

Using MyEngineeringLab for Learning Reinforcement in a Mechanics 1: Statics Course

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Abstract

Since the amount of technology available in the engineering classroom is always increasing, instructors face challenges to find unique and positive ways to incorporate this technology into their classrooms. For the Department of Civil and Environmental Engineering at the J.B. Speed School of Engineering at the University of Louisville, the Mechanics 1: Statics course continues to be an area of focus for the adoption and incorporation of technology into the class. The department is willing to explore technology based approaches to improve student learning and success in the course.

As has been observed many times previously, in the Statics course students who attend class and conscientiously do their homework have a higher probability of succeeding. Class quizzes are given to encourage the students to come to class prepared. These quizzes were based along homework problems to help prevent the students from procrastinating on the homework. This allows the students time to attempt the homework and get clarification on topics that they do not understand, instead of waiting until the night before an exam to complete the homework.

Most recently, the department started adopting the use of Pearson's MyLabsPlus™, an online multimedia textbook with active content, including algorithmic problem generators and computer grading. The homework for this course has been targeted first for conversion from paper to the online system. The MyLabsPlus problems are immediately graded which provides students feedback on their understanding of the content. If the students get a problem wrong MyLabsPlus can provide them with guidance as to what they did incorrectly, and even let them attempt the problem again with different values. This feedback allows the students to know which topics that they need further study to master.

This paper will further describe the environment that the students are using MyLabsPlus as well as looking at the course outcomes from the semesters using the platform. By analyzing the statistical analytics contained within the platform, we can better assess when and how students complete their homework. In addition, by comparing the performance analytics to exam scores we can identify students that are using other technology sources to accumulate scores rather than master the content. With this information, we can target select groups or individuals for additional help or modify lecture, quiz or exam materials as appropriate.

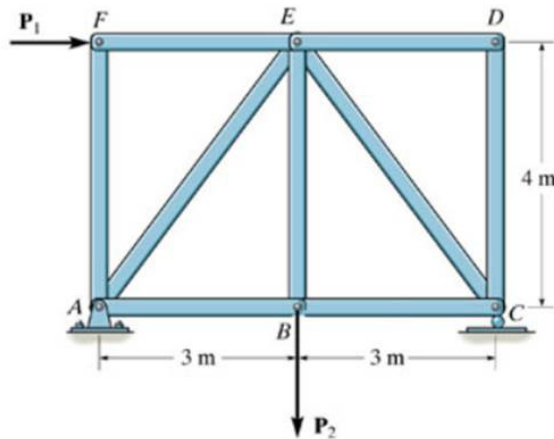
1. Background

The J.B. Speed School of Engineering has a mandatory Tablet PC requirement for all incoming students. The Tablet PCs are used in a variety of ways by different departments since their introduction to the school. Tablet PCs are not required to make use of MyLabsPlus¹ or MasteringEngineering², but it does allow the Department of Civil and Environmental Engineering to assume that all students have access to a computer to access the online system. MyLabsPlus is a multimedia on-line learning complement developed by Pearson, the publisher of the textbook used in the Mechanics I: Statics course. MyLabsPlus provides algorithmically generated homework problems, which are graded automatically, which provides immediate feedback to the students understanding of the material. An example problem from the online system is shown below in Figure 1.

Problem 6.21

Set $P_1 = 35 \text{ kN}$ and $P_2 = 14 \text{ kN}$. (Figure 1)

Figure 1 of 1



Part A

Determine the force in member AB , and state if the member is in tension or compression.

Express your answer to three significant figures and include the appropriate units. Enter negative value in the case of compression and positive value in the case of tension.

      		
$F_{AB} =$	<input type="text" value="Value"/>	<input type="text" value="Units"/>

Submit

My Answers [Give Up](#)

Part B

Determine the force in member AE , and state if the member is in tension or compression.

Express your answer to three significant figures and include the appropriate units. Enter negative value in the case of compression and positive value in the case of tension.

$F_{AE} =$

[Submit](#) [My Answers](#) [Give Up](#)

Part C

Determine the force in member AF , and state if the member is in tension or compression.

Express your answer to three significant figures and include the appropriate units. Enter negative value in the case of compression and positive value in the case of tension.

$F_{AF} =$

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Part D

Determine the force in member BC , and state if the member is in tension or compression.

Express your answer to three significant figures and include the appropriate units. Enter negative value in the case of compression and positive value in the case of tension.

$F_{BC} =$

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Figure 1: Example MyLabsPlus Problem ² ©Pearson Publishing

MyLabsPlus will also provide guidance as to where the students went wrong. It also includes the ability to give algorithmically generated problems on quizzes and exams. All of these assessments can be built by instructors using questions that have already been programmed by Pearson from the book. Quizzes and exams may be password protected, preventing access to the quiz or exam without the password.

As the enrollment at the J.B. Speed School of Engineering has increased, so have section sizes. The Mechanics I: Statics course has ballooned to an average above 60 per section. This course size increase, increased the amount of grading time needed for homework assignments and reduced the ability to provide in depth feedback. So homework was the first assessment item targeted for conversion from paper to using the online system and first implemented during the summer semester of 2014. Based on the increased number of students and the desire to offer them timely and in depth feedback, using MyLabsPlus seemed to be a great fit.

Many studies have shown some of these same pro arguments that the Department of Civil and Environmental Engineering have discovered, such as (1) automated homework systems permit more practice, (2) immediate feedback, to help students master material, and (3) removing the easiest forms of cheating by just copying fellow students' work.^{3,4} Students have positive and negative thoughts related to online homework; they feel like it helps understanding, but at times feel that online homework is extremely specific in the way a question should be answered.^{4,5} Some studies have shown that while homework grades may decrease, overall course grades increase.⁵

As the department has continued to use MyLabsPlus for homework in the Mechanics I: Statics course some concepts and problems from using an online homework system has emerged. Initial analysis is presented in the results section. The conclusion and future directions section identifies potential ways to leverage and expand the current system.

2. Results

The total enrollment in Mechanics I: Statics was 195 students within three sections. The same instructor taught two of the sections and the data presented is from those similar classes (157 students). These two sections met at different times of the day, but had the same homework assignments and exams. As discussed, MyLabsPlus was used to assign and grade homework assignments prior to each exam.

The student response to the mandatory homework assignments, and the associated immediate feedback and scoring has been interesting. As expected many of the students took full advantage of the learning resources provided by MyLabsPlus, and used the assigned homework to help further their knowledge. Other students, however, saw the assigned online homework problems as waste of time. Below are some selected student response submitted during the anonymous course evaluations:

- Both the tests and quizzes were fine, but the online homework was often frustrating.
- The homework on MyLabsPlus is helpful. This is the most useful when it comes to studying for the exams and learning the material. The textbook is so-so. The

instructor explains concepts well, and it is very helpful that he works so many problems in class. I really like having the TA's in the classroom to ask questions and get help. They were extremely nice and helpful.

- Textbook, online homework, and in-class quizzes/homework are all very helpful. MyLabsPlus can get very annoying from time to time, though, especially when drawing vectors.
- The way this course is set up, such as constant quizzes every class, and homework online every week, really encouraged coming to class. However, with the online homework, no one ever really does it. We all just google or chegg the answers. I personally have done this with this class, physics 298, 299, and sometimes even calc. The online homework never really does anything for me except use my time, and buff my grade. The in class quizzes did help somewhat, however, I did not receive feedback on the quizzes until after that unit's test. So I couldn't figure out what I needed to look over, or study, which made the tests more difficult.
- The online homework was really good test prep and helped keeping up with the work. There were also AMPLE TA's and times we could go ask someone for help. That was crucial to my success in the course.
- I found the online homework to be a bit challenging at times but very helpful in being exposed to a variety of different situations. The in class homework assignments I found to be the most helpful. If I was ever unsure that I had not grasped that days material, this gave me the opportunity to try it for myself and ask questions if necessary.
- I really liked the way that the homework was set up, questions made you very prepared for the exam. There were not so many questions that I felt overwhelmed but there were enough that I felt ready when test day came.

The student comment regarding using google or chegg to complete the online homework raises some interesting questions. Obviously, the intent of the homework is not to provide busy work; rather, it is to help students master the course materials. If a majority of students are using online resources to complete the homework problems, and not using them as a learning tool, then it is a needless educational activity and an unnecessary student expense.

To assess if the online homework problems were of benefit to the students, the homework scores and exam scores were plotted for every exam. The generated graph showing both sections for Exam 3 as shown in Figure 2, with the other exam scores vs homework scores following similar trends. From the graph (Figure 2), it is obvious that there is significant scatter in the data; however, some interesting features can still be identified.

Overall looking at the graph, there does appear to be a weak correlation between homework scores and exam scores. While hard to say that this is causation, requiring the online homework

does not appear to be negatively affecting the students. Interestingly, for the Exam 3 plot as shown in Figure 2, there seems to be a large number of students that performed very well on the homework assignments (> 90%, on the horizontal scale) but performed poorly on the exam (<60%, on the vertical scale). The initial thought is that these are the students that are using other online resources for their homework or not making the effort to master the material themselves. Alternatively, however, this could also be an indicator that the exam materials did not correlate well to the homework assignments. The problems on the exams were over the same material as the homework problems, but occasionally the exam problems were worded slightly different.

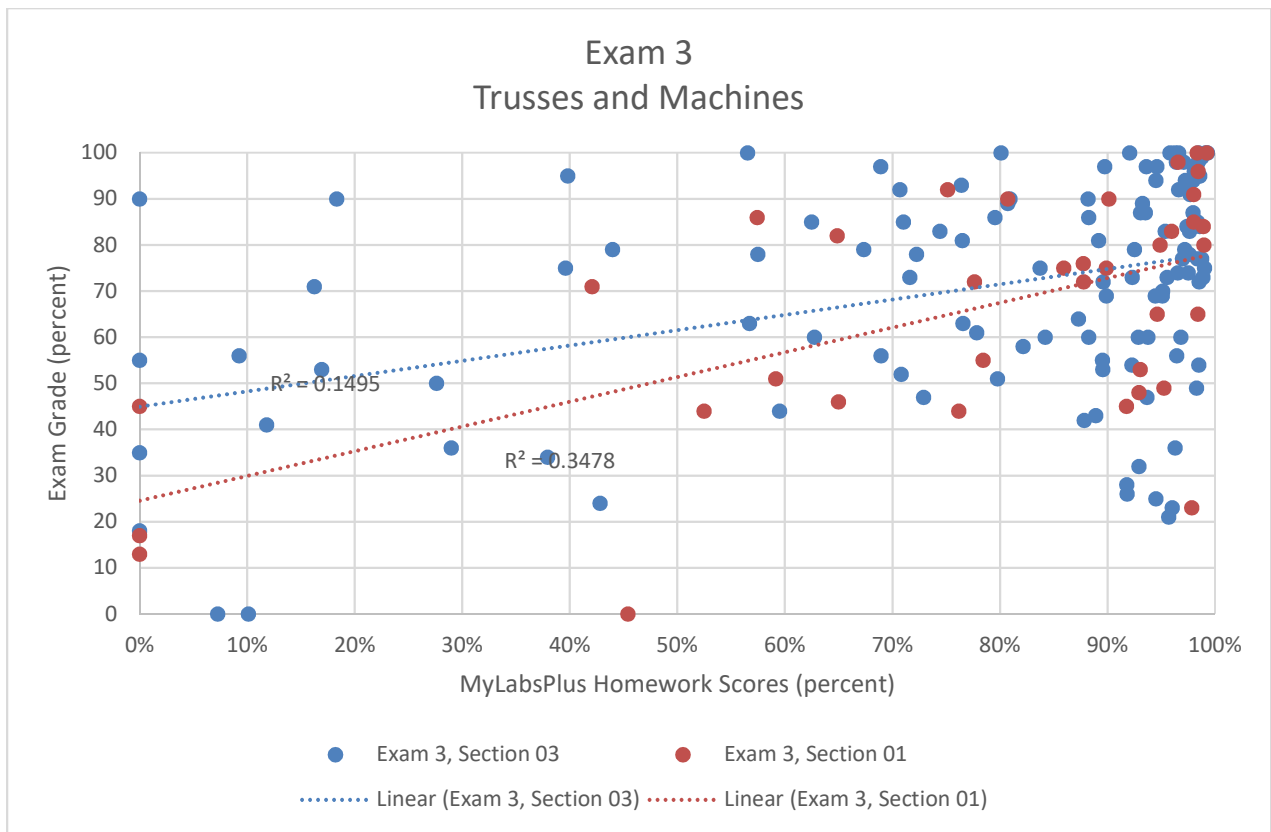


Figure 2: Exam 3 Scores vs MyLabsPlus Homework Scores

The Exam 3 data certainly identified a large number of students with a disconnect between exam scores and homework scores. When the same information was plotted for the students overall final course scores (vertical scale) vs MyLabsPlus homework scores (horizontal scale) (Figure 3), the correlation between homework grades and exam grades Figure 2 was much more significant. In the case of the overall course grades only a few students performed well on the homework assignments (>90%), but performed poorly overall in the course (<60%). Thus student reliance on google or chegg to complete the online homework did not appear to be consistent throughout the semester, this could be attributed to students seeing that good

homework scores by any means was not helping their exam scores as much as spending the time to understand the homework.

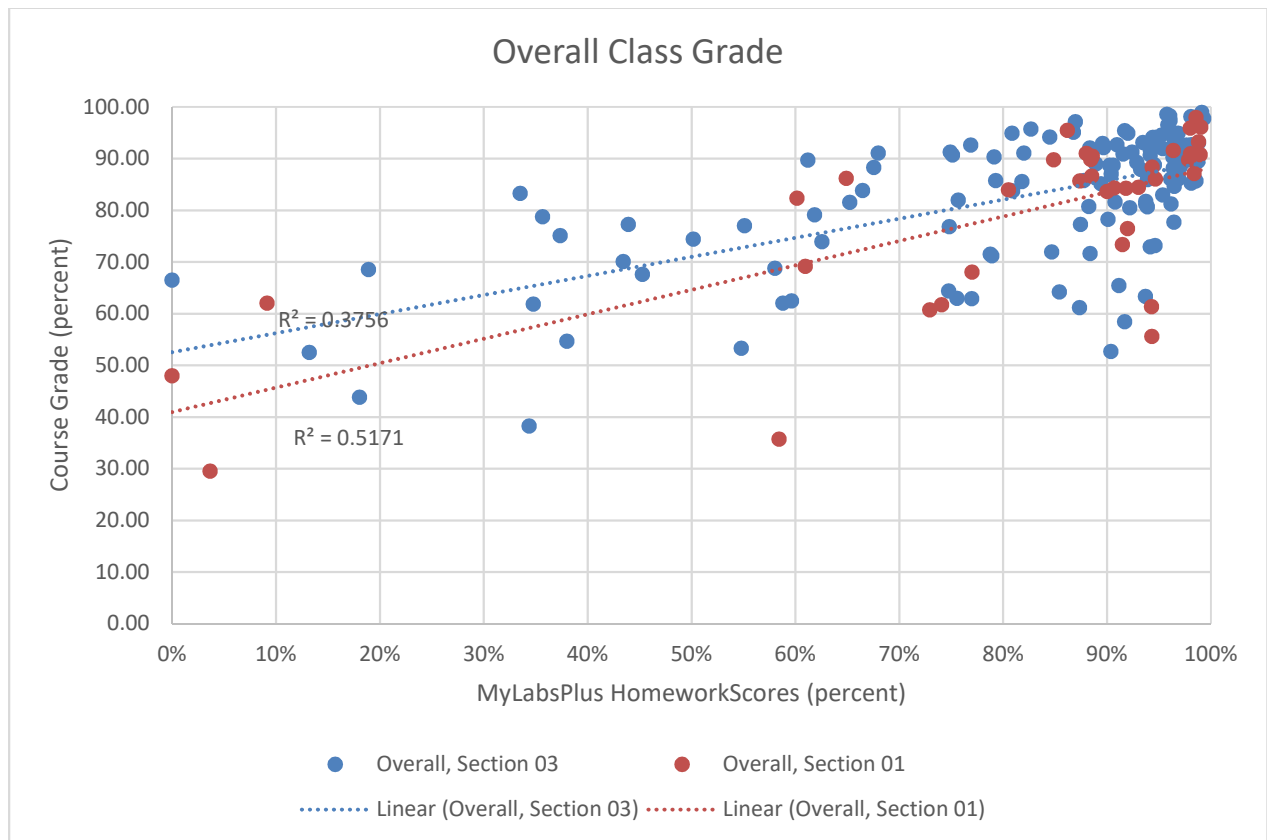


Figure 3: Overall Course Score vs MyLabsPlus Homework Scores

3. Discussion and Conclusions

While department instructors have long encouraged students to do their homework independently to ensure their understanding and mastery of topics, this online system forces this to occur. The students may still work in groups while doing their homework, but each student has different numbers for the same problems due to the algorithmic nature of the problems. This prevents students from just dividing the homework and then sharing answers.

The Department of Civil and Environmental Engineering is planning to continue using the problems from MyLabsPlus to allow for the benefits discussed above. The department is still evaluating the possibility of using the online system for in-class quizzes. Another change for future semesters that the Department of Civil and Environmental Engineering is planning to discuss with the students early in the semester that getting good grades on the homework is not enough to perform well in the class. The online homework is there as a tool to help the students master the material and not just be a hurdle to their grade.

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