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| **Assurance of Student Learning Report****2020-2021** |
| *Ogden College of Science and Engineering* | *Physics and Astronomy* |
| *Physics 754* |
| *Michael Carini* |

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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** | **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 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 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** |
| **Program Summary (Briefly summarize the action and follow up items from your detailed responses on subsequent pages.)**  |
| We expect our students to develop and display a mastery of the empirical methods used in Physics and Astronomy and demonstrate a mastery of foundational principles and requisite mathematics. The Major Field Test (MFT) subscores are monitored and used to determine areas in the curriculum where our students are not performing at or above national medians. 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. The most recent subscore show our students remain within the bounds of the national medians for the introductory and advanced physics content knowledge, with no discernable trends. This year we have our first MFT data point to begin evaluating the efficacy of the curricular change (as measured by the MFT). BY looking for future trends in MFT scores, we will now be able to discern if the curricular change has any effect on student learning , as measured by the MFT.In the senior seminar courses, students often show weakness in oral expression of empirical methods, which stems in part from weakness in thier ability to express empirical methods in a written format. Written skills are honed throughout the laboratory portion of the physics program curriculum; oral skills are honed via oral assessments in junior and senior level classes. Oral and written skills re assessed via presentations in the Physics 498 (senior seminar) class and oral presentations at local, regional and national conferences. The detected weaknesses are being addressed via modifications to the University Physics I and II laboratory courses (Physics 256 & Physics 266) designed to increase the emphasis on proper laboratory report preparation and in the increased use of both oral and written project based assessments in upper division Physics classes. The modifications to the University Physics I laboratory course began in Fall 2019; University Physics II modifications began in Fall 2020. The first cohhort of these students will not reach the Physics 498 course until Fall semester 2021. At that time we will be able to evaluate if there has been a detectable improvement in student ability to express empirical their methods as a result of the course modifications. |

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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 all subfields 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 2021, the cohort size was 5 students.The ETS provides comparative institutional data medians for the MFT. WKU students as a cohort over the same time period score at the median (within the standard deviation) in the total score, as well as the introductory and advanced sub categories. The students take the MFT as rising juniors, thus not all of them have had the complete suite of advanced coursework, yet our students do just as well compared to their peers across the nation at the introductory and advanced level.  |
| **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.) |
| The sub-scores were analyzed and used to determine areas in the curriculum where our students are not performing at or above national medians. Multi-year trends were used to determine curricular weakness and then the curriculum was examined to determine the appropriate course(s) to examine for improvement. The most recent sub-score show our students are within the bounds of the national medians for the introductory and advanced physics content knowledge, with no discernable trends. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| In spring 2021, the first cohort of students who were taught introductory Physics with the Matter and Interactions Curriculum took the MFT; this year we have our first MFT data point to begin evaluating the efficacy of the curricular change (as measured by the MFT). BY looking for future trends in MFT scores, we will now be able to discern if the curricular change has any effect on student learning , as measured by the MFT. |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| 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 3-/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 2020, the cohort size was 3 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.  |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| The modifications to the University Physics I laboratory course began in Fall 2019; those for University Physics II began in Fall 2020. These students will not reach the Physics 498 course until Fall 2021. At that time we will be able to evaluate if there has been a detectable improvement in student written presentation skills.  |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| This will be assessed in the next assessment cycle. The first cohort of Physics majors who experienced the revised University Physics I and II lab will be assessed in the next 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** | **100** |
| **Methods**  | 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. All WKU Physics majors are required to take Physics 498 Senior Seminar class. In Fall 2020, the cohort size was 3 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.) |
| The majority of students 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.  |

**Written Abstract Rubric:**

An abstract is a brief document to provide a potential reader with a description of a conducted or proposed research. The following rubric will be applied to grade your abstract.

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| **Component** | **Points** | **Description** |
| Identifying Information5 | -5 | Missing multiple of title and list of authors |
| -2 | Title is not accurate or informative |
| 0 | Report contains and appropriate title and list of authors |
| Abstract30 | -8 | Abstract is not submitted in a ready-to-publish format or submitted after a deadline  |
| -4 | Abstract exceeds 350 words limit |
| -4 | Does not provide a clear statement of research topic and/or objectives |
| -4 | Does not provide a brief description of method or/and experimental technique |
| -4 | Results and conclusions vague/incomplete or do not support original objectives |
| -4 | Not written in a professional manner: poorly organized/structured, uses slang or informal English (including contractions), and/or changes voice/tense |
| -2 | Contains grammatical and/or spelling errors |
| -2 | Numerical values presented without any description |
| -1 | Units missing on numerical values that should have units |
| -1 | Uncertainties missing on some experimentally measured values  |
| -1 | Excessive numbers of digits provided for numerical values |
| **Total Possible Points** | **40** |

35-40 - Excellent

30-35 -Good

25-30 - Needs improvement

< 25 -needs major improvement

# **Oral Presentation evaluation rubric**

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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. |