Physics Learning Assessment Project Results

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1.1. Meeting core outcomes

1.1.1. Knowledge and critical thinking assessment

In order to demonstrate the improvement in student performance we designed and administered a simple test consisting of 6 questions that covered the key topics taught during the first course in all of our Physics series.

The design criteria were that the test:

1. could be taken by all three series (PHY101, PHY201 and PHY211).
2. should have minimal impact on instruction time.
3. would show whether student knowledge and problem solving abilities improved as a result of attending their Physics classes at PCC.

The nationally administered Force Concept Test and the Mechanics Baseline Test offered the opportunity to compare with national data bases but did not meet the first two criteria for our tests. As a result we decided to design our own test which covered key topics in mechanics. The test is included in Appendix A.

The tests were administered at the beginning of the quarter (pre-test) to 315 students across the district in PHY101, PHY201 and PHY211 classes during Fall 2009 and Winter 2010 quarters. The same test was then administered at the end of the quarter (post test) to a total of 203 students.

The results were significant. The average score on the pre-tests was 2.4 out of 6. This score improved by 60% to 3.8 out of 6 in our post tests. The graph below shows the number of respondents who received a particular score. The pretest shows something close to a normal distribution with most students getting 2 or 3 correct answers and only 1.6% of students getting 6 correct answers (all correct). The post test data shows a large improvement. The curve is now clearly skewed towards a higher number of correct responses. No students got all the answers wrong in the post test and 7% of students now had all the answers correct.

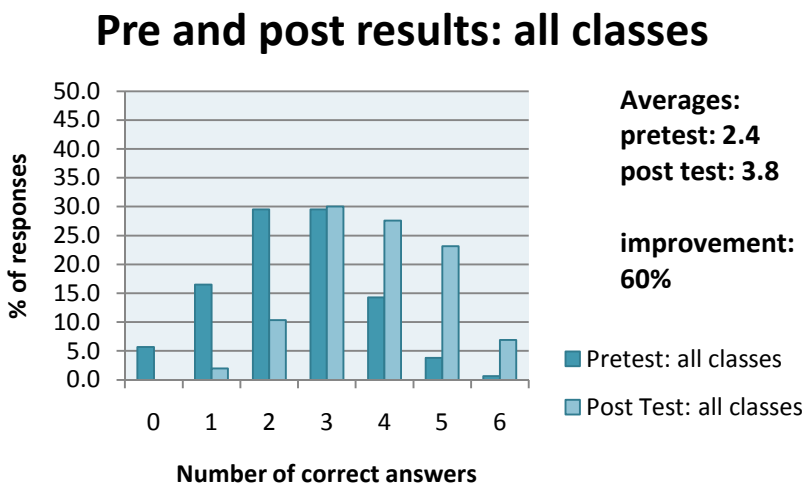

Figure 1: Pre and post test results for all Physics classes. The graph shows the percentage of respondents who received a particular score out of six.

The pre and post test results were also broken down by courses. We have three major series, each of which begins with a course in mechanics (description of motion, forces and Newton's Laws of Motion, momentum, energy and rotational motion). The PHY101 series has the lowest level of math requirement with students required only to meet the general education math prerequisite. The PHY201 series requires algebra and the PHY211 series requires calculus.

All three classes showed an improvement of 60% to 70% between the pre and post test scores. All graphs show a clear shift to a higher number of correct responses in the post test. The pre and post test averages are shown for all classes on the graphs.

The PHY101 class showed the largest improvement, with a 70% improvement between the pre and post test scores. A very pleasing result was that, while 26.5% of students had zero or one correct response in the pre-test, there were no students in these two categories in the post test. The most commonly obtained score was a promising 5 out of 6 in the PHY101 post test.

In the PHY201 class 63% of students scored zero, one or two in the pretest. This was the weakest performance of all three classes (PHY101 had 54.8% of students in this category and PHY211 had 42.4%). However, this figure of 63% did drop dramatically to just 20.6% of students in the post test results. Unfortunately the fraction of PHY201 students who scored 5 or 6 out of 6 in the post test was not as high as in the other two classes (10.3% versus 40% and 46.2% for PHY101 and PHY211 respectively). This may be a result of the fact that the incoming PHY201 students had weaker preparation but also points to an area that needs improvement.

The PHY211 class had the highest pre-test average score. In our experience these students are more likely to have had some prior Physics experience which is consistent with their higher pre-test scores. In spite of this higher starting level these students still managed to improve on average by 60% from pre to post test, giving them the highest post test average score of 4.3 out of 6.

Our test was easy to administer and produced clear and relevant results. This test can be used again periodically in the future to continue to assess our program's performance.

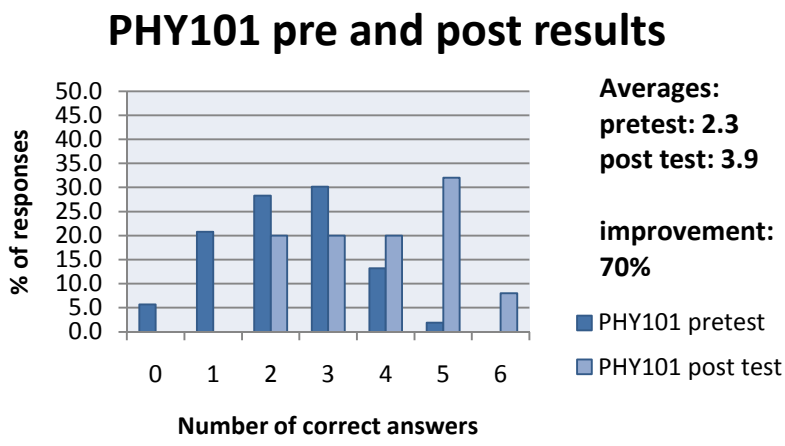

Figure 2: Pre and post test results for PHY101. The graph shows the percentage of respondents who received a particular score out of six.

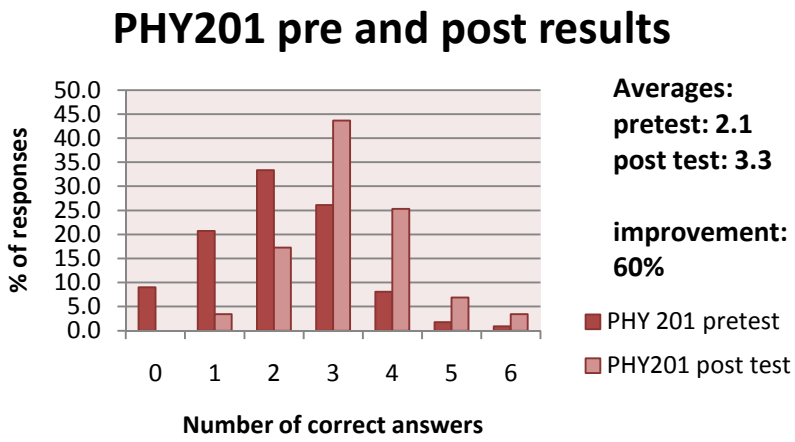

Figure 3: Pre and post test results for PHY201. The graph shows the percentage of respondents who received a particular score out of six.

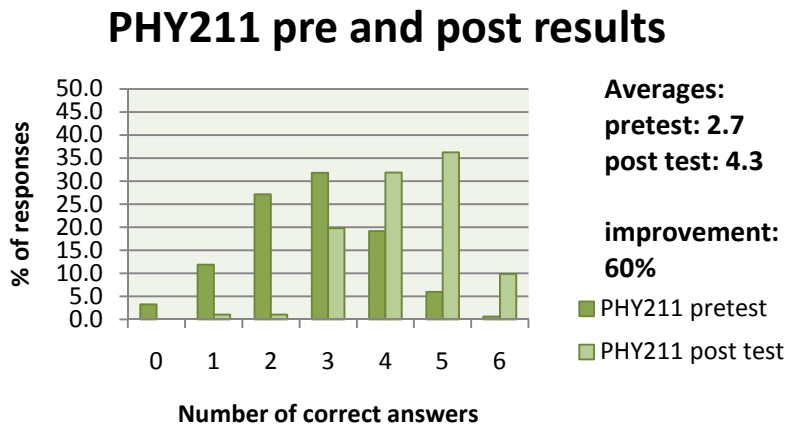

Figure 4: Pre and post test results for PHY211. The graph shows the percentage of respondents who received a particular score out of six.