All Student Learning Outcomes (SLOs) for the program. Along with a listing of all SLO’s, each SLO should include:

a. How each will be measured?

b. When each will be measured (e.g., year 1, year 2, year 3, year 4, and/or year 5)?

c. What are the results of each SLO?

d. What actions are taken based on the results of the assessment?

In August of 2010, the department identified five student learning outcomes for all students in physics-related programs:

1. Utilize scientific reasoning, mathematical techniques and conceptual understanding to solve problems in science.

This SLO is measured yearly via the following methods:

- Experimental paper (PHYS495; year 4), completed at “minimum” level or above. To meet this level, not only must the treatment of the topic reveal a satisfactory understanding of the phenomenon being studied, but the data and theory must adequately support the assertions made in the paper. This is also used for SLO’s 2 and 4. Students find this activity to be challenging, particularly for transfer students who don’t take the introductory courses at ESU. The department has modified the structure of PHYS495 and is looking into making it a 3-credit course (rather than 1 credit).

- ETS Major Field Test for Physics or GRE Physics Subject Test at a satisfactory level (B.S. physics majors only years 3 and 4). ETS physics scores continue to show that ESU students perform on par (or better) than students from other U.S. institutions.

- Passing score on PRAXIS II content exam for their content area (Secondary Education students only; year 4 or post-grad). Physics majors routinely pass the physics exam without a problem but the Earth and Space Science majors occasionally have problems with the earth and space science exam. This has been tied to the large amount of geology on the exam. For that reason, GEOG321 Geomorphology has been made a requirement (rather than an elective).

This SLO is also measured periodically via the following methods:

- A minimum of a C- in all required courses in their content area (all years). The last time this was analyzed 79% of students met the target. The department has modified the course schedule for new first-time students to try to address the high failure rate in PHYS161 (Physics I).

2. Apply scientific inquiry methods to testing, measurement, and analysis.

This SLO is measured yearly via the following methods:

- Experimental paper (PHYS495; year 4). See comments above.

3. Deal with issues involving scientific content in an equitable and scientifically valid way.

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1 Four additional learning outcomes apply to the secondary education concentrations within the science majors. The science education programs are accredited by NCATE and undergo their own periodic review. The last review was submitted in the spring of 2012 and received national recognition. Every standard was met.
This SLO is measured yearly via the following methods:

- Issue paper, completed at “minimum” level or above (PHYS495; year 4). To meet this level, the student must demonstrate a satisfactory understanding of current (recent) knowledge of an issue in science, supported by data from various sources provided in an unbiased way (i.e., with arguments for both sides of an issue) and must provide a recommendation supported by logic, evidence, and research. This is also used for SLO 4. Students find this activity to be challenging even after a modification of PHYS495 and is looking into making it a 3-credit course (rather than 1 credit).

4. Communicate scientific ideas clearly and succinctly.

This SLO is measured yearly via the following methods:

- Issue paper, completed at “minimum” level or above (PHYS495; year 4). See comments above.
- Review of a recently published, peer-reviewed research article, completed at “minimum” level or above (PHYS495; year 4). To meet this level, students must summarize, using language no more advanced than that found in introductory college science courses, the essential ideas contained in a contemporary research article in science. This is challenging but doable by most students.

5. Obtain suitable employment in their field of study (if desired), or enroll in graduate school in physics or a related field of study (if desired).

This SLO is measured periodically via the following methods:

- Post-graduate enrollment and employment history of graduates. Students have not had difficulty unless they restrict their search area. We are looking into making it easier for students to land internships prior to graduation in order to address this.
- For engineering transfer majors, successful matriculation as juniors at Penn State or any other engineering college of their choice. Our students rarely have a problem transferring or succeeding at the transfer school.