CLAS Deans' comments on

BS in Physics, Non-Accredited Program Report

Reviewer: Michael Cornebise, Associate Dean

Last report submitted by department: Fall 2020 (Initial Assessment Plan).

Comments:

The Department of Physics 4-year assessment report is comprehensive and is designed to measure 19 distinctive student learning outcomes (SLOs). The program assesses SLOs using multiple data points including a major field test, exit interviews, an alumni survey, a speaking report, and course grades. Assessment results led to several curricular changes to the program including the development of new upper division course (PHY 4780), the revision of PHY 1001 to include more professionalizing activities, the implementation of new software to enhance student learning, and the development of a recitation section for students in introductory Physics courses to provide better scaffolding and improve problem solving skills. To offer a suggestion to improve future program assessment, I urge the Physics faculty to consider methods in addition to course grades to assess several key SLOs in their program. I also recommend that the department conduct an annual review of their assessment enterprise prior to their next submission.

Year 4 Physics Department Assessment
Non-Accredited Program

Student Learning Outcomes

1. Demonstrate the ability to apply fundamental, overarching themes in physics, including conservation laws, symmetry, the particulate nature of matter, waves, interactions, and fields, and systems, models and their limitations.
2. Demonstrate competency in applying basic laws of physics in classical and quantum mechanics, electricity and magnetism, thermodynamics and statistical mechanics and special relativity, and the applications of these laws in areas such as optics, computational physics, and astronomy.
3. Represent basic physics concepts in multiple ways, including mathematically (including through estimations), conceptually, verbally, pictorially, computationally, by simulation, and experimentally.
4. Demonstrate knowledge of how basic physics concepts are applied in modern technology and apply this knowledge to the solution of applied problems.
5. Solve complex, ambiguous problems in real-world contexts.

6. Show how results obtained relate to the original problem, determine follow-up investigations, and place the results in a larger perspective.
7. Demonstrate instrumentation competency: competency in basic experimental technologies, including vacuum, electronics, optics, sensors, and data acquisition equipment. This includes basic experimental instrumentation abilities, such as knowing equipment limitations; understanding and using manuals and specifications; building, assembling, integrating, operating, troubleshooting, and repairing equipment; establishing interfaces between apparatus and computers; and calibrating laboratory instrumentation and equipment.
8. Demonstrate software competency: competency in learning and using industry-standard computational, design, analysis, and simulation software, and documenting the results obtained from a computation or design.
9. Demonstrate data analytics competency: competency in analyzing data, including with statistical and uncertainty analysis; distinguishing between models; and presenting those results with appropriate tables and charts.
10. Communicate with many different audiences from many different cultures and scientific backgrounds, understand each audience and its needs, and make the communication relevant and maximally impactful for that audience.
11. Obtain information and evaluate its accuracy and relevance through reading (print and online), listening, and discussing.
12. Articulate one's own state of understanding and be persuasive in communicating the worth of one's own ideas and those of others.
13. Communicate in writing about scientific and technical concepts concisely and completely, and revise writing to achieve grammatically-correct and logically-constructed arguments.
14. Organize and communicate ideas using words, mathematical equations, tables, graphs, pictures, animations, diagrams, and other visualization tools.
15. Work collegially and collaboratively in diverse, interdisciplinary teams both as a leader and as a member in pursuing a common goal.
16. Obtain knowledge about existing technology resources relevant for the task at hand. For example: How is the technology made? How does it work? What does it cost? Who tests it? What industries are affected by it? Where are the centers of these industries located? Where can the computational resources needed for the task be found?
17. Demonstrate familiarity with basic workplace concepts. Concepts such as program and project management, including planning, scheduling, tracking progress, adapting, and working within constraints, quality assessment and assurance, and working with and enhancing the safety culture in the workplace.
18. Display awareness of regional and national career opportunities and pathways for physics graduates.
19. Demonstrate critical professional and life skills, including completing work on time, optimism, realism, time management, responsibility, respect, commitment, perseverance, independence, resourcefulness, integrity, ethical behavior, and cultural and social competence

Area	SLO*	ULG**	Measures/Instruments	Results and Evaluations
Physics Specific Skills	1. Demonstrate the ability to apply fundamental, overarching themes in physics, including conservation laws, symmetry, the particulate nature of matter, waves, interactions, and fields, and systems, models and their limitations.	C, Q, W	Major Field Test (given prior to leaving EIU) or possibly some other exam of general physics knowledge	Major Field Tests were on hold during the COVID years due to logistics.
	2. Demonstrate competency in applying basic laws of physics in classical and quantum mechanics, electricity and magnetism, thermodynamics and statistical mechanics and special relativity, and the applications of these laws in areas such as optics, computational physics, and astronomy.	C, Q, W	Grades in PHY 4470, PHY 4750, PHY 4855, PHY 4865, PHY 4320, and PHY 4100	The GPA for all of these courses is 3.017 for the period of evaluation. COVID online depressed these numbers. But in general the material to be evaluated does seem to be learned at an appropriate level.
	3. Represent basic physics concepts in multiple ways,	C, Q, W	Grades in PHY 1371, PHY 1372, PHY 3150, PHY 4711, PHY 4712	The experimental portion of these courses

	including mathematically (including through estimations), conceptually, verbally, pictorially, computationally, by simulation, and experimentally.			show growth as the GPAs go from 3.345 for 1371 and 1372 to 3.714 for 3150 to 3.796 for 4711 and 4712. This shows clear growth in the concepts and experimental knowledge.
	4. Demonstrate knowledge of how basic physics concepts are applied in modern technology and apply this knowledge to the solution of applied problems.	C, Q, W	Grades in PHY 3150, PHY 4713	The GPA of 3.714 for 3150 demonstrates knowledge in this area. And the GPA of 4.0 for 4713 indicates growth and maturity.
Scientific Technical Skills	5. Solve complex, ambiguous problems in real-world contexts.	C, S, R	Grades in PHY 4713, PHY 2601, PHY 4601	End of semester research talks have demonstrated a general ability to problem solve in research contexts.
	6. Show how results obtained relate to the original problem, determine follow-up investigations, and place the results in a larger perspective.	C, Q	Grades in PHY 4713, PHY 2601, PHY 4601	End of semester research talks are very successful in demonstrating the student's overall understanding

				of these issues.
	7. Demonstrate instrumentation competency: competency in basic experimental technologies, including vacuum, electronics, optics, sensors, and data acquisition equipment. This includes basic experimental instrumentation abilities, such as knowing equipment limitations; understanding and using manuals and specifications; building, assembling, integrating, operating, troubleshooting, and repairing equipment; establishing interfaces between apparatus and computers; and calibrating laboratory instrumentation and equipment.	NA	Grades in PHY 3150, PHY 4470, PHY 4711, PHY 4712, PHY 4713	The GPA for these courses is 3.546 which indicates that students are learning experimental techniques and technologies.

	8. Demonstrate software competency: competency in learning and using industry-standard computational, design, analysis, and simulation software, and documenting the results obtained from a computation or design.	C, Q, W	Grades in PHY 3270, PHY 4320	The GPA for these courses is 3.333 and indicates that students are competent in the software that is currently in the instruction system.
	9. Demonstrate data analytics competency: competency in analyzing data, including with statistical and uncertainty analysis; distinguishing between models; and presenting those results with appropriate tables and charts.	C, Q, W	Grades in PHY 1372, PHY 3150, PHY 4711, PHY 4712	Grades for these courses show a 3.690 GPA indicating that error analysis is taught and understood by the students.
Communications Skills	10. Communicate with many different audiences from many different cultures and scientific backgrounds, understand each audience and its needs, and make the communication relevant and	W, S, R	EWP Report	EWP reports indicate that our students write and communicate at a level that is above the College average.

	maximally impactful for that audience.			
	11. Obtain information and evaluate its accuracy and relevance through reading (print and online), listening, and discussing.	W, S	Professor's Evaluation of PHY 1001	Students are exposed to strategies for improving learning in this course. Critical Thinking as well as critical analyzing of word problems are also addressed in this course.
	12. Articulate one's own state of understanding and be persuasive in communicating the worth of one's own ideas and those of others.	S	Speaking Report	Students in this major both show growth in speaking from freshman to senior years and also are generally above the College average.
	13. Communicate in writing about scientific and technical concepts concisely and completely, and revise writing to achieve grammatically-correct and logically-constructed arguments.	C, W	Grades in PHY 3410, PHY 3420, PHY 4855, PHY 4865	The GPA for these courses is 3.444 which indicates that students are able to achieve good levels of writing in technical and scientific modes.

	14. Organize and communicate ideas using words, mathematical equations, tables, graphs, pictures, animations, diagrams, and other visualization tools.	W, Q	Grades in PHY 4000	Students demonstrate growth in their ability to organize and present material in Powerpoint. Faculty are satisfied with the current results.
Professional/Workplace Skills	15. Work collegially and collaboratively in diverse, interdisciplinary teams both as a leader and as a member in pursuing a common goal.	R	Exit Interview	Exit Interviews were not done during the COVID years due to logistics.
	16. Obtain knowledge about existing technology resources relevant for the task at hand. For example: How is the technology made? How does it work? What does it cost? Who tests it? What industries are affected by it? Where are the centers of these industries located? Where can the computational resources needed for the task be found?	S, W	Grades in PHY 3150, PHY 4713	These discussions are a part of the final project for these courses. It is not necessarily reflected in the grades because the course covers so much more. However, instructors report that the students do get exposure to all of these concepts throughout the courses.

	17. Demonstrate familiarity with basic workplace concepts. Concepts such as program and project management, including planning, scheduling, tracking progress, adapting, and working within constraints, quality assessment and assurance, and working with and enhancing the safety culture in the workplace.	R	Alumni Survey	Expense of Alumni Survey is not in the budget.
	18. Display awareness of regional and national career opportunities and pathways for physics graduates.	NA	Exit Interview, Alumni Survey	Expense of Alumni Survey is not in the budget.
	19. Demonstrate critical professional and life skills, including completing work on time, optimism, realism, time management, responsibility, respect, commitment, perseverance, independence,	R	Exit Interview, Alumni Survey	Expense of Alumni Survey is not in the budget.

	resourcefulness, integrity, ethical behavior, and cultural and social competence			
* Student Learning Objectives				
** University Learning Goals -	C = Critical Thinking			
	W = Writing and Critical Reading			
	S = Speaking and Listening			
	Q = Quantitative Reasoning			
	R = Responsible Citizenship			
	NA = Not Applicable			

Improvements and Changes Based on Assessment

1. Provide a short summary (1-2 paragraphs or bullets) of any curricular actions (revisions, additions, and so on) that were approved over the past two years as a result of reflecting on the student learning outcomes data. Are there any additional future changes, revisions, or interventions proposed or still pending?
   a. Implemented a new course as an elective for upper level students. PHY 4780, Plasma Physics will add to their knowledge of Electricity and Magnetism as well as some Mathematical Methods (a course that was deleted from the curriculum in our streamlining of the program).
   b. Utilized PHY 1001 to be more career oriented. We go over resume writing, professional letter writing, and career ideas now. We continue to expound the benefits of studying in technical fields as well as hints for better classroom performance.
   c. Implementing a recitation section in our introductory majors Physics course in the spring of 2023. This is to supplement topics from the usual lecture and give the students further experience in problem solving. It comes from a perceived weakness in student preparation.
   d. We updated our software by purchasing COMSOL which is a simulation package for modeling physical systems. This is both to give computational physics students better software for modeling and to give them additional up to date software to work with. It further enhances our abilities for mentored research because COMSOL is currently widely used.
2. Please provide a brief description or bulleted list of any improvements (or declines) observed/measured in student learning. Be sure to mention any intervention made that has not yet resulted in student improvement (if applicable).

a. Students seem to have been hindered in their education from the COVID years. We find that incoming students are not as prepared as in the past. For 2022-23 the Department had 40 incoming students and the introductory majors class had 15 students. More than half of the incoming majors were not prepared to take calculus based Physics.
b. One intervention is the recitation section mentioned above.

3. Using the form below, please document annual faculty and committee engagement with the assessment process (such as the review of outcomes data, revisions/updates to assessment plan, and reaffirmation of SLOs).

History of Annual Review		
Date of Annual Review	**Individuals/Groups who Reviewed Plan**	**Results of the Review (i.e., reference proposed changes from #1 above, revised SLOs, etc...)**

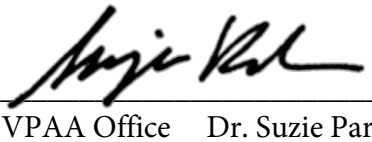
Dean Review & Feedback

January 10, 2023

Dean or designee

Date

Academic Affairs –Review & Feedback
B.S. Physics
The B.S. in Physics program has implemented a number of curricular developments over the review period. While these changes to courses are designed to help students better prepare for their fields of study, the assessment of this preparation is not yet there. In other words, there is no clear indication of an annual departmental-level review of assessment processes and goals for improving student learning. The main source of data remains the average GPA calculations obtained from a list of courses. The total number of students assessed is not noted. The program will want to arrive at a clearer picture of the program's gains and losses by identifying more precise measures for student learning outcomes than the average GPA for a large group of courses.



3/8/23

VPAA Office Dr. Suzie Park

Date