

## Physics Department Assessment Report – 2010

### Preface

Assessment is a very difficult task requiring a well designed process. This process consists of at least three steps: data collection, data analysis, and finally, use of the data to refine both the assessment process and the program. In order to collect meaningful data it is necessary to have agreement on what one is trying to accomplish – this is perhaps best termed goals. The term outcomes is generally used in assessment circles (Student Learning Outcomes - SLO's). However, this is a very poor choice of words because an outcome is a result at the end and is not predictable. How can one not achieve an outcome? Rationally, we must start with student learning goals: “what do we want our students to be at graduation.” The outcomes are able to be determined when looking at the assessment data. Once one has developed goals, the next question is what data can be collected that will provide meaningful information about achieving those goals. Then a meaningful analysis of the data must follow, considering the validity of the acquired data. At this point it is necessary to reflect upon the learning goals and determine how successful the department was in getting the students to achieve the proposed goals. Now it is feasible to go back and refine the learning goals and the program itself. If this assessment is to be meaningful, it requires a significant expenditure of departmental resources and “buy-in” of all members of the department.

At present, the Department of Physics is at a very preliminary stage of assessment. We have an assessment plan that is meaningless. We implemented learning goals within the last two years and we are very focused on making our program more cohesive. As such, we are paying little attention to the whole assessment process as of yet, but are working on designing a new more meaningful process.

List the learning goals ~~and outcomes~~ of the department/program.

1. *Will reason about physically significant problems conceptually and mathematically*
2. *Will solve complex physical problems using sophisticated mathematical techniques*
3. *Will interpret mathematical solutions conceptually and physically*
4. *Will investigate physical phenomena using multiple approaches*
5. *Will use computation and computer modeling to investigate physical phenomena and solve physical problems*
6. *Will communicate in appropriate scientific media and forms*

*We really need to have 100% success for us to believe the goals are being met. However, we find the question of success is arbitrary. These are learning goals and ultimately, it is unlikely that we will ever achieve 100% success and therefore, we need to keep revising the program in an effort to achieve the desired outcomes.*

Indicate how the goals ~~and outcomes~~ reflect the baccalaureate framework

The current learning goals are clearly a reflection of (BF1) *Acquisition and (BF2) Application of knowledge*, (BF5) *Critical thinking and Problem solving*, and (BF6) *Communicate*.

The previously listed Student Learning Goals (SLG's) require a understanding of mathematics and physics. The physics classes build student sophistication in solving problems through learning new techniques as in intermediate mechanics or they are learning about a form of physics they had not seen before such as quantum mechanics or statistical mechanics. Physics is very hierarchical and each

subsequent class generally depends upon the work of previous classes.

A map between our SLG's and the BF is on the following page. The present goals are not explicit about personal and professional values or community. However, this does not mean that we do not have a concern for those aspects. To address community we provide space for the students to work together. Writing and reviewing papers is designed to improve their sense of community and their belonging to a greater community of physics students. We use our Society of Physics Students to create opportunities for community activities. Finally, we stress that students should work together on assignments. Group work is stressed in many classes.

(BF3) Values, such as professionalism in what you create and timeliness are stressed in the classes. Laboratories stress value issues such as scientific integrity, and doing a good job in performing experiments.

Goals	BF1 - Acquisition	BF2 - Application	BF3 - Values	BF4 - Community	BF5 - Critical Thinking	BF6 - Communicate
1. Will reason about physically significant problems conceptually and mathematically	x	x			x	
2. Will solve complex physical problems using sophisticated mathematical techniques	x	x			x	
3. Will interpret mathematical solutions conceptually and physically	x	x			x	
4. Will investigate physical phenomena using multiple approaches	x	x	x		x	
5. Will use computation and computer modeling to investigate physical phenomena and solve physical problems	x	x			x	
6. Will communicate in appropriate scientific media and forms	x			x	x	x

Describe the program assessment process, including what is examined. If different outcomes are assessed each year, the report should address that.

*The Physics Department assesses the program each year through a meeting of faculty to discuss the students at two different levels: rising juniors and graduating seniors. Our discussions simply reflect our impressions of each student in achieving the learning goals when we have had them in class, laboratory or research. These discussions generally expand beyond the two classifications, but this is then part of the informal assessment.*

*Informally, we talk with recent graduates and find out what they needed and did not have, and what they felt they were well prepared. We also talk with our current students to find out how they believe they are performing in the class, to find out what things they think should change and what things*

*should remain the same.*

Provide clear results of the goals and outcomes of the learning goals assessment

- 1. We had no graduating seniors this past year.*
- 2. We had only 1 rising junior this year.*

*SLG1: Students will reason about physically significant problems conceptually and mathematically – The students seem to be suffering from “magic equation syndrome”: they are not reasoning but simply looking for a shortcut to the answer.*

*SLG2: Will solve complex physical problems using sophisticated mathematical techniques – The students do not have a high level of sophistication regarding problem solving.*

*SLG3: Will interpret mathematical solutions conceptually and physically – Not sufficient evidence to discuss.*

*SLG4: Will investigate physical phenomena using multiple approaches – Of five students one could be classified as outstanding. The remaining students would be classified as mediocre.*

*SLG5: Will use computation and computer modeling to investigate physical phenomena and solve physical problems – The students are computer illiterate: they do not know how to write computer programs and are barely able to use Excel effectively.*

*SLG6: Will communicate in appropriate scientific media and forms – The writing is, in general, abismal.*

*Students commented that advanced laboratory should be two semesters long.*

*Address how learning outcomes goals are used in the department's general education courses*

*At present we do not have department wide SLG's for our general education courses or other service courses. When we do finally develop these I predict they will consist of something along these lines 1) understanding the nature of science 2) appreciation of physics 3) conceptual understanding of some aspect of physics, 4) a sense of community, and 5) communicate their understanding.*

Explain any changes to be made to the curriculum and/or assessment process based on results of assessment.

*At present, the department of physics is completely revising the program. This is based more on informal assessment rather than the formal assessment because the previous formal assessment process was meaningless. We are developing course goals for intermediate courses and recently completed a curriculum map which indicated that there are holes within our curriculum. What we are trying to accomplish is to create a more seamless and integrated physics curriculum so that students are moved away from treating each course as a separate leaf, but rather as a portion of the tree. This task is turning out to be much more difficult than originally anticipated.*

- *Develop course learning goals – this is necessary so that we can track student outcomes in more detail.*

- Increase the number of credits of all laboratories post introductory to 2 credit hours to provide an hour of lecture in conjunction with the laboratory to improve laboratory skills.
- Change advanced lab to 0 or 2 credits so that in the first semester it can be taken with a lecture component and the second semester it is 0 credits. Degree requirements will be changed to two semesters.
- Revise the classes we teach and how they are taught using learning goals.
- Update the entire curriculum to make it more seamless and integrated
- Revise/revitalize/consolidate how we teach introductory laboratories
- Develop a coherent assessment plan.
- Adding writing and computational components to every course.
- Add a senior project.