

Product Name **MasteringPhysics**

Course Names **College Physics I and II**

Credit Hours **Four**

Key Results MasteringPhysics provides the kind of resources and feedback students need to practice and learn outside the classroom. As a result, more class time can be spent on hands-on, interactive learning.

Text

College Physics: A Strategic Approach, 2e, Randall D. Knight, Brian Jones, and Stuart Field

Implementation

College Physics I and II is an algebra-based, two-course sequence covering the fundamentals of physics. The experimental aspects of physics are emphasized in the classroom and the lab, and considerable time is devoted to problem solving. Course content includes measurement, vectors, kinematics, dynamics, gravitation, energy, momentum, rotational motion, wave motion, electricity and magnetism, electromechanical devices, geometrical and physical optics, and modern physics. Students are not required to take the lab concurrent to the lecture.

I believe that the key to learning and improving skills is repetition and practice accompanied by effective feedback. MasteringPhysics homework is one way to access that key. I adopted MasteringPhysics in 2009 because it offers students, via homework, an opportunity to practice and learn in a low-stakes environment with immediate, error-specific feedback.

Students are required to complete weekly MasteringPhysics homework assignments comprising a mix of tutorial and end-of-chapter questions. Assignments are due several days after lecture. To help students understand how to use their MasteringPhysics homework as a learning resource and way to develop problem-solving skills, I offer them the following advice:

- Do not expect to solve all physics problems on your first try. Persistence is the key.
- Starting your homework early in the week is crucial. You'll be far more successful (and less stressed) if you tackle homework an hour at a time over five days, rather than in one burst late in the week.
- Meeting regularly with a small study group is an excellent strategy. The only caution is to not submit answers that

you don't understand how to arrive at on your own. That will set you up for disappointment on exams.

- It is of the utmost importance to keep up with reading and homework assignments throughout the semester. Some students require more time than others to digest and comprehend the material and do the assignments. Only you can judge how much time you'll need to succeed.

In addition to MasteringPhysics assignments, students are required to complete a written warm-up exercise prior to each class (using Just-in-Time Teaching). The assignment comprises open-ended questions based on the reading and is graded on effort. I use the responses to the warm-up questions for class discussion.

I am a proponent of active learning and have designed my course to include highly interactive class activities. I use a mixture of traditional lecture, discussion, "clicker" questions, and interactive demonstrations. A classroom response system is used in a manner that follows the Peer Instruction model pioneered by Eric Mazur of Harvard. Students respond to difficult conceptual questions (sometimes predicting the outcome of a physical demonstration). They're invited to discuss their response with nearby students and then to respond again to the same question. Studies show that the discussion that takes place in this process is a huge learning opportunity—that it engages students and promotes a more-interactive class.

Assessments

65 percent	Exams (two exams, one final)
20 percent	MasteringPhysics homework
10 percent	Warm-up exercises
5 percent	Peer instruction participation

Results and Data

I give the Forced Concept Inventory (FCI) pre- and posttest in College Physics I and the Conceptual Survey of Electricity and Magnetism (CSEM) pre- and posttest in College Physics II. I evaluated gains for the FCI in College Physics I for spring 2011, with 76 percent of students having completed both the pre- and posttests, and the CSEM for fall 2011, with 83 percent of students having completed both the pre- and posttests, and found the following:

- Students earning an A in College Physics I averaged a gain of 56 percent from pre- to posttest and scored an average of 93 percent on MasteringPhysics homework.
- Students earning a D in College Physics I averaged a gain of 22 percent from pre- to posttest and averaged 58 percent on MasteringPhysics homework.
- Students earning an A in College Physics II averaged a gain of 28 percent from pre- to posttest and averaged 94 percent on MasteringPhysics homework.
- Students earning a D in College Physics II averaged a gain of 10 percent from pre- to posttest and averaged 60 percent on their MasteringPhysics homework.

I also evaluated MasteringPhysics homework scores compared to final course grades and found that a student's homework score is a strong predictor for that student's final course grade (table 1).

In the spring 2011 College Physics I and the fall 2012 Physics II classes, 94 percent of the students earning an A or B in the course scored 80 percent or higher on their MasteringPhysics homework. As I expected it would, analysis shows that students who put effort into the homework tend to do better in the course. This also is supported by student feedback:

- “Doing the [MasteringPhysics] homework and the warm-ups are pretty important in order to understand the sometimes mind-boggling material in class.”
- “Do the warm ups and do MasteringPhysics. They definitely help prepare you for exams.”

The Student Experience

I survey my students for feedback on MasteringPhysics. Their responses are based on a five-point scale, with 1=very harmful and 5=very helpful. Mean responses from my College Physics II fall 2012 section are typical of all of my sections and show that students felt MasteringPhysics was very helpful to them (table 2).

Final Course Grade	College Physics I		College Physics II	
	Spring 2011	Spring 2012	Fall 2011	Fall 2012
A	92%	93%	95%	95%
B	90%	82%	89%	90%
C	79%	78%	85%	84%
D	61%	65%	60%	83%
F	42%	45%	NA	NA

Table 1. Average MasteringPhysics Homework Score by Final Course Grade, Spring 2011–Fall 2012 (College Physics I: Spring 2011 $n=59$; Spring 2012 $n=71$; College Physics II: Fall 2011 $n=80$; Fall 2012 $n=84$)

Survey Question	Response Mean
How did MasteringPhysics impact your learning compared to traditional paper-and-pencil homework?	4.34
How did MasteringPhysics impact your learning compared to having no homework at all?	4.54
Overall, how do you feel about the helpfulness of the assigned MasteringPhysics homework?	4.15

Table 2. Student Survey Questions and Mean Responses Based on a Scale of 1 (Very Harmful) to 5 (Very Helpful), Fall 2012

When asked what advice they would give future students, student responses included the following:

- “Rework difficult problems and try to do them without help from the book the second time around.”
- “Practice more by doing more problems than those assigned for homework.”

Conclusion

Despite the fact that I deliver a class with high standards and expectations, students consistently seek out my course as a place in which concepts rule and “equation hunting” is a failing strategy. I am passionate about the use of Just-in-Time teaching and integrate multiple learning opportunities into my course to help students succeed. Students take responsibility for their learning outside of class, which has resulted in a higher level of student engagement and active learning during class time.

*Submitted by Jeff Loats
Metropolitan State University of Denver*