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| **Assurance of Student Learning Report****2022-2023** |
| Ogden College of Science & Engineering | Department of Mathematics |
| 049 Master of Arts in Mathematics |
| Hope Marchionda |
| ***Is this an online program***? [x]  Yes [ ]  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 be able to communicate mathematics in a written form at a level commensurate with that of students completing a master’s degree.  |
| **Instrument 1** | Discussion boards, regularly assigned quizzes, a midterm, and a final from MATH 501, Introduction to Probability and Statistics I. A score of 8 or higher on a 10-point multipart rubric for each course will demonstrate students’ ability to communicate mathematically. We expect at least 75% of students to meet this learning |
| **Instrument 2** | Discussion boards, regularly assigned quizzes, and assessments from MATH 515, Introduction to Number Theory. A score of 8 or higher on a 10-point multipart rubric for each course will demonstrate students’ ability to communicate mathematically. We expect at least 75% of students to meet this learning |
| **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 be able to write proofs of theorems in mathematics. |
| **Instrument 1** | Assessments from MATH 503, Introduction to Analysis. A score of 8 or higher on a 10-point multipart rubric for problems given on assessments will indicate that students are able to use multiple strategies in problem solving situations. We expect at least 75% of students to meet this learning outcome. |
| **Instrument 2** | Assessments from MATH 515, Introduction to Number theory. A score of 8 or higher on a 10-point multipart rubric for problems given on assessments will indicate that students are able to use multiple strategies in problem solving situations. We expect at least 75% of students to meet this learning outcome. |
| **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 their capacity to use multiple strategies and appropriate technology to apply mathematics in problem solving situations and will justify their solutions with sound logic. |
| **Instrument 1** | Assessments from MATH 512, Geometry from an Advanced Perspective. A score of 8 or higher on a 10-point multipart rubric will demonstrate students’ ability to choose appropriate strategies, including the use of technology, to solve problems and justify their solutions. We expect at least 75% of students to meet this learning outcome. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 4:** Students will demonstrate their capacity for collaboration in the mathematics classroom as a learner and as a teacher. |
| **Instrument 1** | Discussion boards from MATH 511, Algebra from an Advanced Perspective. A score of 8 or higher on a 10-point multipart rubric will demonstrate students’ ability to collaborate when working towards solutions to problems. We expect at least 75% of students to meet this learning outcome. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 4.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 5:** Students will be able to communicate about research in mathematics education in a written form at a level commensurate with that of students completing a master’s degree. |
| **Instrument 1** | Discussion boards and written assignments from MATH 585, Advanced Mathematical Thinking I. A score of 8 or higher on a 10-point multipart rubric will demonstrate students’ ability to communicate about research in mathematics education. We expect at least 75% of students to meet this learning outcome. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 5.** | **[ ]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 6:** Students will be able to conduct research regarding secondary students’ mathematical thinking. |
| **Instrument 1** | Capstone research projects from MATH 595, Advanced Mathematical Thinking II. A score of 8 or higher on a 10-point multipart rubric will demonstrate students’ ability to communicate about research in mathematics education. We expect at least 75% of students to meet this learning outcome. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 6.** | **[ ]  Met** | **[ ]  Not Met** |
| **Assessment Cycle Plan:**  |
| Tthe Master of Arts in Mathematics underwent a program revision recently. At the time the Student Learning Outcomes, as listed above, we revised. The last two SLOs were not assessed this year as those courses have not yet been offered. Both of them will be offered in the upcoming academic year and will be assessed at that time.  |

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| **Program Student Learning Outcome 1** |
| **Program Student Learning Outcome**  | Students will be able to communicate mathematics in a written form at a level commensurate with that of students completing a master’s degree. |
| **Measurement Instrument 1**  | Discussion boards, regularly assigned quizzes, a midterm, and a final from MATH 501, Introduction to Probability and Statistics I. |
| **Criteria for Student Success** | A score of 8 or higher on a 10-point multipart rubric for each course will demonstrate students’ ability to communicate mathematically. We expect at least 75% of students to meet this learning |
| **Program Success Target for this Measurement** | 75% | **Percent of Program Achieving Target** | 100% |
| **Methods**  | The artifacts from all enrolled students (n=11) that were used to assess this SLO were required discussion boards, regularly assigned quizzes, a midterm, and a final. |
| **Measurement Instrument 2** | Discussion boards, regularly assigned quizzes, and assessments from MATH 515, Introduction to Number Theory.  |
| **Criteria for Student Success** | A score of 8 or higher on a 10-point multipart rubric for each course will demonstrate students’ ability to communicate mathematically. We expect at least 75% of students to meet this learning. |
| **Program Success Target for this Measurement** | 75% | **Percent of Program Achieving Target** | 100% |
| **Methods** | The artifacts from all enrolled students (n=10) that were used to assess this SLO were required discussion boards, regularly assigned quizzes, a midterm, and a final. |
| **Based on your results, highlight whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| The structure of MATH 501 was similar to what it was the previous year, with particular emphasis on students being able to provide statistically precise interpretations for given situations. The 100% of students who met the goal grew with respect to and demonstrated this ability regularly throughout the semester on discussion boards, quizzes, and exams. In the past, the students who did not meet the SLO either completed discussion boards sporadically, regularly engaged in bare minimum levels of interpretation, or both.MATH 515 is a new course that was offered for the first time during the spring 2023 semester. While this is true, students were successful in the course. The main issues centered around the new Blackboard Ultra that the instructor piloted during this semester. The discussion board feature the new BB Ultra is inferior to the old BB interface. Students complained and found it confusion in a course that is truly discussion based and doesn’t just require token DB posts. Both of these courses used to assess this outcome are core courses in the MA in Mathematics Program, and they are offered once a year. Both will be assessed again during the spring 2024 semester when the courses are taught again.  |

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| **Program Student Learning Outcome 2** |
| **Program Student Learning Outcome**  | Students will be able to write proofs of theorems in mathematics. |
| **Measurement Instrument 1** | Assessments from MATH 503, Introduction to Analysis  |
| **Criteria for Student Success** | A score of 8 or higher on a 10-point multipart rubric for problems given on assessments will indicate that students are able to use multiple strategies in problem solving situations. We expect at least 75% of students to meet this learning outcome. |
| **Program Success Target for this Measurement** | 75% | **Percent of Program Achieving Target** | 81.8% |
| **Methods**  | The artifacts from all enrolled students (n=9) that were used to assess this SLO were homework, midterm, final.  |
| **Measurement Instrument 2** | Assessments from MATH 515, Introduction to Number Theory. |
| **Criteria for Student Success** | A score of 8 or higher on a 10-point multipart rubric for problems given on assessments will indicate that students are able to use multiple strategies in problem solving situations. We expect at least 75% of students to meet this learning outcome. |
| **Program Success Target for this Measurement** | 75% | **Percent of Program Achieving Target** | 100% |
| **Methods** | The artifacts from all enrolled students (n=10) that were used to assess this SLO were assignments, midterm, and final. |
| **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)** |
| The results for this SLO are not surprising. Proof writing is a challenging aspect of mathematics and even for those with an undergradate degree in mathematics, sometimes this is a skill that is still developing. MATH 503 is the most challenging course in the MA In Mathematics program (as expected). This will be assessed again during the fall 2023 semester when the course is taught again. MATH 515 is a new course that was offered for the first time during the spring 2023 semester and students did a great job in this course without having an undergrdaute course as a prerequisite. While MATH 503 is the most challenging course in the program (as expected), but there have been students who have left the program because of this course. While that is not necessarily unusal, we need to gather information and decide if there are ways to make the course more accessible for those without a strong theoretical background.  |

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| **Program Student Learning Outcome 3** |
| **Program Student Learning Outcome**  | Students will demonstrate their capacity to use multiple strategies and appropriate technology to apply mathematics in problem solving situations and will justify their solutions with sound logic. |
| **Measurement Instrument 1** | Assessments from MATH 512, Geometry from an Advanced Perspective. |
| **Criteria for Student Success** | A score of 8 or higher on a 10-point multipart rubric will demonstrate students’ ability to choose appropriate strategies, including the use of technology, to solve problems and justify their solutions. We expect at least 75% of students to meet this learning outcome. |
| **Program Success Target for this Measurement** | 75% | **Percent of Program Achieving Target** | 80% |
| **Methods**  | The artifacts from all enrolled students (n=10) that were used to assess this SLO were the midterm, final. |
| **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)** |
| For 2022-2023 we returned to a previous textbook. The program faculty supported this change and it led to better alignments across courses. We plan to use the same textbook for next year. We will continue to monitor student success on this learning outcome.Next Assessment Cycle Plan: The course used to assess this outcome is a core course in the MA in Mathematics program, and it is offered once a year. This course will be assessed again during the Spring 2024 semester when the course is taught again. |

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| **Program Student Learning Outcome 4** |
| **Program Student Learning Outcome**  | Students will demonstrate their capacity for collaboration in the mathematics classroom as a learner and as a teacher. |
| **Measurement Instrument 1** | Discussion boards from MATH 511, Algebra from an Advanced Perspective. |
| **Criteria for Student Success** | A score of 8 or higher on a 10-point multipart rubric will demonstrate students’ ability to collaborate when working towards solutions to problems. We expect at least 75% of students to meet this learning outcome. |
| **Program Success Target for this Measurement** | 75% | **Percent of Program Achieving Target** | 100% |
| **Methods**  | The artifacts from all enrolled students (n=12) that were used to assess this SLO were assignments and discussion boards. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 4.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| For 2022-2023 we returned to a previous textbook. The program faculty supported this change and it led to better alignments across courses. We plan to use the same textbook for next year. We will continue to monitor student success on this learning outcome.Next Assessment Cycle Plan: The course used to assess this outcome is a core course in the MA in Mathematics program, and it is offered once a year. This course will be assessed again during the fall 2023 semester when the course is taught again. |

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| **Program Student Learning Outcome 5** |
| **Program Student Learning Outcome**  | Students will be able to communicate about research in mathematics education in a written form at a level commensurate with that of students completing a master’s degree. |
| **Measurement Instrument 1** | Discussion boards and written assignments from MATH 585, Advanced Mathematical Thinking I. |
| **Criteria for Student Success** | A score of 8 or higher on a 10-point multipart rubric will demonstrate students’ ability to communicate about research in mathematics education. We expect at least 75% of students to meet this learning outcome. |
| **Program Success Target for this Measurement** | 75% | **Percent of Program Achieving Target** | NA |
| **Methods**  | NA |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 5.** | **[ ]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| This SLO will be assessed for the first time during the 2023-2024 academic year.  |

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| **Program Student Learning Outcome 6** |
| **Program Student Learning Outcome**  | Students will be able to conduct research regarding secondary students’ mathematical thinking. |
| **Measurement Instrument 1** | Capstone research projects from MATH 595, Advanced Mathematical Thinking II. |
| **Criteria for Student Success** | A score of 8 or higher on a 10-point multipart rubric will demonstrate students’ ability to communicate about research in mathematics education. We expect at least 75% of students to meet this learning outcome. |
| **Program Success Target for this Measurement** | 75% | **Percent of Program Achieving Target** | NA |
| **Methods**  | NA |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 6.** | **[ ]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| This SLO will be assessed for the first time during the 2023-2024 academic year.  |

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| **CURRICULUM MAP 049** |
| **Program name:** | Master of Arts in Mathematics |
| **Department:** | Mathematics |
| **College:** | Ogden College of Science & Engineering |
| **Contact person:** | Hope Marchionda |
| **Email:** | hope.marchionda@wku.edu |
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| Key:  |  |  |  |  |  |  |  |
| I=Introduced |  |  |  |  |  |  |  |
| R = Reinforced/Developed |  |  |  |  |  |  |  |
| M = Masters |  |  |  |  |  |  |  |
| A = Assessed |  |  |  |  |  |  |  |
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|  |  |  | Learning Outcomes |
|  |  |  | LO1: | LO2: | LO3: | LO4: | LO5: | LO6: |
|  |  |  | Communicate mathematics in a written form at a level commensurate with that of students completing a master’s degree | Write proofs of theorems in mathematics | Demonstrate their capacity to use multiple strategies and appropriate technology to apply mathematics in problem-solving situations and will justify their solutions with sound logic | Demonstrate their capacity for collaboration in the mathematics classroom as a learner and as a teacher | Students will be able to communicate about research in mathematics education in a written form at a level commensurate with that of students completing a master’s degree.  | Students will be able to conduct research regarding secondary students’ mathematical thinking.  |
| Course | Course Title |  |  |  |  |  |  |
| MATH 501 | Introduction to Probability and Statistics I | R/M/A |   | I/R | I/R |  |  |
| MATH 503 | Introduction to Analysis | I/R | R/M/A |   | I/R |  |  |
| MATH 511 | Algebra from an Advanced Perspective | I/R | I/R | I/R | R/M/A |  |  |
| MATH 512 | Geometry from an Advanced Perspective | I/R | I/R | R/M/A | I/R |  |  |
| MATH 515 | Number Theory  | R/M/A | R/M/A | R/M | R/M |  |  |
| MATH 585 | Advanced Mathematical Thinking I  |  |  |  |  | I/R/M/A | I/R |
| MATH 595 | Advanced Mathematical Thinking II |  |  |  |  |  | R/M/A |