking an economics class before has a positive effect of 1.1 points to the final grade per period compared to not taking an economics class before; being one year older have a negative effect 0.22 points of the final grade per period respectively and these two variables are statistically significant at 1%; study less than 1 hour a week compared to study between 1 and 5 hours a week and have a GPA less than 3.00 compared to subjects who have a GPA between 3.00 and 3,500 have a negative effect of 0.67 and 1.10 points to the final grade per period, and these two variables are statistically significant by 5%; studying more than 5 hours a week compared to studying between 1 and 5 hours at a time has a negative effect of 1.186 points to the final grade per period while a GPA greater than 3.50 has a positive effect compared to subjects who have a GPA between 3.00 and 3.50, these two variables are statistically significant by 10%; belonging to the treatment group has a negative effect of 0.09 points compared to belonging to the control group and this is not statistically significant; while the other control variables have no statistical significance.

	(1)	(4)	(5)	(6)	(7)
DV	Grade				
VARIABLES					
Group	0.265 [0.302]	0.051 [0.306]	0.095 [0.301]	-0.109 [0.294]	-0.087 [0.283]
Study Level					
Low			-0.650 [0.498]		-0.671** [0.512]
Medium			0.00 [0.00]		0.00 [0.00]
High			-0.600* [0.326]		-1.186* [0.325]
Class Before				0.917*** [0.288]	1.101*** [0.306]
Age		-0.224*** [0.048]	-0.202*** [0.054]	-0.240*** [0.047]	-0.224*** [0.052]
Year		0.352 [0.203]	0.312 [0.203]	0.280 [0.221]	0.243 [0.215]
GPA					
Low		-0.643 [0.5711]	-0.750 [0.548]	-0.959** [0.535]	-1.105** [0.505]
Medium		0.00 [0.00]	0.00 [0.00]	0.00 [0.00]	0.00 [0.00]
High		1.104*** [0.340]	1.093*** [0.344]	0.712* [0.347]	0.650* [0.353]
Gender					
Male		0.273 [0.307]	0.316 [0.316]	0.037 [0.300]	0.072 [0.306]
Constant	5.16 [0.201]	8.362 [1.126]	8.235 [1.288]	8.227 [1.138]	8.075 [1.127]
Observations	201	180	180	180	180
R-squared	0.003	0.169	0.189	0.206	0.235
Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1 Standard errors clustered at the firm-region level are reported in parentheses.					

Table 3 Second equation model regressions

In Table 4, the fixed effect by period was added and the following effects can be observed: Column 8 presents that the variable of belonging to the treatment group has a positive effect of 0.27 points to the grade compared to be in the control group, this is not statistically significant; the difficulty of the lesson

in period two was greater compared to the lesson in period 1 and this had a negative effect of 0.82 points to the grade, being this statistically significant at a 5%.

Column 9 presents that an additional year of life has a negative effect of 0.202 points to the grade and having a GPA greater than 3.50 has a positive effect of 1.1 points to the grade compared to subjects who have a GPA between 3.00 and 3.50, being these two variables statistically significant in 1%; the difficulty of the lesson in period 2 was greater compared to the lesson in period 1 and this has a negative effect of 0.77 points to the grade, being statistically significant at 5%; studying more than 5 hours a week compared to studying between 1 and 5 hours a week has a negative effect of 0.59 points to the grade and these are statistically significant at 10%. Belonging to the treatment group has a positive effect of 0.1 points, but this is not statistically significant. And the remaining control variables have no statistical significance.

In column 10 it is presented that an additional year of life has a negative effect of 0.24 points to the grade and having had economics classes before has a positive effect of 0.92 points to the grade compared to subjects that didn't had economics classes before, these two being statistically significant in 1%; the difficulty of the lesson in period 2 was greater compared to the lesson of period 1 and this has a negative effect of 0.77 points of the grade and that having a GPA greater than 3.50 has a positive effect of 0.71 points compared to subjects who have a GPA between 3.00 and 3.50, these two variables being statistically significant in 5%, than having a GPA lower than 3.00 has a negative effect of 0.96 points compared to subjects who have a GPA between 3.00 and 3.50, this being statistically significant at 10%. Belonging to the treatment group has a negative effect of 0.11 points, but this is not statistically significant. And the remaining control variables have no statistical significance.

Column 11 shows that an additional year of life has a negative effect of 0.22 points to the grade, subjects having had an economics classes before has a positive effect of 1.1 points to the grade compared

to subjects that did not have economics classes before, being these two statistically significant in 1%; the difficulty of the lesson in period 2 was greater compared to the lesson of period 1 and this has a negative effect of 0.77 points, having a GPA less than 3.00 has a negative effect of 1.1 points compared to subjects who have a GPA between 3.00 and 3.50, studying less than 1 hour or more than 5 hours a week has a negative effect of 1.18 points and 0.67 points in the grade, these four variables are statistically significant at 5%; having a GPA greater than 3.50 has a positive effect of 0.650 points compared to subjects who have a GPA between 3.00 and 3.50, this being statistically significant at 10%. Belonging to the treatment group has a negative effect of 0.09 but this is not statistically significant. And the remaining control variables have no statistical significance.

Finally, in column 12 an interaction between the GPA and Group was added, to be able to see if there is a difference between the level of GPA of individuals belongs with the type of grading methodology. As it can be seen, in this case the treatment variable (Group) had a positive effect of 2.46, this is the first case of all regressions, where it is statistically significant at 1%. While the interaction between the GPA and the group that participated in the treatment had the following effects: if the characters belonging to the high GPA group (between 3.50 and 4.00) there is a negative effect of 2,460 being statistically significant at 5%, which shows an effect of 0 points to this group (having added this variable and group); in the case of subjects belonging to the medium GPA group (between 3.00 and 3.50) there is a negative effect of 3.46 being this statistically significant at 1%, which shows that students have a total effect of -1 point to the final grade if they belonged in the treatment group; and in the case of belonging to the low GPA group (between 2.00 and 3.00) it does not have an effect, which leads us to note that this group had a total positive effect. The other variables remained with the same effect as the results in column 11, but with different magnitudes.

	(8)	(9)	(10)	(11)	(12)
DV	Grade				
VARIABLES					
Group	0.265 [0.300]	0.095 [0.296]	-0.109 [0.289]	-0.087 [0.278]	2.462*** [0.918]
Study Level					
Low		-0.650 [0.494]		-1.186** [0.508]	-0.954* [0.496]
Medium		0.00 [0.00]		0.00 [0.00]	0.00 [0.00]
Hi		-0.594* [0.323]		-0.671** [0.321]	-0.619* [0.313]
Class Before			0.916*** [0.284]	1.100*** [0.303]	1.291*** [0.290]
Age		-0.202*** [0.052]	-0.240*** [0.045]	-0.224*** [0.050]	-0.260*** [0.048]
Year		0.312 [0.198]	0.280 [0.217]	0.242 [0.211]	0.416** [0.178]
GPA					
Low		-0.749 [0.546]	-0.958* [0.533]	-1.105** [0.502]	-1.917*** [0.557]
Medium		0.00 [0.00]	0.00 [0.00]	0.00 [0.00]	0.00 [0.00]
High		1.093*** [0.340]	0.712** [0.0342]	0.650* [0.350]	1.241*** [0.442]
Gender		0.316 [0.309]	0.037 [0.293]	0.702 [0.299]	0.307 [0.298]
Period					
Period 2	-0.820** [0.379]	-0.767** [0.377]	-0.767** [0.371]	-0.767** [0.367]	-0.767** [0.358]
Period 3	-0.373 [0.373]	-0.450 [0.379]	-0.450 [0.372]	-0.450 [0.369]	-0.450 [0.349]
GPA#Group					
Average					-2.460** [1.012]
High					-3.466*** [1.007]
Constant	5.557	8.640	8.632	8.480	8.000
Observations	201	180	180	180	180
R-squared	0.028	0.2101	0.226	0.255	0.304

Standard errors in brackets

\*\*\* p<0.01, \*\*

p<0.05, \* p<0.1

Standard errors clustered at the firm-region level are reported in parentheses.

Table 4 Equation 3 regressions period fixed effects

## Conclusions and recommendations

As it was observed in the previous study, the methodology that was used when grading the students does not have a statistically significant effect with the final grades in each period until the interaction between GPA and Treatment is made. With this result, two things can be assumed: firstly, the group with a lower GPA does not see a challenge about the class and making them participate with this grade elimination system, where a loss has a greater value than a gain, incentivizes students not to lose those points since they will get a minor utility. Secondly, it can be shown that people with a medium or high GPA are already accustomed to the previous evaluation system and therefore understand their utilities when acquiring grades. And when they participate with the new methodology, they tend not to adapt in the best way, which makes them uncomfortable and making them have negative results.

While other variables such as the GPA level, taking an Economics class before, the number of hours spent studying, among other variables do have a direct effect, which leads to not accepting the hypothesis presented in section 2. This allows us to conclude that issues related to exogenous and endogenous characteristics of students have a greater effect on their performance than the type of methodology at the time of grading, which can be studied in the future in order to improve the performance of students within classes.

A possible problem that could have occurred in this experiment is the lack of time in the learning curve for the subjects, where the small number of periods could have affected the performance or the understanding of the process of how they were going to be graded. Another problem that the experiment could have presented is that the difficulty between periods (especially between period 1 and 2) could have affected the results of the students, although by comments of the teachers who verified the questions before presenting them, the third and last period would present a greater difficulty to the students.

For any future research on the matter, if studies like the one hereby presented were to be performed, it would be recommended that additional periods should be used within the subjects, in order to verify the change between longer periods. One of the possible shortcomings of the experiment has been the small number of periods that individuals participated in. Another recommendation for this experiment is for the methodology to be changed to an open environment, where this experiment can be used in the field and for a longer time, so that a greater amount of data can be obtained by subjects who participate and by the number of activities in which subjects participate.



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<sup>3</sup> This paper is a preliminary draft. Made in 2016 by the same authors as Improving student performance through loss aversion

# Appendixes

## Appendix A: Experimental design

This screenshot shows a vertical list of three question blocks in a software interface. The first block is 'Show Block: Default Question Block (3 Questions)' with options 'Add Below', 'Move', 'Duplicate', and 'Delete'. The second block is 'Show Block: Información general (13 Questions)' with the same options. The third block is a purple 'Randomizer' block with a dropdown set to '1' and a checked 'Evenly Present Elements' option. It also has 'Add Below', 'Move', 'Duplicate', 'Collapse', and 'Delete' options.

This screenshot shows two main groups of question blocks. The first group is 'Group: Tratamiento' and the second is 'Group: Control'. Each group contains a sequence of question blocks: an example block (5 questions), three test blocks (10 questions each), and three corresponding answer blocks (1 question each). Each individual block has its own set of control options: 'Add Below', 'Move', 'Duplicate', 'Collapse', and 'Delete'. There are also '+ Add a New Element Here' buttons at the bottom of each group.

## Appendix 2: Variable's description

variable name	storage type	display format	value label	variable label
<b>Subject</b>	byte	%8.0g		<b>ID of subject who took the experiment</b>
<b>Period</b>	byte	%8.0g		<b>Period of the experiment</b>
<b>Grade</b>	byte	%8.0g		<b>Grade the subject got</b>
<b>Group</b>	byte	%8.0g		<b>Group the subject belong 0=Control Group 1=Treatment Group</b>
<b>Age</b>	byte	%8.0g		<b>Subjects Age</b>
<b>Year</b>	byte	%8.0g		<b>Year of study</b>
<b>stud1</b>	long	%8.0g	stud1	<b>Time they spent studying in the class</b>
<b>classb</b>	long	%8.0g	classb	<b>If the subject did take a economy class before</b>
<b>friend</b>	long	%8.0g	friend	<b>If the subject take the class with a friend</b>
<b>knownp</b>	long	%8.0g	knownp	<b>If someone the subjects knows had took before the class</b>
<b>GPA1</b>	long	%8.0g	GPA1	<b>GPA os the subject High = Above 3.50 Average=Between 3.00 and 3.50 Low=Below 3.0</b>
<b>daded</b>	long	%8.0g	daded	<b>Subjects Dad has a third or higher educational education</b>
<b>momed</b>	long	%8.0g	momed	<b>Subjects Mom has a third or higher educational education</b>
<b>gender</b>	long	%8.0g	gender	<b>Subjects Gender</b>
<b>major</b>	long	%16.0g	major	

### Appendix 3: Stata Commands

\*Endowment effect on the grading system inside classes\*

\*First use the data file\*

\*Panel Data\*

```
use "C:\Users\flasc\OneDrive\Desktop\thesis\PanelDataThesis.dta"
```

```
xtset Subject Period
```

```
xtdescribe
```

```
xtsum
```

\*In these cases, because of the continuous periods, I used a Pooled OLS to compare the results from the obtained data\*

\*First, we use a simple regression looking to see if the treatment group had an effect on the final grades\*

```
reg Grade Group, robust
```

\*I had to replace this numbers because they were the same\*

```
replace studl=2 if studl==3
```

\*Firsts regressions based on Shrader et al.\*

\*Regression 2 and 3\*

```
reg Grade Group i.studl classb friend knownp, robust
```

```
reg Grade Group i.studl class friend knownp i.daded i.momed, robust
```

```
test
```

\*Regressions based on the intrinsic variables\*

\*By dropping GPA1 we didn't use the NA data from students who didn't want to give this data\*

```
drop if GPA1==4
```

\*Refression 4\*

```
reg Grade i.Group Age Year i.GPA1 i.gender, robust
```

\*Second study part, used for the experiment\*

\*Regressions 5,6,7\*

```
reg Grade Group i.studl Year i.GPA1 i.gender Age, robust
```

```
reg Grade Group i.classb Year i.GPA1 i.gender Age, robust
```

```
reg Grade Group i.studl i.classb Age Year i.GPA1 i.gender, robust
```

\*Add the variable Period fixed effect\*

\*Regressions 8, 9, 10, and 11\*

```
reg Grade Group i.Period, robust
```

```
reg Grade Group i.studl Age Year i.GPA1 i.gender i.Period, robust
```

```
reg Grade Group classb Age Year i.GPA1 i.gender i.Period, robust
```

```
reg Grade Group i.studl classb Age Year i.GPA1 i.gender i.Period, robust
```

\*In the last regression, I'm adding an interaction of GPA and Group to see if there's any difference between the low and high GPA students\*

\*Regression 12\*

```
reg Grade Group i.studl classb Age Year i.GPA1 gender i.Period i.GPA1#Group, robust
```