



Pearson

Mastering Physics

Efficacy Report Summary

Mastering Physics is an online tutorial system that provides lessons featuring hints and targeted wrong-answer feedback. It is used in higher education introductory physics courses to help students achieve mastery of core physics concepts.

Studies 1 & 2:

Is usage of Mastering Physics associated with students doing better in their exams and external standardized tests?

To analyze the relationship between student usage and course outcomes, we partnered with Penn State University, an institution known for academic research in science as well as educational research throughout its physical science departments, on two research studies. Students at Penn State used Mastering Physics in the Fall 2015 and Fall 2016 only applies to Study 1 where we examined students taking the first physics course for 2 semesters. For study 2, we followed students from Fall 2015 to Spring 2016.

The first study examined the relations in a first-semester introductory physics course, Phys 211, General Physics Mechanics. The second study followed students who completed the first-semester class and then went on to study Phys 212, Electricity and Magnetism the following semester, to examine these relations longitudinally.



What we found


The first semester course

We found that students' average scores on Mastering Physics homework assignments were positively and significantly related to their average exam scores.

Students' average scores in Mastering Physics were also related to Force Concept Inventory (FCI) test score gains. The FCI is a widely accepted standardized test that measures a student's mastery of concepts commonly taught during the first semester of physics.

Relationship between average score in Mastering Physics and a standardized physics exam

Mastering Physics Platform Variables	Achievement Outcome Measure	
	Average Exam Score	FCI Gain
Average Score on Homework Assignments	 Effect Size = 0.26	 Effect Size = 0.10

 Significant positive association, higher values for platform variable associated significantly with higher scores on the achievement outcome measure.

The total time students spent using Mastering Physics was not significantly associated with exam scores, although total time spent was significantly associated with FCI gains. These findings should be viewed with caution since the 'time spent' variable does not differentiate between time spent actively engaged and idle time. Therefore, some students might not have been actively engaged for the entire time they were logged in.

We also found no significant relationship between the number of hints students requested and their course performance.

How the instructor used the product

As there are many ways to implement Mastering Physics, it is important to note that in both semesters:

- There was a strong emphasis placed on homework as practice
 - not homework as summative assessment
- All hints were free (no penalties or rewards)

The textbook used in this course was *Scientists and Engineers: A Strategic Approach*, 3rd edition by Randall D. Knight.

In the context of the study conducted at Penn State University for students enrolled in Phys 211, Pearson is able to make the following statements about the efficacy of Mastering Physics:

- A 10% increase in Mastering Physics homework grades is linked to a 4% increase in exam scores.
- A 10% increase in Mastering Physics homework grades is linked to a 2% increase in FCI gains.

These statements are set out in full in the box titled “Efficacy statements” on page 12 of the Research Report where they have been subject to assurance by PwC, whose report can be found at the end of the Research Report.

How we did the research





This study examined the association between the use of Mastering Physics for homework assignments and students' achievement on their course exams and the Force Concept Inventory (FCI) test during the first semester physics course (Phys 211—General Physics Mechanics).


The second semester course

Students' average score on Mastering Physics homework assignments was positively and significantly related to the average exam scores in Spring 2016.

The average score on Mastering Physics homework assignments was also positively and significantly linked to achievement in Brief Electricity and Magnetism Assessment (BEMA) post-test scores. BEMA is a widely accepted standardized test that measures students' qualitative understanding of basic concepts in electricity and magnetism.

Relationship between Mastering Physics homework assignment usage and exam scores

Mastering Physics Platform Variables	Achievement Outcome Measure	
	Average Exam Score	BEMA scores
Average Score on Homework Assignments	 Effect Size = 0.29	 Effect Size = 0.20
Total Number of Hints Requested	 Effect Size = 0.11	 Effect Size = 0.21

 Significant positive association, higher values for platform variable associated significantly with higher scores on the achievement outcome measure.

The number of hints requested by students was positively and significantly associated with both exam scores and BEMA post-test scores. However, total time spent was found to be marginally and negatively related to average exam scores and it was not significantly related to BEMA post-test scores.

As with the first semester course, since it was not possible to differentiate between the time that students spent actively engaged when logged in to Mastering Physics and the time when they were not actively engaged when logged in, the findings on 'time spent' should be viewed with caution.

In the context of the study conducted at Penn State University, where Mastering Physics was used by students enrolled in Phys 212, after completing Phys 211 the prior semester, Pearson is able to make the following statements about the efficacy of Mastering Physics:

- A 10% increase in Mastering Physics homework grades is linked to a 4% increase in exam scores.
- A 10% increase in Mastering Physics homework grades is linked to a 3% increase in BEMA post-test scores.
- Requesting an additional 50 hints on homework assignments is associated with an increase in average exam scores of 2 percentage points.
- Requesting an additional 50 hints on homework assignments is associated with an increase in students' BEMA post-test scores of 3 percentage points.

These statements are set out in full in the box titled "Efficacy statements" on page 15 of the Research Report where they have been subject to assurance by PwC, whose report can be found at the end of the Research Report.

How the instructor used the product

As there are many ways to implement Mastering Physics, it is important to note that in both semesters:

- There was a strong emphasis placed on homework as practice
 - not homework as summative assessment
- All hints were free (no penalties or rewards)

The textbook used in this course was *Scientists and Engineers: A Strategic Approach*, 3rd edition by Randall D. Knight.

How we did the research

To examine the relationship between Mastering Physics use and student achievement on the course exams and BEMA, a regression analysis that accounted for prior physics achievement was used.

We measured usage by looking at the time students spent logged in to the Mastering Physics platform, and the number of hints requested. We measured performance by the average scores students achieved on homework assignments.

Explore the full report at [Pearson.com/corporate/efficacy-and-research](https://www.pearson.com/corporate/efficacy-and-research)

Pearson's Efficacy Commitment

In 2013, Pearson made a commitment to efficacy: to identify the outcomes that matter most to students and educators, and apply evidence-based approaches to product design, development and implementation support so we could have a greater impact on improving those outcomes. We committed to reporting on the impact of use of products, commencing in 2018 with some of our most frequently used products.

To Pearson, efficacy is more than a commitment to report on the impact of use of our products on outcomes. It is even more than a way to continuously improve our products. Efficacy is a priority for everyone at Pearson. Applying outcomes-focused, evidence-based design to our products, and supporting educators to use them to help more learners learn more, is at the heart of who we are, what we do — and of our vision for the future of learning.