

ANNUAL ASSESSMENT REPORT

College	Science
Department	Mathematics
Program	MS
Reporting for Academic Year	2016-2017
Last 5-Year Review	2010-2011
Next 5-Year Review	2017-2018

SUMMARY OF MS ASSESSMENT

MASTER'S OF SCIENCE IN MATHEMATICS

A. Program Learning Outcomes (PLO)

Students graduating with a Master's of Science in Mathematics will be able to:

1. Apply the fundamental definitions and theorems of pure mathematics (ILOs #1 & #4)
2. Apply the fundamental definitions and theorems of applied mathematics (ILOs #1 & #4)

B. Program Learning Outcome(S) Assessed

PLO 2: Apply the fundamental definitions and theorems of applied mathematics.

This is the first year PLO 2 is being assessment. PLO 1 was assessed last year.

C. Summary of Assessment Process

Instrument(s): The department used final exam questions and a rubric for each PLO. The rubrics were used to re-score the exam questions for readability, validity and fluency.

Sampling Procedure: The courses for this year's assessment were chosen by the department when we created our five-year assessment plan. For each course assessed, a final exam question was identified as a typical problem for the course that assessed the given PLO. These problems were chosen by the department during one of our monthly department meetings.

Sample Characteristics: The courses selected include required courses for both the Applied and Pure options in the master's degree. The exam questions were selected carefully to ensure they tested material that is essential in the courses.

Data Collection: Final exams were collected by the department assessment coordinator. Each problem was scored by a curriculum committee for readability, validity and fluency using RVF

rubrics similar to those used for undergraduate assessment.

Data Analysis: The results were organized and discussed by the graduate committee.

Courses Assessed: MATH 6200, 6331, 6349

Math 6200 Topology, SLO 1/Mastered (9 Students)

Problem: Prove the continuous image of compact/connected set is compact/connected.

	Missing	Emerging	Developing	Mastering
Readability	0%	11%	45%	44%
Validity	0%	22%	45%	33%
Fluency	0%	11%	45%	44%

These scores indicate 44% of the students have mastered the ability to write a readable and fluent proof about continuous functions on a compact/connected set, yes only 33% mastered the ability to write a valid proof.

Math 6331 Topics in Differential Equations, SLO 2/Mastered (9 students)

Problem: For an initial value problem, show no solutions exist or infinitely many solutions exist under certain conditions.

	Missing	Emerging	Developing	Mastering
Readability	0%	0%	0%	100%
Validity	0%	0%	56%	44%
Fluency	0%	0%	44%	56%

These scores indicate all of the students have mastered the ability to write readable solutions to problems in applied mathematics and all of the students have developed or mastered the ability to write a valid and a fluid solution.

Math 6349 Real Analysis, SLO 1/Mastered (16 students)

Problem: A function f is measurable on $A \cup B$ iff f is measurable on A and B .

	Missing	Emerging	Developing	Mastering
Readability	0%	50%	31%	19%
Validity	6%	20%	27%	47%
Fluency	35%	28%	31%	6%

These scores indicate 47% of the students have mastered and 27% are developing the ability to write a valid proof about measurable functions and 31% are developing the ability to write a readable and fluent proof. Very few students have mastered writing a fluent proof about measurable functions.

D. Summary of Assessment Results

Main Findings: Students in the applied course performed well at all levels. Students in the pure courses had mixed results, which may be due to the courses themselves. In general, the departments needs to find ways to increase performance at the fluency level.

Recommendations for Program Improvement: The department needs to work on agreeing to the level and standards for its graduate courses, especially for the abstract courses.

Next Step(s) for Closing the Loop: The department is creating new expanding syllabi for the semester courses which will include more in depth details regarding course topics, depth of study, grading guidelines, and assessment expectations at the introductory, developing or mastery level for readability, validity and fluency in student work.

Other Reflections: The work described above is a huge project. We will have guidelines ready once semesters begin but will need to continuously improve our course packets for instructors.

E. **Assessment Plans for Next Year**

We plan to assess PLO #1 listed above. We will use two courses for this assessment, one “pure” and one “applied.” This is a change from our original plan, which uses 4 courses. We plan to spend more time analyzing the data and planning for program improvement instead of time on redundant data collection.

APPENDIX A: SAMPLE RUBRICS

SLO 1: Apply the definitions, techniques and theorems of abstract mathematics

SLO 1 RVF Rubric – Readability, Validity, Fluency

	Missing (0)	Emerging (1)	Developing (2)	Mastering (3)
Readability	Informal or non-mathematical language is used. There is misuse of notation/symbols.	Some improper mathematical language or notation is used.	Mostly proper mathematical language and notation is used.	Proper mathematical language and notation is used.
Validity	Significantly inaccurate or irrelevant statements in definitions, techniques and/or theorems are present. Important information is missing.	Mostly accurate statements in definitions, techniques and/or theorems are present. May include some irrelevant or unjustified statements.	Statements in definitions, techniques and/or theorems are accurate and relevant.	Statements in definitions, techniques and/or theorems are accurate and relevant and connected/deduced correctly.
Fluency	No coherent flow of ideas Listing facts without a sense of how to link them to obtain or apply a valid definition, technique or proof of a theorem.	Partially coherent and organized, but inconsistent. Appeals to intuition. Some unjustified or improperly justified statements/conclusions in definitions, techniques or proofs of theorems are present.	A correct and essentially complete definition, solution, or proof given. Logic and flow overall sound. Some small gaps in presentation may require “benefit of the doubt.”	A correct and complete definition, solution, or proof given. Elegance or mathematical maturity present.

SLO 3: Apply mathematical algorithms to solve problems, both individually and in teams

SLO 3 RVF Rubric – Readability, Validity, Fluency

	Missing (0)	Emerging (1)	Developing (2)	Mastering (3)
Readability	Informal or non-	Some improper	Mostly proper	Proper

	mathematical language is used. There is misuse of notation/symbols.	mathematical language or notation is used.	mathematical language and notation is used.	mathematical language and notation is used.
Validity	Significantly inaccurate or irrelevant steps in algorithms are present. Important information is missing.	Mostly accurate steps in algorithms are present. May include some irrelevant or unjustified statements.	Steps in algorithms are accurate and relevant.	Steps in algorithms are accurate and relevant and connected/deduced correctly.
Fluency	No coherent flow of ideas Listing facts without a sense of how to link them to get a correct solution.	Partially coherent and organized, but inconsistent. Appeals to intuition. Some unjustified or improperly justified steps in algorithms are present.	A correct and essentially complete solution given. Logic, steps in algorithms, and flow overall sound. Some small gaps in solution may require “benefit of the doubt.”	A correct, fully justified, and complete solution given. Elegance or mathematical maturity present.