

Mathematics Master's of Science

Assessment Report 2020-21

I. SUMMARY OF MS PLO ASSESSMENT

A. Program Learning Outcomes (PLO)

Students graduating with a MS degree in Mathematics will be able to:	
PLO 1	Evaluate and create proofs in graduate level mathematics using the fundamental definitions and theorems. (ILO Thinking and Reasoning: Quantitative Reasoning.)
PLO 2	Create solutions to problems using techniques in graduate level mathematics.
PLO 3	Communicate Graduate Level Mathematics Effectively. (ILO Communication)

B. Program Learning Outcome(S) Assessed

PLO 3	Communicate Graduate Level Mathematics Effectively.
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C. Summary of Assessment Process

Instrument(s): The department used two comprehensive exam questions and a rubric. The rubric was used to score the exam questions in the areas of readability, validity and fluency.

Sampling Procedure: Two comprehensive exam questions were identified as typical problems for the exam that demonstrates the PLO to be assessed. The problems were chosen by the assessment teams.

Sample Characteristics: The course selected is a course required for all math master's students. The exam question was selected carefully to ensure it included essential program content. This selection was done during one of the assessment team meetings.

Data Collection: Comprehensive exams were collected by the department assessment coordinator. The problem was scored by the faculty for readability, validity and fluency using the rubric found in Appendix A.

Data Analysis:

Course Assessed:

MATH 692 Graduate Capstone

Math 692, PLO 3/Masters

Problem 5: Consider the equation $e^x = 3x^2$ (a) Prove that the equation has exactly three real solutions. (b) Let α be the largest of the three solutions. Use Newton's Method to find an approximation of α with an absolute error of less than 10^{-7} .

	Missing	Emerging	Developing	Mastering
Readability	0%	0%	20%	80%
Validity	0%	0%	0%	100%
Fluency	0%	0%	40%	60%

These scores indicate that 100% of the students have mastered the ability to write a valid solution, 80% mastered writing a readable solution and 60% have mastered writing a fluent solution. Only 40% of the students are still developing writing fluent solutions. The department should consider strategies to increase the percentage of students mastering this communication skill.

Problem 4: Prove that a series of functions converges to a function that is continuous on \mathbb{R} .

	Missing	Emerging	Developing	Mastering
Readability	0%	50%	0%	50%
Validity	0%	50%	0%	50%
Fluency	0%	50%	25%	25%

These scores indicate that 50% of the students are only emerging on the ability to write a readable, valid and fluent solution. 50% mastered writing a readable or valid solution and only 25% of the students have mastered writing a fluent solution. The department should consider strategies to increase the percentage of students mastering this important communication skill.

D. Summary of Assessment Results

Main Findings: This year all of the students were able to communicate a valid solution to an applied problem but only half of the students could do so for a pure problem.

Recommendations for Program Improvement: The department needs to work on ensuring that strong communication skills are developed within the coursework of the program. High expectations need to be set and communicated to the graduate students.

Next Step(s) for Closing the Loop: The department is updating expanded syllabi for semester courses which will include more 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. Professors will be encouraged to share the assessment rubrics with their students. This is time consuming and ongoing work. The department is also revisiting the timing for the different comprehensive exams.

Other Reflections: The work described above is a huge project. We have guidelines ready and did a revisit this past summer but we will need to continuously improve our course packets for instructors.

E. Assessment Plans for Next Year

Year 2: 2021-2022

1. Which PLO(s) to assess PLO 1
2. Is it aligned to an ILO? Yes
3. If yes, list ILO. Thinking and Reasoning: Quantitative Reasoning
4. Course name and number MATH 692 Graduate Mathematics Capstone
5. SLO from course 692: Students who successfully complete MATH 692 will have mastered evaluating and creating mathematics proofs using the fundamental definitions and theorem.
6. Assessment activity Comprehensive Exams
7. Assessment Instrument Re-score comprehensive exam questions using the Readability, Validity and Fluency Rubric
8. How data will be reported Quantitative
9. Responsible person(s) Math Assessment Committee
10. Time (which semester(s)) Spring 2022
11. Ways of closing the loop Data will reported in Mathematics Department Annual Report and discussed in faculty meetings to continuously improve the program.

Appendix A - Rubric

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Communication 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.

