2015-2016 Annual Assessment Report
Department of Physics
BS Physics

August 22, 2016

Preamble:

The Department of Physics has three programs: BS Physics, BS Biomedical Physics, and Physics MS. The following assessment report focuses on our BS Physics Student Outcomes Assessment Plan (SOAP). Although the reports for BS Physics and BS Biomedical Physics are split since these are two separate programs, the same activity was assessed in both programs this past year, because of overlap of curriculum.

This report follows a question-and-answer format as sent by Daunette Dryden from the Office of the Provost in an email dated August 10, 2016 (see Attachment A).

1. What learning outcome(s) did you assess this year? Be sure to list the student learning outcome(s) assessed, not simply the activity or assignment evaluated.

    I. This year we report on one assessment activity for both the BS Physics and BS Biomedical Physics Program. For BS Physics, we assessed the student learning outcome of the Physics BS SOAP Goal and Outcome 1: "Students will develop mastery of problem solving in the following core disciplines described in textbooks that universally recognized as standards in undergraduate physics education in Classical Mechanics, Electricity and Magnetism, and Thermodynamics." This is the first time we report the collected data in the form of embedded common questions from our Phys 4A and Phys 4B series (Direct Measure C).

2. What instruments did you use to assess them? If this does not align with the outcomes and activities detailed in the timeline of the SOAP, please provide an explanation of this discrepancy.

    I. The assessment instrument consists of 3 embedded questions in the final exams of Phys4A, and Phys 4B.
        a. Phys 4A is about classical mechanics. The embedded questions cover three essential core concepts and principles in this area: 1) Newton's second law in linear motion, 2) momentum and energy conservation in linear motion, and 3) kinematics in rotational motion.
        b. Phys 4B is about thermodynamics, electricity and magnetism. The embedded questions cover three essential core concept and principles in the areas: 1) The first law in thermodynamics, 2) Coulomb's law in electricity, and 3) Faraday's law and Lenz's law in magnetism.

3. What did you discover from these data? Provide a discussion of student performance in relation to your standards of performance. Where possible, indicate the relative strengths and weaknesses in student performance on the outcome(s).

In F15-S16, five instructors (1-5) taught 8 sections of Phys 4A&4B (each course offered two sections in each term). Totally 639 students enrolled in the courses (356 in 4A, and 283 in 4B). The embedded question data was collected in all 4A sections taught by instructors 1-3 (356 enrolled students). The data from 2 sections in 4B was collected by instructor 2 (119 out of 283 enrolled students).

Course/ Term/ Instructor	**DFW rate**	***(enrolled students)***	**Common question 1 (correct rate)**	***(Std. Dev)***	**Common question 2 (correct rate)**	***(Std. Dev)***	**Common question 3 (correct rate)**	***(Std. Dev)***	**Common questions all (correct rate)**	***(Std. dev)***
4A/F15										
Instructor 1	12.0%	*(105)*	67.3%	*(47.1%)*	54.0%	*(50.1%)*	67.3%	*(47.1%)*	63.0%	*(34.4%)*
Instructor 2	28.0%	*(94)*	61.7%	*(48.6%)*	35.1%	*(47.7%)*	30.8%	*(46.2%)*	52.0%	*(32.0%)*
4A/S16										
Instructor 1	23.5%	*(80)*	50.0%	*(50.3%)*	24.3%	*(43.2%)*	37.8%	*(48.8%)*	34.2%	*(29.3%)*
Instructor 3	27.3%	*(77)*	80.5%	*(39.6%)*	71.4%	*(45.2%)*	80.5%	*(39.6%)*	77.3%	*(32.0%)*
4B/F15										
Instructor 2	12.0%	*(63)*	36.5%	*(48.1%)*	63.5%	(48.1%)	58.7%	*(49.2%)*	52.7%	*(30.7%)*
Instructor 4	11.0%	*(81)*	***N/A***							
4B/S16										
Instructor 2	14.3%	*(56)*	32.1%	*(46.7%)*	44.6%	(49.7%)	39.3%	*(48.8%)*	38.6%	*(30.6%)*
Instructor 5	30.0%	*(83)*	***N/A***							

Table 1. 4A&4B DFW rates and embedded question rates in F15-S16

Table 1 shows DFW rates and embedded question corrected answer rates of each instructor and term of 8 sections. In table 1, three embedded questions were named ***common question 1***, ***2***, and ***3***, respectively. It also shows a standard deviation of correct answers of each embedded question. Notice that instructors 1 and 2 taught both terms and embedded three common questions in their final exams; instructor 3 taught one term with common questions embedded in final exam; but instructors 4 and 5 did not have embedded questions in their final exams. The weighted average DFW rate of 4A was 22.1% (N=356) in the range from 12.0% to 28.0%; the average correct answer of 3 embedded questions is 1.62 (N=356). The weighted average DFW rate of 4B was 17.4% (N=283) in the range from 11.0% to 30.0%; the average correct answer of 3 embedded questions is 1.39 (N=119).

Phys 4A Report

Com all

Final grade	Mean	N	Std. dev
F	.37	43	.725
D	1.00	35	1.029
C	1.53	126	1.071
B	2.00	94	.973
A	2.50	58	.707
Total	1.62	356	1.136

Com all	# of student	Percent	Cumulative Percent
0	80	22.5	22.5
1	82	23.0	45.5
2	87	24.4	69.9
3	107	30.1	100.0
Total	356	100.0	

Final grade	# of students	Percent	Cumulative Percent
F	43	12.1	12.1
D	35	9.8	21.9
C	126	35.4	57.3
B	94	26.4	83.7
A	58	16.3	100.0
Total	356	100.0	

Phys 4B Report

Com all

Final grade	Mean	N	Std. dev
F	.30	10	.483
D	.67	6	.516
C	1.11	27	.934
B	1.26	35	.657
A	2.05	41	.865
Total	1.39	119	.949

Com all	# of student	Percent	Cumulative Percent
0	23	19.3	19.3
1	43	36.1	55.5
2	37	31.1	86.6
3	16	13.4	100.0
Total	119	100.0	

Final grade	# of students	Percent	Cumulative Percent
F	10	8.4	8.4
D	6	5.0	13.4
C	27	22.7	36.1
B	35	29.4	65.5
A	41	34.5	100.0
Total	119	100.0	

Table 2. 4A&4B final grades and embedded questions (Com all) correlation

We analyzed final grades and embedded questions (the column named “Com all” in table 2) by using IBM SPSS Statistics. We found that these two factors quite strong correlate with each other (ANOVA sig < 0.001, the two factors are strong correlated if sig < 0.050).

I. In 4A, grade A students Mean of Com all is 2.50, grade B is 2.00, grade C is 1.53, grade D is 1.00, and grade F (including grade W) is 0.37

II. In 4B, grade A students Mean of Com all is 2.05, grade B is 1.26, grade C is 1.11, grade D is 0.67, and grade F (including grade W) is 0.30

We conclude that a 4A student passes the class with C and above should earn about 1.53 (or 51%) from 3 embedded questions. Meanwhile, a 4B student should reach the level at 1.11 (or 37%).

It is the first time to quantitatively assess the outcomes in Phys4A&B via embedded common questions in final exams (Direct Measures C). So we can setup these results as baselines for the future assessment in Direct Measures C Physics SOAP.

4. What changes did you make as a result of the findings? Describe what action was taken based on the analysis of the assessment data.

   The assessment instrument for this outcome and goal is 3 embedded questions in 4A&4B. The analyzed data reflects measuring student success and achieving the goal we expect. We will continue the use of this assessment instrument in the following semesters. Meanwhile in this coming academic year, we will revise the assessment instrument by using common final exams in both 4A&4B sections since embedded questions having a narrow scope to completely reveal the outcome and goal of SOAP program. In addition, we will add another assessment instrument in Direct Measures, FCI for 4A and CSEM for 4B, since these two have been already adopted in 4A&4B for several semesters through the FLOCK project in CSM. The FCI (force concept inventory) instrument is nationwide-use to assess student understanding the most basic concepts in 4A. It includes 30 conceptual questions in classical mechanics. Similarly in 4A, the CSEM (conceptual survey on electricity and magnetism) instrument has 32 conceptual questions in electricity and magnetism in 4B. We expect to update assessment instruments in our SOAP in the next cycle.

5. What assessment activities will you be conducting in the 2016-17 academic year? Briefly list the outcomes to be assessed and how you will measure them. This should align with the activities provided in your SOAP.

   For BS Physics, we will conduct an assessment (Direct Measures A) of the Physics Major Field Test (MFT) in next academic year. All physics major students enrolled in Phys 110 (Physical Optics) in fall 2016 will be required to take the test. The test consists of 70 questions that cover all core disciplines in physics. Our benchmark for student scores is set at or above the 50^{th} percentile of the physics MFT institutional average scores for the 8 years running average supplied by ETS.

6. What progress have you made on items from your last program review action plan? Please provide a brief description of progress made on each item listed in the action plan. If no progress has been made on an action item, simply state "no progress."

   I. Our action plan dated 2009, item 2.V: revised SOAP for physics/BS program, Revision 2: November 1, 2015. We are anticipating a further revision this year.

Attachment A
Annual Assessment Report Guidelines
Provided in an email from the Office of the Provost dated August 10, 2016

Dear Chairs, Associate Deans, Deans, and Assessment Coordinators,

The annual departmental assessment reports are due this fall, September 1, 2016.

In the assessment report, departments and programs should address the six questions below separately for each of their degree programs. Responses should be brief, but thoughtful and complete. A well-written assessment report can also be used in the assessment section of self-studies for future program reviews.

You may submit the reports separately or collectively for the college in one document.

Please send your assessment reports to Dr. Angel A. Sanchez aansanchez@csufresno.edu, in the Office of Institutional Effectiveness (OIE), and copy Dr. Melissa Jordine mjordine@csufresno.edu, Director, University Assessment and Ms. Marie Fernandez mfernandez@csufresno.edu, Administrative Analyst in OIE.

Due: September 1, 2016

1. What learning outcome(s) did you assess this year?
Be sure to list the student learning outcome(s) assessed, not simply the activity or assignment evaluated. Note: these should be program level outcomes, not general education outcomes - the GE committee will issue a separate call for GE assessment reports.

2. What instruments did you use to assess them?
If this does not align with the outcomes and activities detailed in the timeline of the SOAP, please provide an explanation of this discrepancy. If the standards for student performance are not included in your SOAP, you should include them here. For example "On outcome 2.3, 80% of students will score an average of 3.5 out of 5 on the attached rubric."

3. What did you discover from these data?
Provide a discussion of student performance in relation to your standards of performance. Where possible, indicate the relative strengths and weaknesses in student performance on the outcome(s).

4. What changes did you make as a result of the findings?
Describe what action was taken based on the analysis of the assessment data.

5. What assessment activities will you be conducting in the 2016-17 academic year?
Briefly list the outcomes to be assessed and how you will measure them. This should align with the activities provided in your SOAP.

6. What progress have you made on items from your last program review action plan?
Please provide a brief description of progress made on each item listed in the action plan. If no progress has been made on an action item, simply state "no progress."