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| **Assurance of Student Learning Report****2022-2023** |
| *OCSE* | *Physics and Astronomy* |
| *BS Physics 754* |
| *Michael Carini* |
| ***Is this an online program***? [ ]  Yes [x]  No | Please make sure the Program Learning Outcomes listed match those in CourseLeaf. Indicate verification here [x]  Yes, they match! (If they don’t match, explain on this page under **Assessment Cycle)** |

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| ***Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages. Add more Outcomes as needed.*** |
| **Program Student Learning Outcome 1: Students will show a mastery of foundational principles and requisite mathematics** |
| **Instrument 1** | **Major Field Test (MFT) Scores** |
| **Based on your results, check whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 2: Students will demonstrate a mastery of empirical methods via written expression.** |
| **Instrument 1** | **Written summary of research projects in senior seminar (Physics 498)** |
| **Based on your results, check whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 3: Students will demonstrate a mastery of empirical methods via oral expression.** |
| **Instrument 1** | **Oral presentation of research projects in senior seminar (Physics 498)** |
| **Based on your results, check whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Assessment Cycle Plan:**  |
| The MFT total and sub scores will be analyzed for significant trends indicating curricular success and/or need for improvement and the curriculum will be adjusted as needed. Weaknesses found in the rubric-assessed oral presentation/written abstract scores will be shared with the faculty, and appropriate changes will be made in the curriculum to address these weaknesses. Strengths and successes in written/oral presentation skills will also be identified and shared with the faculty to determine best practices in our curriculum for our student’s success.  |

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| **Program Student Learning Outcome 1** |
| **Program Student Learning Outcome**  | **Students will show a mastery of foundational principles and requisite mathematics** |
| **Measurement Instrument 1**  | Total and sub scores of the Physics Major Field Test (MFT). |
| **Criteria for Student Success** | As a cohort, students will score at or above the national median in the sub scores and in the total score. |
| **Program Success Target for this Measurement** | 100% | **Percent of Program Achieving Target** | 100 |
| **Methods**  | All WKU physics majors are required to take the Physics 398 (Junior Seminar) class and participate in the MFT. The students typically take the MFT as rising juniors, thus not all of them have had the complete suite of advanced coursework assessed on the MFT. The current year’s cohort of 6 students scored within the range defined by the national medians. |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| The current year’s cohort of 6 students scored within the range defined by the national medians. Multi-year trends are used to determine knowledge gaps and then the curriculum is examined to determine the appropriate course(s) to target for improvement. In spring 2023, the third cohort of students who were taught introductory Physics with the Matter and Interactions curriculum took the MFT. Thus, we are only just beginning to have data to discern meaningful long-term trends. The MFT breaks down the total score into two sub scores- introductory and advanced physics. These sub scores will continue to be analyzed for significant trends indicating curricular success or need for improvement. Base don’t his analysis, adjustments will be made to the curriculum as appropriate to meet our learning goal targets. This will be assessed in the same fashion in the next assessment cycle. |

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| **Program Student Learning Outcome 2** |
| **Program Student Learning Outcome**  | **Students will develop a mastery of empirical methods via written expression** |
| **Measurement Instrument 1** | Written summary of research projects in the Senior Seminar (Physics 498) class. |
| **Criteria for Student Success** | 90% of all students evaluated will have an overall score of 30/40 or better on the written abstract. |
| **Program Success Target for this Measurement** | 90 | **Percent of Program Achieving Target** | 100 |
| **Methods**  | The written thesis is evaluated on a rubric (see attached) with the goal that 100% of all students evaluated will have an overall score of good or better.  |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| Evaluation of student abstracts written for their student presentations in the Physics 498 course is used to identify weaknesses in student’s ability to demonstrate a mastery of empirical methods via written expression. In the senior seminar courses, students often show weaknesses in expression of empirical methods via independent writing skills. To address this weakness, the introductory laboratory sequence (University Physics I and II) was modified to include an increased emphasis on proper laboratory report preparation. In fall of 2023, the third cohort of students who experienced the revised laboratory curriculum in University Physics I and II were evaluated in Physics 498. We found 100% of the 8 students in the cohort achieved a score of 30/40 or higher on their written abstracts. Any weakness/successes found in the written abstract scores will be shared with the faculty, and appropriate changes will be made to the emphasis in the laboratory curriculum to address these weaknesses or to determine best practices arising from successes. This will be assessed in the next assessment cycle. |

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| **Program Student Learning Outcome 3** |
| **Program Student Learning Outcome**  | **Students will demonstrate a mastery of empirical methods via oral expression** |
| **Measurement Instrument 1** | **Oral presentation of research projects in the Senior Seminar (Physics 498) class.** |
| **Criteria for Student Success** | 90% of all students evaluated will have an overall score of good or better on the oral presentation. |
| **Program Success Target for this Measurement** | 90 | **Percent of Program Achieving Target** | 100 |
| **Methods**  | Students give two oral presentations in Physics 498-one at the beginning of the semester, which is typically a prospectus of their planned research for the semester and one at the end, which summarizes their progress and results. Student presentations are evaluated on a rubric (see attached) with the goal that 90% of all students evaluated will have an overall score of good or better on the final presentation. All WKU Physics majors are required to take Physics 498 Senior Seminar class.  |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| We expect majority of students will display a gradual maturation in their oral expression as they progress through the physics curriculum and are engage in mentored research projects with faculty. Despite opportunities to practice and hone this skill as part of their mentored research experiences, students still often show weakness in oral expression of empirical methods as they approach graduation. This skill is assessed in the student oral presentations in the Physics 498 course, utilizing the attached rubric. In AY 22/23, we found 100% of the 8 students in the cohort achieved a score of good or better. The results of the rubric based assessment will be analyzed and used to provide feedback to research mentors and classroom instructors on specific student weaknesses that need to be addressed. As a corrective measure, and to reinforce the importance of oral communication of ideas, we have begun to make use of oral project-based assessments, utilizing the same attached rubric, in upper division physics classes. This will be assessed in the next assessment cycle. |

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# Oral Presentation evaluation rubric

Based on presentation of work in Graduate seminar.

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|  | 4: Excellent | 3: Good | 2: Needs some improvement | 1: Needs major improvement |
| Understanding of material | Presentation demonstrated excellent understanding of the topic and its context. | Presentation demonstrated adequate understanding of the topic and its context. | Presentation demonstrated some gaps and/or errors in student understanding of the topic and context. | Presentation demonstrated significant gaps or errors in student understanding of the topic and context. |
| Presentation organization and flow. | Presentation was well organized and seamlessly presented. | Presentation was logically organized and adequately presented. | There were minor issues with the organization and flow of the presentation.  | Presentation was disorganized and/or confusingly presented.  |
| Interaction with audience | Student developed excellent rapport with the audience during the presentation. | Student interacted with the audience and made eye contact most of the time. | Student had a little interaction with the audience and made eye contact some of the time. | Student did not interact with or look at audience. |
| Answering questions | Student provided thoughtful, quality responses to questions from audience. | Student provided adequate responses to questions from audience. | Student had some difficulties in understanding or answering questions from audience. | Student completely misunderstood or was unable to provide answers to questions from audience. |

# Scientific Work evaluation rubric

Based on written abstract and presentation

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|  | 4: Excellent | 3: Good | 2: Needs some improvement | 1: Needs major improvement |
| Research question | Research question is original, clearly articulated and of compelling importance. | Research question is clear and doable. | Research question is presented but it is poorly articulated, too broad or narrow in scope, or otherwise problematic. | No identifiable research question presented. |
| Research methodology | Research methodology exceptionally well designed and executed to answer research question. | Employs a research methodology that is appropriate for answering the question.  | Research methodology is mismatched or incomplete for answering research question. | No research methodology employed, or that employed seems unrelated to the research question. |
| Data and theory | Compelling, high-quality data collected & analyzed and/or an ambitious theoretical investigation completed.  | Sufficient data collected and analyzed OR theoretical investigation carried out to answer research question. | Some data collected and analyzed OR theoretical investigation conducted giving a suggestive or partial answer to research question. | No/insufficient data collected and analyzed, or incomplete theoretical investigation, such that cannot begin to answer research question. |
| Conclusions | Clear, articulate and compelling conclusions drawn from investigation. | Appropriate conclusions drawn from investigation. | Conclusions ambiguous or only partially supported by the investigation. | No conclusions presented or the conclusions are unrelated to the scientific investigation. |