

AC 2019 – 2020 Assessment

Mathematics Bachelor of Science Program

College: Arts and Sciences

Prepared by: Frank Serio

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Approved by: Francene J Lemoine

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Northwestern Mission. Northwestern State University is a responsive, Student-oriented institution that is committed to the creation, dissemination, and acquisition of knowledge through teaching, research, and service. The University maintains as its highest priority excellence in teaching in graduate and undergraduate programs. Northwestern State University prepares its Students to become productive members of society and promotes economic development and improvements in the quality of life of the citizens in its region.

College of Arts and Sciences' Mission. College of Arts and Sciences' Mission. The College of Arts & Sciences, the largest college at Northwestern State University, is a diverse community of scholars, teachers, and students, working collaboratively to acquire, create, and disseminate knowledge through transformational, high-impact experiential learning practices, research, and service. The College strives to produce graduates who are productive members of society equipped with the capability to promote economic and social development and improve the overall quality of life in the region. The College provides an unequalled undergraduate education in the social and behavioral sciences, English, communication, journalism, media arts, biological and physical sciences, and the creative and performing arts, and at the graduate level in the creative and performing arts, English, TESOL, and Homeland Security. Uniquely, the College houses the Louisiana Scholars' College (the State's designated Honors College), the Louisiana Folklife Center, and the Creole Center, demonstrating its commitment to community service, research, and preservation of Louisiana's precious resources.

Department of Mathematics. The Department of Mathematics is dedicated to the development of students for roles in academic, professional, and research careers in the various areas of the field of mathematics. The department also fosters the mathematical development of all students through our offerings in general education and support courses for other degree programs. We are committed to providing a modern, effective education to all students using traditional practices and current technology throughout our course offerings. The department delivers Bachelor of Science degrees in Mathematics with available concentrations in Healthcare Informatics and Actuarial Mathematics. A minor in Mathematics is also available.

Mathematics Program Mission Statement: The Department of Mathematics offers a Bachelor of Science in Mathematics. The coursework includes a foundation in the classic coursework in mathematics covering Calculus, Foundations, and Algebra which is enhanced with a strong student research component. All coursework is delivered using appropriate, modern technology. Mathematics coursework is supplemented with a strong

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selection of courses in the Biological, Physical, and Computer Sciences. Choice of upper-level electives allows for customization of the degree emphasizing preparation for graduate school or a professional career or a mixture of both. The concentrations in Healthcare Informatics and Actuarial Mathematics also require an Internship experience further preparing the student for a professional career.

Methodology: The assessment process for the BS program is as follows:

- (1) Data from assessment tools (both direct – indirect, quantitative and qualitative) are collected and returned to the department head.
- (2) The department head will analyze the data to determine whether students have met measurable outcomes.
- (3) Results from the assessment will be discussed with the faculty.
- (4) The Department Head, in consultation with the Advisory Committee, will propose changes to measurable outcomes, assessment tools for the next assessment period and, where needed, curricula and program changes.

Student Learning Outcomes:

SLO 1. Students will gain a strong understanding of the fundamental ideas, concepts, and applications of mathematics

Course Map: Tied to course syllabus objectives.

MATH2110: Analytic Geometry and Calculus II

MATH3100: Modern Algebra I

MATH4950: Mathematics – A Capstone Course

Measure 1.1. (Direct – other)

MATH2110 is taken at the end of the freshman year. MATH3100 is the last explicitly required course before the student begins taking upper-level electives in mathematics. MATH4950 is the senior research project course taken shortly before graduation. By looking at the pass rate in each of these courses, we get a sense of whether majors are making progress. The targets are 75% of Mathematics majors earn a Grade of C or higher in 2110. 90% of Mathematics majors earn a Grade of C or higher in 3100 and 4950.

Finding: Overall target not met

- MATH2110 – target not met
- MATH3100 – target met
- MATH4950 – target met

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Analysis: In AC 2018-2019, MATH 2110 met the target, MATH 3100 met the target, and MATH 4950 did not meet the target.

In AC 2019 – 2020, the following results were measured:

- MATH2110 – 2 of 3 math majors met the goal – 67%
 - (0 of 0 in Fall 2019, 2 of 3 in Spring 2020)
- MATH3100 – 5 of 5 math majors met the goal. – 100%
 - (5 of 5 in Fall 2019, not taught Spring 2020)
- MATH4950 – 4 of 4 math majors met the goal. – 100%
 - (0 of 0 in Fall 2019, 4 of 4 in Spring 2020)

There was a slight downturn in MATH2110. Results from MATH3100 held at optimal levels. Results from MATH4950 showed dramatic improvement.

Given that the only data to collect for MATH2110 was during the Spring 2020 semester and that semester was disrupted by the Covid19 pandemic, the department is unable to draw too many conclusions from the data.

Continued adjustments to the homework structure in MATH3100 allowed for better outcomes. An explicit Class Participation component was added to the grading which resulted improvements with completion of assignments.

Implementation of MATH4940 improved performance in MATH4950 as expected.

Decision: Based on the analysis of the AC 2018-2019 results, and to drive improvement, faculty will do the following: Faculty will meet during on-call week in August to discuss the topics which are mandatory, and which are optional in MATH 2110. In the past, the coursework has not been consistent from instructor to instructor. The department will also develop a formal instrument to use in measure 4.1. Homework assignments in MATH3100 are stable. Faculty will continue to experiment with a Class Participation grade. As the unified rubric system for evaluating writing across the curriculum comes online, faculty will place a greater emphasis on the importance of cogent writing in mathematics. This will help solidify progress in this area. In addition, faculty will implement the additional goal of 50% of the mathematics majors earning a grade of B or better. Implementation of the unified rubric throughout the curriculum will solidify the progress in MATH4950. In addition to keeping the goal of 90% of majors earning a grade of C or better, the department will implement the additional goal of 50% of the mathematics majors earning a grade of B or better.

Measure 1.2. (Indirect – Attitude)

Students make a self-assessment of their preparation in the Graduating Senior Survey. We examine responses to questions on the ability to “reason abstractly” and “Use numerical data and statistics.” Our targets are 75% or more of Mathematics majors will

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report "Satisfied" or "Very Satisfied" to the questions regarding how their education has helped them in these areas.

Finding: No data was collected.

Analysis: In AC 2018-2019, the target was met. One hundred percent (100%, 1 of 1) of students who participated in the survey responded "Very Satisfied" in both areas. The remainder of the graduating seniors did not respond to the survey.

In AC 2019-2020, the plan had been to administer this survey during class time in MATH4950. There were no mathematics majors in MATH4950 in the fall 2019 semester. In mid-March, plans were being made to schedule a survey date in late April. Because of the statewide shelter-in-place order due to the COVID-19 pandemic, faculty were unable to administer this survey.

Decision: Based on the analysis of the AC 2018-2019 results and having no data to act on for AC 2019 - 2020, the department will continue with the plan for the last assessment cycle: to drive improvement, faculty will integrate this activity into MATH4950 to increase the number of responses.

Measure: 1.3. (Direct – Skill/Activity)

All mathematics majors will take the ETS Major Field Exam in Mathematics during the semester they take MATH4950. Our target is 75% or more of mathematics majors will score above the 50th percentile on the exam.

Findings: No data was collected.

Analysis: In AC 2018-2019, the target was not met. Twenty-five percent (25%, 1 of 4) students scored above the 50th percentile on the exam.

In AC 2019-2020, the plan had been to administer this exam during class time in MATH4950. There were no mathematics majors in MATH4950 in the fall 2019 semester. In mid-March, plans were being made to schedule a test date in late April. Because of the statewide shelter-in-place order due to the COVID-19 pandemic, faculty were unable to administer this test.

Analysis during the previous year of the test results indicates that students are not putting forth the effort because the exam is not connected to any coursework and, therefore, a low priority for them.

Decision: Based on the analysis of the AC 2018-2019 results and having no data to act on for AY2019-2020, the department will continue with the plan for last assessment cycle: to drive improvement, faculty will devote a day of MATH 4950 to the administration of the exam to increase participation and engagement with the exam.

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SLO 2. Students will demonstrate a college-level proficiency in oral communication of mathematical concepts.

Course Map: Tied to course syllabus below.

MATH1010: Introduction to Mathematics

MATH2080: Fundamentals of Proof

MATH4950: Mathematics

Measure: 2.1. (Direct – Skill/Activity)

All mathematics majors take MATH1010 the first fall semester they are a major. Their final project is to make a presentation on a career in mathematics which they have researched. In AC 2018 – 2019, our goal was for 75% of mathematics majors to score 70% or higher on their final presentation.

For the first time this Academic Year (AC 2019-2020), we have a unified rubric for use in evaluating Oral Communications of Mathematical Ideas. Students were evaluated in the categories of Organization, Delivery, and Visual Support; they will be given a score of 0-2 in each category. Our goal is that 70 of students will score at least 5 out of 6 possible points

Findings: Target met.

Analysis: In AC 2018-2019, the target was met. There were 7 mathematics majors. All 7 scored higher than 70% on the final presentation. Four (4) of the students scored above 90% on the presentation. In AC 2019-2020, faculty refined the rubric to give clearer evaluation to students.

In AC 2019 – 2020, 71% of students (5 of the 7 mathematics majors in this class) scored at least 5 points in these three categories.

Decision: Based on the analysis of the AC 2019-2020 results, and to drive improvement, faculty will begin a thorough discussion of the rubric at the beginning of this course to make the basis for their evaluations clear. Faculty believe evaluating these presentations using a unified rubric system for evaluating oral communication of mathematical ideas will allow them to give still more granular feedback to the students. In addition, the department will raise the goal to 85% of students in MATH1010 scoring 5 out of 6 points on the rubric.

Measure: 2.2. (Direct – Skill/Activity)

Mathematics majors take MATH2080 the fall of their sophomore year. In this course, students are required to present solutions of proofs on the board. Students only receive credit for the presentation if it is correct and complete. Our goal for AC 2018-2019 was at

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least 75% of mathematics majors in MATH2080 will complete the required quota of presentations (this quota varies from year to year based on the size of the class).

For the first time this Academic Year (AC 2019-2020), we have a unified rubric for use in evaluating Oral Communications of Mathematical Ideas. This will allow us to evaluate quality rather than just quantity. Students were evaluated in the categories of Mathematics and Delivery; they will be given a score of 0-2 in each category. Our goal is that 75% of students will score at least 3 out of 4 possible points

Findings: Target met.

Analysis: In AC 2018-2019, the target was met. There were 11 mathematics majors enrolled in MATH 2080. Of these 11, 10 met the quota. This gives a 91% success rate. In AC 2019 – 2020, there was only 1 mathematics major enrolled in MATH2080. This student scored 4 out of 4 possible points giving us a success rate of 100% (with an admittedly very small sample size). In AC 2019-2020, faculty refined the rubric to give clearer evaluation to students.

Decision: Based on the analysis of the AC 2019-2020 results, and to drive improvement, faculty continue a discussion of the rubric at the beginning of this course to make the basis for their evaluations clear. Faculty believe evaluating these presentations using a unified rubric system for evaluating oral communication of mathematical ideas will allow them to give still more granular feedback to the students. In addition, the department will raise the goal to 85% of students in MATH2080 scoring at least 3 out of 4 points on the rubric.

Measure: 2.3. (Direct – Skill/Activity)

All mathematics majors take MATH4950 either the last or next to last semester before graduation. This class involves an independent research project which culminates in a paper and a public presentation. Our goal in AC 2018 – 2019 was at least 75% of mathematics majors in MATH4950 will score 7 out of 10 or better on the presentation rubric on their final presentation.

For the first time this Academic Year (AC 2019-2020), we have a unified rubric for use in evaluating Oral Communications of Mathematical Ideas. Students were evaluated in all five categories: Organization, Central Message, Mathematics, Delivery, and Visual Support; they will be given a score of 1-4 in each category. Our goal is that 70% of students will score at least 18 out of 20 possible points.

Findings: Target not met.

Analysis: In AC 2018-2019, the target was met with a 100% success rate. In Fall 2018, there were 3 mathematics majors enrolled in the course. Of these, all scored 7/10 or better. In Spring 2019, there was 1 mathematics major enrolled in this course. That student scored 7/10 on their final presentation. For the academic year, 4 of 4 met the goal

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for a 100% success rate. In AC 2019-2020, faculty refined the rubric to give clearer evaluation to students.

In AC 2019-2020, the success rate was 50%. There were no mathematics majors enrolled in Fall 2019. There were 4 in Spring 2020. Of these, 2 out of 4 scored 18 or better on the rubric. It should be noted that the other 2 students each scored a 17 on the rubric, so they were very close to meeting the goal.

Decision: Based on the analysis of the AC 2019-2020 results, and to drive improvement, faculty continue a discussion of the rubric at the beginning of this course to make the basis for their evaluations clear. Evaluating these presentations using a unified rubric system for evaluating oral communication of mathematical ideas will allow faculty to give more granular feedback to the students. As faculty continue to integrate this rubric into the curriculum student learning will improve.

SLO 3. The students will demonstrate proficiency in written communication of mathematical concepts.

Course Map: Tied to course syllabus below.

MATH3100: Modern Algebra I

MATH4950: Mathematics – A Capstone Course

Measure 3.1. (Direct – Skill/Activity)

MATH3100 is the last required course before majors begin their upper-level elective courses in mathematics. Responses to questions on the final exam will be analyzed to determine if students are writing about mathematics at the appropriate level. At least 75% of students will display the ability to write cogently and logically.

For the first time this Academic Year (AC 2019-2020), we have a unified rubric for use in evaluating Written Communications of Mathematical Ideas. Students were evaluated on two questions from their final exam using the Logical Rigor, Thoroughness and Depth, and Conventions sections of the rubric. Each category was scored from 1-3. Our goal was that 70% of mathematics majors would score at least 15 out of 18 on this assessment.

Findings: Target met.

Analysis: In AC 2018-2019, the target was met. There was 1 mathematics major in the course in the Fall 2018 semester. This student displayed written skills at an acceptable level in this course. This is a success rate of 100%.

In AC 2019 – 2020, the success rate was 80%. There were 5 mathematics majors in the class and 4 scores 15 points or better.

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The changes to the structure of homework assignments drove success in this area. The integration of the unified rubric made faculty feedback more effective.

Decision: Based on the analysis of the AC 2019-2020 results, and to drive improvement, faculty continue a discussion of the unified rubric at the beginning of this course to make the basis for their evaluations clear. Evaluating these papers using a unified rubric system for evaluating written communication of mathematical ideas will allow faculty to give more granular feedback to the students. As the department continues to integrate this rubric into the curriculum, student learning will improve. In addition, the department will raise the goal to 85% of student scoring at least 15 points out of 18 on the assessment.

Measure: 3.2. (Direct – Skill/Activity)

All mathematics majors take MATH4950 either the last or next to last semester before graduation. This class involves an independent research project which culminates in a paper and a public presentation. At least 75% of mathematics majors in MATH4950 will score 10 out of 14 or better on the rubric for their final paper.

For the first time this Academic Year (AC 2019-2020), we have a unified rubric for use in evaluating Written Communications of Mathematical Ideas. Students were evaluated in all five categories: Context, Organization, Logical Rigor, Thoroughness and Depth, and Conventions; they will be given a score of 1-4 in each category. Our goal is that 70% of students will score at least 18 out of 20 possible points.

Findings: Target met.

Analysis: In AC 2018-2019, the target was met. In the Fall 2018 semester, there were 3 mathematics majors enrolled in the course. Of these, 3 scored 10/14 or better. In the Spring 2019 semester, there was 1 mathematics major enrolled in this course. This student did not score 10 out of 14 on their final paper. For the academic year, 3 of 4 met the goal for a 75% success rate. In AC 2019-2020, faculty refined the rubric to give clearer evaluation to students. MATH 4940 was introduced as a prerequisite for MATH 4950 to improve student learning.

In AC 2019 – 2020, the success rate was 75%. There were no mathematics majors enrolled in Fall 2019. There were 4 in Spring 2020. Of these, 3 out of 4 scored 18 or better on the rubric. It should be noted that the other student scored a 17 on the rubric, so they were very close to exceeding the goal.

Decision: Based on the analysis of the AC 2019-2020 results, and to drive improvement, faculty continue a discussion of the rubric at the beginning of this course to make the basis for their evaluations clear. Evaluating these papers using a unified rubric system for evaluating written communication of mathematical ideas will allow faculty to give more granular feedback to the students. As the department continues to integrate this rubric into the curriculum, student learning will improve. In addition, the department will raise the goal to 85% of mathematics majors earning a score of at least 18 out of 20.

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SLO 4. Students will demonstrate proficiency in use of technology for problem solving and communication

Course Map: Tied to course syllabus below.

MATH2110: Analytic Geometry and Calculus II

MATH4950: Mathematics – A Capstone Course

Measure 4.1. (Direct – Skill/Activity)

MATH2110 is the second semester of Calculus. The use of technology is integrated into this course. A survey of questions on the final exam which require technology to answer will allow us to assess whether mathematics majors have mastered the appropriate skills. Our target is 75% of students will display competency with technology.

Findings: Target not met.

Analysis: In AC 2018-2019, the target was met. There were two students enrolled in the course in the Fall 2018 semester and two students enrolled in the course in the Spring 2019 semester. Both students in the fall semester displayed proficiency. However, only one student in the spring semester displayed proficiency. For the entire academic year, 75% of students measured displayed proficiency. In AC 2019-2020, faculty discussed mandatory and optional topics and assignments for MATH 2110 to be more unified across sections.

In AC 2019 – 2020 the success rate was 67%. There were no mathematics majors enrolled in MATH2110 in the Fall 2019 semester. In the Spring 2020 semester, there were 3 mathematics majors in MATH2110. 2 of the 3 displayed proficiency.

Given that the only data to collect for MATH2110 was during the Spring 2020 semester and that semester was disrupted by the COVID-19 pandemic, the department is unable to draw too many conclusions from the data.

Decision: Based on the analysis of the AC 2019-2020 results, faculty will meet during on-call week in August to address the concerns from Measure 4.1 by discussing the topics which are mandatory, and which are optional in MATH 2110. In the past, the coursework has not been consistent from instructor to instructor. Faculty will also develop a formal instrument to use in this measure.

Measure 4.2. (Direct – Skill/Activity)

All mathematics majors take MATH4950 either the last or next to last semester before graduation. This class involves an independent research project which culminates in a

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paper and a public presentation using presentation software. The “organization” portion of the presentation rubric evaluates the ability to integrate equations, mathematical symbols, graphs, and other illustrations into an electronic presentation. Our target is 75% of mathematics majors will earn a score of 2 out of 3 or better on Organization on their final presentation.

For the first time this Academic Year (AC 2019-2020), we have a unified rubric for use in evaluating Oral Communications of Mathematical Ideas. Students were evaluated in all five categories: Organization, Central Message, Mathematics, Delivery, and Visual Support; they will be given a score of 1-4 in each category. For this measure Organization and Visual Support will be used as they cover the technical aspects of the presentation. Our goal is that 70% of students will score at least 6 out of 8 possible points.

Findings: Target met.

Analysis: In AC 2018-2019, the target was met. During the Fall 2018 semester, there were 3 mathematics majors enrolled in the course. Of these, 2 scored a perfect 3/3 on Organization, and the 3rd scored 2/3. In the Spring 2019 semester, there was 1 mathematics major enrolled in this course who scored 2/3 on Organization. For the academic year, 4 of 4 met the goal for a 100% success rate. In AC 2019-2020, faculty discussed mandatory and optional topics and assignments for MATH 2110 to be more unified across sections.

In AC 2019-2020, the success rate was 100%. There were no mathematics majors enrolled in Fall 2019. There were 4 in Spring 2020. Of these, 4 out of 4 scored 6 or better on the rubric.

The experience of taking an introductory course in student research practices, MATH4940, has helped these students to master the technical aspects.

Decision: Based on the analysis of the AC 2019-2020 results, and to drive improvement, faculty continue a discussion of the rubric at the beginning of this course to make the basis for their evaluations clear. Evaluating these presentations using a unified rubric system for evaluating oral communication of mathematical ideas will allow faculty to give more granular feedback to the students. As the department continues to integrate this rubric into the curriculum, student learning will improve. In addition, the department will modify the goal to 90% of students will score at least 6 out of 8 and 50% will score at least 7.

Measure 4.3. (Direct – Student Artifact)

All mathematics majors take MATH4950 either the last or next to last semester before graduation. This class involves an independent research project which culminates in a paper and a public presentation. A rating of Satisfactory or better on the Conventions and Clarity portions of the paper rubric displays the ability to integrate equations,

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mathematical symbols, graphs, and other illustrations into text. Our target is 75% of mathematics majors will score Satisfactory or better on the Conventions and Clarity portion of the paper rubric.

For the first time this Academic Year (AC 2019-2020), we have a unified rubric for use in evaluating Written Communications of Mathematical Ideas. Students were evaluated in all five categories: Context, Organization, Logical Rigor, Thoroughness and Depth, and Conventions; they will be given a score of 1-4 in each category. The corresponding categories in our new rubric are Context and Conventions. Our goal is that 70% of students will score at least 6 out of 8 possible points.

Findings: Target met.

Analysis: In AC 2018-2019, the target was met. In the Fall 2018 semester, there were 3 mathematics majors enrolled in the course. Of these, all 3 scored Satisfactory or better on Conventions and Clarity. In the Spring 2019 semester, there was 1 mathematics major enrolled in this course who did not score Satisfactory or better on Conventions and Clarity. For the academic year 3 of 4 met the goal for a success rate of 75%. In AC 2019-2020, faculty discussed mandatory and optional topics and assignments for MATH 2110 to be more unified across sections.

In AC 2019-2020, the success rate was 100%. There were no mathematics majors enrolled in Fall 2019. There were 4 in Spring 2020. Of these, 4 out of 4 scored 6 or better on the rubric.

Decision: Based on the analysis of the AC 2019-2020 results, and to drive improvement, faculty continue a discussion of the rubric at the beginning of this course to make the basis for their evaluations clear. Evaluating these papers using a unified rubric system for evaluating written communication of mathematical ideas will allow faculty to give more granular feedback to the students. As the department continues to integrate this rubric into the curriculum, student learning will improve. In addition, the department will modify the goal to 90% of students will score at least 6 out of 8 and 50% will score at least 7.

SLO 5. Students will develop the ability to think in an analytical fashion.

Course Map: Tied to course syllabus below.

MATH2080: Fundamentals of Proof

MATH4950: Mathematics – A Capstone Course

Measure 5.1. (Direct - Skill)

MATH2080 is the first course in the mathematics major where students are expected to write at length about mathematics. Responses to questions on the final exam in this course will be evaluated regarding whether the student can write about mathematics in a

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clear and logically rigorous manner. Our target is for 75% or higher of mathematics majors to show proficiency on this measure.

For the first time this Academic Year (AC 2019-2020), we have a unified rubric for use in evaluating Written Communications of Mathematical Ideas. This will allow us to evaluate quality rather than just quantity. Students were evaluated in the categories of Logical Rigor, Thoroughness and Depth, and Conventions; they will be given a score of 0-2 in each category. Our goal is that 75% of students will score at least 6 out of 6 possible points

Findings: Target met.

Analysis: In AC 2018-2019, the target was met. In Fall 2018, there were 11 mathematics majors enrolled in the class. Of these 9 demonstrated appropriate levels of skill in critical thinking and analysis on their Final Exam for a success rate of 82%. In AC 2019-2020, faculty placed a greater emphasis on the importance of cogent writing in mathematics. A unified rubric system was implemented across the mathematics curriculum.

In AC 2019 – 2020, there was only 1 mathematics major enrolled in MATH2080. This student scored 6 out of 6 possible points giving a success rate of 100% (with an admittedly very small sample size).

Decision: Based on the analysis of the AC 2018-2019 results, and to drive improvement, faculty continue a discussion of the rubric at the beginning of this course to make the basis for their evaluations clear. Evaluating this written work using a unified rubric system for evaluating written communication of mathematical ideas will allow faculty to give still more granular feedback to the students. In addition, the department will raise the goal to 85% of students in MATH2080 scoring at least 5 out of 6 points on the rubric.

Measure 5.2. (Direct - Knowledge)

All mathematics majors take MATH4950 either the last or next to last semester before graduation. This class involves an independent research project which culminates in a paper and a public presentation. A rating of Satisfactory or better on the Organization and Depth portions of the paper rubric displays the think analytically. Our target is 75% of mathematics majors will score Satisfactory or better on the Organization and Depth portion of the paper rubric.

For the first time this Academic Year (AC 2019-2020), we have a unified rubric for use in evaluating Written Communications of Mathematical Ideas. Students were evaluated in all five categories: Context, Organization, Logical Rigor, Thoroughness and Depth, and Conventions; they will be given a score of 1-4 in each category. The corresponding categories in our new rubric are Organization, Logical Rigor, and Thoroughness and Depth. Our goal is that 70% of students will score at least 9 out of 12 possible points.

Findings: Target met.

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Analysis: In AC 2018-2019, the target was met. In the Fall 2018 semester, there were 3 mathematics majors enrolled in the course. Of these, 3 scored Satisfactory or better on both Depth and Organization. In the Spring 2019 semester, there was 1 mathematics major enrolled in this course who did not score Satisfactory or better on Organization and Depth. For the academic year 3 of 4 met the goal for a success rate of 75%. MATH 4940 was introduced as a prerequisite for MATH 4950 to improve student learning.

In AC 2019-2020, the success rate was 100%. There were no mathematics majors enrolled in Fall 2019. There were 4 in Spring 2020. Of these, 4 out of 4 scored 9 or better on the rubric.

Decision: Based on the analysis of the AC 2019-2020 results, and to drive improvement, faculty continue a discussion of the rubric at the beginning of this course to make the basis for their evaluations clear. Evaluating these papers using a unified rubric system for evaluating written communication of mathematical ideas will allow faculty to give more granular feedback to the students. As the department continues to integrate this rubric into the curriculum, student learning will improve. In addition, the department will modify the goal to 90% of students will score at least 9 out of 12 and 50% will score at least 10.

Comprehensive Summary of Key Evidence of Improvement Based on Analysis of Results

For AC 2018-2019, the Mathematics Bachelor of Science program assessed 13 measures for 5 student learning outcomes (SLOs). Decisions that were implemented in AC 2019-2020 were:

- MATH4940 was fully implemented. All students who participated in MATH4950 in this academic year had completed MATH4940 as a prerequisite.
- Faculty refined the rubric to give clearer evaluation to students.
- The uniform rubric for Oral Communications of Mathematical Ideas was finalized. It was used to assess students work in MATH1010, 2080, 4940, and 4950.
- In AC 2019-2020, faculty discussed mandatory and optional topics and assignments for MATH 2110 to be more unified across sections.
- In AC 2019-2020, faculty placed a greater emphasis on the importance of cogent writing in mathematics.
- The uniform rubric for Written Communications of Mathematical Ideas was finalized. It was used to assess student work in MATH2080, 3100, 4940, and 4950.

Plan of Action Moving Forward

The program showed improvement in several areas. To help to continue to make and/or solidify progress faculty will make the following changes.

- Faculty will meet during on-call week in August to discuss the topics which are mandatory, and which are optional in MATH 2110. In the past, the coursework

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has not been consistent from instructor to instructor. The department will also develop a formal instrument to use in measure 4.1.

- Homework assignments in MATH3100 are stable. Faculty will continue to experiment with a Class Participation grade. As the unified rubric system for evaluating writing across the curriculum comes online, faculty will place a greater emphasis on the importance of cogent writing in mathematics. This will help solidify progress in this area. In addition, faculty will implement the additional goal of 50% of the mathematics majors earning a grade of B or better.
- Implementation of the unified rubric throughout the curriculum will solidify the progress in MATH4950. In addition to keeping the goal of 90% of majors earning a grade of C or better, the department will implement the additional goal of 50% of the mathematics majors earning a grade of B or better.
- Faculty will begin a thorough discussion of the rubric at the beginning of this course to make the basis for their evaluations clear.

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APPENDIX

Uniform Rubrics for Math Paper/Presentations

The descriptions below each category give the expectations to receive an excellent evaluation, i.e. what is expected of our best students.

Written Communication

1. Context

Clear, focused statement of problem or topic; Demonstrates thorough understanding of context, audience, and purpose; Relevant contextual factors addressed; Problem is of a level appropriate to a senior mathematics major; Research plan is well thought out

2. Organization

Clear organization effectively supports the central idea; Introduction includes clear statement of problem; No awkward transitions; Conclusion is thorough and specific; Uses graceful language that skillfully communicates meaning

3. Logical Rigor

Development of topics is clear and logical; Assertions clearly stated and well supported; Mathematics is correct and fully demonstrated; Evaluation of solutions is deep and elegant; Definitions and notation clearly stated or explained; Reaches sound, justified conclusions

4. Thoroughness and Depth

Uses appropriate, relevant, and compelling content to illustrate mastery of the subject; Addresses thoroughly and deeply the contextual factors of the problem; Demonstrates working knowledge and understanding of the mathematics; Reviews results with specific consideration of need for further work

5. Conventions

Voice is appropriate for mathematical writing; Word use is precise and accurate; Document is free of errors; Formatted in an appropriate and professional manner which strengthens the development of the central idea; Sources are cited and quoted appropriately

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Oral Communication

1. Organization

Organization pattern makes the content of the presentation cohesive; Gives clear statement of problem; Sequence of presented material allows listener to follow; Conclusion is thorough and specific; Length is appropriate

2. Central Message

Central message is precisely stated, appropriately repeated and strongly supported; Language is appropriate to audience; Focus is on big concepts more than rote skills; Questions addressed thoroughly

3. Mathematics

Mathematics presented makes sense; Defines unfamiliar terminology and notation; Probes beyond surface material; Examples, explanations, and illustrations establish presenter's credibility and command of subject matter

4. Delivery

Speaks clearly and audibly; Speaker actively engages the audience through eye contact, posture, expressiveness, etc.; Pace is appropriate; Speaker appears polished and confident

5. Visual Support

Prepared visual aids complement the speaker's presentation without distracting from the presentation; Illustrations and typefaces formatted professionally; Slides contain appropriate amount of material