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| **Assurance of Student Learning Report****2021-2022** |
| *Ogden College of Science and Engineering* | *Physics and Astronomy* |
| *Physics 754* |
| *Michael Carini* |

***Is this an online program***? [ ]  Yes [x]  No

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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.*** |
| **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** |
| **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** |
| **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.** | **[ ]  Met** | **[x]  Not Met** |
| **Program Summary (Briefly summarize the action and follow up items from your detailed responses on subsequent pages.)**  |
| MFT subscores will be analysized for significant trends indicating curricular success or need for improvement and the curcciculm will be adjusted as needed. Weaknesses found in the oral presentation/written abstract scores will be shared with the faculty, and appropriate changes will be made to the emphasis in the curriculm 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 curriculm for our students success.  |

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| **Student Learning Outcome 1** |
| **Student Learning Outcome**  | **Students will show a mastery of foundational principles and requisite mathematics** |
| **Measurement Instrument 1**  | **Major Field Test (MFT)** |
| **Criteria for Student Success** | As a cohort, students will score at or above the national median in the subscores 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 Physics 398 Junior Seminar class and participate in the MFT. In spring 2022, the cohort size was 6 students. The students 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 tyear’s cohort scored within the range defined by the National medians. |
| **Based on your results, highlight whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| Multi-year trends are used to determine curricular weakness and then the curriculum is examined to determine the appropriate course(s) to examine for improvement. In spring 2022, the second 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 trends. The MFT breaks down the total score into two subscores-introductory and advanced physics. These subscores will continue to be analysized for significant trends indicating curricular success or need for improvement.  |
| **Follow-Up** The scores are analyzed and adjustments to the curriculm are made as appropriate to meet our learning goal target. |
| **Next Assessment Cycle Plan** This will be assessed in the same fashion in the next assessment cycle. |

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| **Student Learning Outcome 2** |
| **Student Learning Outcome**  | **Students will demonstrate a mastery of empirical methods via written expression** |
| **Measurement Instrument 1** | **Written summary of research projects in Senior Seminar (Physics 498).** |
| **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 writing examples are evaluated on a rubric (see attached) with the goal that 90% of all students evaluated will have an overall score of 30/40 or higher. All WKU Physics majors are required to take Physics 498 Senior Seminar class. In Fall 2021, the cohort size was 4 students. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions planned for program improvement. The actions should include a timeline.) |
| Evaluation of student abstracts written for their student presentations in the Physics 498 course is used to identify deficiencies in students ability to demonstrate a mastery of empirical methods via written expression. In the senior seminar courses, students often show weakness in independent writing skills expression of empirical methods. As a result of this weakness, the introductory laboratory sequence (University Physics I and II) has been modified to include an increased emphasis on proper laboratory report preparation. Fall of 2021 the first 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 students achieved a score of 30/40 or higher on their written abstracts. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| 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 curriculm to address these weaknesses or to determine best practices arsing from successes. |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| This will be assessed in the next assessment cycle. |

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| **Student Learning Outcome 3** |
| **Student Learning Outcome**  | **Students will demonstrate a mastery of empirical methods via oral expression** |
| **Measurement Instrument 1** | **Oral presentation of research projects in senior seminar (Physics 498)** |
| **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** | 75% |
| **Methods**  | Students give two presentations in Physics 498-one at the beginning of the semester, which is typically a prospectus of their planned research for the smester and one at the end, which summarizs their progress and results. Student presentation 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 clas; in Fall 2021, the cohort size was 4 students. 75% (3/4) of the students in the cohort achieved a score of good or better on their final presentation. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.** | **[ ]  Met** | **[x]  Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| 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. However, in the senior seminar course, students still often show weakness in oral expression of empirical methods. This is assessed in student presentations in the Physics 498 course sequence, utilizing the attached rubric. To address this issue, we have begun to make use of oral project based assessments, utilizing the attached rubric, in some upper division Physics classes.  |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| The results of the rubric based assessment will be analyzed over the summer, and used to provide feedback to research mentors and classroom instructors on specific student weaknesses that need to be addressed.  |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| This will be assessed in the next assessment cycle. |

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# Oral Presentation evaluation rubric

Based on presentation of work in Senior 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. |