

# 2018-2019 Program Review Cycle



Instructional Programs

## CAN Program Review (Instructional) - Physics (Odd Year)

### Program Review Narratives

2018-2019

#### **Instructional Program Review (IPR)**

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#### **Executive Summary**

**0. Executive Summary:** The physics program at Cañada College presents the opportunity to introduce students to the physical sciences and scientific thinking. The courses require students to learn content and develop critical thinking skills. Additionally, they foster a positive social environment through group oriented Lab and study sessions.

Physics enrollments are decreasing as are the general College enrollments. The average success rate over the past five years is 70.7%. When looked at in more detail, PHYS 210 and PHYS 250, the entry courses for the algebra and calculus based courses respectively, are the major barriers to student success.

#### **Program Context**

**1. Mission:** Career Technical Basic Skills Transfer Lifelong Learning

Mission statement:

The Physics & Astronomy Department endeavors to prepare students for successful transfer to four-year institutions, to provide the prerequisite foundation in physical sciences for further work in engineering and the sciences, to foster critical thinking and active learning, and to fulfill the needs and interests of students by having a well-rounded curriculum of lecture and laboratories.

**2. Articulation:** There are no expected changes for physics.

**3. Community & Labor Needs:** There are no expected changes for physics.

#### **Looking Back**

**4. Curricular Changes:** All physics courses have been updated as of Fall 2018. There were no significant changes. The textbooks were updated. Language was cleaned up for lecture and lab content as well as SLO's.

**5A. Progress Report - IPC Feedback:** The 2016-17 review requested that our programs connect our performance and data packet analysis more explicitly to our action plans. While we feel this was satisfied last year, we continue to make additions to our respective analysis and plans.

**5B. Progress Report - Prior Action Plans:** In the 2016-17 Program Review we did not include any Action Plans. So there is nothing specific to report. In general, however, the program continually works to improve student success, remove barriers, and to decrease equity gaps.

We have been active in ACES and in the GANAS grant (Generating Access to Navigate and Achieve in STEM ) through the IWITTS project (Institute for Women in Trades, Technology and Science)

The results of these activities is hard to determine. At best, the improvement is incremental.

**6A. Impact of Resource Applications:** The funding for the update of the physics equipment over the past several years has brought the labs closer to being fully effective for more of the students enabling smaller groups and more experiments. The funding of the STEM center and the Physics Tutoring program as well as EPICs has been crucial in maintaining student success.

**6B. Impact of Staffing Changes:** N/A

#### **Current State of the Program**

**7. Enrollment Trends:** Over the past five years, the load has averaged 412.2 with a standard deviation of 38.9. The fill rate has averaged 83.4% with a standard deviation of 10.2%. The Load is largely driven by the class size limitation for lab classes. While demand for physics courses has been high enough to allow double lab sections of PHYS 250-260-270. The double lab sections increase the maximum load to 412 from 400 for a single lab section. With declining enrollments we expect the Load to drop to the normal level of Load for a physics lab class.

**8-A. Access & Completion:** The average success rate for the last 5 years is 70.7% with a standard deviation of 4.5%. The average retention rate over the same time is 80.7% with a standard deviation of 3.5%

The average success rate by course over the last five years

	Success Rate	Standard Deviation
PHYS 210	65%	19%
PHYS 220	79%	10%
PHYS 250	58%	13%
PHYS 260	65%	15%
PHYS 270	87%	8%

These figures show that PHYS 210 PHYS 250 and PHYS 260 are the courses that the students struggle with the most.

According to the equity data, females and Hispanic students are disproportionately affected in access. Currently, we are working with the ACES group and the IWITTS program to understand why females do not take physics courses. Data suggest that females complete calculus (a prerequisite for calculus based physics) at a comparable rate to males but that they do not then go on and take a physics class at the same rate as males. Hence the access equity gap. The causes of this are not known but we are in the process of looking into what might be done.

Female students have a higher completion rate than males. This may come down to females being better able to self-assess what it takes to pass a physics course and a lack of maturity on the part of some male students.

The Hispanic student population tells a different story. In terms of access, Hispanic males are 10% of the college student population and 19% of the physics student population. They are thus over represented in physics. Hispanic females are 18% of the college student population and only 6.7% of the physics student population. Hispanic females are under represented in the physics program.

In terms of success, Hispanic males is 50% well below the average success rate. However, for Hispanic females, the success rate is 95.5% well above the average success rate.

Thus the Hispanic student population in physics is similar to the overall population in that females have a higher success rate than males and at the same time females are under represented in the physics program.

The problems to address are:

- 1) Attract more women into the physics program.
- 2) Develop resources targeted to Hispanic male student population to help them succeed in physics.

We are engaged with the ACES group as well as the IWITTS program to study ways of improving instruction with the goal of improving the success rate and increase the number of female students in STEM courses. And with ACES to develop ways to improving the overall success rate for minority students.

**8-B. Completion - Success Online:** Physics does not offer any online or hybrid courses.

**9A. SLO Assessment - Compliance:** Yes, all SLOs are systematically assessed and are current.

In the fall-18, during the curriculum update, the SLO's for PHYS 250 were changed to reflect Bloom's taxonomy. They will be evaluated in upcoming semesters.

**9B. SLO Assessment - Impact:** SLO assessments have prompted only slight modifications to existing teaching (slight revisions to handouts, introductions to labs) but not any significant changes to methods.

However, we have significantly changed to SLO's in PHYS 250 to the following

- A. Draw on conceptual understanding of physics to explain various real-world phenomena related to Newtonian mechanics.
- B. Apply mathematical techniques, as appropriate to the course level, to quantitatively analyze real-world phenomena related to Newtonian mechanics.
- C. Use laboratory equipment to collect and process data and apply appropriate equations to calculate results for experiments related to Newtonian mechanics.
- D. Interpret experimental data for trends and deduce their connection with theories of Newtonian mechanics, including identifying sources of experimental error.

We will look to see if the SLO's written in this way produce any more significant insights.

**10. PLO Assessment:** The program student learning outcomes are supported by the course level SLO's. The PLO's are:

- 1) The Scientific Method
- 2) Effective Communication and Documentation
- 3) Critical Thinking and analysis of physical systems

The SLO's are evaluated through written Lab reports, presentations, and embedded questions on exams.

The department is successful in completing the PLO's. Thus no changes are planned.

### **Looking Ahead**

**11. Program Planning:** Student success in the entry courses PHYS 210 and PHYS 250 continues to be a problem. About 50% of the students in these courses seem to not be ready for the work-load that these courses demand. Consequently these students get behind, get frustrated and drop/fail. The department has tried a diagnostic pre-test in the past to see if we could determine who is ready physics and who is not. The results were inconclusive, some students who seemed not likely to pass rose to the challenge while others who should have done fine did not succeed. This seems to suggest that the key element in student success is motivation. Thus a possible resolution is to offer a supplementary physics course that could be taken simultaneously with PHYS 210 and PHYS 250 that would re-enforce the material presented in those courses and develop the skills needed to succeed in those courses. This would certainly benefit the motivated but unprepared student.

Thus our plans in looking ahead are to

- 1) Explore the need for and effectiveness of an auxiliary physics course or courses to help improve student success in PHYS 210 and PHYS 250.
- 2) Continue working with ACES and the IWITTS program to assess and develop classroom strategies for the retention of women in our courses.
- 3) Continue to work to identify and reduce equity gaps and barriers to success for all students

**Program Review Narrative Status:** Complete

## **Objective: Academic Support Courses and Other Resources**

Explore the need for and effectiveness of an auxiliary physics course or courses to help improve student success in PHYS 210 and PHYS 250. These 1 unit courses would be taken concurrently with with PHYS 210 and PHYS 250.

Also, explore other resources and implementation methods to facilitate student success. For example EPIC and ways to improve on the EPIC model.

**Objective Status:** 1 - New (PR)

**Objective Year:** 2020-2021

**Estimated Start Date:** 01/14/2019

**Estimated Completion Date:**

**Please select the college goals with which this objective aligns.:** Student Completion/Success - Provide educational and student services programs that highlight inclusivity, diversity, and equity in their mission to help students meet their unique educational goals and minimize logistical and financial barriers to success.

**Please select the district goals with which this objective aligns.:** District Goal #1 - Develop and Strengthen Educational Offerings, Interventions, and Support Programs that Increase Student Access & Success

## **Objective: Increase retention of women in physics**

Physics faculty have been working with IWITTS to assess class climate, and test strategies for increased retention of women in physics. The IWITTS program has a long term plan to first assess class climate (level of comfort, participation rate, etc.) as well as the role of the instructor (what strategies increase or decrease these) for students in the classroom. Some of these strategies (awareness, group work, relatability of content etc.) are already being tested in both physics and astronomy. However we are waiting on results from a more comprehensive student survey on their experiences before taking further steps.

**Objective Status:** 1 - New (PR)

**Objective Year:** 2019-2020

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