

The Impact of Gender Difference Motivating Assessing and Grading Student's Performance

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Abstract

This experiment was conducted to find out the influence of grade incentives and gender on student's performance at the graduate level. We perform a two way analysis of variance on a sample of three groups of students taking a first-year core mathematics course and another three groups taking a fourth-year compulsory accounting course. We find that grade incentives significantly affect student performance for both sampled courses across all six groups. Gender is found to significantly affect the performance of mathematics students, but not of accounting students. The interaction between gender and grade incentives does not have a significant impact on performance in either experiment.

Keywords: Student performance, grade incentive, gender, experimental research, accounting students, mathematics students.

1. Introduction

Students' academic performance has been extensively researched over the last eight decades from numerous perspectives. It is affected by cognitive as well as motivational factors (Richardson, Abraham, & Bond, 2012). Performance-related motivation is divided into intrinsic and extrinsic factors (Griffin, MacKewn, Moser, & VanVuren, 2013; Matei & Abrudan, 2011). Of the latter, grades are an important factor affecting student performance (Maksy, 2012a, 2012b). MacDermott (2013) reports that alternative grading policies have a substantial impact on student performance: when different methods are used to improve students' grades, such as dropping the lowest graded assignment, they perform better on their final examination for that course. Grant and Green (2013), however, find that grade incentives have no significant impact on performance.

The literature exploring the effect of gender on academic performance, while extensive, is not necessarily conclusive. Some studies report that gender has a significant effect on performance while others find it is not a significant factor. Many studies have looked at the influence of gender on performance in conjunction with other factors, such as personality type. Russo and Kaynama (2012) report that women students with a "judging type" personality perform better. Arthur and Everaert (2012) find that gender has a significant impact on examination performance: based on a sample of accounting students, they note that women performed better overall in the examination, but that gender played a more significant role in subjective questions than multiple-choice questions (MCQs). On the other hand, Picou (2011) and Borg and Stranahan (2002) find no significant impact for gender on student performance.

Adopting an experimental approach, this study runs univariate tests to find out the impact of grade incentives and gender differences on student performance at the university level. We address the following research questions:

Do grade incentives influence student performance?

Do gender differences influence student performance?

Does the interaction between grade incentives and gender differences affect student performance?

2. Theoretical Background

Earlier discussions have focused on how students perform in different subjects. Harbeson (1943) observes that better textbooks and course material improve student performance in any subject. Student's participation in the learning process is also discussed as an important feature of learning and performance. Joseph (1965) examines role-play by students of economics and argues that parts in which they were asked to act out real-life scenarios enabled a better comprehension of the concepts being taught in the class. Doney and Neumann (1965) find that neither teaching methodology nor the weekly frequency of classes affect student performance on accounting courses.

Current studies have focused on a number of new facets that might affect student performance. An important factor leading to better performance is computer-based problem solving, especially for accounting

students (King & Mo, 2013). Hatcher, Henson, and LaRosa (2013) discuss grade point average (GPA) as an intermediate factor in the relationship between mode of teaching and performance, where the mode of teaching ceases to be a significant factor while GPA becomes more important.

Motivational factors remain the most widely discussed topic in the literature. Chung's (1968) model predicts student performance based on ability, needs, incentives, and expectations. Grades are an important motivational factor in this context. Carpenter and Strawser (1971) have carried out an experimental study of how grading systems affect student performance. Drawing on a sample of accounting students, they find that a proper grading system improved performance as compared to one in which students were told merely whether they had performed satisfactorily or otherwise. Artés and Rahona (2013) observe that questions assigned as graded problems in an examination heightened the performance of a sample of Spanish students compared to questions from an ungraded problem set.

Dobrow, Smith, and Posner (2011) identify a "grading paradox" where by grades are/were supposed to increase students' activity in a class, but can also do the adverse. Giving students more choice in the classroom increases their interest in that particular subject. Aloysius (2013) builds on this idea and finds that student empowerment is an important factor affecting performance: students who feel they have more choice in what they study are likely to perform better.

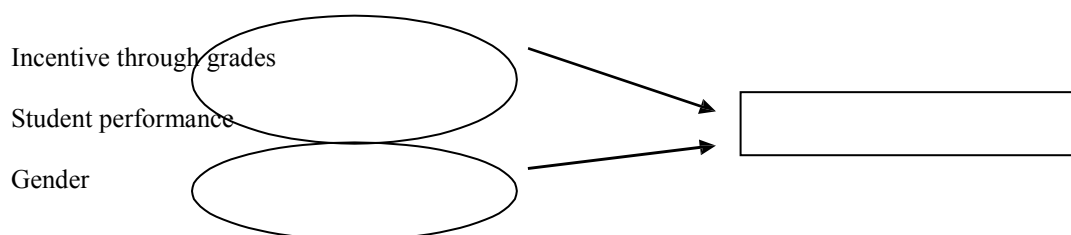
The findings on student performance and gender are mixed. Very few studies have looked at the impact of gender alone; most focus on its effect in interaction with other factors. Buckless, et al. (1991) conclude that gender has a significant impact on performance with women performing better than men on accounting courses. This result also holds when student's gender and instructor's gender interact, but the impact of gender on performance is reduced if students' previous grades are considered a covariate.

Tan and Laswad (2008) find that gender has a substantial impact on students' performance, through its effect on their meta-cognitive knowledge. Huh, Jin, Lee, and Yoo (2009) test the effect of several student characteristics on academic performance and observe that gender affects performance more significantly for a sample of offline accounting students than for online accounting students. Marks (2008) studies the impact of gender on performance for different socioeconomic groups of students, but does not find that gender has any significant impact in this context.

3. Framework and Research Hypotheses

The purpose of this study is to test whether grade incentives and gender affect student performance independently as well as when interacting with each other. The conceptual framework is given in Figure 1.

Figure 1: Model testing student performance



We test the following hypotheses:

Hypothesis 1(H0): There is no significant difference in the means of performance across all levels of grade incentives offered to students.

Hypothesis 1(H1): There is a significant difference in the means of performance across all levels of grade incentives offered to students.

Hypothesis 2(H0): There is no significant difference in the means of performance across gender.

Hypothesis 2(H1): There is a significant difference in the means of performance across gender.

Hypothesis 3(H0): There is no significant interaction effect in the means of performance across three levels of grade incentives and both genders.

Hypothesis 3(H1): There is a significant interaction effect in the means of performance across three levels of grade incentives and both genders.

4. Research Methodology

This section describes the sample and methodology used, and the variables employed.

4.1. Sample

The study's sample comprised 247 university students studying toward a BBA degree. Of these, 120 were

studying a first-year core mathematics course and 127 were studying a fourth-year cost accounting course at the same university. The sample included 53 percent men and 47 percent women, and their average age was 21 years.

4.2. Procedure

We have employed an experimental factor design (Table 1) to test the relationship b/w (i) performance and grade incentives, (ii) performance and gender, and (iii) performance and the interaction between grade incentives and gender. The two subsamples (of first-year and fourth-year students divided across six sections) were tested separately. As a laboratory experiment, the study was conducted during class over the same semester. The first-year students were given the same mathematics test and the fourth-year students were given the same accounting test. Both tests had been announced a week before, giving all six sections equal time to prepare.

In both cases, the mathematics and accounting courses represent a separate experiment. Students on each course were divided into two experiment groups and one control group. The first experiment group was given a 5 percent incentive, i.e., they were told the test was worth 5 percent of their course grade. The second experiment group was given a 10 percent grade incentive and the third group (control group) was told that the test was merely for practice and would not be marked.

Table 1: Experimental design

Performance observation

Grade incentive	Male	Female
5%	Y11	Y12
10%	Y21	Y22
None(control group)	Y31	Y32

Observations were recorded only after the treatments had been applied. Overall, 96 students were given the 10 percent grade incentive (45 for mathematics and 51 for accounting), 81 were given the 5 percent grade incentive (35 for mathematics and 46 for accounting), and 70 were assigned the no-incentive condition (40 for mathematics and 30 for accounting).

We minimized the order-effects bias by changing the order of the experiment groups and control groups for both courses. Thus, in the case of the mathematics course, the no-incentive test took place first, followed by the 5 percent and 10 percent grade incentive tests. In the case of the accounting course, the 5 percent and 10 percent grade incentive tests took place first, followed by the no-incentive test. At the end of the week, once all the tests had been completed, the students were told about the experiment and their grades were included in the study with their consent.

4.3. Variables

We have employed three independent variables: grade incentive, gender, and their interaction. In the first case, two levels of grade incentive were offered. Students in the first and second sections were told they could easily improve their performance by sitting a test that would count toward 5 and 10 percent, respectively, of their overall grade. They were also told that the test would include basic questions. The third section or control group was told that sitting the test would not add anything to their grade.

The second independent variable was gender. The sample comprised both men and women, and the purpose was to test for significant differences, if any, in their academic performance. The interaction term was used to determine if grading incentives had a more significant impact on men or women, that is, whether women performed better than men when given a grading incentive (in the two experiment groups) relative to none.

We have hypothesized that academic performance, the dependent variable, is affected significantly by the different levels of incentive given to students. In testing this hypothesis, we have used the marks they obtained as a measure of their performance. According to the second hypothesis, gender is expected to play a significant role in affecting performance and is, therefore, included in the experiment as an independent variable.

5. Analysis & Results

A two-way ANOVA was used to examine the relationship between the dependent variable (student performance) and independent variables (the different levels of grade incentive and gender). This was done independently for the mathematics and accounting class samples because both courses constitute two different experiments.

5.1. Results for Mathematics Students

Table 2 gives the descriptive statistics (mean performance scores) for the first experiment. Levene's test statistic for the equality of error variances is found to be insignificant, which satisfies the basic assumption about the model being used. As Table 3 shows, the different levels of grade incentive ($F= 9.923$, $p = 0.000$) have a significant impact on student performance. Students tended to perform better when given a higher incentive level. This finding supports the first hypothesis (H1) proposing that there are significant differences in the means of

performance across various levels of grade incentive.

Table 2: Mean performance scores for mathematics students

Incentive	Gender	Mean	SD	N
None	Male	9.4091	4.23600	22
	Female	7.1944	3.86971	18
	Total	8.4125	4.17546	40
5%	Male	10.4750	4.90830	20
	Female	8.6333	4.05967	15
	Total	9.6857	4.59393	35
10%	Male	13.5435	3.30947	23
	Female	10.7727	3.94826	22
	Total	12.1889	3.85724	45
Total	Male	11.2000	4.47720	65
	Female	9.0182	4.17772	55
	Total	10.2000	4.46009	120

Source: Authors' calculations.

Post hoc comparisons also support this finding: students given a 10 percent grade incentive performed better (had a higher mean score on the test) than those given a 5 percent incentive or no incentive. This finding is backed by the literature, which argues that increasing the level of grade incentive motivates students, who then are likely to perform better.

Table 3: Two-way ANOVA results for mathematics students

Dependent variable: performance

Source	Type III sum of sq.	DF	Mean square	F	Sig.	Partial eta sq.	Noncentr. parameter	Observed power a
Corrected model	479.021 b		595.804	5.784	0.000	0.202	28.921	0.992
Intercept	11,752.307		111,752.307	709.553	0.000	0.862	709.553	1.000
Incentive	328.724		2164.362	9.923	0.000	0.148	19.847	0.982
Gender	152.014		1152.014	9.178	0.003	0.075	9.178	0.852
Incentive * gender	4.355		22.178	0.131	0.877	0.002	0.263	0.070
Error	1,888.179	114	16.563					
Total	14,852.000	120						
Corrected total	2,367.200	119						

aComputed using alpha = 0.05.

bR-squared = 0.202 (adjusted R-squared = 0.167).

Source: Authors' calculations.

Our results also support the second hypothesis (H1) proposing that there are significant differences in the means of student performance with respect to gender. Table 3 indicates a significant difference between the performance of men and women students ($F = 9.178$, $p = 0.003$). As Table 2 shows, men tended to perform better than women, as seen from their mean scores on the test (11.2 for men and 9.01 for women).

As far as the interaction effect on the means of student performance across different levels of grade incentive and gender is concerned, our results do not support the third hypothesis (H1). There is no statistically significant interaction between gender and grade incentives with respect to student performance, meaning that there is no significant difference in the performance (as measured by the test mean scores) of men and women students for the different levels of incentive; the six means are not significantly different.

5.2. Results for Accounting Students

Table 4 gives the descriptive statistics (mean performance scores) for the second experiment. Levene's test statistic is insignificant, satisfying the basic assumption that the variance of errors for performance are the same across all groups. We can thus apply the ANOVA technique, the results of which are given in Table 5.

Table 4: Mean performance scores for accounting students

Incentive	Gender	Mean	SD	N
None	Male	10.7273	5.95364	22
	Female	10.4167	4.39285	24
	Total	10.5652	5.14091	46
5%	Male	11.9286	4.68162	14
	Female	12.4375	5.53737	16
	Total	12.2000	5.07462	30
10%	Male	16.0333	5.46767	30
	Female	12.4286	7.13142	21
	Total	14.5490	6.39473	51
Total	Male	13.3939	5.93783	66
	Female	11.6393	5.74466	61
	Total	12.5512	5.88880	127

Source: Authors' calculations.

The results of the two-way ANOVA (Table 5) show that, for fourth- year accounting students, grade incentives affect their performance significantly ($F = 5.079$, $p = 0.008$) at a confidence interval of 90 percent. Thus, there are differences in the performance of students who were given a grade incentive and those who were not. This supports our first hypothesis proposing that grade incentives affect student performance.

Post hoc tests run using Scheffe's test reconfirm these results. Students who were given a 10 percent grade incentive performed significantly better than those given a 5 percent grade incentive or no incentive at all. Table 4 indicates a mean score of 10.56 for no incentive, 12.2 for a 5percent incentive, and 14.5 for a 10 percent incentive.

Table 5: Two-way ANOVA results for accounting students

Dependent variable: performance

Source	Type III sum of sq.	DF	Mean sq.	F	Sig.	Partial eta sq.	Noncentr. parameter	Observed power ^a
Corrected model	552.245b		5110.449	3.501	0.005	0.126	17.506	0.905
Intercept	18,118.560		118,118.560	574.338	0.000	0.826	574.338	1.000
Incentive	320.481		2160.240	5.079	0.008	0.077	10.159	0.812
Gender	38.423		138.423	1.218	0.272	0.010	1.218	0.195
Incentive * gender	100.871		250.435	1.599	0.206	0.026	3.197	0.333
Error	3,817.173	121	31.547					
Total	24,376.000	127						
Corrected total	4,369.417	126						

aComputed using $\alpha = 0.05$.

bR-squared = 0.126 (adjusted R-squared = 0.090).

Source: Authors' calculations.

Our results do not, however, support the second hypothesis (that gender affects performance) because there is no significant difference between the performance of men and women ($F = 1.218$, $p = 0.272$). Both genders performed equally well on the test. The third hypothesis (that the interaction of gender and grade incentives affects student performance) is also unsupported by the results. Gender appears not to play a role as neither men nor women's performance was significantly different at different incentive levels ($F = 1.599$, $p = 0.206$).

6. Conclusion and Inferences

This experimental study on the effects of grade incentives and gender on performance yields some interesting results. Grade incentives appear to have a significant impact on performance for both mathematics and accounting students, whether first-year or fourth-year. Increasing levels of grade incentive are found to motivate students who want to improve their course performance.

Gender, on the other hand, is found to have a significant impact on performance among first-year mathematics students, but not fourth- year accounting students. Men appear to have performed better than women on the mathematics test, contradicting the general perception that women perform better. One reason for this could be that the first-year students sampled were from both coeducational and segregated backgrounds, accounting for a potential gender bias in their previous education. On the other hand, such bias would likely have been eliminated among the fourth-year students as a result of having already spent three years together at university.

We can also conclude that, although grade incentives affect performance, they do not affect the performance of men or women differently in either the mathematics or accounting courses.

Our research findings imply that course instructors at the university level could use the grading system as an effective tool to improve students' performance and that such incentives are likely to work equally well for both men and women students.