2018-2019 Annual Program Assessment Report Guide

Please submit report to your department chair or program coordinator, the Associate Dean of your College, and to james.solomon@csun.edu, Director of the Office of Academic Assessment and Program Review, by **September 30, 2019**. You may, but are not required to, submit a separate report for each program, including graduate degree programs, which conducted assessment activities, or you may combine programs in a single report. **Please include this form with your report in the same file and identify your department/program in the file name.**

College: Science and Math.

Department: Physics and Astronomy

Program: Physics and Astronomy

Assessment liaison: Radha Ranganathan

1. **Please check off whichever is applicable:**
   A. X Measured student work within program major/options.
   B. X Analyzed results of measurement within program major/options.
   C. _____ Applied results of analysis to program review/curriculum/review/revision major/options.
   D. _____ Focused exclusively on the direct assessment measurement of General Education Arts and Humanities student learning outcomes

2. **Overview of Annual Assessment Project(s).** On a separate sheet, provide a brief overview of this year's assessment activities, including:
   - an explanation for why your department chose the assessment activities (measurement, analysis, application, or GE assessment) that it enacted
   - if your department implemented assessment **option A**, identify which program SLOs were assessed (please identify the SLOs in full), in which classes and/or contexts, what assessment instruments were used and the methodology employed, the resulting scores, and the relation between this year's measure of student work and that of past years: (include as an appendix any and all relevant materials that you wish to include)
   - if your department implemented assessment **option B**, identify what conclusions were drawn from the analysis of measured results, what changes to the program were planned in response, and the relation between this year's analyses and past and future assessment activities
   - if your department implemented **option C**, identify the program modifications that were adopted, and the relation between program modifications and past and future assessment activities
   - if your program implemented **option D**, exclusively or simultaneously with **options A, B, and/or C**, identify the basic skill(s) assessed and the precise learning outcomes assessed, the assessment instruments and methodology employed, and the resulting scores
   - in what way(s) your assessment activities may reflect the university's commitment to diversity in all its dimensions but especially with respect to underrepresented groups
   - any other assessment-related information you wish to include, including SLO revision (especially to ensure continuing alignment between program course offerings and both program and university student learning outcomes), and/or the creation and modification of new assessment instruments

3. **Preview of planned assessment activities for 2019-20.** Include a brief description as reflective of a continuous program of ongoing assessment.

2. Overview of Annual Assessment Project(s).

2.0 The department chose three laboratory courses and the culminating experience course for assessment of Program SLO, because (i) Laboratory courses are good platforms for assessing program SLO. They require application and integration of fundamental knowledge from a wider range of topics covered in more than one lecture only course; (ii). In Laboratory courses students are required to write reports which is more natural to expressing learning; (iii) There is more time to conduct assessment and for the instructor to observe a student and thus get to know areas of difficulty; (iv) Typically no new lab is assigned in the last week of classes. Students write an essay based on one assigned experiment conducted. So the time can be used effectively to conduct assessment and the essay included for the final grade. Thus the essay report facilitates merging of assessment and grades. This is eventually the desired direction.

1A. Program SLO were assessed in the following Courses
Majors:
Undergraduate Sophomore course PHYS 227 L, a laboratory course in Optics and Modern Physics.
Undergraduate Junior Course PHYS 365, Experimental Physics course on computational methods.
Senior level PHYS 465, Laboratory course in Experimental Physics.
Senior level PHYS 497 Culminating Experience Course

GE Natural Sciences: PHYS 100B

2.1 PHYS 100B Fall 2018

Assessment Instrument: Students are given a conceptual and semi-quantitative pre- and post-test to assess learning gains in electromagnetism. The concept test is a subset of questions from the Brief Electricity and Magnetism Assessment (BEMA) (Ding et al., 2006). The assessment was at the beginning of the semester, on the first day of class, and after the sections on electromagnetism were complete and students had been tested. Student results are not counted towards their final grades (this is a requirement of the BEMA authors).

L. Ding, R. Chabay, B. Sherwood, and R. Beichner, Evaluating an electricity and magnetism assessment tool: Brief electricity and magnetism assessment, Phys. Rev. ST Phys. Educ. Res. 2 (1), 7 (2006).

Evaluation: As students do not have any incentives to perform well on the tests, our expectations are lower than for regular course work.
Excellent > 60%
30 % < Satisfactory < 60%
Unsatisfactory < 30%

SLO	Section	Pre-/Post-test	Excellent	Satisfactory	Unsatisfactory	Number of students
1. Demonstrate an understanding of basic knowledge, principles and laws in the natural sciences.	17017	Pre	0	8	74	82
		Post	3	15	58	76
	17642	Pre	0	3	47	48
		Post	0	11	30	41

Analysis: The results are unsatisfactory. Contributing factors may include the timing of the second test, which was not given immediately after their exam on the topic, lack of incentives, and changes in pedagogy. Both Profs. Cadavid and Luchko implemented a number of active learning strategies and activities in Fall 2018. This assessment suggests that refinement is required. However, this was the first semester this assessment has been used, so it is not possible to compare to previous years.

Planned Activities: The assessment tool will continue to be used. We will perform the post-test immediately after their exam on the topic and stress the importance of the test. Profs. Cadavid and Luchko will continue to implement and improve upon their active teaching techniques.

2.2 PHYS 227 L:

Assessment Instrument. Students conduct the Photoelectric Effect experiment. For assessment, they write an essay on their findings (other than the usual report required), as if they are the first ones to observe and measure the effect. Requirements for the essay are discussed. The essay is assessed for a clear exposition of answers to the following points.

1. Are the data in agreement with the classical wave theory of light ? What is the disagreement ? Why is it at odds with the classical theory ? All points of disagreement should be clearly stated.
2. What is the importance of the occurrence of the cut-off frequency ? How does the photonic theory of light explain all observations? What are the implications of this new theory of light ?
3. How is the Stopping Potential measured?
4. Explain the current vs voltage curve. Is it linear ? How is the curve different from that of metals (which is measured in previous lab courses) ? Why does it saturate?

Evaluation: Excellent: Understands methodology and special ways of setting up experiments to obtain particular information, Understands data analyses, Understands meaning of the data in refuting theories and proposing new ones.

Satisfactory: Able to give partially correct answers; but still incomplete.

Unsatisfactory: Does not understand the purpose of the lab and what the data convey.

PHYS 227L Assessment Rubric: SLO assessed and the question that tests the SLO are provided in Column 1

Number of respondents = 12

SLO	***Excellent***	***Satisfactory***	***Unsatisfactory***	
2a. Set up laboratory experiments and collect data from observations and experiments. Q3	*5*	*7*	*0*	
2d. Analyze data, provide error analysis: Q1	*4*	*4*	*4*	

3a. Convey physical concepts with mathematical expressions (quantitative literacy). Q2 and Q4 ***b. Clearly communicate physical concepts, findings, and interpretations. Q2 and Q4***	2	5	5	

Planned Activity: Continue with the same instrument. Discuss with students individually about what is expected. Require students to write down the main points and what they think is expected in a notebook and discuss this with the instructor before writing the essay. Expand to more than one essay.

2.3 PHYS 365

Assessment Instrument: Students were evaluated on their final project for the course. Final projects consist of a short description of background and theory necessary for the project, a plan to implement a computer program to address the main questions of their project, a written report of their findings, submission of their source code and an exit interview. Student projects are assessed using the following criteria.

1. The background and theory sections are assessed for the student's ability to
    a. explain the physics involved in their project,
    b. identify and communicate the primary equations used to model the phenomena, and
    c. use proper notation and formatting and identify all symbols.
2. Students' source code is assessed using the following questions:
    a. does the code work?
    b. does the code address the questions in their project?
    c. is the code readable by another human being with proper organization and documentation? and
    d. is there testing to indicate that the code is correct?

SLO	Criteria	Excellent	Satisfactory	Unsatisfactory	Number of Students
1. Students will be able to describe natural phenomena in general and in their chosen program option using principles of physics.	**1a**	**6**	**10**	**3**	**19**
3a. Convey physical concepts with mathematical expressions (quantitative literacy)	**1b, 1c**	**5**	**8**	**6**	**19**
2e. **Competently use computer tools, including: software programs for data analysis and presentation, numerical analysis, and computer simulations.**	**2**	**4**	**8**	**6**	**18**

Analysis: The results are mostly satisfactory. Physics students generally struggle with writing but this was, objectively, where they did the best. This may be because the writing assignment was short and the objectives were clear. Students had two primary problems with SLO 3a: they either failed to identify the key equations they would be solving or they failed to identify all symbols used in the equations. Many students still struggle with coding at the end of the course. This is not surprising as the course is quite short and most student have no background in coding.

Planned Activities: The assessment tool will continue to be used. In order to improve student outcomes, a peer learning facilitator (PLF) is being used for the first time in this course and a new textbook is being used. The PLF will help provide additional support for students in the course for both learning to code and on their projects. The new textbook is interactive and, along with a new set of assignments, should give students more practice through a large number of small exercises. Greater effort will be placed on explaining to students how to properly include and format equations in their written work.

2.4. PHYS 465

PHYS 465 Assessment Rubric: SLO assessed are provided in Column 1

Number of respondents = 16

PHYS 465 is a Senior year laboratory course. The experiments in this course are in the field of Optics. Although it is not a capstone course, successful performance of experiments requires knowledge, information, computer and math skills from all other courses. The new format for report submission proposed last year with well-defined requirements was employed.

PHYS 465 Assessment Rubric for each experiment

SLO	***Excellent***	***Satisfactory***	***Unsatisfactory***	***Instrument***
2b. Combine insights and techniques from the various courses in the program (integrate knowledge)	*0*	*4*	*12*	*Prelab Activity report and discussion section of report*
2a. Set up laboratory experiments and collect data from observations and experiments: Ability to obtain the refractive index from analysis of Michaelson interferometer experimental data, determine error, and discuss discrepancy with true value	*10*	*6*	*0*	***Inspection of set-up by Instructor, quality of uploaded data in item 3 of Report.***

2d. Analyze data, provide error analysis test a model or hypothesis by comparing with data.	0	5	11	Item 4 of Lab report
2e. Competently use computer tools, including: software programs for data analysis and presentation, numerical analysis, and computer simulations.	12	4		*Judged by instructor in class on the ability to obtain data using the computer and software for analyzing data and item 3 of Lab report*
3a. Convey physical concepts with mathematical expressions (quantitative literacy) ***4a. Make unbiased and objective judgments of theories and experiments***	0	5	11	*Item 4 of Lab report and discussion section of report*

Excellent: Prepared with material before class; motivated to gets results without much help, help required from Instructor is appropriate.

Satisfactory. Basic preparation with material, just enough to conduct the experiments, requires some help, but eventually understands, exhibits interest in getting good results.

Unsatisfactory: Unprepared; not motivated to get results and does not want to be helped, just presents whatever he / she gets without enquiring if results can be better.

Analysis: Desired outcome is unsatisfactory. Students did not seem to realize the importance of the reports. The attitude seems to be "if I come to the lab and do the experiments, then that should be all; report is just a minor incidental"

Planned Activity: In the current year, students are required to maintain a lab record notebook, which will be inspected and signed by the instructor at the end of class. Expected entries in the notebook are discussed. These are points that should be developed upon in the reports. Time is dedicated to building up the report in stages within the class hour. For assessment purposes, report is graded with SLOs in mind.

2.5. PHYS 497. This is a Senior level culminating experience course, offered for the second time in S 2019. Program SLO 1 and 3 were assessed.

1. Physics: Students will be able to describe natural phenomena in general and in their chosen program option using principles of physics

3. **Communication:** Students will be able to

a. Convey physical concepts with mathematical expressions (quantitative literacy)
b. Clearly communicate physical concepts, findings, and interpretations through oral presentations (oral communication)
c. Write clear, organized and illustrated technical reports with proper references to previous work in the area (written communication)
d. Search for and read scientific literature (information literacy)

SLO 1: The ETS Physics test that our students take at the end of their senior year was used as the instrument to assess SLO 1. We have been using the ETS exam as an exit final assessment.

Results of ETS: The 497 course is an elective course. Of the total 13 students, 8 took the course and 5 did not. The results of the test are:

Student type	**Number of Students**	**Mean**	**Std. Dev.**	**percentile**
Took PHYS 497 (S2019)	8	141	15	29
No Phys 497 (S2019)	5	129	7	6

National	~2700	149.9	15.4	
Took PHYS 497 (2018 and 2019)	18	141	18	
No PHYS 497 (2018 and 2019)	16	132	9	

***Analysis*:** Students that took the PHYS497 (Rows 1 and 4) performed better (higher average and better percentile in 2019 as well as 2018.) than those that did not (Rows 2 and 5). Their percentile of 29 continues to be an improvement over the 6th percentile of those that did not take the course.

SLO 3. The assessment rubric presented at the end of this document was used as the instrument to assess SLO 3.

8 students gave presentations twice in the semester and these were ranked with the presentation rubric. The students were assessed by the instructor using the attached instrument, and awarded scores 1-4. Students also rank their peers anonymously.
At presentation 1, students scored 2.71 +/- 0.66 (instructor scores) while at presentation 2, they scored 3.00 +/- 0.46. It is encouraging to see that the mean goes up and the standard deviation goes down. We are clearly adding value. Peer grading shows a similar increase.

Written Report assessment: We developed an assessment rubric, included at the end of this document, for written technical report.

Planned Activity: We will implement writing assessment the next time.

Presentation evaluation rubric V4

For every aspect, circle your assessment

	Presenter:		**Advisor:**		**Date:**
		Poor	**Needs some improvement**	**Good**	**Excellent**
1	**Engagement/ Receptivity to audience**	Does not respond, responds incorrectly or inappropriately to questions. Hard to understand (too fast, too quiet)	Responds, but answers are not clear or take too long	Ok	Answers clearly, to the point. Pace of speaking good, clear articulation
2	**Statement of problem**	Unclear what problem is being solved and/or why	A little too detailed/specialized	Ok	Clear statement of problem and ties into why the approach discussed may work
3	**Information accuracy**	Gets basic laws of physics wrong	Some technical blemishes	Ok	Not a single mistake
4	**Information clarity**	Not clear what the point is of many of the slides	hard to read or digest slides / too wordy / small fonts / missing figure legends and labels	Ok	Really brings every point home
5	**Explanation of visual components (figures)**	Figures and diagrams unclear and not tied to narrative	Slight disconnect between figures / diagrams and narrative	Ok	Figures and diagrams clearly illustrate the points being made and leads the narrative along the talk
6	**Organization of talk**	Too long introduction, too short introduction, storyline disconnected / lots of back and forth between slides	Some gaps between talk and points being made / needs to skip back and forth between slides	Ok, one slide, one message. Every slide ends with a natural transition to next slide.	Good balance between introduction, problem explanation, findings, discussion, and conclusions
7	**References and attribution**	No references at all and no figure attribution	Not clear what work is by presenter and what is being cited	Ok	Clear delineation between own work and others. References and attribution complete and verifiable

Paper evaluation rubric V1

highlight appropriate observations

	Poor	Needs Improvement	Acceptable	Excellent
Quality of presentation	Figures don't have labels and units, where appropriate	symbols aren't named	not quite excellent yet	shows high degree of eye for detail, e.g. consistent formatting, labeling, coloring
	page limits aren't honored	font size is too small		
	paper is not two column	figures aren't referenced (correctly, in order) in text		
		no figure captions		
		abbreviations are not explained upon first use		

Quality of writing	lots of spelling / grammar mistakes	paragraphs do not start with opening and/or closing sentence that summarizes the paragraph	not quite excellent yet	Title captures the essence of the subject
	objective of study is not clearly defined	disconnect in narrative somewhere, detours in subject		Motivation (introduction) leads naturally into the subject of the paper
		observations and discussions are not separated. (note: may be done in same section, but need to at least have their own sets of sentences)		No loose ends: all observations have corresponding discussions and are tied together in conclusions
		not using space wisely (paper too short / section lengths off)		

Quality of work	methods are not appropriate avenue to address stated problem	no (statistical) error analysis is used	not quite excellent yet	work is ready for submission to peer reviewed journal
	gets basic laws of physics wrong	conclusions are not backed by observations and discussion		
		discussion is not adequately discussing or addressing all observations		
		references aren't used correctly and (mostly, some preprints may be ok) to peer reviewed literature.		