Student Outcomes Assessment and Success Report AY2020-21 ***Consult with your college dean's office regarding due date and how to submit. Deans will submit reports to the Office of Assessment & Accreditation annually by October 15.***

Unit/Program Name: _____Physics_____ **Contact Name(s) and Email(s)** ___Joseph West: joseph.west@indstate.edu____

Part 1a: Summary of Student Learning Outcomes Assessment

NOTE: If data is missing due to COVID-19 transition issues, please describe these issues, their impact on your ability to assess student learning, and what, if anything, will change as a result.

a. What learning outcomes did you assess this past year? If this is a graduate program, identify the Graduate Student Learning Outcome each outcome aligns with.	**b. (1) What assignments or activities did you use to determine how well your students attained the outcome? (2) In what course or other required experience did the assessment occur?**	**c. What were your expectations for student performance?**	**d. What were the actual data/results?**	**e. What changes or improvements were made or will be made in response to these assessment results or feedback from previous year's report?** *Can expand on this in Part 2.*
1. (Outcome #1) Students pursuing a baccalaureate degree in physics will exhibit a sound grasp of fundamental concepts in the discipline.	(1) All Physics majors took the Major Fields Test in Physics during finals week of the spring semester of their senior year. (2) This standardized exam was administered as part of PHYS 405, a capstone course required of all Physics majors in their senior year. Taking the exam is a requirement in the course, worth 10% of the course points. Students earn these points regardless of how well they perform on the exam. We do, however, explain the importance of the exam and encourage students to do their best.	All students will score at the "Fair" level or better, using the following system based on students' percentile ranking on the exam compared to national data: Very Good = 60-100% Good = 40-60% Fair = 20-40% Poor= 10-20% Very Poor = lowest 10%	There was only one senior Physics major this year (the Physics program is small). The student performed at the "Fair" level, so the target achievement was met. This student was double majoring in Science Education.	Relative to their peers nationwide, our students tend to score better on advanced topics than on introductory topics. To help establish better conceptual understanding of the introductory material, we introduced a PRS system (clickers) in the freshman-level physics course sequence (PHYS 115 and 116). This system was not yet implemented when the student (who was assessed this year) took these courses, however. Also, use of the PRS system was disrupted in the past year due to COVID, and this could have an impact going forward on this year's cohort. We have considered making students' grades in PHYS 405 dependent upon their scores on the Major Fields Test, rather than simply giving them credit for taking the test. We do not have evidence to suggest that students are not taking the exam seriously and under-performing

				as a result, so we plan to continue with the current policy.
2. (Outcome #2) Students pursuing a baccalaureate degree in physics will be able to employ problem solving skills together with scientific models and mathematical techniques to explain and predict behavior of physical systems.	(1) Each physics faculty member completed the "Problem Solving Skills Rubric" for each individual Physics major by examining a student's performance on a variety of exams and projects from the assessed courses (below) for the 2019-20 and 2020-21 academic years. An average was calculated for each student for each category in the rubric by averaging the scores from all faculty members. (A 5-point scale for each category.) (2) The assignments were from the following courses, all part of the Physics Core Curriculum which is required of all Physics majors: PHYS 215, 216, (306 and 308 are also included as new courses replacing the 215-216 sequence) 310, 311, 341, 342, 420 and 497.	All of the categories in the rubric will be rated at least satisfactory. A satisfactory rating in a category means that at least 80% of the students received an average score of 3 or better on a 5-point scale.	Five students were assessed. The results show that over 90% of the student performances reviewed were rated as satisfactory or better in each category of the rubric. The target achievement has been met. See Table 1 below.	To increase the focus on problem solving in PHYS 115/116 (the freshman-level course sequence), we include problems that students must work out by hand—with all steps of their work shown—in every homework assignment. We plan to continue this practice. We are starting to incorporate more group/team work into PHYS 115/116 where student groups work problems on small whiteboards. We were not able to do much of this during Spring 2020 due to COVID. PHYS 306 + 307 + 308/L is a new sophomore-level course sequence required of all Physics majors; it replaced PHYS 215/L + 216/L, beginning in 2020-21. In the new courses we introduce programming for Arduino devices (PHYS 306) and emphasize expert-level physics problem solving (PHYS 307). PHYS 306 and 307 were taught for the first time in 2020-21. Despite some modifications that were necessary due to COVID, both courses seem to have gone very well. Based on this first offering, we are planning improvements/changes that will be implemented in 2021-22. We hope to see improvements in student problem-solving ability going forward in the cohorts of students who take this new course sequence.

Note: *If you would like to report on more than three outcomes, place the cursor in the last cell on the right and hit "tab" to add a new row.*

Helpful Hints for Completing this Table

a. Use your outcomes library as a reference. Note any alignment with professional standards, as applicable.
b. Each outcome should be assessed by at least one direct measure (project, practica, exam, performance, etc.). If students are required to pass an examination to practice in the field, this exam should be included as one of the measures. At least one of the program's outcomes must use an indirect measure (exit interview, focus group, survey, etc.). Use your curriculum map to correlate outcomes to courses. Describe or attach any evaluation tools such as rubrics, scales, etc.
c. Identify the score or rating required to demonstrate proficiency (e.g., Students must attain a score of "3" to be deemed proficient; at least 80% of students in the program will attain this benchmark.)
d. Note what the aggregate level of proficiency actually was and the number of students included in the cohort or sample (e.g., 85% of the 25 students whose portfolios were reviewed met the established benchmark).

Part 1b: Review of Student Success Data & Activities

Use Blue Reports to generate the following information (as well as any other information helpful to you). A dashboard has been created in the Chairs view:

1) Cohort Sizes

	Fall 2017	Fall 2018	Fall 2019	Fall 2020
Physics (1423)	13	8	8	11

2) Year-to-Year Retention

	Fall 2014		Fall 2015		Fall 2016		Fall 2017		Fall 2018		Fall 2019		Fall 2020	
	Cohort Total	Cohort Retention %	Cohort Total	Cohort Retention %	Cohort Total	Cohort Retention %	Cohort Total	Cohort Retention %	Cohort Total	Cohort Retention %	Cohort Total	Cohort Retention %	Cohort Total	Cohort Retention %
College of Arts & Sciences	828	63.89%	871	64.52%	809	68.11%	851	62.04%	816	67.16%	641	70.05%	653	60.80%
Physics (1423)	5	60.00%	4	75.00%	3	66.67%	4	50.00%			2	100.00%	4	75.00%

3) 5-Year Graduation Rate (undergraduate)

	Fall 2010		Fall 2011		Fall 2012		Fall 2013		Fall 2014		Fall 2015	
	Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %
College of Arts & Sciences	808	36.01%	780	39.36%	824	37.86%	839	36.47%	828	36.84%	871	40.87%
Physics (1423)	10	10.00%	3	66.67%	4	25.00%	8	25.00%	5	60.00%	4	75.00%

What worked well in supporting student success this year?
The introduction of PHYS 306 + 307 + 308/L to replace PHYS 215/L + 216/L seems to be a positive move in transitioning students from their freshman-level introductory classes and labs (PHYS 115-116/L) into the upper-level lecture and laboratory courses. Specifically, PHYS 306 introduces some programming and higher-level data analysis via hands-on labs and requires a more extended lab report format. PHYS 307 heavily emphasized problem-solving strategies.

What are the most significant opportunities for improvement upon which to focus in the coming year?
Despite the COVID influences on the first-time offering of the new courses (PHYS 306, 307, 308/L), these courses went well during 2020-21 and are serving their intended purposes. We are carefully considering feedback received from students along with in-class observations by the instructors, and having discussions among the faculty, in order to make significant improvements in the pacing and content of these courses for 2021-22.

Part 2: Continuous Quality Improvement

Reflect on the information shared above regarding student learning, success, and career readiness. In no more than one page, summarize:

1) **the discoveries assessment and data review have enabled you to make about student learning, success, and career readiness** (ex: What specifically do students know and do well—and less well? What evidence can you provide that learning is improving? How might learning, success, and career readiness overlap? What questions do your findings raise?)
2) **findings-based plans and actions intended to improve student learning and/or success (expansion of Part 1a, box e as needed)**
3) **what your assessment plan will focus on in the coming year**
4) **how this information will be shared with other stakeholders**

1) In the 2019-20 review cycle, it was noted that there had been an encouraging decrease in the number of students scoring in the "poor" category. We are pleased to see that this trend has continued into the current assessment cycle, with no students scoring in the "poor" category. The summary data is below in Table 1. We hope/expect that this will continue because the new course PHYS 307 strongly emphasizes advanced problem solving. Problem solving is an essential career-readiness skill in the field of physics.

Table 1. Results of Faculty Assessment of Student Problem Solving

Problem Solving Skills	Knowledge of Concepts	Use of Appropriate Procedures	Math / Comp Skills	Accuracy of Solutions
Totals	63.2	65.3	62.7	63.3
Averages (on 5-point scale)	4.21	4.35	4.18	4.22
N students	15	15	15	15
St. Dev.	0.85	0.78	0.77	0.78

2) The introductory courses for Physics majors (PHYS 115/L and 116/L) were impacted very negatively by the necessary COVID protocols. The decrease in group/team activities in class, and the lack of teams for performing the laboratory experiments, made the learning environment less than optimal for students. This has convinced the faculty that when "normal" conditions return, even more emphasis should be placed on collaborative activities and teamwork involving problem solving on whiteboards during the lecture courses.

Regarding the new sophomore-level course sequence (PHYS 306 + 307 + 308/L), see box e above. In addition, going forward students in PHYS 306 will be able to work in teams on hardware design and wiring—this was not possible during the pandemic. We expect this to have a positive impact on student learning, and it will enable us to increase the scale of the projects they can complete in the course.

3) Next year we will assess Outcome #3 (laboratory procedures) and Outcome #4 (written and oral communication skills).

4) Upon completion this report will be submitted to the Chairperson of the Department of Chemistry and Physics (Jennifer Inlow) who will, upon her approval, forward it to the Dean of the College of Arts and Sciences and subsequently the Office of Assessment for review. Once approved by the Chairperson, information contained in this assessment report will be discussed at a departmental meeting in Fall 2021. Feedback from this assessment cycle will also be addressed at future departmental assessment committee meetings as well as departmental meetings of the full faculty. Interested faculty will be encouraged to assist in gathering data for future assessment cycles. This report will be posted on our departmental Blackboard site so all physics faculty can review it at any time.

Thank you so much for sharing your assessment process and findings for AY 2020-21 with the Assessment Council. You will find feedback and ratings on the rubric below. It is understood that some of the feedback might encompass practices that you already engage in but were not documented in this report. As the purpose of this evaluation is focused on recognizing great work and helping faculty improve assessment practice, it is not necessary to retroactively add documentation. Please feel free to let me know if you have any questions or if there is any way I can assist you in further developing assessment practice and use in your program.

This report will be shared with the Associate Dean(s) and Dean of your college and summarized findings will be shared as composite college/institutional data with the President's Office and the Provost's team.

Sincerely,

Kelley (x7975)

Program: Physics B.S.	**Overall Rating: Exemplary (3.00/3.00)**
Strengths	**Recommendations**
• Assessment in Physics continues to be an exemplar of practice at ISU. • Learning outcomes are clear, specific, and measurable. • Measures of student learning are clearly described, direct measures of student knowledge and application of knowledge in problem-based learning. Measures are taken from various points in the curriculum to demonstrate student learning throughout. • Evaluation of student performance on measures is clearly described, and the breakdown of scores beyond "met" and "didn't meet" expectations gives faculty greater insight into student achievement. • Expectations for student performance and actual performance data are clearly reported with useful context as needed. • Thoughtful, detailed discussion is included about student performance trends, comparison to peers, and faculty insights about the teaching techniques that support student learning. Notes are included about covid disruptions to planned pedagogical/curricular changes, including how such changes reinforced faculty understanding of the critical nature of collaborative, hands-on work for student learning. • Clear information is provided about the ongoing, collegial nature of assessment of learning in the Physics department, and a plan for how findings are shared, discussed, and used is described in detail.	•

Student Outcomes Assessment & Success Report Rubric **Unit/Program: Physics B.S.**
Office of Assessment & Accreditation, Indiana State University **Evaluation Date: Fall 2021**

Evaluation Criteria	3 Exemplary	2 Mature	1 Developing	0 Undeveloped
Student Learning Outcomes	Identified, aligned learning outcomes are specific, measurable, student-centered, and program-level. Outcomes directly integrate institution or college-level learning goals. Outcomes are consistent across modes of delivery (if applicable). More than one outcome is assessed this cycle, and rationale is provided for why they were selected for assessment.	Identified, aligned learning outcomes are specific, measurable, student-centered, and program-level. Outcomes support institution or college-level learning goals. Outcomes are consistent across modes of delivery (if applicable). At least one outcome is assessed this cycle.	Learning outcomes are identified and alignment with courses is demonstrated. Outcomes are consistent across modes of delivery (if applicable). At least one outcomes is assessed this cycle.	No learning outcomes are identified, and/or alignment of learning outcomes to courses is not demonstrated (e.g. – curriculum map).
Performance Goals & Measures	Performance goals are clear and appropriate, and rationale is provided for why these were selected. Identified measures and tools are assigned to each outcome, are clear and intentionally designed to address student performance on aligned outcomes, and rationale and examples are provided (e.g. – rubrics, checklists, exam keys). Most are direct measures, and their design enhances the validity of findings. Licensure exams and high-impact practices are reflected in measures (if applicable).	Performance goals are clear and appropriate. Identified measures and tools are assigned to each outcome, are clear and intentionally designed to address student performance on aligned outcomes, and examples are provided (e.g. – rubrics, checklists, exam keys). At least one direct measure is included.	Performance goals are identified with little rationale or clarity. Identified measures are poorly suited to performance goals, underdeveloped, or are solely indirect measures.	No goals for student performance of learning outcomes are identified, and/or no measures are provided.

Analysis & Results	Data collection process is clear and designed to produce valid/trustworthy results. The process is useful to those collecting and/or interpreting data. Data is collected and analyzed with clear rationale and description. Results are provided with thoughtful discussion of analysis and description of conclusions that can be drawn.	Data collection process is clear and designed to produce valid/trustworthy results. Data is collected and analyzed with clear rationale and description. Results are provided with some discussion of analysis.	Description of data collection is unclear as to process and quality. Some data is collected and analyzed with little rationale or description. Some results are provided with no discussion of analysis.	No information is provided about the data collection process, and/or no data is being collected. No results are provided.
Sharing & Use of Results for Continuous Improvement	A plan for sharing information and included program faculty and appropriate staff in discussion and planning is detailed and enacted. Outcomes and results are easily accessible on the program website or other appropriate designated area. Plans for improvement or change based on results are clear and connected to results. If few students met performance goals, this is included in discussion and plans. Reflection if offered about results or plans moving forward, and compares prior year plans to current outcomes in an effort to foster continuous improvement as a result of assessment process.	A plan for sharing information broadly across program faculty is detailed and enacted. Plans for improvement or change based on results are clear and connected to results. If few students met performance goals, this is included in discussion and plans. Reflection is offered about results or plans moving forward.	Information is provided about sharing results, but sharing is limited in scope or content. Plans for improvement or change based on results are incomplete, vague, or not clearly connected to results. Little reflection is offered about results or plans moving forward.	No information is provided about sharing results and/or plans for improvement or change based on results. No evidence of reflection on results in provided.
Overall Rating	□ **Exemplary**	□ **Mature**	□ **Developing**	□ **Undeveloped**