

## **Relationship Between Voluntary Graded Homework Assignment Pickup on Exam and Course Performance**

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# **Relationship Between Voluntary Graded Homework Assignment Pickup on Exam and Course Performance**

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## **Abstract**

Student performance depends not only on their intellectual ability, but also their habits and decision making. Homework assignments can directly affect student performance in a course, but also indirectly through preparation for exams. This is specifically prevalent for engineering courses which involve homework assignments as practice problem sets to prepare for examination questions. This work investigates the differences in grade performance between two student groups within an engineering dynamics course: those who voluntarily picked up a graded homework assignment prior to an exam, and those who did not. Results from this research effort indicate that on average students who picked up their assignment performed better on the assignment, the midterm exam, and the overall course grade, however statistical significance was only found for the final course grade.

## **Keywords**

Engineering Dynamics, Grading, Homework Assignments, Study Habits

## **Introduction**

Student performance within a course is a function of many different factors in addition to their intellectual ability. Study habits and skills have been identified as a clear predictor of academic performance<sup>1</sup>. In addition to good study habits, self-motivation plays an important role in student interest and engagement with their academics<sup>2</sup>. In particular, many courses in engineering rely on homework assignments to both instruct course content and assess learning outcomes. These assignments implicitly require students to be motivated to complete the assignment as well as to learn the necessary course material. Some motivation strategies for students to complete their homework assignments include providing representative questions for an exam<sup>3</sup>, or even the recycling of homework questions on exams<sup>4</sup>. Rather than implementing a typical graded homework structure, some instructors administer recommended study problems and periodic quizzes to motivate and assess learning within engineering courses<sup>5</sup>.

For courses with a standard homework system in place, some effort has been done to determine if course performance can be predicted from homework habits<sup>6</sup>. This has potential for helping to develop early warning systems to help students with advising decisions or early corrective action within the course to help with final course grades. Other work has considered non-traditional grading approaches such as allowing re-submissions of assignments<sup>7</sup> or having students self-correct their work based on a provided solution<sup>8</sup>.

Rather than looking at modified grading structure or direct homework habits or measures, this work investigates a particular scenario regarding homework assignments that occurs within an engineering dynamics class. This course meets twice per week on Tuesdays and Thursdays. Each week, a homework assignment is given on the material for that week which is collected in class on the following Tuesday. Assignments are then graded and returned during the next class period. Exams for the course are given on Thursdays, with a review during the previous Tuesday class. With this model, students do not have a class period to receive their homework assignment prior to the exam. I.e., the students submit a homework assignment during the review, but the next class period is the exam. To allow students the opportunity to review their graded assignment, the instructor has the last graded assignment prior to the exam available for pickup any time on the day before the exam. This is done voluntarily, so not all students decide to make the effort to pick up the assignment. This work aims to investigate the differences in grade performance of students who did pick up their last homework assignment with those who did not pick up their last homework assignment prior to taking a midterm exam.

## Methodology

Data were collected for this study across two sections of dynamics implemented during the same semester. Students in this course are typically sophomore students planning on majoring in mechanical engineering, aerospace engineering, or civil engineering. The names of students who did not pick up their homework assignment prior to the exam were anonymously recorded. These assignments were still made available for students to pick up at any time. After the completion of the course, the grades for the homework assignment, the midterm exam, as well as the final grades for the courses were recorded and divided into the two groups based on the prior observation of homework pickup. These data were used to analyze and determine if there were any significant differences between the two groups.

## Results

In total, data were collected for 57 students across the two sections of the course. Of the 57 students, 38 picked up their homework assignment prior to taking the midterm exam, while the remaining 19 did not. The grades for the considered homework assignment, the midterm exam, and the overall course were evaluated within each group. The mean grades for each group are offered in Table 1, including the results of a two-sample t-test to determine if there is enough statistical significance in the difference between the means of the two groups.

*Table 1: Comparison of Grades including Two-Sample t-test*

<b>Graded Item</b>	<b>Picked Up (Mean Grade)</b>	<b>Not Picked Up (Mean Grade)</b>	<b>Null Hypothesis (Means Equal)</b>	<b>Significance (p-value)</b>
Homework Assignment	95.0	92.6	Cannot Reject	0.5503
Midterm Exam	80.9	75.6	Cannot Reject	0.1367
Final Course Grade	86.9	82.8	Reject	0.0369

It is shown in Table 1 that only the final grades showed statistical significance between the two groups. This indicates that the students who picked up the homework prior to taking the midterm exam ended up with higher course grades than students who did not. Even though on average the

grades for the homework assignment and midterm exam were higher for students who picked up the assignment, there was not enough significance observed in the data according to the t-test at 95% confidence. Additional statistics are offered visually in Figure 1 for the midterm exam grades (left) and final course grades (right). It is shown in Figure 1 that the mean, median, and maximum for students who picked up their homework assignment is higher for both the midterm exam and final course grades. It is worth mentioning as well that picking up the homework assignment did not guarantee a good grade, as the minimum grade identified was from a student who did pick up their assignment. The standard deviation within the homework pickup group was slightly higher for midterm and final grades, indicating that there is greater variation within the students who picked up their assignments. This could possibly indicate that higher and lower performing students are more likely to pick up their assignments, while more average performing students may not pick up their assignments.

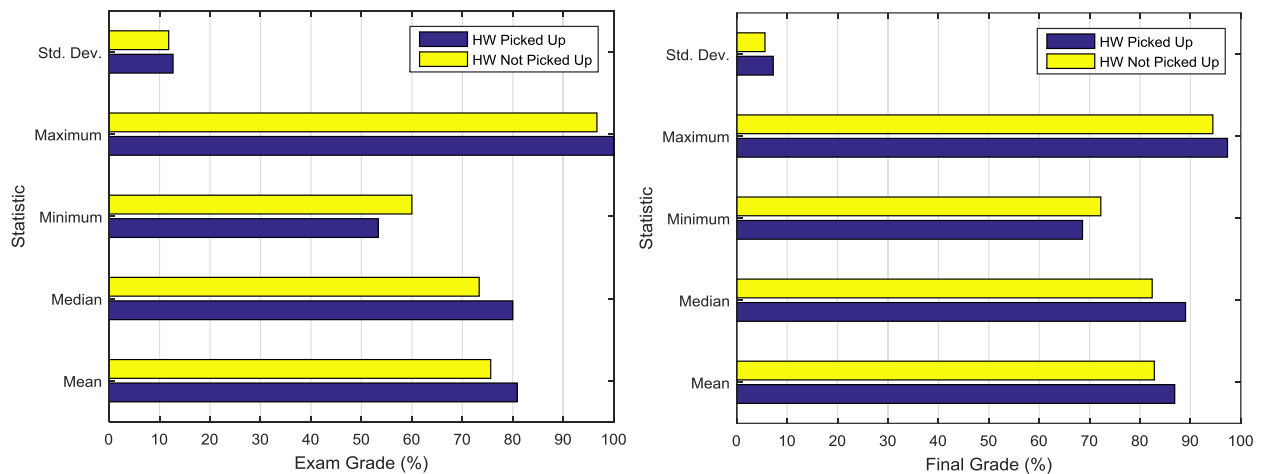


Figure 1. Statistics for Midterm Exam (left) and Final Course (right) Grades with and without HW Pickup

As an alternative means of assessing student performance between the two groups, the number of students receiving letter grades in categories A, B, C, D, and F (including corresponding + and – modifiers) for the midterm exam (left) and the course (right) are offered in Figure 2. It is shown in Figure 2 that more of the students who picked up their homework assignments received A’s and B’s than those who did not. Since 67% of the students in the course picked up their homework assignment, another representation of this data is provided in Figure 3, which contains stacked bars for the two groups as percentages of the overall student population. Figure 2 and Figure 3 also illustrate the different distributions within the student groups. In particular, the students who did pick up their homework assignment are weighted more heavily in the higher grade ranges, while the opposite is true for those who did not. I.e., most of the students in the assignment pickup group received an A, while most of the students in the group who did not pick up their assignment received a C or D.

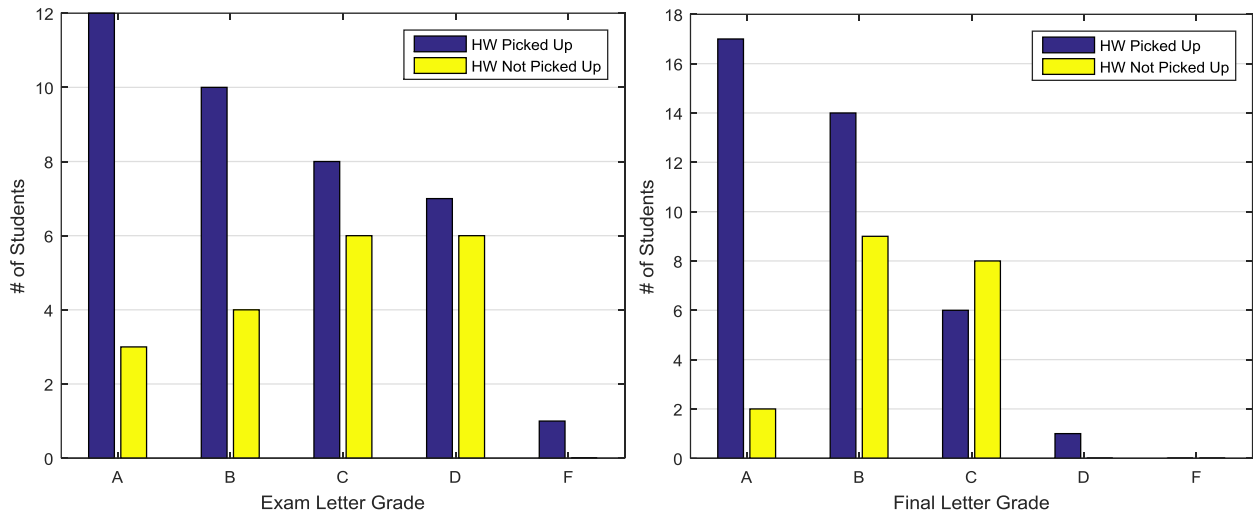


Figure 2. Midterm Exam (left) and Final Course (right) Letter Grades as Number of Students with and without HW Pickup

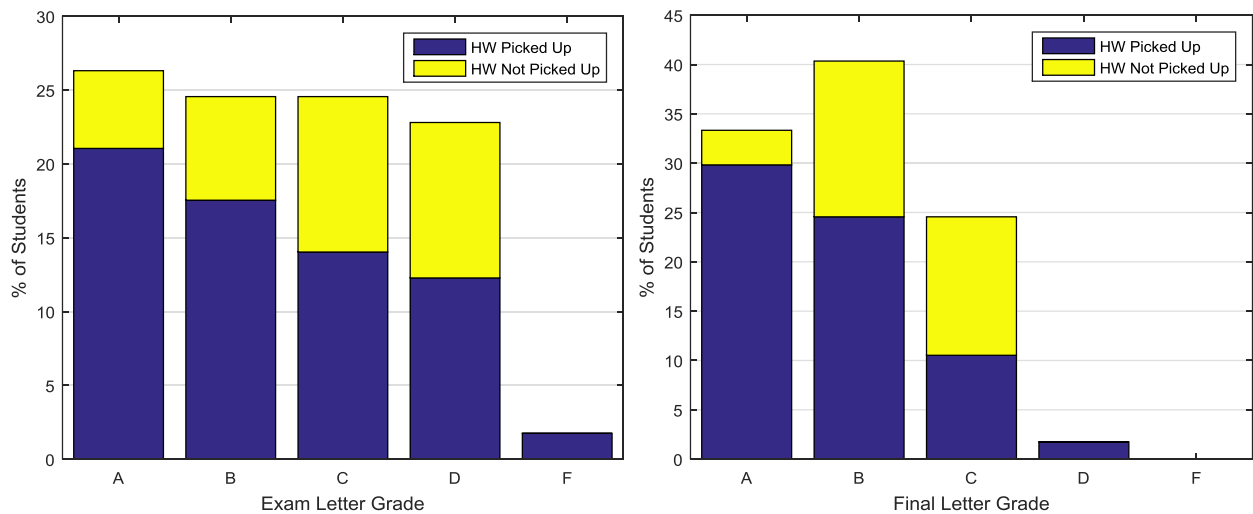


Figure 3. Distribution of Letter Grades as Percentages of the Entire Cohort for Midterm Exam (left) and Final Course (right)

Instead of looking at each group as part of the whole, the distributions of the letter grades within each of the two groupings is presented Figure 4. This shows similar information to Figure 2 and Figure 3, however it additionally shows the specific percentages within each group. Figure 4 provides some insight into the distribution of the different groups. The students who pickup their assignment are weighted more towards the higher grade categories, while the students who did not pickup their assignments followed more closely with a normal distribution.

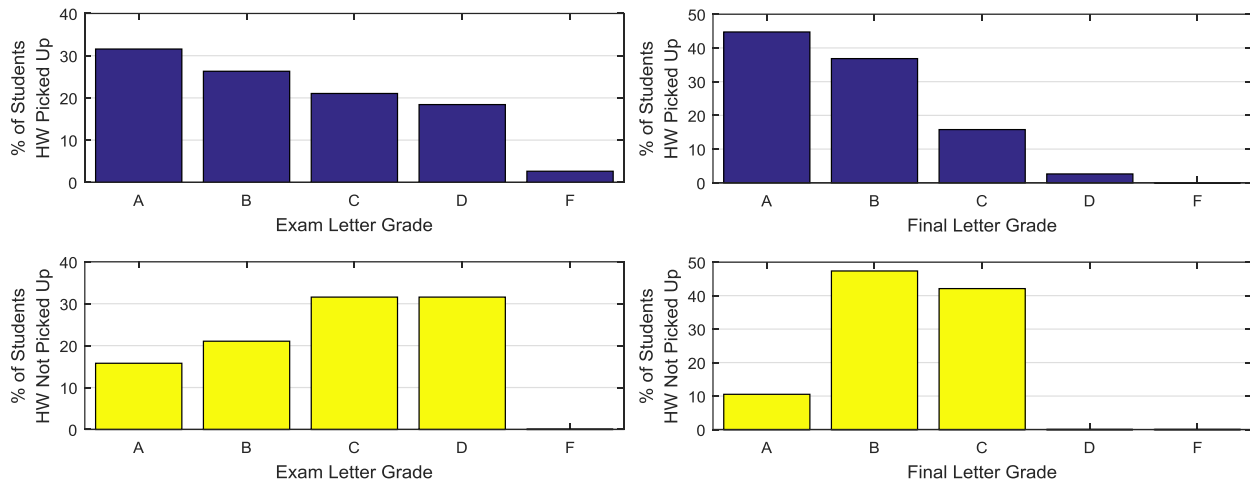


Figure 4. Distribution of Letter Grades as Percentages within each Grouping for Midterm Exam (left) and Final Course (right)

## Discussion

While the results from this study indicate some differences in the two different groups, it is worth noting that there are many possible confounding variables for this study. Students who have better study habits may be more likely to perform better on exams, but also be more likely to pick up assignments. There are possible conflicts with the pickup times for the homework assignments. E.g., some students may not be able to come to campus the day before the exam, and therefore be unable to pick up the assignment. Students received their previous homework assignments back in class. It is possible that some students may not have perceived the feedback from the instructor as sufficiently helpful to merit picking it up. Since instructor solutions are provided, some students may simply prefer to review the solutions rather than looking back over their own work. The instructor also recommends re-working out the homework problems for practice. Students planning to use this study tactic may not see the value in receiving their former work since they plan to repeat it.

## Conclusions

This work offered an assessment of student exam and course performance based on whether or not they voluntarily picked up a homework assignment prior to taking an exam. The results demonstrated that in general students who picked up their assignment performed better than those who did not, however statistical significance was only determined for the final course grades. This indicates the possibility that either the student having their own work helped their performance, or alternatively that better performing students are more likely to pick up a graded assignment.

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