

Ohlone College

Program Review Report

- **Program Description and Scope:**

- *Program Review Title:* Physics
- *Academic year:* 2015/2016
- *Review Type:* Instructional Disciplines
- *Program/Departments:* Physics (include astronomy) (19000/22002)
- *Authority Code:* 44-Dean, Science, Engineering, and Mathematics
- *External Regulations:* Yes_ No X
- *Provide a brief narrative that describes the instructional program/discipline:*

- The physics department offers a variety of courses, satisfying both general education requirements for non-science majors, and transfer requirements for majors in the biomedical, chemistry, physics and engineering fields.

- In addition, the transfer courses are articulated with and fulfill the lower-division requirements at most four-year schools in the UC & CSU system, allowing students to complete a baccalaureate degree after transfer.

- The department also offers an Associate of Science (A.S.) degree from Ohlone College, besides Certificates of Completion in Introductory Physics (two-semester) and Advanced Physics (three-semester). Again, in order to obtain the degree or the certificate, students have to take, besides the appropriate physics courses, a selection of math and other basic science courses, with which the physics curriculum is tightly integrated.

- **College Mission:**

- *Mission Statement:*

Ohlone College responds to the educational needs of our diverse community and economy by offering high quality instruction supporting basic skills, career development, university transfer, and personal enrichment and by awarding associate degrees and certificates to eligible students in an innovative, multicultural environment where successful learning and achievement are highly valued, supported, and continually assessed.
- *Program Relation to College Mission:*
 - Basic Skill
 - University Transfer
 - Personal Enrichment
- *State Your Program Mission/Purpose:*

The mission of the physics program is to create appreciation for fundamental physics, as well as to instill an informed awareness of its foundational importance in applied fields. The overarching purpose is to

develop critical thinking skills besides discipline-specific conceptual and quantitative skills to a level that prepares students for lifelong critical and individual questioning and learning.

o *Briefly Describe Program Accomplishments:*

All the transfer courses for the biomed and science/engineering majors are articulated with and fulfill the lower-division requirements at most four-year schools in the UC & CSU system, allowing students to complete a baccalaureate degree after transfer. Although no tracking of Ohlone students after transfer is done, personal feedback of Ohlone alumni indicates that they usually feel well prepared for upper-division coursework in fundamental and applied physics. Alumni often report experiencing a competitive edge over their peers coming from elsewhere.

Based on Ohlone's internal program review data for physics collected between Fall 2011 and Spring 2014, the major accomplishments in the department are:

- a) increased success rates in the first semester courses for both biomed and science/engineering majors (24.5% and 18%, respectively)
- b) markedly reduced withdrawal rates in the first semester courses for both biomed and science/engineering majors (24% and 16.5%, respectively)
- c) success increase amongst female students (9%), African American students (7%) and Filipino students (21.5%)

• **Achievement and Resource Data Analysis:**

1. *Research Questions:*

- 1. We have already identified that there are disproportionately few women enrolled in physics. What can be done at the college level to provoke higher enrollments among women?
- 2. Overall success rates in physics are below the college-set minimum standard of 69.1%. What could be done to bring those success rates up?
- 3. Hispanics, African Americans, and Filipinos have disproportionately low success rates--and exorbitant withdraw rates. Is there anything that can be done to keep these students enrolled and to finish with passing grades?

- **Resource Assessment Summary:**

1. *Academic Year:* 2013-14
2. *Activity Center Fund 10 Budget Allocation:* \$264118.00
3. *FTES:* Fall: 34 Spring: 34 Summer: 0
4. *WSCH/FTEF:* Fall: 474 Spring: 506 Summer: 0
5. *Course Sections Offered:* Fall: 8 Spring: 8 Summer: 0
6. *Sections Taught FT Faculty:* Fall: 3 Spring: 4 Summer: 0
7. *Sections Taught PT Faculty:* Fall: 5 Spring: 4 Summer: 0

- **Human Resources:**

1. *# of FT Faculty:* 1
2. *# of PT Faculty:* 4
3. *# of Classified Staff:* 0
4. *# of Administrators:* 0
5. *% Faculty release/reassigned time:*
6. *Technology:*
 - Specialized Software
 - Technology Enhanced Instructional Equipment
 - Laptops
7. *Physical Resources:*
 - Specialized Labs
 - Tutoring/Learning Center

- **Program Analysis PSLOs - Student Learning:**

(Key: I-Introduced, P-Practiced with Feedback, M-Demonstrated at the Mastery Level)

1. *PSLO Matrix:*

Course	PSLO-1	PSLO-2	PSLO-3	PSLO-4	PSLO-5
PHYS 108		I		P	
PHYS 120	P	P		M	
PHYS 120A		M		P	P
PHYS 121	P	P		M	M
PHYS 121A		M		P	M
PHYS 131D					
PHYS 140	P	P	I	M	
PHYS 141	P	M	M	M	M
PHYS 142	P	M	M	M	M
PHYS 190					

2. *Please Indicate the PSLO(s) which you are reporting on:*

- Students should acquire basic experimental skills, by the practice of setting up and conducting an experiment with due regards to minimizing measurement error, and by the thoughtful discussion and interpretation of data.
 - Students should build critical thinking and quantitative skills, by gaining insight into the thought processes of physical approximation and physical modeling, by practicing the appropriate application of mathematics to the description of physical reality, and by searching for a physical interpretation of mathematical results.
 - Students should aim at completing a comprehensive physics study program, by satisfying the A.S. degree in Physics for Transfer Majors, or obtaining the Certificate of Accomplishment in Advanced Physics.
 - Students should develop a deeper appreciation of physical reality, including a deeper comprehension of technology, by understanding how the few fundamental principles of physics underlie the huge variety of physical phenomena and by understanding the working principles of technological devices on a fundamental level.
 - Students should retain information from course to course, by aiming at proficiency in the correct memorization, nomenclature and use of all the fundamental laws and equations to solve integrated problems.
3. *Analyze and summarize your assessment findings. What in the data jumped out?*

By tracking individual student progress and success in the 3 semester science/engineering sequence, starting with the Spring 2012 semester enrollment and final grade roster data, and continuing until the Fall 2014 semester, the following findings emerge:

1) Success rates in the first-semester course PHYS140 are low. Only 50% of those students enrolled on day 1 pass with grade C or better. Some attrition may take place before census date, but I did not check for this, as withdrawal before or after census date does not change the fact that in both cases the students most likely felt or knew they were not going to achieve the result they hoped for.

2) Surprisingly large numbers of successful PHYS140 students do not immediately continue with the capstone courses PHYS141 or PHYS142. The reason for this 'interrupted progression' is not clear at all. Further details in comments below.

3) Grades obtained in the capstone courses PHYS141 and PHYS142 compared favorably with grades obtained in the PHYS140 course, not just statistically speaking, but individually. Most students kept or improved on their PHYS140 grade in both capstone courses. These data obviously reflect positively on PSLO2 and PSLO3, although the reality experienced by the instructor in the classroom suggests a more problematic situation. Further details in comments below.

4) The survey of PHYS140 students' self-assessment reveals that these students

typically appear to be rather realistic about 'grade inflation', and that they do not seem to fall in the trappings of 'overconfidence'. Yet, the results they obtain on their first midterm clearly fall below their own expectations. In my opinion, this is the result of a general lack of preparedness for the challenges posed by a first-semester physics course.

4. *Give examples of assessments used for your PSLO analysis:*

Three assessments were conducted. For details see attached file.

1) Student transition rates and success across the science/engineering 3 semester sequence (PHYS140/141/142) were tracked on an individual basis (that is, based on student name instead of group numbers) between Spring2012 and Fall 2014. These data reflect on PLSO2, PSLO3 and PSLO5.

2) A survey of first semester PHYS140 students' self-assessment was conducted in the Fall of 2014, and the students' answers were compared with the results on their first midterm. These data reflect on PLSO2.

3) The quality of students' answers to a few specifically constructed questions on the first midterm of the PHYS141 of Fall 2014 were analyzed and served to assess PSLO2 and PSLO3.

5. *Describe input from Program Advisory Committee (if applicable):*

N/A

6. *Comments:*

1) The observed 'interrupted progress' through the physics sequence does not seem to relate to a dissatisfaction with PHYS140 grades, since many students with B and A grades nevertheless do not immediately take the next course. Even when allowance is made for one semester of interruption, many individuals are not encountered on the enrollment rosters for a second semester of physics. Although I have no quantitative data to support the following conjecture, one explanation of the observed 'interrupted progress' may be that many students take their second and third semester physics courses after transfer: informal conversations with students indicate that quite a few students have already taken most of the math curriculum before enrolling in PHYS140. Moreover, after taking PHYS140, they are in a position to enroll in all engineering classes, with the exception of ENG130 (circuits). It is possible therefore that

students opt to transfer out and take PHYS141 and ENG130 after transfer. In order to confirm this hypothesis, a specific questionnaire would have to be submitted to the PHYS140 students, inquiring about their study plan after PHYS140.

2) Although student grades generally improve in the capstone courses, it is the instructor's strong impression that students perform better in the capstone courses to the extent that they are not challenged to integrate too much prerequisite knowledge. Likewise, there is often no real evidence for increased conceptual maturity, especially in the PHYS141 course. Apparently not all aspects of learning are reflected in the final grade!

- **Program Improvement Objectives**

1. *Based on the program data analysis and PSLO analysis, identify your Program Improvement Objective(s): What are you going to do? Why are you going to do it?*

Establish a preparatory PHYS102 course for both the biomed major and the science & engineering first semester physics courses. The purpose is to increase student success in the first-semester PHYS120 & PHYS140 courses.

Notes (optional): Please include any notes related to your PIO. (2500 Character limit)

Analysis of PSLOs clearly shows that student success in the first-semester PHYS120 & PHYS140 courses is too low, and that exam scores are below students' expectations, even when these expectations are not overtly unrealistic. In my opinion, these observations point toward the fact that beginning physics students are often largely underprepared for a first-semester physics course. This underpreparedness manifests itself both on the mathematical, quantitative and logical level, as well as on the intuitive, conceptual and commonsensical level. An important program improvement objective therefore is to establish a preparatory PHYS102 course, that would help those students who need it, or elect it, be better prepared to solve integrated word problems and understand the theoretical derivations of a first-semester physics course (PHYS140 as well as PHYS120).

Program PIO will address the following:

- Student Learning & Achievement
- Course Retention

- Course Completion
- Persistence
- Success Rates
- Increase Program Enrollments
- Increase Degrees/Certifications

How will you assess the effectiveness of your PIO:

1) student survey polling self-assessment of preparedness for PHYS140/120 2) tracking on an individual basis of final grades in PHYS140, with or without the preparatory PHYS102 coursework 3) continued tracking on the basis of student name of success in the capstone courses 4) comparative (that is, with or without PHYS102) assessment of the quality of answers to selected exam questions in PHYS140, 141 and 142, aimed at establishing either quantitative prowess or conceptual insight 5) comparison of number of degrees and certificates awarded before and after PHYS102 was offered

PIO Action Plan:

How will you accomplish this?

By putting together teaching materials in the format of a manual/textbook that addresses directly the hiatus in prerequisite knowledge and the difficulties with its application, as well as the shortcomings in use of technical vocabulary, and the lack of experience with abstract and conceptual analysis of physical processes, as I witnessed it with the Ohlone students. This text is not going to be a mere compilation of existing sources, as these sources precisely do not effectively address the aforementioned problems.

What is your timeline?

Although the PHYS102 could probably be offered starting in Spring 2017, my goal is to present this work in published format, including the usual references to web links, end-of-chapter exercises and solution manual. To finish an endeavor of this magnitude would require the sympathy and support of supervisors and administrators in the form of a sabbatical leave approval. I am planning to apply for a sabbatical during the academic year 2017-2018.

Who is going to do this?

I will create the materials for this course. I believe that I possess the necessary passion and energy, in addition to more than two decades of teaching

experience in physics and mathematics at both the university and community college level, to make a difference, not only for the first-semester physics students at Ohlone College, but to contribute as well to improving physics education in general.

PIO Status:

- New
- In-Progress

Closing the loop - Describe the results of your PIO implementation or completion:

N/A

Conclusion: Complete if PIO has been completed

Fiscal Resources Status:

- No fiscal resources requested. Request for sabbatical needs to be submitted through sabbatical application process.

PIO Resources:

- Resource: People Time

2. *Based on the program data analysis and PSLO analysis, identify your Program Improvement Objective(s): What are you going to do? Why are you going to do it?*

Continued purchase of lab/demonstration equipment, as well as simulation software. These educational materials will enhance students' exposure to a variety of physical phenomena and processes and thereby stimulate and expand their physical insight.

Notes (optional): Please include any notes related to your PIO. (2500 Character limit)

PSLO analysis shows that students have a hard time imagining physical reality and its processes, as well as thinking about these in a disciplined and systematic, physical, manner. This learning difficulty can be addressed to an important, albeit not full extent, by offering students the opportunity to perform hands-on experiments, or, where such labs become impracticable, to perform computer simulations.

Program PIO will address the following:

- Success Rates
- Student Learning & Achievement

How will you assess the effectiveness of your PIO:

By organizing a final lab/simulation exam. By assessing the quality of answers on those theoretical exam questions that expect students to think about a variation on the initially given situation and thereby incorporate what they learned from their experiences with simulations ("what do you think would happen, if this or that were changed?" type of questions).

PIO Action Plan:

How will you accomplish this?

By integrating demos more frequently in the lectures. By combining in a complementary manner shorter lab experiments with simulation projects. By increasing the number of existing lab stations from the current 6 to 8 stations, to 12, so that students can work in groups of two and have enhanced hands-on time and learning experience.

What is your timeline?

ongoing

Who is going to do this?

the full-time faculty, who will also have to instruct, mentor the adjunct faculty and encourage them to incorporate these tools in their teaching.

PIO Status:

- New
- In-Progress

Closing the loop - Describe the results of your PIO implementation or completion:

N/A

Conclusion: Complete if PIO has been completed

Fiscal Resources Status:

- Possible source Instructional Equipment (\$10,000) 2015-16.

PIO Resources:

- Resource: Instructional Equipment
Description: Demonstration equipment
Est. Cost: \$5,000.00

3. *Based on the program data analysis and PSLO analysis, identify your Program Improvement Objective(s): What are you going to do? Why are you going to do it?*

Redesign the existing PHYS120A and PHYS121A courses as online courses. The reason is it is difficult to find a time slot that is equitable to all PHYS120 students, or to find adjuncts who are available on that time slot.

Notes (optional): Please include any notes related to your PIO. (2500 Character limit)

Program PIO will address the following:

- Institutional Effectiveness
- Increase Program Enrollments
- Use human, fiscal, technological, and physical resources responsibly,

How will you assess the effectiveness of your PIO:

feedback from students as well as enrollment statistics will indicate whether the online format works well

PIO Action Plan:

How will you accomplish this?

approval through curriculum committee

What is your timeline?

The next offering of PHYS120A and PHYS121A will be in Fall 2016 and in Spring 2017, respectively. We would like those to be online offerings.

Who is going to do this?

Full-time faculty.

PIO Status:

- New

Closing the loop - Describe the results of your PIO implementation or completion:

N/A

Conclusion: Complete if PIO has been completed

Fiscal Resources Status:

PIO Resources:

- Resource: No Resources Identified

Attached Files:

