

Physics Assessment

2010-2011

This year's assessment activities were focused on student learning outcome #3 which states, "Apply new knowledge in the areas of Newtonian mechanics, electricity and magnetism, and physical principles in modern physics." The introduction of a new online homework system focused this assessment on how homework affects this learning outcome. Not only performance on homework but also its correlation with scores from other performance metrics (quizzes, tests, final exam, overall score) was examined by comparing data from spring semester 2010 and fall semester 2010 in both Engineering Physics I and II (PHYS 180 and 181).

In spring 2010 traditional homework was assigned, collected once per week and graded by hand. In fall 2010 online homework was due once per week and was graded automatically by the online system. The same grading scale was used in order to make comparison of data easier. Homework sets in each semester consisted of the same (when possible) or at least similar problems all from the course textbook, "*Physics for Scientists and Engineers*", Serway and Jewett 8th Ed. 2010 (Brooks/Cole). The online homework system associated with this text is WebAssign (www.webassign.net) which provides online homework capabilities for many textbooks across a range of fields in science and mathematics. A quick comparison of overall class homework and test averages for each semester is shown in Table 1.

	Spring 2010 (Traditional HW)		Fall 2010 (Online HW)	
	Class HW Average	Class Test Average	Class HW Average	Class Test Average
PHYS 180	70.48%	77.39%	86.50%	85.01%
PHYS 181	82.00%	84.07%	78.23%	81.44%

Table 1. A comparison of class homework and test averages using traditional vs. online homework for PHYS 180 and PHYS 181.

For PHSY 180 an increase in both homework scores and test scores is seen in the online homework class. However, in PHYS 181 a small decrease in both averages occurred but is not as significant a difference as seen in the PHYS 180 classes. Because of the relatively small sample sizes involved these differences may be simple statistical variation, particularly in the case of the much smaller change in PHYS 181 scores. This motivated a closer look at how homework performance affects other metrics.

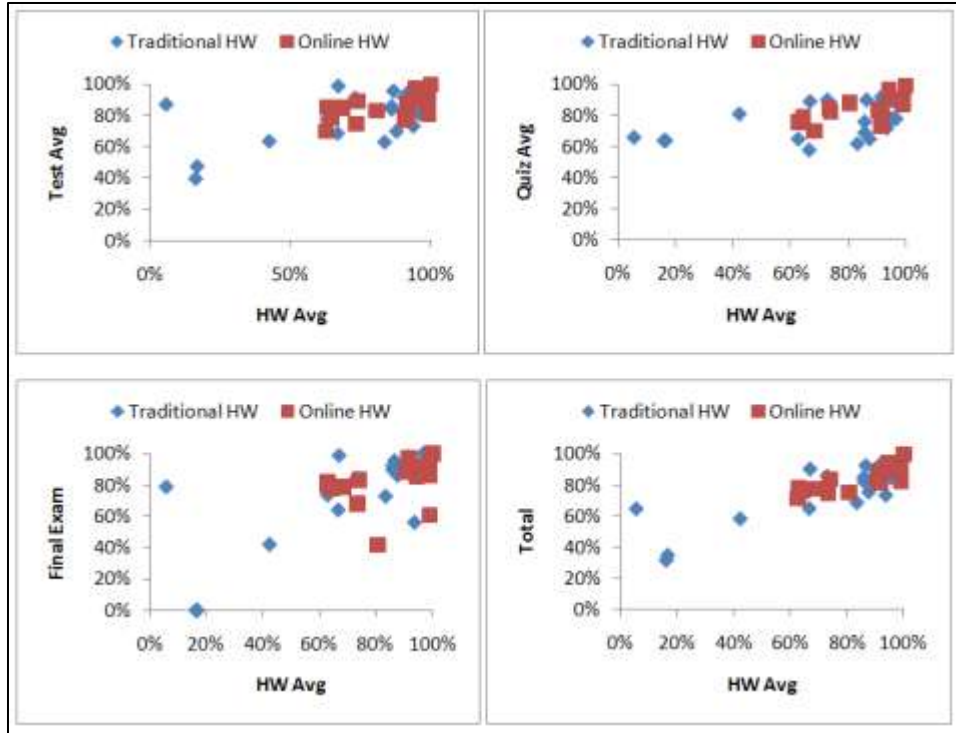


Figure 1. Physics 180 homework averages plotted versus other performance metrics. Strong correlation between homework and each of these metrics is evident despite the presence of a few outliers.

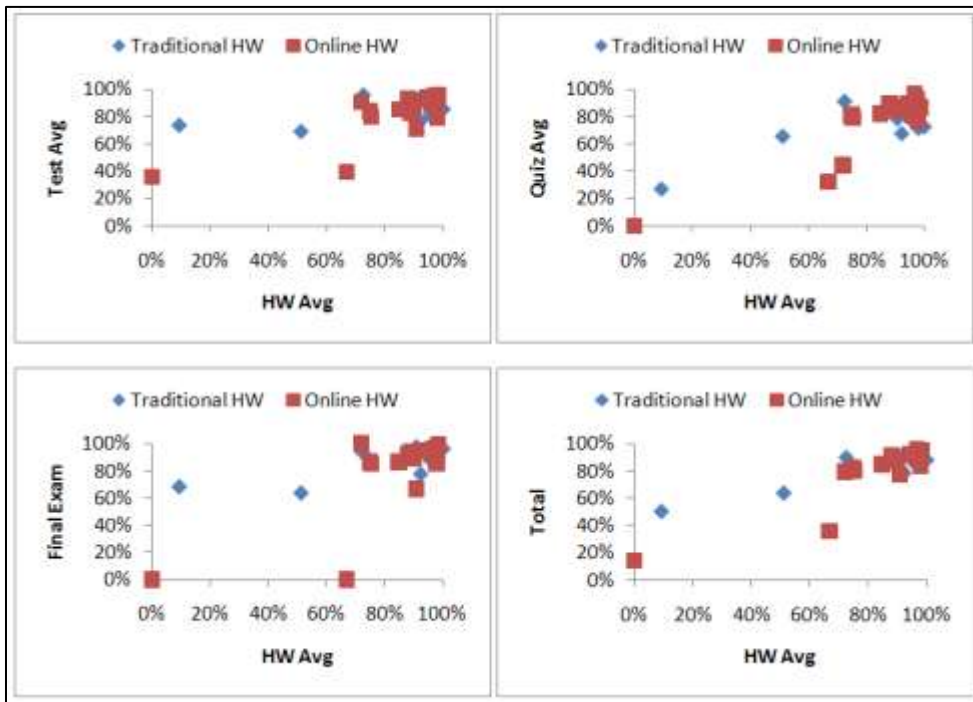


Figure 2. Physics 181 homework averages plotted versus other performance metrics. Strong correlation between homework and each of these metrics is evident despite the presence of a few outliers.

In order to assess the effect of the different homework systems on overall student performance, and thus the stated learning outcome, individual homework scores were plotted versus individual test scores, quiz scores, final exam scores, and overall total scores as shown in Figures 1 and 2. These graphs show a strong correlation between average homework score, test average, quiz scores, final exam scores, and total score with the presence of very few notable outliers. It is clear that students who perform well on homework are much more likely to succeed in other areas of the course. However, it is not clear that online homework provides any distinct advantage versus traditional homework in regards to other performance metrics. The only observable advantage to online homework is that fewer students have very low or zero homework averages. The cause of this effect is not clear and further investigation into the mechanisms behind this effect is warranted. It is suspected that this effect is due to the ability of the online homework system to provide almost instant feedback to the students allowing them to self correct before submitting homework to be graded.

In addition to the quantitative data above a more qualitative question regarding the online homework system was included in the course evaluations for the fall semester physics courses involved in this assessment. The question read, "Rate the effectiveness of the online homework system."

Student response was overall positive with 50% of students rating it as excellent and 92% rating it as satisfactory or better. Interestingly the students who had experienced traditional homework in the spring 2010 physics 180 course unanimously (100%) rated the online homework in the fall semester 2010 physics 181 course as excellent. Overall the students preferred online homework to traditional homework with some minor dissent. Most dissenters did not provide clear reasons for their dislike simply stating that the online homework system was "not good." Only one dissenter pointed out the inability of the online homework system to provide detailed feedback about performance on a particular homework question. However, this deficiency had been addressed the first day of class. All students were made aware of the availability of the professor during office hours to answer questions regarding the homework assignments and were informed that this was to address deficiencies in the online homework system.

After examination of this data it is clear that performance on homework assignments is a good indicator of the probability of a student's success in physics courses. However, it is not clear that online homework offers any distinct advantage over traditional homework in this regard. Since students, on average, preferred the online system to traditional homework its use will be continued in future courses. In future assessment it would be useful to try to determine the cause of higher homework averages when using online homework. Additionally, a test to determine whether other performance metrics show any correlation would help determine the role of homework assignments in providing learning opportunity for students.