

Academic Year 2008/09 Assessment Report
Physics Department
Fairmount College of Liberal Arts and Sciences

The Physics Department at Wichita State University offers a B.S. and B.A. in Physics. We also offer introductory Physics classes for engineering, pre-medical and education majors. The Wichita State University Physics Dept. has a nationally endorsed Society of Physics Students SPS organization and places students into Physics graduate studies elsewhere, most recently our best graduate went to the Harvard University in Boston, last year's student went to KU for graduate studies and the previous year student has just got accepted into Univ. of Colorado at Boulder. The majority of students taking our Physics courses are in accredited majors like engineering, education or chemistry; many of these test students' acquisition of physics. Thus we aspire to numerical proof of good learned outcomes through systematic administration of standardized examinations which gives us our rank nationally. For our introductory courses at the 200- and 300-level, these exams are the AP tests at the B and C levels, respectively. For our undergraduate Physics majors we judge their performance by results from the GRE Physics test.

Introductory Courses Assessment

In this, the fifth year of our assessment testing, there was an extensive program of testing in 200 and 300 level classes using Advanced Placement questions for all students at the end of each class. In Physics 213, 214, 313, and 314 we used exams as described in previous year's report but with different questions. Performances of tested students are summarized in the attached grid. Overall our 200 and 300 level physics class students performed well, with 54% of the students doing above the minimum required level. The results from these tests are what we have used to rank our students performance to a national average of mid B to upper C.

The Spring 2009 semester was the first year we tested the incoming Physics 313 students for math proficiency. We found that only 60% of the students were prepared mathematically for the class. This problem was then investigated and we found that the Math Calculus 1 and 2 class material was miss-matched to the Physics curriculum. This problem has been corrected in the Fall 2009 semester and we expect to see improvements in the students' performance.

In Physics 111, our conceptual physics course, we used the Force Concept Inventory as both pre- and post-test, and examined both final level of understanding and gain in understanding. On the pre-test, the average was 63%, and on the post-test, 76%, for an average gain in knowledge (defined as $g = (\text{post-pre})/(100-\text{pre})$) of 0.43. According to Hake¹, pre-test numbers in the 30's are typical in colleges and universities, so our

¹ Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66, 64-74.

Can be accessed from:

<http://scitation.aip.org/dbt/dbt.jsp?KEY=AJPIAS&Volume=66&Issue=1>

students are typical of others; our gains are below average: he reports $\langle g \rangle_T = 0.23 \pm 0.04$. Never-the-less, this year's Physics 111 class performance is much better than two years ago by Prof. Foster which was only 0.08; this may be due to the fact that the new instructor who taught this class was performance demanding of the students and although there were complaints that she was hard and expected too much from the student it may be the reason that the student actually improved.

Overall, the results were informative for preparations for future improvements. We think that this may be due to several reasons, not all of which apply to each class. Some of the problems can be solved straightforwardly: warning students ahead of time about the assessment exam; having some sort of incentive to do well; ensuring that the concurrent enrollment class uses a college-level textbook. We all agree that a major problem in 213 and 313 is lack of mathematical preparation: Though each course specifies a prerequisite (Math 112 and 242, respectively) many students ignore this requirement, which is not enforced institutionally. In addition 313 requires either high school physics or Physics 151. Our plan to deal with this was to institute a pre-test which helps us find a course material deficiency in Math that has been corrected. Eventually the goal is to require this exam for entering students to perform sufficiently well to be able to sign up for the class.

The single biggest factor that affects the quality of learning is class size. At extremely large schools Lectures are done in 250 student classes by highly experienced faculty and then these students break down into smaller 20 person recitation and lab sections for interactive learning exercises. These recitation and lab sections are often taught by Graduate Teaching Assistants which we currently lack. An alternative is to have class sizes of 30 to 35 students for the 200 and 300 level introductory physics classes. This would be the single major factor that could dramatically improve student performance in standardized tests with national rankings. It would require a substantial increase in the Physics Dept. faculty size but any such improvements would be welcomed by the Engineering Depts.

This year Prof. Taher was assigned to teach the day class and Prof. Behrman the evening class of Physics 313. The result was the lower performance of the evening class remained and it did not move with the instructor, hence concluding that it was a difference in student quality between the day and evening sections with the evening section being noticeable worse.

Also in the Spring 2009 semester there were 4 sections of Phys 313 with smaller class size. We clearly see that the smaller class size of <50 students had better performance than the previous Fall 2008 or Spring 2008 semesters, demonstrating a performance improvement of students with smaller class size.

Graduating Senior Assessment

We had one graduating senior this year. This student entered graduate school at KU, he did not release his GRE exam results to us.
