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# The Effects of Penalties On Homework that is Submitted Late for Grading on Learning in a Statics Course

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# The effects of penalties on homework that is submitted late for grading on learning in a Statics course

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A literature review of research on the benefits of homework to learning indicates that this is a very complex subject and that there is no agreement on whether doing homework is beneficial to learning or not. Indeed, the importance and the amount of homework that students should be assigned have been debated for more than 100 years [1].

Whether assigning, collecting, and grading homework enhances learning or not remains controversial to this day. Results of many studies disagree [2] - [13], [14] - [16]. It is argued in the literature that these disagreements arise because the methodologies used are very, very disparate; that students cannot be treated as objects that are identical; that, indeed, their individual characteristics, beliefs, motivations, psychological predispositions to learning vary widely; and that the academic traditions and standards of the schools that students came from vary a lot as well. The literature on this subject is very vast [2] - [13], [14] - [16].

Generally, there are two camps: those who support the use of homework and those who do not [1]. Those researchers who assert that doing homework is very important to academic success list the following reasons: 1) Homework is an important tool for learning in the classroom **[**17], [18], [19]. 2) Homework is positively correlated with student achievement; this means that students who do their homework regularly perform better on exams than those who do not, in general **[**20], [21], [6]. 3) Homework is also reported to be "an inexpensive way of improving student academic preparation, because it does not require the hiring of new staff or the modification of the curriculum **[**20]." 4) Graded homework is a significant predictor of final grades **[**19**]**. And 5) graded homework can facilitate timely progress toward graduation **[**21]. Those who hold the opposite view also have their long list of reasons **[**1], [22], [19], [16].

It is recommended that a viable option for the improvement of final course grades is to experiment with the impact of graded homework on final grades **[**21**]**. This paper is based on the implementation of that recommendation **[**21**]**. Specifically, the paper is about the results of data collected on how the timely completion and submission of solved homework problems for grading correlated with grades earned in exams in an engineering technology statics course; and with how

students' perceptions of the instructor changed over the duration of the study. The course was studied for three consecutive semesters and met face to face every semester.

## Design of the study

The instructor (the first author) used the syllabus to lay out the homework policies in the course [10], [12], [13]. It spelled out clearly all the dates on which homework was to be submitted for grading. It was required that homework papers be submitted at the beginning of class. The required formats of its presentation and the definitions of homework that was on time, moderately late, very late, or unacceptably late were specified; so were the penalties associated with each type of late submission. Submitted homework was collected, graded, and returned to the students promptly. All homework assignments were graded.

There were four exams in addition to the homework. Their weights were as follows: Homework (20%), Exam 1 (20%), Exam 2 (20%), Exam 3 (20%) and the final Exam (20%). All homework assignments were done individually on paper by students. The number of assessments, exams and their weights remained the same from one semester to the next. They covered every major topic of the course. However, the homework problems assigned were different every semester. Classes met twice a week, for 75 minutes at a time, and for a whole semester. After the first meeting, homework was due at each subsequent session. The policy on late homework was changed from one semester to the next by modifying the syllabus to be used for that semester.

The course was designed for, and enrolled, students who were in their first or second year of college. Enrolled students came from the different technology majors in the school of technology that required the statics course. The four majors represented among enrolled students consisted of Construction Engineering Technology, Construction Management, Industrial Engineering Technology, and Mechanical Engineering Technology.

The instructor, who is very experienced in teaching this course and other mechanics courses, conceived a study in which he taught the same course over three consecutive semesters, stiffening the penalties for late submissions of homework progressively after each semester. He started with a very lenient policy in the first semester, followed it with a strict policy in the second, and ended the study with a stricter policy in the third. During each semester, the names of the students were placed into one of three categories according to the timeliness of the submissions of their homework: those who submitted it on time were placed in category G1; those who submitted it late were in category G2; and those who rarely/never submitted homework were in category G3. Submitted homework papers were graded, recorded, and returned promptly; so were exams; then, the performances of the three groups were compared at the end of each semester, using the grades that students earned in the course.

## Brief overview of results of the study

In general, it was found that those students who submitted no homework earned the lowest scores on exams every semester; those who submitted their homework on time earned the highest

scores on exams every semester; and those who submitted their homework late earned scores that were between the first two. This pattern remained consistent from one semester to the next. Furthermore, a particular item in the teaching evaluations of the instructor who taught this course during those three semesters caught our attention: scores given to the instructor by students on that particular item, the extent to which students perceived their instructor as being helpful, decreased with time progressively. They were the highest when the policy was lenient (3.78/4); lower when the policy became strict (3.43/4); and the lowest when the policy was the strictest (3.06/4). Therefore, according to this study, instituting strict penalties on late homework and enforcing them signified to the students that the instructor was not helpful and the stricter the penalties, the less helpful the instructor appeared to them. The instrument used by the school of technology to evaluate the teaching effectiveness of instructors is online and has many other items on it. However, the authors did not consider them pertinent to the study at hand and were not included in this paper for that reason. The specific data and details on which these conclusions were based are presented below.

Data from the study

Every semester in this study, there were three groups of students:
G1, Group 1 represented the number of students who submitted all homework problems on time.
G2, Group 2 represented the number of students who submitted some homework problems on time.
G3, Group 3 represented the number of students who submitted no homework problems for grading.

In what follows, data are presented in three tables: Table 1, Table 2, and Table 3. Given the many small groups of data collected, the authors found that the presentation of data in tabular forms was more succinct and easier to follow at a glance than graphs. Consider Table 1. Table 1 shows data for whole classes over three semesters. The percentages under the heading called "Total Enrollment" indicate the size of each group during a given semester. For example, G1 consisted of 14 students out of a total of 23 during semester 1, hence a percentage of 60.87 is placed next to 14. The percentages under the heading called "performance of each class, as a whole", Table 1, line 7, show the distribution of semester grades within each class. For example, during semester 1, five students out of 23 earned As, hence a percentage of 21.74 is placed next to 5. Similarly, during semester 2, G1 consisted of 22 students out of a total of 30 students, hence a percentage of 73.34, and five students out of 30 earned As, hence a percentage of 16.67, Table 1, line 8. The last row of Table 1 displays the scores that students gave to their instructor on course evaluations regarding the extent to which they perceived him as being helpful. Those scores decreased progressively from semester 1 (3.78/4), to semester 2 (3.43/4.00), to semester 3 (3.06/4.00).

Table 1. Total numbers of students in each class and group and the performance of each class.

| | **Semester 1** | **Semester 2** | **Semester 3** |
|---|---|---|---|
| Line 2. **Total Enrollment** | 23 | 30 | 23 |
| Line 3. **Group 1** | 14(60.87%) | 22(73.34%) | 20(86.95%) |
| Line 4. **Group 2** | 6(26.09%) | 4(13.34%) | 1(4.35%) |
| Line 5. **Group 3** | 3(13.04%) | 4(13.34%) | 2(8.70%) |

| | | | |
|---|---|---|---|
| Line 6. **Total** | 23(100%) | 30(100%) | 23(100%) |
| Line 7. **Performance of each class, as a whole** | | | |
| Line 8. Students who earned As | 5(21.74 %) | 5(16.67%) | 7(30.43%) |
| Line 9. Students who earned Bs | 4(17.39%) | 7(23.34%) | 8(34.78%). |
| Line 10. Students who earned Cs | 3(13.04 %) | 8(26.67%) | 4(17.40%) |
| Line 11. Students who earned Ds | 2(8.70%) | 3(10%) | 2(8.70%) |
| Line 12. Students who earned Fs | 9(39.13%) | 7(23.34%) | 2(8.70%) |
| Line 13. **Scores on students' perception of the helpfulness of the instructor** | 3.78/4 | 3.43/4.00 | 3.06/4.00 |

Analyses of data. Table 2 shows the distributions of the letter grades earned by students within each group: G1, G2, and G3, across three semesters. Analyses of the collected data appear to reveal that the policy of introducing penalties on late homework increased learning in many remarkable ways; six of which are summarized in Table 3. However, the main negative effect is that students did not like the homework policies and the penalties that were associated with them; and they blamed the instructor for them in writing during course evaluations of the instructor's teaching performance. See Table 1, line 13.

Table 2. Percentages of grade distributions within groups G1, G2, and G3 over three semesters.

| **Group 1 Only** | **Semester 1** | **Semester 2** | **Semester 3** |
|---|---|---|---|
| Percentage of As | 35.1 | 22.73 | 35.0 |
| Percentage of Bs | 28.57 | 31.82 | 40.0 |
| Percentage of Cs | 14.29 | 36.36 | 20.0 |
| Percentage of Ds | 7.14 | 9.09 | 5.00 |
| Percentage of Fs | 14.29 | 0.00 | 0.00 |
| **Group 2 Only** | **Semester 1** | **Semester 2** | **Semester 3** |
| Percentage of As | 0.00 | 0.00 | 0.00 |
| Percentage of Bs | 0.00 | 0.00 | 0.00 |
| Percentage of Cs | 16.67 | 0.00 | 0.00 |
| Percentage of Ds | 16.67 | 25.0 | 100 |
| Percentage of Fs | 66.67 | 75.00 | 0.00 |
| **Group 3 Only** | **Semester 1** | **Semester 2** | **Semester 3** |

| | | | |
|---|---|---|---|
| Percentage of As | 0.00 | 0.00 | 0.00 |
| Percentage of Bs | 0.00 | 0.00 | 0.00 |
| Percentage of Cs | 0.00 | 0.00 | 0.00 |
| Percentage of Ds | 0.00 | 0.00 | 0.00 |
| Percentage of Fs | 100.00 | 100.00 | 100.00 |

Table 3. The apparent effects of penalties on the late submission of homework for grading.

| **Apparent effects of increasing penalties on late homework on the timeliness of submissions.** | **Percentage of students who submitted homework on time increased.** |
|---|---|
| **1.** On-time submissions of homework papers increased: The percentage of students in G1 increased from 60.87%, to 73.34 %, to 86.95%. Table 1, line 3. One can argue that stiffening penalties on late homework was responsible for this. | **1.** When homework policy was lenient, the percentage was 60.87 %.<br>When homework policy was strict, it became 73.34 %.<br>When homework policy was stricter, that percentage became 86.95 %. Therefore, the percentage of students who submitted their homework papers on time increased from semester 1, to semester 2, to semester 3. |
| **2.** The percentage of students who submitted their homework late decreased every semester. G2 decreased from 26 % to 4.35%. Table 1, line 4. One can argue that stiffening penalties on late homework was responsible for this as well. Indeed, effects 1 and 2 are complementary. Table 1, line 4. | **2.** When homework policy was lenient, 26.0% of students were in G2.<br>When homework policy was strict, 13.34 % of students were in G2.<br>When homework policy was stricter, 4.35 % of students were in G2. Clearly, the percentage of students in G2 decreased from semester 1, to semester 2, to semester 3. |
| **3.** Percentages of students in G3 stayed about the same for a while; then, they decreased substantially in the third semester. Table 1, line 5. | **3.** When homework policy was lenient, 13.04 % of students were in G3.<br>When homework policy was strict, 13.34 % of students were in G3.<br>When it was stricter, 8.7 % of students were in G3. |

| **Effects of increasing penalties on late homework on grades earned.** | **Increasing penalties on late homework enhanced learning in three ways.** |
|---|---|

| | |
|---|---|
| 1. In general, students in G1, those who avoided penalties by submitting their homework on time, earned all the As and all the Bs, every semester. See Table 2. | 1. The percentage of students in G1, the high performers, increased every semester. Table 2. The data suggest that timely submission of homework papers is associated with high performance, in general. It is possible that increases in the percentages of students who entered G1 are associated with the policies that increased penalties on late homework. |
| **2.** In semester 1, 78 % of students in G1 earned at least a C. In semester 2, that percentage increased to 90.91; and in semester 3, that percentage became 95. See Table 2. | **2**. Students in G1 passed the course at higher rates than those of any other group; and those rates increased, as the penalties increased. Table 2. |
| **3.** Increasing penalties seemed to have caused failure rates to decrease progressively during the study. Table 1, line 12. And most Fs earned in the courses came from Groups G2 and G3, every semester. See Table 2. | **3.** Failure rates decreased from 39.1% in semester 1, to 23.34 % in semester 2, to 8.7 %, in semester 3. See Table 1, line 12. |
| **4.** Course evaluations revealed that the perception of the instructor by the students suffered every semester of the study, due to the enforcement of the penalties on late homework. Table 1 line 13. | **4.** Increasing penalties on late homework caused students to perceive the instructor as not being very helpful to them. These feelings were reflected on the evaluations of the course by the students. The course-evaluation instrument that was used consisted of many items, one of which asked the students to score the extent to which they perceived the instructor as being helpful. In semester 1, the score given was 3.78/4; in semester 2, that score was 3.46/4; and in semester 3, the score became 3.06/4. Table 1, line 13. |

Limitations of the study.

This study has two limitations. 1.) The potential effects of cheating on the data are missing. It is well known that cheating occurs in colleges and universities; it is reported that cheating is particularly prevalent in colleges of Engineering [23] - [25]. A limitation of this study is that the authors did not, and could not, account for the possible effects of cheating. It would have been

difficult to identify students who cheated without accusing them of having cheated. Such accusations require proof of cheating from the instructor. Experience indicates that showing that students have submitted homework papers that are nearly identical in their contents only represents circumstantial evidence but does not constitute conclusive proof of cheating. 2.) The results of statistical analyses of data are missing. Basic and simple statistical analyses performed on the data were not very informative, perhaps, because the numbers of students enrolled in some categories of students (G1, G2, G3) proved to be very small during some semesters.

## Conclusions

The results of the study described in this paper strongly indicate that collecting homework for grading, if it is accompanied with penalties for late submissions, enhances learning among those students who do and submit their homework for grading on time. It appears that the stricter the penalties, the better the enhancement of learning among those who comply. The results also suggest that most students in these courses responded to higher academic expectations, but the instructor paid a price for instituting and enforcing policies that raise such expectations.

In this study, learning was measured by using the letter grades earned by all students at the end of the semester. Letter grades of students who did and submitted their homework for grading on time were compared with those of students who did not do so. This study was carried over three consecutive semesters and consisted of a total of 76 students from engineering technology departments. The resulting comparisons clearly indicate that, as a group, every semester, students who did and submitted their homework for grading on time earned much higher grades than those who did not. This conclusion is supported by those of other studies [6], [9], [10], [16], [26], [27], [28].

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