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| **Assurance of Program Student Learning Report**  **2022-2023** | | |
| Ogden College of Science & Engineering | | Department of Mathematics |
| 085 Master of Science in Mathematics | | |
| Mikhail Khenner | | |
| ***Is this an online program***?  Yes  No | Please make sure the Program Learning Outcomes listed match those in CourseLeaf . Indicate verification here  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.*** | | | |
| **Program Student Learning Outcome 1:**  Students will be able to read, analyze, and solve problems in statistics commensurate with that of students in a mathematics master’s degree program. | | | |
| **Instrument 1** | The instructor of record for STAT 549, Statistical Methods I, a required course for master of science students, will designate a portion of the final exam or project to be evaluated by a 2-3 person committee appointed by the graduate director of the Master of Science program. We expect 75% of the students to score 75% or higher on that portion of the final exam to meet this student learning outcome. | | |
| **Based on your results, check whether the program met the goal Program Student Learning Outcome 1.** | | **Met** | **Not Met** |
| **Program Student Learning Outcome 2:** Students will be able to read, analyze, and solve problems in applied mathematics commensurate with that of students in a mathematics master’s degree program. | | | |
| **Instrument 1** | Master of science students are required to take MATH 531, Advanced Differential Equations, or MATH 535, Advanced Applied Mathematics-I. The instructor of record for MATH 531 or MATH 535 will designate a portion of the final exam or project to be evaluated by a 2-3 person committee appointed by the graduate director of the Master of Science program. We expect 75% of the students to score 75% or higher on that portion of the final exam to meet this student learning outcome. | | |
| **Based on your results, check whether the program met the goal Program Student Learning Outcome 2.** | | **Not applicable this cycle** | |
| **Program Student Learning Outcome 3:**  Students will be able to read, analyze, and solve problems in discrete mathematics commensurate with that of students in a mathematics master’s degree program. | | | |
| **Instrument 1** | Master of science students are required to take MATH 541, Graph Theory, or MATH 542, Advanced Topics in Discrete Mathematics. The instructor of record for MATH 541 or MATH 542 will designate a portion of the final exam or project to be evaluated by a 2-3 person committee appointed by the graduate director of the Master of Science program. We expect 75% of the students to score 75% or higher on that portion of the final exam to meet this student learning outcome. | | |
| **Based on your results, check whether the program met the goal Program Student Learning Outcome 3.** | | **Met** | **Not Met** |
| **Program Student Learning Outcome 4:**  Students will be able to demonstrate command of LaTeX, a powerful mathematical typsetting language. | | | |
| **Instrument 1** | Students will complete multiple assignments in MATH 598, Graduate Seminar: Communicating Mathematics and Technical Writing, a required course for master of science students, using LaTeX. A 2-3 person committee appointed by the graduate director of the Master of Science program will evaluate the student’s use of LaTeX for both the slides of their final presentation and their final project. The committee will use a grading rubric for each and assign a score of 1 for unsatisfactory use of LaTeX, a score of 2 for a satisfactory use of LaTeX, and a score of 3 for an outstanding use of LaTeX. We expect 100% of the students to average 2 or more as evaluated by the committee using this grading rubric to meet this student learning outcome. | | |
| **Based on your results, check whether the program met the goal Program Student Learning Outcome 4.** | | **Met** | **Not Met** |
| **Program Student Learning Outcome 5:** Students will be able to write with mathematical maturity commensurate with that of students in a mathematics master’s degree program. | | | |
| **Instrument 1** | Students will complete at least one writing assignment in MATH 598, Graduate Seminar: Communicating Mathematics and Technical Writing, a required course for master of science students, in addition to multiple class discussions on writing a thesis and a manuscript for a professional journal. A 2-3 person committee appointed by the graduate director of the Master of Science program will evaluate the written final project. The committee will use a grading rubric for the final project and assign a score of 1 for an unsatisfactory written final project, a score of 2 for a satisfactory written final project, and a score of 3 for an outstanding written final project. We expect 100% of the students to score 2 or more as evaluated by the committee using this grading rubric to meet this student learning outcome. | | |
| **Based on your results, check whether the program met the goal Program Student Learning Outcome 5.** | | **Met** | **Not Met** |
| **Program Student Learning Outcome 6:**  Students will be able to speak with mathematical maturity commensurate with that of students in a mathematics master’s degree program. | | | |
| **Instrument 1** | Students will give at least two presentations in MATH 598, Graduate Seminar: Communicating Mathematics and Technical Writing, a required course for master of science students. A committee appointed by the graduate director of the Master of Science program will evaluate the final presentation. The 2-3 person committee will use a grading rubric for the final presentation and assign a score of 1 for an unsatisfactory final presentation, a score of 2 for a satisfactory final presentation, and a score of 3 for an outstanding final presentation. We expect 100% of the students to score 2 or more as evaluated by the committee using this grading rubric to meet this student learning outcome. | | |
| **Based on your results, check whether the program met the goal Program Student Learning Outcome 6.** | | **Met** | **Not Met** |
| **Program Summary (Briefly summarize the action and follow up items from your detailed responses on subsequent pages.)** | | | |
| Beginning in the Fall 2020, all students are required to complete a 33-credit-hour Masters program. As part of the program change, students are required to complete four core courses – three content classes (one each in statistics, applied mathematics, and discrete mathematics) and a professional development class (MATH 598). Additionally, all students are required to complete a Master’s thesis. Since the Program Student Learning Outcomes for 2022-2023 were met, we believe that upon graduation from the Master of Science program our students are competitive for either a PhD program or a post-graduate job. | | | |

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| **Program Student Learning Outcome 1** | | | | | |
| **Program Student Learning Outcome** | Students will be able to read, analyze, and solve problems in statistics commensurate with that of students in a mathematics master’s degree program. | | | | |
| **Measurement Instrument 1** | The instructor of record for STAT 549, Statistical Methods I, a required course for master of science students, will designate a portion of the final exam or project to be evaluated by a 2-3 person committee appointed by the graduate director of the Master of Science program. We expect 75% of the students to score 75% or higher on that portion of the final exam to meet this student learning outcome. | | | | |
| **Criteria for Student Success** | 75% of the students to score 75% or higher on that portion of the final exam. | | | | |
| **Program Success Target for this Measurement** | | 75% | **Percent of Program Achieving Target** | 100% | |
| **Methods** | The instructor of record for STAT 549 will designate a portion of the final exam or project to be evaluated by a 2-3 person committee appointed by the graduate director of the Master of Science program. | | | | |
| **Based on your results, highlight whether the program met the goal Program Student Learning Outcome 1.** | | | | **Met** | **Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) | | | | | |
| STAT 549 was offered in 2022-2023 academic year (Fall 2022) and a 2 person committee was formed to assess the students’ ability to read, analyze, and solve problems in statistics. The assessment was completed in December 2022. This is the first assessment of STAT 549 that was completed for ASL. | | | | | |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) | | | | | |
| STAT 549 will be offered during the 2024-2025 academic year (Fall 2024). | | | | | |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) | | | | | |
| We believe the best assessment cycle is every two years, which is how long it typically takes for a cohort of students to start and complete their Master’s degrees. Therefore, the next assessment will be during the 2024-2025 academic year. We will continue to monitor the rates of meeting this student learning outcome. | | | | | |

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| **Program Student Learning Outcome 2** | | | | |
| **Program Student Learning Outcome** | Students will be able to read, analyze, and solve problems in applied mathematics commensurate with that of students in a mathematics master’s degree program. | | | |
| **Measurement Instrument 1** | Master of science students are required to take MATH 531, Advanced Differential Equations, or MATH 535, Advanced Applied Mathematics-I. The instructor of record for MATH 531 or MATH 535 will designate a portion of the final exam or project to be evaluated by a 2-3 person committee appointed by the graduate director of the Master of Science program. We expect 75% of the students to score 75% or higher on that portion of the final exam to meet this student learning outcome. | | | |
| **Criteria for Student Success** | 75% of the students to score 75% or higher on that portion of the final exam. | | | |
| **Program Success Target for this Measurement** | | 75% | **Percent of Program Achieving Target** | Not applicable |
| **Methods** | The instructor of record for MATH 531 or MATH 535 will designate a portion of the final exam or project to be evaluated by a 2-3 person committee appointed by the graduate director of the Master of Science program. | | | |
| **Based on your results, circle or highlight whether the program met the goal Program Student Learning Outcome 2.** | | | | **Not Applicable this Cycle** |
| **Actions** (Describe the decision-making process and actions planned for program improvement. The actions should include a timeline.) | | | | |
| MATH 531 or MATH 535 were not offered during the 2022-2023 academic year. MATH 531 was offered during the 2021-2022 academic year (Fall 2021). In that academic year the program success target for Measurement Instrument 1 was exceeded. | | | | |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) | | | | |
| MATH 535 will be offered during the 2023-2024 academic year (Fall 2023). | | | | |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) | | | | |
| We believe the best assessment cycle is every two year, which is how long it typically takes for a co-hort of students to start and complete their Master’s degrees. Therefore, the next assessment will be during the 2023-2024 academic year. We will continue to monitor the rates of meeting this student learning outcome. | | | | |

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| **Program Student Learning Outcome 3** | | | | | |
| **Program Student Learning Outcome** | Students will be able to read, analyze, and solve problems in discrete mathematics commensurate with that of students in a mathematics master’s degree program. | | | | |
| **Measurement Instrument 1** | Master of science students are required to take MATH 541, Graph Theory, or MATH 542, Advanced Topics in Discrete Mathematics. The instructor of record for MATH 541 or MATH 542 will designate a portion of the final exam or project to be evaluated by a 2-3 person committee appointed by the graduate director of the Master of Science program. We expect 75% of the students to score 75% or higher on that portion of the final exam to meet this student learning outcome. | | | | |
| **Criteria for Student Success** | 75% of the students to score 75% or higher on that portion of the final exam. | | | | |
| **Program Success Target for this Measurement** | | 75% | **Percent of Program Achieving Target** | 86% | |
| **Methods** | The instructor of record for MATH 541 or MATH 542 will designate a portion of the final exam or project to be evaluated by a 2-3 person committee appointed by the graduate director of the Master of Science program. | | | | |
| **Based on your results, circle or highlight whether the program met the goal Program Student Learning Outcome 3.** | | | | **Met** | **Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) | | | | | |
| MATH 541 was offered during the 2022-2023 academic year (Spring 2023) and a 2 person committee was formed to assess the students’ ability to read, analyze, and solve problems in discrete mathematics. The assessment was completed in May 2023. This is the first assessment of MATH 541 or MATH 542 that was completed for ASL. | | | | | |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) | | | | | |
| MATH 541 or MATH 542 will be offered during the 2024-2025 academic year. | | | | | |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) | | | | | |
| We believe the best assessment cycle is every two year, which is how long it typically takes for a co-hort of students to start and complete their Master’s degrees. Therefore, the next assessment will be during the 2024-2025 academic year. We will continue to monitor the rates of meeting this student learning outcome. | | | | | |

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| **Program Student Learning Outcome 4** | | | | | |
| **Program Student Learning Outcome** | Students will be able to demonstrate command of LaTeX, a powerful mathematical typsetting language. | | | | |
| **Measurement Instrument 1** | Students will complete multiple assignments in MATH 598, Graduate Seminar: Communicating Mathematics and Technical Writing, a required course for master of science students, using LaTeX. A 2-3 person committee appointed by the graduate director of the Master of Science program will evaluate the student’s use of LaTeX for both the slides of their final presentation and their final project. The committee will use a grading rubric for each and assign a score of 1 for unsatisfactory use of LaTeX, a score of 2 for a satisfactory use of LaTeX, and a score of 3 for an outstanding use of LaTeX. We expect 100% of the students to average 2 or more as evaluated by the committee using this grading rubric to meet this student learning outcome. | | | | |
| **Criteria for Student Success** | 100% of the students average 2 or more as evaluated by the committee using the grading rubric. | | | | |
| **Program Success Target for this Measurement** | | 100% | **Percent of Program Achieving Target** | 100% | |
| **Methods** | A 2-3 person committee appointed by the graduate director of the Master of Science program will evaluate the student’s use of LaTeX for both the slides of their final presentation and their final project. The committee will use a grading rubric for each and assign a score of 1 for unsatisfactory use of LaTeX, a score of 2 for a satisfactory use of LaTeX, and a score of 3 for an outstanding use of LaTeX. | | | | |
| **Based on your results, circle or highlight whether the program met the goal Program Student Learning Outcome 4.** | | | | **Met** | **Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) | | | | | |
| MATH 598 was offered during the 2022-2023 academic year (Spring 2023) and a 2 person committee was formed to assess the students’ use of LaTeX for both the slides of their final presentation and their final project. The assessment was completed in May 2023. This is the second assessment of the use of LaTeX that was completed for ASL. Previous assessment in May 2022 showed that the program success target for Measurement Instrument 1 was met. | | | | | |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) | | | | | |
| MATH 598 will be offered during the 2023-2024 academic year (Fall 2023). | | | | | |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) | | | | | |
| The next assessment will be during the 2023-2024 academic year. We will continue to monitor the rates of meeting this student learning outcome. | | | | | |

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| **Program Student Learning Outcome 5** | | | | | |
| **Program Student Learning Outcome** | Students will be able to write with mathematical maturity commensurate with that of students in a mathematics master’s degree program. | | | | |
| **Measurement Instrument 1** | Students will complete at least one writing assignment in MATH 598, Graduate Seminar: Communicating Mathematics and Technical Writing, a required course for master of science students, in addition to multiple class discussions on writing a thesis and a manuscript for a professional journal. A committee appointed by the graduate director of the Master of Science program will evaluate the written final project. The committee will use a grading rubric for the final project and assign a score of 1 for an unsatisfactory written final project, a score of 2 for a satisfactory written final project, and a score of 3 for an outstanding written final project. We expect 100% of the students to score 2 or more as evaluated by the committee using this grading rubric to meet this student learning outcome. | | | | |
| **Criteria for Student Success** | 100% of the students score 2 or more as evaluated by the committee using the grading rubric. | | | | |
| **Program Success Target for this Measurement** | | 100% | **Percent of Program Achieving Target** | 100% | |
| **Methods** | A 2-3 person committee appointed by the graduate director of the Master of Science program will evaluate the written final project. The committee will use a grading rubric for the final project and assign a score of 1 for an unsatisfactory written final project, a score of 2 for a satisfactory written final project, and a score of 3 for an outstanding written final project. | | | | |
| **Based on your results, circle or highlight whether the program met the goal Program Student Learning Outcome 5.** | | | | **Met** | **Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) | | | | | |
| MATH 598 was offered during the 2022-2023 academic year (Spring 2023) and a 2 person committee was formed to assess the students’ writing with mathematical maturity of their final project. The assessment was completed in May 2023. This is the second assessment of writing that was completed for ASL. Previous assessment in May 2022 showed that the program success target for Measurement Instrument 1 was met. | | | | | |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) | | | | | |
| MATH 598 will be offered during the 2023-2024 academic year (Fall 2023). | | | | | |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) | | | | | |
| The next assessment will be during the 2023-2024 academic year. We will continue to monitor the rates of meeting this student learning outcome. | | | | | |

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| **Program Student Learning Outcome 6** | | | | | |
| **Program Student Learning Outcome** | Students will be able to speak with mathematical maturity commensurate with that of students in a mathematics master’s degree program. | | | | |
| **Measurement Instrument 1** | Students will give at least two presentations in MATH 598, Graduate Seminar: Communicating Mathematics and Technical Writing, a required course for master of science students. A committee appointed by the graduate director of the Master of Science program will evaluate the final presentation. The committee will use a grading rubric for the final presentation and assign a score of 1 for an unsatisfactory final presentation, a score of 2 for a satisfactory final presentation, and a score of 3 for an outstanding final presentation. We expect 100% of the students to score 2 or more as evaluated by the committee using this grading rubric to meet this student learning outcome. | | | | |
| **Criteria for Student Success** | 100% of the students score 2 or more as evaluated by the committee using the grading rubric. | | | | |
| **Program Success Target for this Measurement** | | 100% | **Percent of Program Achieving Target** | 100% | |
| **Methods** | A committee appointed by the graduate director of the Master of Science program will evaluate the final presentation. The committee will use a grading rubric for the final presentation and assign a score of 1 for an unsatisfactory final presentation, a score of 2 for a satisfactory final presentation, and a score of 3 for an outstanding final presentation. | | | | |
| **Based on your results, circle or highlight whether the program met the goal Program Student Learning Outcome 6.** | | | | **Met** | **Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) | | | | | |
| MATH 598 was offered during the 2022-2023 academic year (Spring 2023) and a 2 person committee was formed to assess the students’ abilities to speak with mathematical maturity. The assessment was completed in May 2023. This is the second assessment of speaking that was completed for ASL. Previous assessment in May 2022 showed that the program success target for Measurement Instrument 1 was met. | | | | | |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) | | | | | |
| MATH 598 will be offered during the 2023-2024 academic year (Fall 2023). | | | | | |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) | | | | | |
| The next assessment will be during the 2023-2024 academic year. We will continue to monitor the rates of meeting this student learning outcome. | | | | | |

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| **Program name:** | Master of Science in Mathematics (MS 085) |  |  |  |  |
| **Department:** | Mathematics |  |  |  |  |
| **College:** | Ogden College of Science and Engineering |  |  |  |  |
| **Contact person:** | Mikhail Khenner |  |  |  |  |
| **Email:** | [Mikhail.Khenner@wku.edu](mailto:Mikhail.Khenner@wku.edu) |  |  |  |  |
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| **KEY:** |  |  |  |  |  |
| **I = Introduced** |  |  |  |  |  |
| **R = Reinforced/Developed** |  |  |  |  |  |
| **M = Mastered** |  |  |  |  |  |
| **A = Assessed** |  |  |  |  |  |
|  |  |  | **Learning Outcomes** |  |  |
|  |  |  | **LO1:** | **LO2:** | **LO3:** |
|  |  |  | Students will be able to  read, analyze, and solve  problems in statistics  commensurate with that  of students in a  mathematics master’s  degree program. | Students will be able to read, analyze, and solve problems in applied mathematics commensurate with that of students in a mathematics master’s degree program. | Students will be able to read, analyze, and solve problems in discrete mathematics commensurate with that of students in a mathematics master’s degree program. |
| **Course Subject** | **Number** | **Course Title** |  |  |  |
| Statistics | STAT 549 | Statistical Methods I | M, A | N/A | N/A |
| Applied Mathematics | MATH 531 or MATH 535 | Advanced Differential Equations or Advanced Applied Mathematics-I | N/A | M, A | N/A |
| Discrete Mathematics | MATH 541 or MATH 542 | Graph Theory or Advanced Topics in Discrete Mathematics | N/A | N/A | M, A |
| Communicating Mathematics and Technical Writing | MATH 598 | Graduate Seminar | N/A | N/A | N/A |

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| **Program name:** | Master of Science in Mathematics (MS 085) |  |  |  |  |
| **Department:** | Mathematics |  |  |  |  |
| **College:** | Ogden College of Science and Engineering |  |  |  |  |
| **Contact person:** | Mikhail Khenner |  |  |  |  |
| **Email:** | [Mikhail.Khenner@wku.edu](mailto:Mikhail.Khenner@wku.edu) |  |  |  |  |
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| **KEY:** |  |  |  |  |  |
| **I = Introduced** |  |  |  |  |  |
| **R = Reinforced/Developed** |  |  |  |  |  |
| **M = Mastered** |  |  |  |  |  |
| **A = Assessed** |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  | **LO4:** | **LO5:** | **LO6:** |
|  |  |  | Students will be able to demonstrate command of LaTeX, a powerful mathematical typsetting language. | Students will be able to write with mathematical maturity commensurate with that of students in a mathematics master’s degree program. | Students will be able to speak with mathematical maturity commensurate with that of students in a mathematics master’s degree program. |
| **Course Subject** | **Number** | **Course Title** |  |  |  |
| Statistics | STAT 549 | Statistical Methods I | N/A | N/A | N/A |
| Applied Mathematics | MATH 531 or MATH 535 | Advanced Differential Equations or Advanced Applied Mathematics-I | N/A | N/A | N/A |
| Discrete Mathematics | MATH 541 or MATH 542 | Graph Theory or Advanced Topics in Discrete Mathematics | N/A | N/A | N/A |
| Communicating Mathematics and Technical Writing | MATH 598 | Graduate Seminar | M, A | M, A | M, A |