CALIFORNIA STATE UNIVERSITY
EAST BAY

College of Science (CSCI)
North Science 135
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2014-2015 CSCI EETF Assessment Year End Report, June, 2015

Program Name(s)	EETF Faculty Rep	Department Chair
Mathematics BS	Kathy Hann	Kevin Callahan

A. Program Student Learning Outcomes

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

1. Apply the definitions, techniques and theorems of abstract mathematics
2. Apply the definitions, techniques and theorems of applied mathematics
3. Apply mathematical algorithms to solve problems, both individually and in teams
4. Creatively conjecture and rigorously write, analyze and critique proofs
5. Communicate mathematics to others in written and/or oral form with precision, clarity and organization
6. Apply techniques of at least one area of mathematics in depth

Students taking Option B or C for the Bachelor in Mathematics receive focused emphasis on particular PLOs as follows:

- The Applied Mathematics Option emphasizes PLOs #2, 3 & 6 above.
- The Mathematics Teaching Option emphasizes #1, 2, & 5 above.

B. Program Student Learning Outcome(s) Assessed

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

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

C. Summary of Assessment Process

Multiple choice questions were given in the following lower division courses: Math 1304 Calculus I, Math 2304 Calculus III and Math 2101 Elementary Linear Algebra. The exams were scored by the instructors and the data was organized and discussed by the undergraduate committee. For each upper division course assessed, a final exam question was identified as a typical problem for the course that assessed the given SLO. Each problem was scored by the undergraduate committee for readability, validity and fluency using the rubric below. The results were organized and discussed by the undergraduate committee. The scoring rubrics are pasted below.

CSU East Bay Mathematics
AY 2014-15

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-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 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.

D. Summary of Assessment Results

Courses Assessed

Lower Division: 1304, 2101, 2304, 3331

Upper Division: 3121, 3301, 3600, 3750, 3841

SLO's Assessed

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

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

Lower Division Math Assessment

I= introduced in this course

D= developed in this course

Math 1304 Calculus I, % Correct on Assessment

Section (# Students)	SLO 1(I)	SLO 2(I)	SLO 3(I)
I(42)	62%	50%	55%
II(19)	53%	47%	58%
III(19)	63%	53%	47%

Math 2304 Calculus III, % Correct on Assessment

Section (# Students)	SLO 1(I)	SLO 2(I)	SLO 3(D)
I(13)	77%	69%	69%
II(25)	88%	84%	76%

Math 2101 Elementary Linear Algebra, % Correct on Assessment

Section (# Students)	SLO 1(I)	SLO 2(I)	SLO 3(I)
I(8)	63%	100%	88%
II(27)	93%	78%	78%

Most of these courses had an enrollment of 30-40 students. The number of students participating in the assessment varied greatly from section to section. Also, the method of giving the assessment varied greatly. We have concluded that next year we will require the questions to be imbedded in the final exam so all student who take the final will participate in the assessment process.

The scores seem to indicate that SLOs 1 and 2 was adequately introduced in 2304 and SLO 3 was actually better developed in 2101 that in 2304. All three SLOs were introduced well in 2101. The results for 1304 indicate that we need to re-examine the assessment questions. We will be more confident in our results next year when all students who take the final exam participate in the assessment.

Math 3600 Number Theory, SLO 3/M (20 students)

	Missing	Emerging	Developing	Mastering
Readability	5%	45%	25%	25%
Validity	15%	35%	5%	45%
Fluency	5%	55%	35%	5%

These scores indicate that half of the students have developed or mastered writing a readable solution using a basic algorithm, almost half have mastered writing a valid solution, 35% have developed and only 1 student has mastered the ability to write a fluent solution.

Math 3121 Abstract Algebra, SLO 1/D (20 Students)

	Missing	Emerging	Developing	Mastering
Readability	0%	30%	20%	50%
Validity	20%	30%	25%	25%
Fluency	15%	30%	30%	25%

These scores indicate that 70% of the students have developed or mastered writing a readable proof using a basic definition, half have developed or mastered writing a valid proof, and over half of the students developed or mastered the ability to write a fluent proof.

Math 3301 Real Analysis II, SLO 1/M (27 students)

	Missing	Emerging	Developing	Mastering
Readability	4%	15%	15%	67%
Validity	4%	15%	26%	56%
Fluency	4%	19%	26%	52%

These scores indicate that over half of the students have mastered writing a readable, valid and fluent proof and at least 77% of the students have developed or mastered writing a readable, valid and fluent proof.

Math 3750 Numerical Analysis I, SLO 3/M (34 students)

	Missing	Emerging	Developing	Mastering
Readability	0%	15%	56%	29%
Validity	0%	15%	29%	62%
Fluency	0%	24%	56%	21%

These scores indicate that 85% of the students have developed or mastered writing a readable solution using an algorithm, 62% have mastered writing a valid solution, and 77% have developed or mastered the ability to write a fluent solution.

Closing the Loop:

Lower Division:
In using common multiple choice questions (in lower division) we learned that there was significant variation in students ability to answer the questions based on content coverage. We will reexamine the questions to ensure they are central and either modify the questions or ensure deeper coverage and/or emphasis within the course.

Upper Division:

This was our first attempt at using rubrics to score authentic student work for attainment levels of PLOs. We learned that

a) developing a rubric to be used for a variety of courses forced/allowed us to examine common features of successful student work that was not exclusively looking for the "right answer = validity."

b) identifying appropriate problems for scoring takes some care as the dimensions of the rubric (readability, validity, flow) were not really required 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 majors 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.

f) learned that it was not always easy for instructors unfamiliar with course content to score student work....even with the RVF rubric.

E. Suggestions and Recommendations for the CSCI EETF in the Future

None at this time.