



2015-2016 CSCI EETF Assessment Year End Report, June, 2016

Program Name(s)	EETF Faculty Rep	Department Chair
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A. Program Student Learning Outcomes

Masters of Science in Mathematics

Students graduating with a Masters of Science in Mathematics will be able to:

1. Apply the fundamental definitions and theorems of pure mathematics
2. Apply the fundamental definitions and theorems of applied mathematics

B. Program Student Learning Outcome(s) Assessed

SLO 1: Apply the fundamental definitions and theorems of pure mathematics

C. Summary of Assessment Process

For each graduate course used in our assessment, a final exam question was identified as a typical problem for the course that assessed the given SLO. Each problem was scored by the graduate committee for readability, validity and fluency using the rubric below. The results were organized and discussed by the graduate committee.

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	Mostly accurate statements in definitions, techniques and/or theorems are present. May include some irrelevant or	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.

	information is missing.	unjustified statements.		
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.

D. Summary of Assessment Results

Courses Assessed

MATH: 6339, 6340, 6119

SLO Assessed

SLO 1: Apply the fundamental definitions and theorems of pure mathematics

D = developed in this course

M = mastered in this course

Math 6339 Introduction to Complex Variables, SLO 2/D (10 students)

Problem: State theorems precisely.

	Missing	Emerging	Developing	Mastering
Readability	0.00%	10.00%	40.00%	50.00%
Validity	0.00%	20.00%	30.00%	50.00%
Fluency	10.00%	20.00%	30.00%	40.00%

These scores indicate half of the students have mastered and 40% have developed the ability to write a readable theorem statement, 80% have mastered or developed the ability to write a valid theorem statement, 30% have developed and 40% of the students have mastered the ability to write a theorem statement with fluency.

Math 6340 Complex Analysis, SLO 1/M (10 Students)

Problem: Find all Riemann Surfaces associated with a function.

	Missing	Emerging	Developing	Mastering
Readability	10%	0%	50%	40%
Validity	10%	20%	20%	50%
Fluency	10%	10%	40%	40%

These scores indicate 90% of the students have developed or mastered the ability to write a readable proof using the fundamental definitions and theorems of pure mathematics, 70% have developed or mastered the ability to write a valid proof, and 80% of the students developed or mastered the ability to write a proof with fluency.

Math 6119 Advanced Algebra SLO 1/M (12 Students)

Problem: Prove the Cartesian product of two groups is a group and that it's also abelian if both of the groups are abelian.

	Missing	Emerging	Developing	Mastering
Readability	0%	17%	50%	33%
Validity	0%	8%	50%	42%
Fluency	0%	50%	25%	25%

These scores indicate 88% of the students have developed or mastered the ability to write a readable proof using the fundamental definitions and theorems of pure mathematics, 92% have developed or mastered the ability to write a valid proof, and 50% of the students developed or mastered the ability to write a proof with fluency.

Closing the Loop

Math Graduate

This was our second attempt at using the RVF (readability-validity-fluency) rubrics to score authentic student work for attainment levels of PLOs. We learned/improved our process in the following ways:

- a) developing a rubric to be used for a variety of courses forced/allowed us to examine common features of successful student work that is not exclusively looking for the right answer = “validity.” Working with faculty across the department with different areas of expertise to identify and measure three features, readability, validity and fluency, which characterize quality and maturity in student work created opportunities for conversations about pedagogy and priority of outcomes for our students.
- b) identifying appropriate problems for scoring takes some care as the dimensions of the rubric (readability, validity, flow) were not necessarily demonstrated and/or were too interdependent on some types of problems.
- c) we will continue to refine the rubrics for greater ease of use and applicability.
- d) we will consider sharing the rubrics with math students to further emphasize the importance of each dimension of successful student work.
- e) we will consider how the different levels/scores via the rubrics may (or may not) align with I/D/M levels of attainment of PLOs. In particular, we know that not all students in a specific course are at the same point in their major. So, some students taking Math 3600, for example, might be doing so as their first advanced proof-based course while others might be completing their degree and have a higher level of maturity. We see this in the generally lower overall scores for “fluency” since this skill will likely be most developed for those students with experience in proof-intensive courses. With the move to semesters, some of the courses currently aligned with mastery will align with developing knowledge attainment.
- f) we will continue to explore ways to support instructors unfamiliar with course content to score student work using the RVF rubric. This is needed as the rubric based scoring is most effective when faculty score student work from courses where they were not the instructor.
- g) As a department, we will discuss ways to support students in mastering the ability to write proofs with fluency. We will establish more common norms in terms of the practice and expectations for attainment of this element of proof writing.