Weber State University
Annual Assessment of Evidence of Learning

Cover Page

Department/Program: Physics
Academic Year of Report: 2016/17 (Summer 2016, Fall 2016, Spring 2017)
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A. **Brief Introductory Statement:**
Please review the Introductory Statement and contact information for your department or academic program displayed on the assessment site: **http://www.weber.edu/portfolio/departments.html** - if this information is current, please place an 'X' below. No further information is needed. We will indicate "Last Reviewed: [current date]" on the page.

__X_ Information is current; no changes required.
___ Information is not current; updates below.

Update:

B. Mission Statement
Please review the Mission Statement for your department or academic program displayed on the assessment site: **http://www.weber.edu/portfolio/departments.html** - if it is current, please indicate as much; we will mark the web page as "Last Reviewed [current date]". No further information is needed.
If the information is not current, please provide an update:

__X_ Information is current; no changes required.
___ Information is not current; updates below.

Update:

C. Student Learning Outcomes

Please review the Student Learning Outcomes for your academic program displayed on the assessment site: **http://www.weber.edu/portfolio/departments.html** - if they are current, please indicate as much; we will mark the web page as "Last Reviewed [current date]". No further information is needed.
If they are not current, please provide an update:

_X__ Information is current; no changes required.
___ Information is not current; updates below.

D. **Curriculum**

Please review the Curriculum Grid for your department or academic program displayed on the assessment site: **http://www.weber.edu/portfolio/departments.html** - if it is current, please indicate as much; we will mark the web page as "Last Reviewed: [current data]". No further information is needed.
If the curriculum grid is not current, please provide an update:

___ Information is current; no changes required.
__X_ Information is not current; updates below

NOTE: Our "grid" is formatted differently from the standard. We've added courses, PHYS 2040 and 3040, to our collective list, and even though the overall changes are minimal we're including a re-creation of the entire collection for clarity.

1) At graduation, Physics majors should have a thorough knowledge and comprehension of the core concepts of classical and modern physics, as assessed by:

a) student success in passing the required and elective courses for their physics major.
Courses: PHYS/ASTR 2040, 2210, 2219, 2220, 2229, 2300, 2600, 2710, 3040, 3160, 3170, 3180, 3190, 3300, 3410, 3420, 3500, 3510, 3540, 4200, 4400, 4410, 4610, 4620, 4800, 4830, 4970, 4990.

b) student scores on the GRE Physics Exam (in comparison with nationwide results from AIP, AAPT).
Extra-curricular experience: GRE Physics Exam.

c) student acceptance rates for graduate school and/or job placement (in comparison with nationwide results from AIP, AAPT).
Extra-curricular experiences: application for graduate school and/or employment.

d) a comparison of WSU's physics curriculum with the curricula of 1) physics programs in schools with a comparable student profile, and 2) the best physics programs.
Courses: PHYS/ASTR 2040, 2210, 2219, 2220, 2229, 2300, 2600, 2710, 3040, 3160, 3170, 3180, 3190, 3300, 3410, 3420, 3500, 3510, 3540, 4200, 4400, 4410, 4610, 4620, 4800, 4830, 4970, 4990.

2) At graduation, physics majors should have a set of fundamental skills that can be applied to a variety of situations. These skills should include the following:

a) Presentation skills. Physics majors should be able to express (orally and in writing) their understanding of core physical principles, the results of experiments, and their analysis of physical problems, as assessed by their success in the Physics capstone presentation required of all majors and in other courses which require a written or oral report.
Courses: PHYS 4400, 4410, 4970, 4990.

b) Laboratory skills. Physics majors should be competent experimentalists. They should be able to design and set up an experiment, collect and analyze data, identify sources of error, and interpret their result and connect it to related areas of physics, as assessed by student performance in physics laboratory courses and faculty-supervised research projects. Students should have a basic understanding of laboratory safety issues, and follow safe practices in their own laboratories.
Courses: PHYS 2040, 2219, 2229, 2600, 3040, 3190, 3410, 3420, 4400, 4410, 4800, 4970.

c) Computer skills. Physics majors should be competent users of basic software, such as word processing, spreadsheet, and graphing programs. They should also have an understanding of the fundamental aspects of a programming and/or computer algebra language (PYTHON, C++, Mathematica, LabView etc), as assessed by student performance in the computing components of courses in the physics curriculum.
Courses: PHYS 2219, 2229, 2300, 3300, 2710, 3510, 4400.

d) Problem-solving skills. Physics majors should be competent problem-solvers. They should be able to identify the essential aspects of a problem and formulate a strategy for solving the problem. They should be able to estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of their solution, interpret their result and connect it to related areas of physics, as assessed by student performance in the problem-solving components of courses in the physics curriculum.
Courses: PHYS/ASTR 2040, 2210, 2220, 2710, 3040, 3160, 3170, 3180, 3190, 4200, 3300, 3410, 3420, 3500, 3510, 3540, 3640, 4570, 4610, 4620, 4800, 4830, 4970.

3) Physics majors should be adequately trained to apply their physics experience and knowledge to analyze new situations, as assessed by:

a) student acceptance rates and success in academic and industrial intern positions.
Extra-curricular experiences: application for graduate school and/or employment.

b) post-graduation student success in graduate school, industry, or teaching --- in physics or otherwise -- as established by questionnaires and interviews of graduates, employers, and graduate faculty. This should include a "long-term" evaluation to obtain feedback from majors of 5 - 10 years ago.

Extra-curricular experiences: opportunities for career advancement and promotion.
4) All physics students (majors, minors, support, and Gen Ed students) should understand the nature of science, as assessed by questionnaires, interviews, and student focus groups.
Courses: PHYS/ASTR 1010, 1040, 1360, 2010, 2010L, 2020, 2020L, 2210, 2210L, 2220, 2220L, 2740, 3160, 3170,3180, 3190, 4200, 3300, 3410, 3420, 3500, 3510, 3540, 3640, 4610, 4620, 4800, 4830, 4970, 4990; HNRS 1500

5) General Education students should understand several core concepts of physics, as assessed by nationally reviewed pre- and post-tests (for example, the Hestenes Force Concept Inventory and the Hestenes Mechanics Baseline Test for Newton's laws) and interviews.
Courses: PHYS/ASTR 1010, 1040, 1360, 2040, 2010, 2210; HNRS 1500

6) Physics Teaching majors and Elementary Teaching majors should have an appropriate knowledge of physics and a variety of teaching strategies to accommodate the multiple learning styles of their students, as assessed by:

a) a comparison of the WSU Physics Teaching major with the Utah State Core Curriculum.
Courses: PHYS/ASTR 1010, 1040, 1360, 2210, 2220, 2600, 2710, 3160, 3170, 3180, 3190, 3200, 3300, 3410, 3420, 4570.

b) classroom observation of student teachers.
Extra-curricular experience: student teaching.

c) interviews with physics teachers and pre-teachers.
Extra-curricular experiences: preparation and employment experiences of teachers and pre-teachers.

d) job placement in major teaching field.
Extra-curricular experience: application for employment with public or private schools.

E. Assessment Plan

Please review the Assessment Plan for your department displayed on the assessment site: http://www.weber.edu/portfolio/departments.html - if the plan is current, please indicate as much; we will mark the web page as "Last Reviewed [current date]". No further information is needed.

The site should contain an up-to-date assessment plan with planning going out a *minimum of three years* beyond the current year. Please review the plan displayed for your department at the above site. The plan should include a list of courses from which data will be gathered and the schedule, as well as an overview of the assessment strategy the department is using (for example, portfolios, or a combination of Chi assessment data and student survey information, or industry certification exams, etc.).

Please be sure to include your planned assessment of any general education courses taught within your department. This information will be used to update the General Education Improvement and Assessment Committee's planning documentation.

Assessment plan:

The Assessment Plan currently documented (re-pasted below) still reflects department policy and action. In addition, the department is discussion additions to our plan, including:

- Department discussion and possible plan for assessment of students in our "capstone" Seminar (PHYS 4990) course. All faculty are engaged in determining how we best serve all of our majors as we recruit more students, how we recruit and direct students into research projects, and how we assess the capstone project. As the course can represent a culmination of all work in a physics students' program, it's both an important part of our students' learning and a critical touchpoint to see student outcomes.
- Signature Assignments and "Big Questions" in Physical Science general education coursework are being adopted by some faculty and shared with others. Of interest to us is how these can be used in place of or in addition to other assessments in general education (for GELOs as well as for "old" PS outcomes). This will be part of a department working group, and we will consider re-vamping our entire general education assessment plan at that point. (Although we successfully completed our general education assessment review last year, we feel that we could still make this process more useful for our courses and our students.)

Physics Department General Education Assessment Strategy
2014-15
(Approved in April 2014)

The Department of Physics is devoted to providing an education for all students and towards scientific literacy that prepares individuals for both

professional goals and the responsibilities of citizenry. Many of these goals are inherent in the General Education outcomes created by university faculty and approved by our faculty senate. However, we are taking on an experiment to try to develop more authentic and meaningful evaluations of these outcomes than we've seen modeled for us thus far. Our process will be as follows:

1. For a given academic year, individual instructors involved in General Education instruction (PHYS 1010, 1040, 1360, 2010, 2210; HNRS 1500; and other future courses as approved) will assemble and select two learning outcomes, one from the "Foundations of Natural Sciences" list and one from the "Physical Sciences" list (see below; or http://www.weber.edu/academicaffairs/natural_sciences.html).
2. Collaborating instructors will first share what they already do to assess such outcomes, whether these be formalized on standard assignments or part of other formative assessments (course discussions, student interviews, etc.).
3. Instructors will collaborate on how to further develop these strategies and/or brainstorm on other assessment strategies. These should be varied, as appropriate for a given learning outcome.
4. Instructors will collaboratively plan how they can document the evaluation of these assessments, to be included in the Department's annual report and other assessment documents.

An overarching objective is to create a strategy that gives instructors more useful information about their students' learning than a percentage of correct answers on a test. For example, a one-paragraph essay at the end of a class session may tell us more about the nature of student learning and instructional needs than a quantitative answer to a problem. Or, instructors may find a way to diagnose student difficulties by documenting conversations with small samples of students in lab settings. Or, a class session may utilize an in-class survey that is designed to gauge understanding of how evidence refutes an explanation. Or, instructors could document the occurrences of specific categorical flaws in students' analysis of forces on a test problem. There are limitless possibilities.

Our hope is that these efforts will become more than just a spreadsheet of percentages, but information that we can use in our courses. Additionally, this gives us the chance to collaborate (something we naturally do anyway) and focus on reasonable chunks that can generate helpful information for both ourselves and our students.

F. Report of assessment results for the most previous academic year:

Coursework within the Major:
We had an extensive reporting of our general education efforts in the previous year, and we are currently refocusing efforts on major programs. This could lead to a future change in our overall assessment plan, a strange but useful outcome of our own previous assessments. Although this was not according to our regular plan, the latest installment of assessment efforts have focused on conversation with our Department Advisory Committee, our faculty, and changing needs of students both within and beyond our major programs. These have led to new course developments, including:

1. Development of a new, advanced course in observational astronomy, PHYS/ASTR 3040. This course is an upper division offering for students who have advanced in the major but realized they want to develop more understanding and skills in the practice of astrophysics. Previously, they were limited to course offerings at the lower division level. However, these students have advanced skills in thermal and modern physics that are essential for advanced work in astrophysics. Moreover, these students have mathematical skills for advanced data analysis. This coursework meets a need of these students and builds towards future work, graduate studies, or research projects.
2. Revision and retitling of PHYS 3420 to incorporate current advances in scientific laboratory techniques and technologies. These changes filled holes in our major program, as well as for other related fields (chemistry, engineering, and technology fields in particular) to give students learning opportunities in advanced data acquisition and the designing of research devices through 3D printing and advanced instrumentation.
3. A department focus group has identified our "capstone" course, Advanced Physics Seminar, as a focal point for future assessment. For this course we need to assess the preparation of our students in physics research, as well as the outcomes in advanced physics and research skills that can be documented in this 1-credit opportunity. (It's correct to say that our assessment efforts are making us rethink our assessment efforts. Such is progress.)

High Impact Practices:
We have documented in previous reports our evidence of HIPs, and in our current report we note that we are currently re-doubling efforts to assess our capstone and undergraduate research programs. Notably, the development of our 3040 course to give students upper division research experiences in astrophysics, as well as our established undergraduate research and seminar capstone, 4990. Although these have been a model for other programs and a highlighted feature in program reviews and in feedback from our Advisory committee, we will dive into this more deeply.

General Education Courses:
Our previous year's work documented an extensive overview of our general education program. This work is ongoing, but we are currently reconsidering how "Signature Assignments," "Big Questions," and the advent of Weber State's "GELOs" can be incorporated into our assessment program. We have faculty currently testing these measures in their classes, and this will reshape our future assessment efforts.

Appendix A

Most departments or programs receive a number of recommendations from their Five-Year Program Review processes. This page provides a means of updating progress towards the recommendations the department/program is acting upon.

Over the course of the year we formed and convened a meeting of our advisory board, which was a recommendation of the program review team and the CoS dean. The members of the board represented the most significant paths for our graduates: a representative from secondary education, a graduate-school-admissions expert, and representatives from local industry.

With the feedback from the advisory board, the department made hiring a tenure-track faculty member in computational physics & interdisciplinary research our top priority and requested that position to fill the vacancy left by Dr. Galli's retirement. The request was not approved and Dr. Galli's vacancy will be filled by an ongoing instructor-level position in the department.

Appendix B

Please provide the following information about the full-time and adjunct faculty contracted by your department during the last academic year (summer through spring). Gathering this information each year will help with the headcount reporting that must be done for the final Five Year Program Review document that is shared with the State Board of Regents.

Faculty 2016-17	
Headcount	18
With Doctoral Degrees (Including MFA and other terminal degrees, as specified by the institution)	13
Full-time Tenured	7
Full-time Non-Tenured (includes tenure-track)	2
Part-time and adjunct	7
With Master's Degrees	
Full-time Tenured	
Full-time Non-Tenured	1
Part-time and adjunct	4
With Bachelor's Degrees	
Full-time Tenured	
Full-time Non-tenured	
Part-time and adjunct	
Other	
Full-time Tenured	
Full-time Non-tenured	
Part-time	
Total Headcount Faculty	18
Full-time Tenured	7
Full-time Non-tenured	2
Part-time	9

Please respond to the following questions.

1. Based on your program's assessment findings, what subsequent action will your program take?
   As documented above, the Department of Physics will be reconsidering assessments of the following:
   a. General Education Learning Outcomes along with "Signature Assignments" in our coursework. We will investigate if these can replace or augment other assessment practices in physical science general education.
   b. Capstone and High Impact research experiences for our majors.
2. Please provide a short narrative …
   We are grappling with how to incorporate our capstone experience more overtly into department assessments. As described above, the Advanced Physics Seminar represents a capstone to all of our coursework and gives students the opportunity to demonstrate their research skills, physics knowledge, and scientific communication practices. Students (in exit interviews) nominate their research and seminar as a critical experience in their education, but we need to document this more clearly. We are investigating how this can be done more effectively while still retaining the robustness of the experience.