COMMITTEE ON ACADEMIC PLANNING AND REVIEW

ANNUAL

College	**CoS**
Department	**Mathematics**
Program Unit	**Mathematics and Computer Science**
Reporting for Academic Year	**2014-2015**
Department Chair	**Kevin Callahan, report prepared by Kathy Hann**
Date Submitted	**6/26/2015**

PROGRAM REPORT
Mathematics

1. SELF-STUDY

A. Five-year Review Planning Goals

Our last five year program review was in 2010-11. The goals listed in the plan for that review included issues regarding students, curriculum, faculty and support. The specific goals were:

1. Students: The Department will continue to try to provide a high caliber, creative undergraduate and graduate math program. The challenge is to retain high quality regular faculty and to maintain a large enough student demand in order to be able to provide these courses. The quality of these courses is also put at risk by lack of funding for graders, which has always been central to the effective delivery of our math courses. The Department also needs to continue to be responsive to the needs of entering freshmen who are taking remedial math courses. Several aspects of the remedial math program have been changed over the last five years, which has improved the student flow through these courses and increased the amount of mathematical feedback within the courses.

2. Curriculum: Continue to be responsive to the needs and requirements of local K-12 schools in the preparation of future teachers. Continue to update curriculum to provide innovative and challenging experiences for our undergrad and grad math majors. Continue to investigate ways to improve student preparation, so that meeting a prerequisite should enable a student to succeed in future courses.

3. Faculty: Hire new faculty in appropriate areas of expertise and retain the faculty that the Department already has. Try to increase faculty support funds for travel and research.

4. Outside Reviewer's Report: Main points suggested were (1) increase number of sections of upper division math courses, and decrease their size, (2) encourage faculty cohesiveness, (3) encourage faculty research

5. Program Response to Outside Reviewer's Report: The Department would indeed like to have better physical offices for faculty, and smaller classes offered more often. Achieving all of these goals does not seem reasonable given current budget restrictions. Many faculty are focusing their efforts in STEM Education projects. This work is generally not recognized as "research" by outside reviewers, but is strongly in line with institutional and college level priorities. It has been the historical stance of the department to value and reward this type of work. In addition, this work allows for the participation of undergraduates in relevant professional development through the programming provided. Many of our students graduate and become teachers at various levels, as well as teaching for us during their time at CSU East Bay, and thus this work is supportive of their goals and those of CSU East Bay. We also recognize the importance of engaging students in more traditional research of discovery, and we have new faculty who are also working in this area. Our most recent position descriptions have included an emphasis on the ability to work with undergraduates in research. We look forward to filling our vacant positions with new faculty who can help us strengthen this aspect of our program.

B. Five-year Review Planning Goals Progress

1. Students: We have maintained our graduate and undergraduate numbers of majors and we continue to offer a wide variety of courses. Some funds have been made available for graders, but only for overenrolled courses, so only for some of the lower division courses. Learning mathematics requires solving many problems for practice and extension of conceptual knowledge (strongly supporting our PLOs). Faculty must weigh how to productively spend their instructional time and adjust their pedagogy if they do not have support in the form of graders. Moreover, our upper division and graduate students gain valuable experience and develop mentee relationships through grading for their past professors. Since department budgets have increased, we plan to increase the number of readers available for next year.

The math club was thriving three years ago with a strong membership, meeting monthly. The student leaders have since graduated and the club needs to be revived. The club did meet a few times this year. We will search for good student leadership for the club for next year. A room has been set aside in Robinson Hall as a student study room and students are indeed using this room. It is ideal that most faculty offices, classroom, and the student study room are all in the same building. It is slight problem that the department office is located in a different building.

Prof Kamalinejad currently has three students working with him on research projects, one undergraduate and two graduate students. Two of these students were awarded a CSUEB student research grant this year. This opportunity to do research greatly improves the student experience in mathematics.

The research team presented two posters on the research poster session at CSUEB. A research article is being written that is nearly finished and will be posted for publication soon. Three more students have expressed their interest to join the team, from which two who are the best fits will join us.

We continue to attempt to improve the remedial mathematics program. For 2013-15, Professors Kevin Callahan and Julia Olkin received an internal grant to create a new version of the lowest level of remedial math: MATH 805 to replace MATH 800. This population of students takes a year-long course of remedial math, with high failure rates, over 50%. Our goal was to not only increase the pass rates, but to also improve the content knowledge. On this project, Changing Remedial Math (ChaRM), Professors Callahan and Olkin, along with several of their Math Masters students, developed the curriculum in a workbook format, to be hands on and exploratory in nature, de-emphasizing memorization and formulas. We impose high standards of mastery of all topics, weekly online and written homework, and regular attendance.

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All of the teaching assistants who teach our remedial mathematics courses are required to take a two unit training course their first quarter of teaching and a one unit teaching seminar in subsequent quarters.

2. Curriculum:

Our main curriculum work this year was in preparation for the switch to semesters. The department faculty met regularly over several weeks to discuss new features, models, and innovations to incorporate in order to better serve our students and the university. It was determined that program transformation should include changes in content and cognitive goals as well as changes in the overall structure of the major. These changes will be reflected in new program learning outcomes and new processes and procedures in the department including strategic planning and robust and relevant actionable assessment. The goals of these changes are to modernize the major; to improve recruitment and retention of mathematics majors; to incorporate innovative pedagogy; to make the curriculum more relevant to STEM careers; and to incorporate tools, strategies, and skills needed in STEM fields and for a more informed citizenry.

Planned structural change: The major will more clearly include a set of “core” courses required for all majors and sequences and electives more clearly connected and streamlined for each option. Scheduling will be more transparent allowing for better planning and facilitating graduation. Additionally, students will complete a capstone experience modeled on the High Impact Practice advocated by the AAC&U.

Planned content and cognitive change: The major will more clearly include the transformed outcomes and objectives described below which will be introduced, developed and mastered according to a new curriculum map. These outcomes and objectives will be clearly communicated to students via departmental syllabi and through other department guides and publicity materials.

We are working with our service departments on the new semester service courses. We have held general meetings for all departments who require calculus and/or linear algebra. We met individually with departments who have or wish to have a mathematics course or courses designed specifically for their majors. These departments are Biology, Business, Computer Science and Liberal Studies. We also met with Statistics since both of our majors are required to take courses in each department. The service courses are listed below.

Old Course: Math 1810 Math for Business and Social Sciences
New Course: Calculus for Business, Social Sciences and Life Sciences

New Course: Math XXXX Linear Algebra and Differential Equations

New Course: Math XXXX Numerical Algorithms for Computer Science

Old Courses: Math 2011 Number Systems & Math 4012 Geometry and Measurement
New Course: Number Systems and Geometry

Old Courses: Math 4013 Statistics, Data Analysis and Probability and
Math 4014 Algebra and Functions
New Course: Statistics, Algebra, and Functions

Math 4030 Advanced Study of School Mathematics
This course will be updated and redesigned to meet the needs of future 6-8 mathematics teachers.

Old Courses: Math 805/806
New Courses: Developmental Math I

Old Courses: Math 806/807
New Courses: Developmental Math II

New Courses: Developmental Math LAB

Old Courses: Math 900
New Courses: Introductory and Intermediate Algebra

Old Courses: Math 950
New Courses: Accelerated Introductory and Intermediate Algebra

Last year we completed our curriculum update so that the courses for our future K-12 teachers now meet the new California Common Core Standards. A course list, a matrix describing alignment with CCCS and a justification were sent to the California Commission on Teacher Credentialing for both the Single Subject Preparation Program in Mathematics (for future 9-12 teachers) and in Foundational Mathematics (for future 6-8 teachers). These materials were approved for the high school level program last year and were approved for the middle school level this year.

3. Faculty: We will be hiring a tenure track mathematics professor who will start Fall 2016. We were able to hire a new professor in applied mathematics who started in Fall 2013. In Fall 2014, Prof Glass returned from leave. We continue to have faculty and lecturers retire. We will need to hire new lecturers just to meet our scheduling needs for 2015-16. Some of these lecturers will

need to have their doctorate degree as they will be needed to teach upper division and graduate level courses. Faculty are very active in a variety of grants and only two faculty members will be teaching full time in 2015-16. We have a very strong need for new faculty.

Almost all math faculty now have an office in Robinson Hall where there is a student study room. This change has greatly improved faculty cohesion and student/faculty interactions.

C. Program Changes and Needs

We have completed our work on splitting the mathematics and computer science departments so that each department will have a strong leader who is given enough University support to lead their department. With continued retirements of both faculty and lecturers in mathematics we have an even stronger need for additional tenure track faculty and lecturers.

2. SUMMARY OF ASSESSMENT

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.

Masters of Science in Mathematics

Students graduating with a Masters of Science in Mathematics will be able to:
1. Students will be able to apply the fundamental definitions and theorems of pure mathematics
2. Students will be able to apply the fundamental definitions and theorems of applied mathematics
3. Students will be able to apply advanced techniques of mathematical analysis
4. Students will be able to apply techniques of advanced algebra
5. Students will be able to apply advanced techniques of geometry and topology
6. Students will be able to use mathematical algorithms

Students taking Option B or C for the Masters 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, 4 & 5 above.

B. Program Student Learning Outcome(s) Assessed

Math BS:
SLO 1: Apply the definitions, techniques and theorems of abstract mathematics
SLO 3: Apply mathematical algorithms to solve problems, both individually and in teams

Math MS:
SLO 1: Apply the fundamental definitions and theorems of pure mathematics
SLO 2: Apply the fundamental definitions and theorems of applied mathematics

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 and graduate 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 and graduate committees.

Please see the scoring rubric in Appendix A.

D. Summary of Assessment Results

Please see data summaries in Appendix B

Undergraduate

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 and Graduate:

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.

3. STATISTICAL DATA

These data were collected from the following resources:

a) Student demographics of majors
http://www20.csueastbay.edu/ir/files/html/apr/enrollment%20by%20major%20and%20ethnicity.html

b) Degrees Conferred by the program

http://www20.csueastbay.edu/ir/academic-program-review/index.html#

c) SFR's by discipline

http://www.csueastbay.edu/ira/tables/sfr/APR%20sfr%20by%20Subject.html

d) Course History data

http://www.csueastbay.edu/ira/factbook/APR%20course_History.html

a) Student demographics of majors – Headcount Enrollment by Major for Fall 2014

			Fall 2014				
			Degree Level				TOTAL
			Bachelor	PostBaccalaureate	Master	Ed. Doctor	
Mathematics	**Female**	**Black, non-Hispanic**	1		1		2
		American Indian or Alaska Native					
		Asian	7		8		15
		Pacific Islander	1				1
		Hispanic	7		1		8
		White	8		6		14
		Multiple ethnicity	2				2
		Race/ethnicity unknown	2		1		3
		Nonresident aliens	1		2		3
		total	29		19		48

	Male	**Black, non-Hispanic**	3				3
		American Indian or Alaska Native					
		Asian	6		10		16
		Pacific Islander					
		Hispanic	15		3		18
		White	12		13		25
		Multiple ethnicity	1		1		2
		Race/ethnicity unknown	1		5		6
		Nonresident aliens			2		2
		total	38		34		72
	Total	**Black, non-Hispanic**	4		1		5
		American Indian or Alaska Native					
		Asian	13		18		31
		Pacific Islander	1				1
		Hispanic	22		4		26
		White	20		19		39
		Multiple ethnicity	3		1		4
		Race/ethnicity unknown	3		6		9
		Nonresident aliens	1		4		5
		total	201	0	159	0	360

	Fall Quarter				
Headcount Enrollment	**0**	**0**	**0**	**0**	**0**
Math					
1. Undergraduate	82	73	71	81	67
2. Postbaccalaureate	3	4	1	1	0
3. Graduate	79	74	66	58	53
4. Total Number of Majors	164	151	138	140	120

	College Years				
Degrees Awarded	**2010**	**2011**	**2012**	**2013**	**2014**
Math					
1. Undergraduate	15	15	20	11	21
2. Graduate	16	19	24	16	26
3. Total Number of Majors	31	34	44	27	47

D. Student Faculty Ratios	Math				
1. Tenured/Track	22.1	17.6	18.0	16.5	21.0
2. Lecturer	28.0	27.2	27.0	28.5	30.0
3. SFR By Level (All Faculty)	24.9	24.2	24.5	24.8	27.1
4. Lower Division	27.1	26.1	25.6	27.1	28.7
5. Upper Division	16.9	15.4	19.5	17.7	20.6
6. Graduate	8.6	15.2	11.3	7.3	12.8
E. Section Size					
1. Number of Sections Offered	74.0	91.0	90.0	88.0	89.0
2. SCU taught	8199.0	8951.0	8965.0	9093.0	9000.0
3. Average Section Size	28.5	25.2	25.3	26.4	25.6
4. Average Section Size for LD	30.4	26.5	26.0	27.4	27.0
5. Average Section Size for UD	22.0	19.0	23.0	23.3	22.3
6. Average Section Size for GD	11.3	16.3	13.7	9.7	8.8
7. LD Section taught by Tenured/Track	24	12	12	10	12
8. UD Section taught by Tenured/Track	7	9	7	8	9
9. GD Section taught by Tenured/Track	5	4	3	5	5
10. LD Section taught by Lecturer	36	64	66	64	62
11. UD Section taught by Lecturer	2	2	2	2	2
12. GD Section taught by Lecturer	0	0	0	0	0

Please note that the following data could only be found for Math/CS Combined.

	Fall Quarter				
	2010	**2011**	**2012**	**2013**	**2014**
C. Faculty					
Tenured/Track Headcount	Computer Science and Mathematics Combined				
1. Full-Time	25	25	23	21	22
2. Part-Time	4	2	1	1	2
3a. Total Tenure Track	29	27	24	22	24
3b. % Tenure Track	80.6%	62.8%	58.5%	52.4%	57.1%
Lecturer Headcount	Computer Science and Mathematics Combined				
4. Full-Time	1	1	1	2	2
5. Part-Time	6	15	16	18	16
6a. Total Non-Tenure Track	7	16	17	20	18
6b. % Non-Tenure Track	19.4%	37.2%	41.5%	47.6%	42.9%
7. Grand Total All Faculty	36	43	41	42	42
Instructional FTE Faculty (FTEF)	Computer Science and Mathematics Combined				
8. Tenured/Track FTEF	22.4	19.4	16.5	17.4	17.0
9. Lecturer FTEF	11.1	18.1	19.0	19.3	18.4
10. Total Instructional FTEF	33.5	37.4	35.4	36.7	35.4
Lecturer Teaching	Computer Science and Mathematics Combined				
11a. FTES Taught by Tenure/Track	439.1	307.1	288.1	314.9	356.4
11b. % of FTES Taught by Tenure/Track	58.7%	38.7%	36.0%	36.2%	39.4%
12a. FTES Taught by Lecturer	308.5	487.1	513.2	553.9	547.3
12b. % of FTES Taught by Lecturer	41.3%	61.3%	64.0%	63.8%	60.6%
13. Total FTES taught	747.7	794.2	801.3	868.7	903.7
14. Total SCU taught	11215.0	11913.0	12019.0	13031.0	13556.0

Source and definitions available at: http://www.csueastbay.edu/ira/apr/summary/definitions.pdf

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.

Mathematics Undergraduate Assessment Results 2014-15

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 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 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 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 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.

Mathematics Graduate Assessment Results 2014-15

Courses Assessed

Math 6151, 6200, 6349 and 6842

SLO's Assessed

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

SLO 2: Apply the fundamental definitions and theorems of applied mathematics

D = developed in this course

M = mastered in this course

Math 6151 Graph Theory, SLO 2/D (6 students)

	Missing	Emerging	Developing	Mastering
Readability	0%	17%	33%	50%
Validity	17%	0%	0%	83%
Fluency	0%	17%	17%	67%

These scores indicate half of the students have mastered and 33% have developed writing a readable solution using fundamental definitions and theorems of applied mathematics, 83% have mastered writing a valid solution, 17% have developed and 67% of the students have mastered the ability to write a fluent solution.

Math 6200 Introduction to Topology, SLO 1/M (10 Students)

	Missing	Emerging	Developing	Mastering
Readability	0%	0%	40%	60%
Validity	0%	10%	20%	70%
Fluency	0%	0%	50%	50%

These scores indicate 100% of the students have developed or mastered writing a readable proof using the fundamental definitions and theorems of pure mathematics, 90% have developed or mastered writing a valid proof, and 100% of the students developed or mastered the ability to write a fluent proof.

Math 6349 Theory of Functions of a Real Variable, SLO 1/M (13 Students)

	Missing	Emerging	Developing	Mastering
Readability	0%	8%	62%	31%
Validity	0%	31%	62%	8%
Fluency	0%	15%	54%	31%

These scores indicate 93% of the students have developed or mastered writing a readable proof using the fundamental definitions and theorems of pure mathematics, 80% have developed or mastered writing a valid proof, and 85% of the students developed or mastered the ability to write a fluent proof.

Math 6842 Advanced Topics in Optimization, SLO 2/M (13 students)

	Missing	Emerging	Developing	Mastering
Readability	0%	8%	23%	69%
Validity	0%	0%	31%	69%
Fluency	0%	8%	46%	46%

These scores indicate 69% of the students have mastered and 23% have developed writing a readable solution using fundamental definitions and theorems of applied mathematics. Also, 31% have developed and 69% have mastered writing a valid solution. Additionally, 17% have developed and 67% of the students have mastered the ability to write a fluent solution.