2015-2016 Annual Assessment Report
Department of Physics
MS Physics
August 31, 2016

Preamble:

The Department of Physics has three programs: BS Physics, BS Biomedical Physics, and Physics MS. The following assessment report addresses the Student Outcomes Assessment Plan (SOAP) submitted on September 16, 2015 and covers the M.S. program in the Department of Physics. A copy of the SOAP is attached as Appendix 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.

This assessment report concentrates on Measure A1 of the MS program's SOAP:

> Physics MS students will take the physics subject GRE and/or the MFT in physics. The MFT will be administered by the department assessment coordinator. The GRE scores and MFT scores will be collected by the department assessment coordinator for analysis. Advancement to candidacy requires GRE scores at or above the 25th percentile, or MFT scores at or above the median (148).

Measure A1 covers Outcomes 1.1, 1.2, and 3.3 of the SOAP.

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.

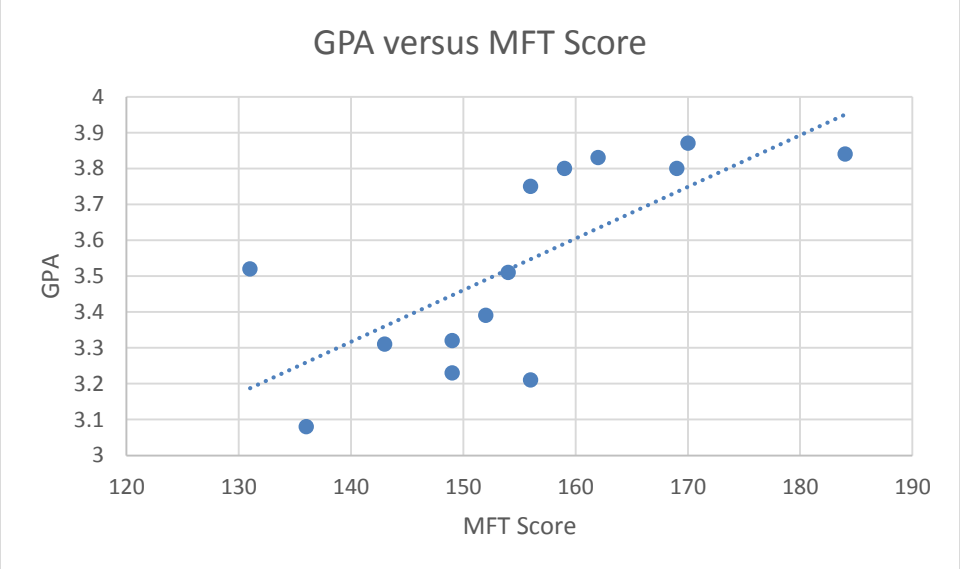
15 MS Physics students took the Major Field Tests (MFT) in Physics during the period ranging from Fall 2012 to Spring 2016.

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).

The table below provides a summary of the scores reported by ETS. Some students come to us with a weak background in physics. These weaknesses are not captured by the admissions process, but are revealed very clearly by the MFT results. Eventually all our students manage to satisfy our requirement that the MFT scores should be at or above the median. In some cases it is simply a matter of overcoming test anxiety, or of adjusting to unfamiliar features of the test itself; these students typically receive passing scores on a second attempt. In other cases the low scores are a direct reflection of weak backgrounds. For these students, more time, direct intervention, and more trials are required to improve their scores.

Last Name	First Name	Date	Scaled Score	Percentile rank (%)
Afshari	Arya	10/21/12 0:10	**156**	**64**
Angulo	Emmanuel	10/21/12 0:10	141	27
Rad	Navid	10/21/12 0:10	**184**	**97**
Thompson	Johnathon	10/21/12 0:10	**169**	**85**
Trelawny	Dillon	10/21/12 0:10	**154**	**60**
Angulo	Emmanuel	6/27/13 0:06	**152**	**55**
Doria	Alaric	6/27/13 0:06	**162**	**77**
Rubio	James	6/27/13 0:06	133	11
Rubio	James	12/20/13 18:26	143	31
Rubio	James	5/15/14 19:22	**149**	**47**
Menkabo	Raua	5/15/14 19:26	128	4
Menkabo	Raua	11/21/14 18:23	125	2
Menkabo	Raua	12/10/14 15:13	131	8
Menkabo	Raua	12/16/14 18:06	128	4
Menkabo	Raua	1/22/15 14:11	130	6
Blacketer	Melissa	2/20/15 17:53	141	27
Ruelas-Rivera	Victor	3/16/15 18:34	148	43
Blacketer	Melissa	3/20/15 17:42	**149**	**47**
Ruelas-Rivera	Victor	4/14/15 18:22	**156**	**64**
Menkabo	Raua	5/14/15 14:12	131	8
Gonzalez	Simon	5/14/15 14:15	**131**	**8**
Brazickas	Marijus	10/13/15 18:26	130	6
Andosca	Ryan	10/19/15 18:20	**170**	**87**
Menkabo	Raua	12/17/15 15:31	**143**	**31**
Brazickas	Marijus	12/21/15 18:13	136	15
Brazickas	Marijus	2/4/16 18:02	**136**	**15**
Scott	John	5/6/16 19:12	**159**	**71**
	Fall 2012 - Spring 2016	**Avg. of the best individual scores**	**155.0**	**57.7**
		Standard deviation of the best individual scores	**13.8**	**26.3**

As may be seen from the chart below, MFT scores are roughly correlated with GPAs.



This is precisely the kind of information the department was seeking, as it pits a local measure of performance (GPA) against a national benchmark (MFT) and is therefore better suited as an objective assessment of our success – or lack thereof - in meeting the goals stated in our SOAP. The trendline in the graph suggests that students with higher GPAs are indeed acquiring a solid background in the principal areas of physics (goal 1) and the expected educational and technical knowledge (goal 3).

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.

No changes have been introduced yet. The next step in the assessment process requires an examination of subscores in the MFT to find out if there are areas where students display common deficiencies. If such areas are found, we would need to address the problem by either providing deeper, more detailed coverage of those areas in our existing curriculum, or by designing a new course if we discover that there is a gap in our program.

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.

In accordance with our timeline in the SOAP, we plan to assess outcomes 1.1, 1.2, 2.2, 2.3, 2.4, 3.2, and 3.3 using Measure A2:

"Every other year the department assessment coordinator will collect all published papers with student co-authors, all projects (Phys 298) and Theses (Phys 299), and all student presentations given (departmental colloquia, regional, national, and/or international conferences). The department assessment coordinator will summarize the content of the student works (papers, projects, theses, talks) and will collect these together with the student works for the review committee."

We will collect and analyze Phys 298 reports, theses, and published papers. Student presentations will be evaluated as far as possible, but our past experience has revealed that while valuable in principle, student presentations at conferences are in practice more difficult to evaluate by a committee. We may have to introduce a modification of our SOAP to address the issue.

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."

We are currently undergoing program review and may be able to report on this item after the review is complete.

APPENDIX A

College of Science and Mathematics

Department of Physics/MS Program

Student Outcomes Assessment Plan (SOAP)

I. Mission Statement

The primary mission of the Graduate Physics Program at California State University, Fresno, is to provide graduate students with a solid education in physics that is intended to form the basis for several career options. Our graduates are able to proceed on to Ph.D. studies, work in industry or teach at the secondary or junior college level. We achieve our mission by offering a flexible, broad-based academic program with the opportunity for specialization in theoretical physics, experimental physics or physics pedagogy. Our graduate students acquire a firm grounding in the major areas of classical mechanics, electrodynamics, quantum mechanics and mathematical physics. Optional courses are offered in particle physics, general relativity, relativistic quantum mechanics/field theory, and condensed matter. Further specialization is possible – and encouraged – by taking Phys 290 (Independent Study) courses in advanced topics. As part of our efforts to provide a more comprehensive education, students serving as Teaching Associates (TAs) in introductory laboratories gain valuable hands-on teaching experience.

II. Goals and Student Learning Outcomes

GOAL 1. To provide students with a solid background in the principal areas of physics.

Outcome 1. Students will pass courses and demonstrate proficiency in most of the major fundamental areas listed above.

Outcome 2. Students will broaden their knowledge and acquire additional experience in important special topics by successfully completing elective courses in physics and related areas.

GOAL 2. To provide adequate opportunity for students to apply their knowledge to practical experimental and theoretical research problems.

Outcome 1. The required culminating experience is to complete either a project (Phys 298) and a competency examination, or a thesis (Phys 299) in one of the three research avenues offered by the Department of Physics: experiment, theory, or physics education. Either alternative (Phys 298/299) provides practical experience.

Outcome 2. Provide computational experience using packages such as Mathematica, Excel and other relevant software, along with numerical techniques.

Outcome 3. Students performing experimental research will learn to design and set up experiments, and will become familiar with the operation of research instruments as well as with computer interfacing and digital data handling. Students performing theoretical research will learn advanced problem-solving methods to identify and address relevant questions probing or extending fundamental theories of physics. Research in physics education generally involves the development of visual and

diagrammatic teaching aids and demonstration equipment, identification of physics learning difficulties, and uncovering the role that misconceptions play in hindering physics learning.

Outcome 4 Students will demonstrate competency in searching and reading relevant physics literature. They will learn to find online and peer-reviewed journal articles, critically read and evaluate work by professionals in their field, and summarize these papers in written or oral form.

GOAL 3. To prepare students to pursue advanced degrees or to assume positions in education or science or industry, and to provide scientific speaking and writing experience.

Outcome 1. Students will demonstrate competency in speaking and presentation skills by delivering talks in courses, departmental colloquia, and in regional, national, and/or international conferences.

Outcome 2. Students will gain experience using word-processing, graphics and presentation software in preparing written reports, transparencies, posters, seminars, etc. They will write papers that meet the style and format of an appropriate peer-reviewed journal. Students will be encouraged to learn widely used software such as LaTex in the preparation of papers for publication in peer-reviewed journals.

Outcome 3. Students will acquire the requisite educational/technical background.

III. Curriculum Map (Matrix of Courses X Learning Outcomes)

Table 1: Alignment of Courses and Objectives for the Master of Science Degree in Physics.

	OUTCOMES								
COURSE	**1.1**	**1.2**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**
Phys 203	I								I
Phys 220A	I			I	I	I	I	I	I
Phys 220B	R, A			I	I	I	I	I	R, A
Phys 222A	I			I	I	I	I	I	I
Phys 222B	R, A				I	I			R, A
Phys 270	A			R	R	I			A
Phys 272	R, A			R	R, A	I			I, R
Phys 290	A	I, R, A		R, A	R, A	R, A	R	R	A
Phys 298	A	A	A	A	A	A	A	A	A
Phys 299	A	A	A	A	A	A	A	A	A

Phys 203: Classical Mechanics (4)

Phys 220A-B: Advanced Electricity and Magnetism (3-3)

Phys 222A: Quantum Mechanics I (3)

Phys 222B: Quantum Mechanics II (3)

Phys 270: Advanced Mathematical Physics (3)

Phys 272: General Relativity (3)

Phys 290: Independent Study (1-3)

Phys 298: Project (2-6)

Phys 299: Thesis (2-6)

I = Introduced; R = Reinforced; A = Advanced/Mastered

IV. Assessment Methods

A. Direct Measures

1. Physics MS students will take the physics subject GRE and/or the MFT in physics. The MFT will be administered by the department assessment coordinator. The GRE scores and MFT scores will be collected by the department assessment coordinator for analysis. Advancement to candidacy requires GRE scores at or above the 25th percentile, or MFT scores at or above the median (148).

2. Every other year the department assessment coordinator will collect all published papers with student co-authors, all projects (Phys 298) and Theses (Phys 299), and all student presentations given (departmental colloquia, regional, national, and/or international conferences). The department assessment coordinator will summarize the content of the student works (papers, projects, theses, talks) and will collect these together with the student works for the review committee.

B. Indirect Measures

1. An online, running alumni survey will be set up on the departmental webpage. The department assessment coordinator will collect this data every three years and summarize the results.

V. Student Learning Outcomes X Assessment Methods Matrix

Table 2: Learning Outcomes and Assessment Methods for the Master of Science Degree in Physics.

	OUTCOMES								
MEASURE	**1.1**	**1.2**	**2.1**	**2.2**	**2.3**	**2.4**	**3.1**	**3.2**	**3.3**
A1	X	X							X
A2	X	X		X	X	X		X	X
B1	X	X	X	X	X	X	X	X	X

VI. Timeline for Implementation of Assessment Methods and Summary Evaluations

Every Year
Measure A1. Outcomes 1.1, 1.2, 3.3.
Every Other Year
Measure A2. Outcomes 1.1, 1.2, 2.2, 2.3, 2.4, 3.2, 3.3.
Every Third Year
Measure B1. Outcomes 1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3.

VII. Process for Closing the Loop

The Department of Physics will establish a Graduate Assessment Committee which will consist of the department assessment coordinator and at least two other faculty members. The Graduate Assessment Committee will meet at least once a year and will review the scores of the GRE/MFT. Every second year they will review the summary and collected works of the students. Every third year they will also review the alumni survey data. Based on these reviews the Graduate Assessment Committee will suggest changes to the curriculum and/or the MS SOAP.

Assessment data and suggested program and assessment activities changes are presented to the entire faculty during a department faculty meeting near the end of each spring semester, and the entire faculty will decide whether to implement any changes.

Appendix E: Indirect Measure B.1 – Alumni Survey

Fresno State Department of Physics Alumni Survey

Personal information

Name: Last name when a student:

Address (City, State, Zip):

Email: Telephone (home/work):

Education

Fresno State degree(s) earned (check all that apply): ___Physics BS ___ Biomedical Physics BS ___Physics MS

Fresno State Graduation year:

Other academic institutions attended:

Name	**City, State, Country**	**Program Name**	**Dates Attended**	**Full/Part Time?**	**Degree Obtained (if any)**	

Fresno State Physics Program Effectiveness

for career 1. not very important 2. somewhat important 3. important 4. very important 5. extremely important N/A not applicable	Below are some abilities or types of knowledge that a student should possess upon graduation from the Department of Physics. Please use the scales on each side of the table to rate their importance for your career advancement as well as the effectiveness of your education at FRESNO STATE in developing them.	*education was* 1. not very effective 2. somewhat effective 3. effective 4. very effective 5. extremely effective N/A not applicable
1 2 3 4 5 N/A	Physics depth and breadth of knowledge	1 2 3 4 5 N/A
1 2 3 4 5 N/A	scientific problem solving	1 2 3 4 5 N/A
1 2 3 4 5 N/A	mathematical skills	1 2 3 4 5 N/A
1 2 3 4 5 N/A	lab or instrument skills	1 2 3 4 5 N/A
1 2 3 4 5 N/A	computer programming	1 2 3 4 5 N/A
1 2 3 4 5 N/A	communicating scientific information (speaking, writing)	1 2 3 4 5 N/A
1 2 3 4 5 N/A	research experience	1 2 3 4 5 N/A

1 2 3 4 5 N/A	word-processing, graphics and presentation software	1 2 3 4 5 N/A

Educational Experience

Please list up to three attributes of a professional in your discipline that you believe will either continue to be or will become important in the future.

a)_____

b)_____

c)_____

How would you rate your overall preparation to:	Not applicable	Extremely satisfied	Very satisfied	Satisfied	Somewhat satisfied	Not satisfied	
a) practice professionally within your discipline?							
b) interview and obtain your first job after graduation?							
c) succeed in subsequent graduate or professional education?							

If employed in physical sciences, how do you rate the overall quality of your educational preparation, relative to recent graduates from other schools? ____ much higher than average ___ higher than average ____ average ____ lower than average ___ much lower than average

What three things would you recommend to the Fresno State Department of Physics that would improve its education program?

a)_____

b)_____

c)_____

What three things about the Fresno State Department of Physics did you find most valuable for your career preparation?

a)_____

b)_____

c)_____

Would you recommend a Fresno State physics education to a friend or relative? ____ yes ____ no___ maybe

Would you recommend another Fresno State program to a friend or relative? ____ yes ____ no___ maybe

Professional Development

Membership in professional organizations:

Advanced professional certification:

Employment

Company (City, State, Country)	**Product/service**	**Yrs. employed**	**Job titles**	**Salary Code***
Current employer:		_____ to _____	start: finish:	start: finish:
First employer:		_____ to _____	start: finish:	start: finish:

*Salary codes in thousands per annum: A < 30; B = 30-39; C = 40-49, D = 50-75, E = 75-100, F > 100

Comments

Please use the space below for comments you may have about your education at Fresno State or about this survey.