Assessment Cycle AY 2018 – 2019

Mathematics Bachelor of Science Program

College: Arts and Sciences

Prepared by: Frank Serio **Date: January 8, 2019**

Approved by: Greg Handel **Date: July 17, 2019**

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 unequaled 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 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:

- MATH2110 – 3 of 4 math majors met the goal – 75%
  (2 of 2 in Fall 2018, 1 of 2 in Spring 2019)
- MATH3100 – 2 of 2 math majors met the goal. – 100%

(2 of 2 in Fall 2018, not taught Spring 2019)
- MATH4950 – 3 of 4 math majors met the goal. – 75%
  (2 of 3 in Fall 2018, 1 of 1 in Spring 2019)

Analysis: In AY 2017-2018 the following results were measured:
- MATH2110 – 3 of 3 math majors met the goal – 100%
  (1 of 1 in Fall 2017, 2 of 2 in Spring 2018)
- MATH3100 – 2 of 2 math majors met the goal. – 100%
  (2 of 2 in Fall 2017, not taught Spring 2018)
- MATH4950 – 2 of 4 math majors met the goal. – 50%
  (2 of 3 in Fall 2017, 0 of 1in Spring 2018)

There was a downturn in MATH2110. Results from MATH4950 show modest improvement.

Continuing adjustments to the homework structure in MATH3100 seem to be leading to better outcomes. An explicit Class Participation component was added to the grading which resulted improvements with completion of assignments.

Decision: Based on the analysis of the AY 2018-2019 results, and to drive improvement, faculty will meet during on-call week in August to have a meeting 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.

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.

Faculty are currently implementing the current QEP. Starting this fall, all students taking MATH4950 will have completed an introductory course in mathematical research, MATH4940. This will help aid improvement in this area.

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

Finding: Target met.

Analysis: In AY 2017-2018 the target was not met. The following results were measured: 100% of students reported “Very Satisfied” in both areas.
- (0 of 1 response in Fall 2017, 1 of 1 response in Spring 2018)

Assessment Cycle AY 2018 – 2019

In AY 2018-2019, 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.

Decision: Based on the analysis of the AY 2018-2019 results, and 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: Target not met.

1 of 4 students met the goal – 25%

Analysis: There is no data on this measure from previous academic years. In AY 2018-2019, 25% (1 of 4) students scored above the 50th percentile on the exam. Analysis 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 AY 2018-2019 results, and 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.

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. For the first time this Academic Year, MATH1010 is a A – F Graded class instead of Pass/Fail. Our target is for 75% of mathematics majors to score higher than 70% on their final presentation.

Findings: Target met.

Assessment Cycle AY 2018 – 2019

Analysis: In AY 2017-2018, the target was met. Twelve (12) mathematics majors were enrolled in MATH 1010. Of these, 11 made a passing grade on the final presentation for a 92% success rate.

In AY 2018-2019, there were 7 mathematics majors. All 7 scored higher than 70% on the final presentation. Thus, the target was 100% met. Four (4) of the students scored above 90% on the presentation.

Decision: Based on the analysis of the AY 2018-2019 results, and to drive improvement, faculty will be evaluating these presentations using a unified rubric system for evaluating oral communication of mathematical ideas. This will allow faculty to give still more granular feedback to the students.

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. At 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).

Findings: Target met.

Analysis: In AY 2017-2018 the target was met. There were 2 mathematics majors enrolled in MATH 2080. Both students met the quota.

In AY 2018-2019, there were 11 mathematics majors enrolled in MATH 2080. Of these 11, 10 met the quota. This gives a 91% success rate.

Decision: Based on the analysis of the AY 2018-2019 results, and to drive improvement, faculty will be evaluating these presentations under the unified rubric system for evaluating oral communication of mathematical ideas. This will allow faculty to give still more granular feedback to the students.

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. At least 75% of mathematics majors in MATH4950 will score 7 out of 10 or better on the presentation rubric on their final presentation.

Findings: Target met.

Analysis: In AY 2017-2018 the target was not met. In Fall 2017, there were 3 mathematics majors enrolled in the course. Of these, 2 scored 7/10 or better (the

remaining one did not make a final presentation). And in Spring 2018, there was 1 mathematics major enrolled in the course. This student did not make a final presentation. For the academic year 2 of 4 met the goal for a 50% success rate.

In AY 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 for a 100% success rate.

Decision: Based on the analysis of the AY 2018-2019 results, and to drive improvement, faculty will be evaluating these presentations under the unified rubric system for evaluating oral communication of mathematical ideas.

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.

Findings: Target met.

Analysis: In AY 2017-2018 the target was met. There were 2 mathematics majors in the course in the Fall 2017 semester. Both students displayed written skills at an acceptable level in this course. This is a success rate of 100%.

In AY 2018-2019, 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%.

The changes to the structure of homework assignments continues to contribute to success in this area.

Decision: Based on the analysis of the AY 2018-2019 results, and to drive improvement, faculty will place a greater emphasis on the importance of cogent writing

in mathematics. A unified rubric system for evaluating writing across the mathematics curriculum will come online.

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.

Findings: Target met.

Analysis: In AY 2017-2018 the target was not met. In the Fall 2017 semester, there were 3 mathematics majors enrolled in the course. Of these, 2 scored perfect 14/14 well exceeding the target (the remaining one did not turn in a final paper). In the Spring 2018 semester, there was 1 mathematics major enrolled in the course. This student did not turn in a final paper. For the academic year 2 of 4 met the goal for a 50% success rate.

In AY 2018-2019, 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.

Decision: Based on the analysis of the 2018-2019 results, and to drive improvement, faculty will be evaluating these papers under the unified rubric system for evaluating written communication of mathematical ideas. Also, in Fall 2019, students entering this course will have completed MATH4940. This is a new course designed in conjunction with our QEP which will help improvements in this area.

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 met.

Analysis: In AY 2017-2018 the target was met. In the Fall 2017 semester, there was 1 mathematics major enrolled in the course. That student displayed proficiency. In the Spring 2018 semester, there were 3 mathematics majors enrolled in the course. Of these, 3 displayed proficiency. For the academic year 4 of 4 displayed proficiency for a 100% success rate.

In AY 2018-2019, 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.

Decision: Based on the analysis of the results from AY 2018-2019, and to drive improvement, during on-call week, faculty will meet to discuss which topics are mandatory and which topics are optional for MATH 2110. In the past, coursework from instructor to instructor has varied greatly.

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 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.

Findings: Target met.

Analysis: In AY 2017-2018, the target was not met. In the Fall 2017 semester, there were 3 mathematics majors enrolled in the course. Of these, 2 scored a perfect 3/3 on Organization (the remaining student did not make a final presentation). In the spring 2018 semester, there was 1 mathematics major enrolled in the course. This student did not make a final presentation. For the academic year 2 or 4 met the goal for a 50% success rate.

In AY 2018-2019, 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.

Decision: Based on the analysis of the AY 2018-2019 results, and to drive improvement, faculty will be evaluating these presentations under the unified rubric

system for evaluating oral communication of mathematical ideas. Also, Fall 2019 will be the first time students enter this course having completed MATH4940 which is a new course designed in conjunction with our QEP.

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, 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.

Findings: Target met.

Analysis: In AY 2017-2018 the target was not met. In the Fall 2017 semester, there were 3 mathematics majors enrolled in the course. Of these, 2 scored Excellent on Clarity, and 2 scored Excellent on Conventions (the remaining student did not turn in a final paper). In the Spring 2018 semester, there was 1 mathematics major enrolled in the course. This student did not turn in a final paper. For the academic year, 2 of 4 met the goal for Clarity (50% success rate) and 2 of 4 met the goal for Conventions (50% success rate).

In AY 2018-2019, the target was met. In the Fall 2017 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%.

Decision: Based on the analysis of the AY 2018-2019 results, and to drive improvement, faculty will be evaluating these papers under the unified rubric system for evaluating written communication of mathematical ideas. Also, Fall 2019 will be the first time students enter this course having completed MATH4940 which is a new course designed in conjunction with our QEP.

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

Assessment Cycle AY 2018 – 2019

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 or not the student can write about mathematics in a clear and logically rigorous manner. Our target is for 75% or higher of mathematics majors to show proficiency on this measure.

Findings: Target met.

Analysis: In AY 2017-2018, the target was met. In the Fall 2017 semester, there were 2 mathematics majors enrolled in the class. Of these 2 demonstrated appropriate levels of skill in critical thinking and analysis on their Final Exam for a success rate of 100%.

In AY 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%.

Decision: Based on the analysis of the AY 2018-2019 results, and to drive improvement, faculty will place a greater emphasis on the importance of cogent writing in mathematics. A unified rubric system will be implemented across the mathematics curriculum.

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.

Findings: Target met.

Analysis: In AY 2017-2018, the target was not met. In the Fall 2017 semester, there were 3 mathematics majors enrolled in the course. Of these, 2 scored Excellent on both Depth and Organization (the remaining student did not turn in a final paper). In the Spring 2017 semester, there was 1 mathematics major enrolled in the course. This student did not turn in a final paper. For the academic year, 2 of 4 met the goal for Organization (50% success rate) and 2 of 4 met the goal for Depth (50% success rate)

In AY 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%.

Assessment Cycle AY 2018 – 2019

Decision: Based on the analysis of the AY 2018-2019 results, and to drive improvement, faculty will be evaluating these papers under the unified rubric system for evaluating written communication of mathematical ideas. Also, Fall 2019 will be the first time students enter this course having completed MATH4940 which is a new course designed in conjunction with our QEP.

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

For AY 2017-2018, the Mathematics Bachelor of Science program assessed 13 measures for 5 student learning outcomes (SLOs). Decisions that were implemented in AY 2018-2019 were:

- MATH1010 was changed from Pass/Fail to Letter Grade to provide more granular feed back to students on their progress.
- A more explicit Class Participation component was added to MATH2080 and MATH3100 to make clear to the students how important this class material is to progress in the major.
- We added the requirement that graduation seniors take the ETS Major Field Test.
- Initial discussions for implementing uniform rubrics for oral and written communication were tabled. We decided we needed to fulling implement MATH4940 as a pre-requisite for MATH4950 before making these changes. A pilot section of MATH4940 was taught in Spring 2019.

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.

- Implementation of a uniform rubric for evaluating oral communication of mathematics.
- Implementation of a uniform rubric for evaluation written communication of mathematics.
- MATH4940 will now be a pre-requisite for MATH4950.

Students who have completed MATH4950 will be ready to begin work on their project without having to spend a month picking topics as they do now.