2019-2020 Annual Program Assessment Report Guide

Please submit your report to your department chair or program coordinator, the Associate Dean and Dean of your College, and to james.solomon@csun.edu, Director of the Office of Academic Assessment and Program Review, by **September 30, 2020**. 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. Please do not change the date on the form, and be sure to check that your report is ADA accessible.**

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. Participated in the 2019-20 assessment of General Education Section D: Social Sciences and U.S. History and Government 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 GE 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: e.g. SLO revision (especially to ensure continuing alignment between program course offerings and both program and university student learning outcomes) and the creation or modification of new assessment instruments
3. **Preview of planned assessment activities for 2020-21.** Include a brief description as reflective of a continuous program of ongoing assessment.

2. Overview of Annual Assessment Project(s).

The department intended to continue with the practice of assessing Program SLO in three laboratory courses and the culminating experience course for the same reasons as detailed in the 2018-19 report. However, PHYS 227L could not be assessed because of the sudden closure due to COVID in Spring, the semester in which this course is offered. It was a little difficult to develop or modify the assessment instrument because the instructor was quite busy converting to a virtual platform for instruction. The other courses in the plan were assessed.

1A. Program SLO were assessed in the following Courses
Majors:
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

2.1. GE Natural Sciences: PHYS 100B
Assessment Instrument:

Non-credit concept test: 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).

Credit concept test: Three multiple choice questions covering electricity, magnetism and modern physics were given on the final for credit.

Evaluation:

Non-credit concept test: 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 < 30%
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.	17117	Pre	0	6	69	75
		Post	4	13	37	54
	17652	Pre	0	16	63	79
		Post	2	18	43	63

Credit concept test:

Question 10. The second most popular choice (E) indicates that they are confusing momentum with speed and have not understood that all photons travel at the speed of light.

Answer Text	**Number of Respondents**		**Percent of respondents selecting this answer**	
	17117	**17562**	**17117**	**17562**
A, (Incorrect answer)A	2 respondents	2	3 %	3
B, (Incorrect answer)B	3 respondents	5	4 %	6
C, (Incorrect answer)C	2 respondents	2	3 %	3

D, (Correct answer)D	44 respondents	39	**61 %**	**49**
E, (Incorrect answer)E	21 respondents	31	29 %	39

61% answered correctly

Question 11. The second most popular choice (C), indicates they are exchanging the positive and negative charges when placed in a magnetic field. The right hand rule continues to be a challenge.

Not choosing A indicates they do understand the particle must be charged in order to experience a magnetic force.

Answer Text	**Number of Respondents**		**Percent of respondents selecting this answer**	
	17117	**17652**	**17117**	**17652**
A, (Incorrect answer)A		2	0 %	3
B, (Correct answer)B	44 respondents	40	**61 %**	**51**
C, (Incorrect answer)C	27 respondents	34	38 %	43
D, (Incorrect answer)D	1 respondent	0	1 %	0
E, (Incorrect answer)E		3	0 %	4

Question 12. The second most popular choice (C), suggests they are exchanging the positive and negative charges when placed in an electric field.

Answer Text	**Number of Respondents**	**Percent of respondents selecting this answer**

	17117	**17652**	**17117**	**17652**
A, (Correct answer)A	39 respondents	44	**54 %**	**56%**
B, (Incorrect answer)B	4 respondents	3	6 %	4%
C, (Incorrect answer)C	24 respondents	30	33 %	38%
D, (Incorrect answer)D	4 respondents	2	6 %	3%
No Answer, (Incorrect answer)No Answer	1 respondents	0	1 %	0

Analysis:

Non-credit concept test: The results are unsatisfactory. A likely contributing factor may be a lack of incentive for the students to do well as we are not permitted to use these results for their grades. Supporting this is the fact that students did much better on the for-credit concept tests. Both Profs. Cadavid and Luchko implemented a number of active learning strategies and activities in Fall 2018 and have continued to refine them since then. While there is a small improvement in the results since last year, the results are not statistically significant.

Credit concept test: Both classes performed satisfactorily but just barely. In all three cases a single incorrect choice was the most common error. In the case of electricity and magnetism, students most commonly confused the sign of the charge but otherwise had the correct idea. For modern physics, many students have failed to recall a fundamental fact about light.

Planned Activities:

Non-credit concept test: The assessment tool will continue to be used at least one more year and attempt to incentivize the students without counting it for credit. However, if the results do not reflect the performance of the students on similar for-credit questions, then this assessment will not have much value.

Credit concept test: Dr. Luchko is preparing an interactive webapp to help the students practice the concepts involved in question 11 and 12. Future assessments will help evaluatethe success of this.

2.2. 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**	**13**	**3**	**3**	**19**

3a. Convey physical concepts with mathematical expressions (quantitative literacy)	**1b, 1c**	**13**	**3**	**3**	**19**
2e. **Competently use computer tools, including: software programs for data analysis and presentation, numerical analysis, and computer simulations.**	**2**	**8**	**7**	**4**	**19**

Analysis: The results are satisfactory to excellent and significant improvement from the previous year. Students struggled the most with SLO 3a, which was the focus of the course. Still, this was a modest improvement on past years. 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.

Several measures were put in place to improve student performance from past years. These include, introducing a peer learning facilitator (PLF) during class, introducing a new interactive textbook, and allowing students to resubmit part of their written work after initial grading. The PLF allowed students to get more one-on-one support during the lab, which in previous years was quite strained. This was particularly helpful during the project part of the course as it allowed the instructor to meet with each student individually, improving accountability and feedback. Also, many students were more comfortable interacting with a PLF than the faculty member. The new textbook received positive feedback from the students and allowed much more intensive practice of fundamentals early in the course. Finally, resubmission did allow students a few students to improve the grades but only five out of 19 used the opportunity.

Planned Activities: The assessment tool will continue to be used though a new faculty member has taken over the course. Much of the content has been passed on to support the positive changes that were made.

2.3. PHYS 465

PHYS 465. This 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. **SLOs assessed were (the item indices are those from the list of Program SLOs**

2b. Combine insights and techniques from the various courses in the program (integrate knowledge)
2d. Analyze data, provide error analysis test a model or hypothesis by comparing with data.

3a. Convey physical concepts with mathematical expressions (quantitative literacy)
4a. Make unbiased and objective judgments of theories and experiments

Lab report is the instrument.
The format for report writing was the same as last year. An important difference was repeated instructions on the report writing and calling attention to the well-defined requirements in the report writing guidelines. Experimental procedure and steps, organization and content were discussed in every meeting and closely supervised. It is somewhat "spoon-feeding". A check-list with what must be present in the report was provided. Students were asked to refer to this list and grade their own report for inclusion of the required item, content, and their own satisfaction of their answers, and then redo their report and submit the revised report. The final report was graded by the instructor and a feedback was given individually to students at a one-on-one in-person meeting.

PHYS 465 Assessment Results

SLO	***Excellent***	***Satisfactory***	***Unsatisfactory***	***Instrument***
2b. Combine insights and techniques from the various courses in the program (integrate knowledge)	*5*	*9*	*7*	*Prelab Activity report and discussion section of lab report*
2d. Analyze data, provide error analysis test a model or hypothesis by comparing with data.	8	6	7	Lab report
3a. Convey physical concepts with mathematical expressions (quantitative literacy) ***4a. Make unbiased and objective judgments of theories and experiments***	5	7	9	*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 was better than the previous year. Those who took the instructions seriously, paid attention to the instructions produced a better-quality report. The attitude noted last year ("if I come to the lab and do the experiments, then that should be all; report is just a minor incidental") changed to surprise "didn't realize that all this is required and didn't know this was serious". There were at least about 5 students who did not pay any attention to the instructions and their reports were unsatisfactory. The reports were judged "unsatisfactory" because of missing information and careless writing which were quantified and students were made aware of in the feedback. These students reported that they did not take the instructions seriously and did not expect the level of engagement required.

Planned Activity: A similar pattern of assessment will be followed in the current yea. However, the one-om-one chat and feedback on in-class engagement and lab report will be provided before writing the lab report and again after. For assessment purposes, report is graded with SLOs in mind.

2.4. PHYS 497. This is a Senior level culminating experience course, offered for the third time in S 2020. Program SLOs 1 and 3 were assessed.

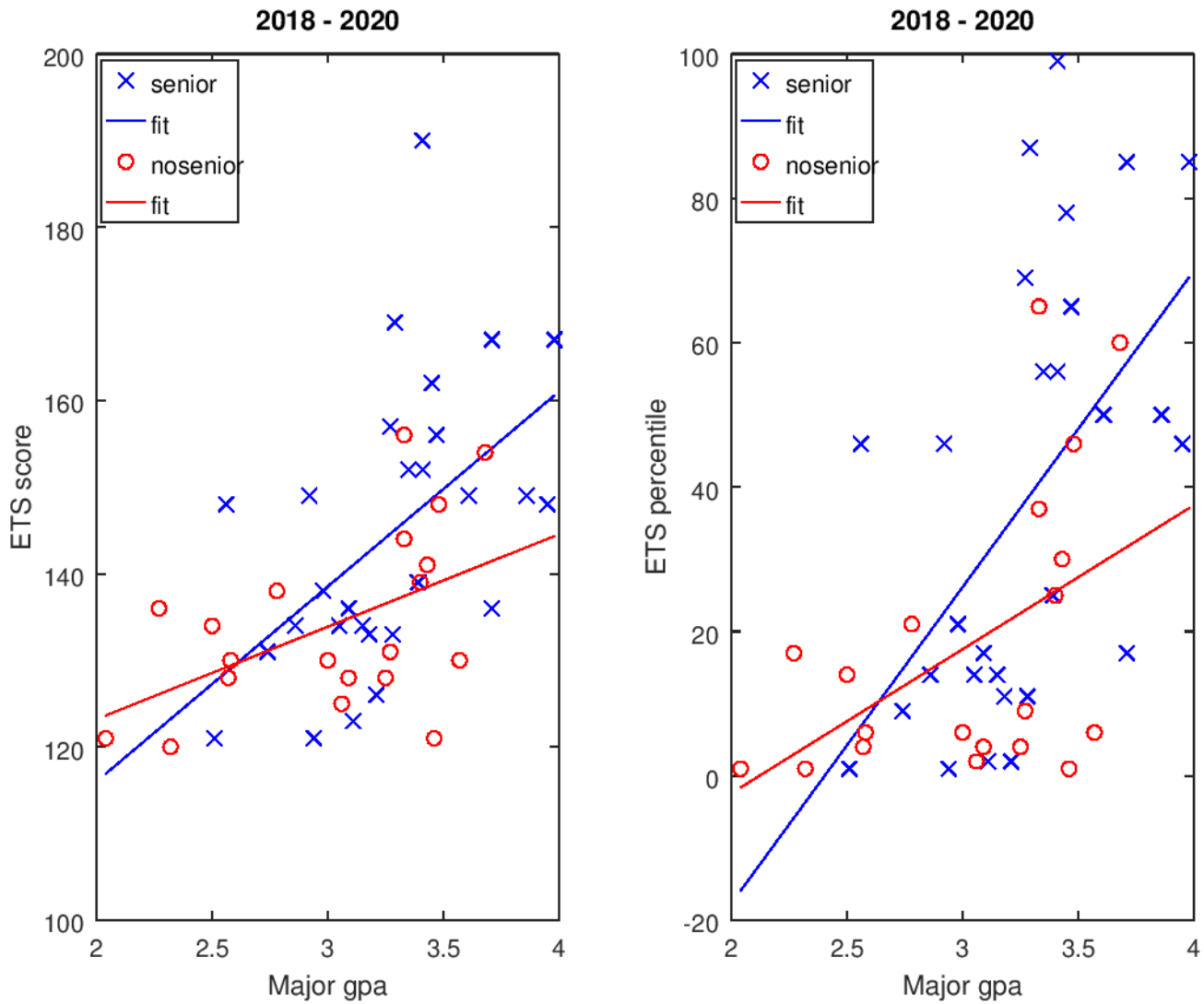
1. Physics: Students will be able to describe natural phenomena in general and in their chosen program option using principles of physics

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. ETS performance of students that take the course and those that don't are compared in the graphs below. ETS score and percentile do increase with GPA which is not surprising. There is a clear correlation of score with GPA. Interestingly, the steeper slope for ETS score and percentile vs. GPA (blue lines) for students that take the senior project compare to the slopes for students that don't take the course show that those that elect to take PHYS 497 overall do better.



***Analysis*:** Students that took the PHYS497 (blue lines) performed better (higher average and better percentile in every year (2018-2020) than those that did not (red lines). This course adds value through the improved performance.