California State University, East Bay

Department of Mathematics

Five Year Program Review for

Mathematics BS and MS

2018

Self Study and 5-Year Plan approved by faculty on: 3/12/18
External Reviewer Report received by program on: PENDING as of 8/24/18
Program's response to External Reviewer's report completed on: Awaiting ER Report
Complete 5-year program Review Report submitted to CAPR on: 12/19/18

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1. Summary

The Department of Mathematics offers a Bachelor of Science degree and a Master of Science degree in Mathematics. The BS degree under quarters has three options: Applied Mathematics, Pure Mathematics, and Mathematics Teaching Option. The MS degree has two options: Applied Mathematics and Pure Mathematics. We have done away with options/concentrations for our semester degrees. All programs are included in this single report.

Degree programs
• B.S., Mathematics
• Minor in Mathematics
• M.S., Mathematics

Other programs
• Remedial Mathematics
• Foundational Mathematics
• Service courses for other majors
• General education mathematics

The Math Department takes seriously its responsibility to provide a rigorous curriculum for our undergraduate and graduate majors as well as serving the university as a whole. A list of departments that require either STEM Calculus and its prerequisites or Business Calculus and its prerequisite is included in Appendix A (B4 Math Requirements by Major). As the list makes evident, the Department of Mathematics touches almost every student on campus. In addition, we offer a course for Arts and Humanities students to fulfil their GE Area B4 requirement.

The department prides itself on being a good partner to our K-14 neighbors, our sister campuses, the departments we serve, and the community at large. Our self-study and 5-year plan demonstrate this commitment and collaborative spirit by describing ongoing and planned projects that support student success across these areas and build relationships among instructors at all levels.

Major challenges during the past five years include (1) system-wide CSU budget declines, (2) the continued loss of regular faculty members and recent loss of long-term lecturers, and (3) the influx of a large population of underprepared freshman through our math courses. With our split from Computer Science and new mandates system-wide, we expect that the next five years will be a time of challenge and opportunity.

2. Self-Study

2.1. Summary of Previous Five-Year Review and Plan and Annual Program Reports

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. Specific goals were:

- Improve student experience for Majors
- Improve student experience and success in Service Courses
- New tenure line faculty hiring
- Physical unification of the department and consideration of split from Computer Science
- Improve faculty support and cohesion

We will summarize progress made on each of these goals below in the areas of *students, curriculum, faculty* and *funding and support*. Many of the changes we have made and the plans we have in place are a result of mandates from the CSU system level such as the move to semesters (Fall, 2018), Executive Order (EO) 1110: Assessment of Academic Preparation and Placement in First-Year General Education Written Communication and Mathematics/Quantitative Reasoning Courses, and Executive Order 1100 Revised: General Education Breadth Requirements.

The department split from Computer Science in 2015 becoming the Department of Mathematics. This split has presented a number of opportunities and challenges. The opportunities include the ability to build a stronger community among our faculty and to focus more directly on the needs of mathematics students; both majors and those in our service courses. In fact, the department now meets monthly throughout the academic year. These meetings serve as opportunities to share ideas for teaching, advising, and building community. New challenges include significantly reduced enrollments (as a individual department rather than joint department), and lower profile with fundraisers and community partners.

Also since the last 5 year review the Department moved to a new building. At this time, all tenure line faculty have individual offices on the same floor of the Student and Faculty Support Building (SF). Our department office and staff are also located in this building. This proximity has improved departmental cohesion. However, our FERP faculty, lecturers and Teaching Associates are still located in far flung buildings around campus. Another result of our move is that our classes are not taught in consistent proximity to faculty/instructor offices and students are not always sure where they can find math support from the department.

a) Students

Providing Graders: Starting in 2016-17 graders were provided for all regular and lecturer faculty who requested them. This grader policy was originally for one year while we assessed the impact of the support and determined whether the budget would allow ongoing provision of graders at this level. We have requested college funding to continue to support graders for undergraduate classes with at least 30 students and graduate classes with at least 20 students. Our plan is to survey Instructors who used graders about the usefulness of having graders and those who did not request graders will be surveyed as to why they chose not to make a request. In addition, we will consider surveying student graders to see if they felt the experience was beneficial in terms of solidifying their learning and building stronger relationships with their faculty.

Active learning across the curriculum: The department has made a major effort to encourage the implementation of active learning strategies in all of our classes. We have received funding for a redesign

of calculus from the Chancellor's Office and an NSF sub-grant (SEMINAL) for precalculus through calculus to develop active learning materials and faculty training and support for implementation. Quarterly messages are sent to all instructional staff encouraging them to use active learning strategies and pointing them to resources and support for implementation.

Major enrollment: Our major enrollment at both the undergraduate and graduate level has remained fairly constant. Our course offerings have remained broad, allowing students' exposure to a variety of topics of current interest. Our semester degrees streamline and simplify our curriculum, allowing for greater flexibility while maintaining the quality and integrity of our offerings. Specific data can be found in Appendix B.i (Degree Data).

Student Clubs: We have 2 active student clubs, the Recreational Math and Computer Science Club and the Association for Women in Mathematics Student Club. They have sponsored speakers and activities that have attracted a wide range of students. Both clubs plan on establishing a web presence and we look forward to continuing to support their efforts.

Student engagement beyond the classroom: We have two faculty working with students on research projects (Dr. Shirley Yap and Dr. Ehsan Kamalinejad) and several others who supervise "independent study" courses for students with interests beyond the standard curriculum. We hope to increase the number of research opportunities for students as resources and faculty availability allow.

Supporting underprepared students: The new Executive Orders on Academic Preparation (EO 1110) and General Education (EO 1100 (revised)) will have a significant impact on our work as a service department. The department has been hard at work to develop courses that will support underprepared students entering the university in Fall, 2018. The department has played a leadership role in our institutional response and compliance with these new mandates. We will develop versions of College Algebra and Math for the Arts and Humanities that incorporate additional support for students who are admitted to the university but who are identified as under-prepared in mathematics and quantitative reasoning. More information about relevant curricular changes can be found in the 5-year plan.

Addressing high DFW rates: We have many projects in development and ongoing to support students and instructors in our lower division service courses through calculus. These include course coordination, Learning Assistants, Supplemental Instruction (SI) and more robust training for graduate student Teaching Associates. Specifically, the department has expanded its use of Supplemental Instruction which is now implemented in several sections of College Algebra, Trigonometry and Analytic Geometry, Calculus I and II, and Math for Business and Social Sciences. We have made our implementation more robust through better communication with instructors and SCAA trainers and supervisors. Dr. Kathy Hann led a task force for College Algebra/Precalculus during AY 2015-16. Working with two experienced contract lecturers, Sharon Buckley and Sue Benjamin, the task force developed annotated/curated syllabi, sample exams, sample grading rubrics/examples, a coordinator position description, and a "shared experience" document. Each of these serves to provide more complete support for instructors and also serves as model for support materials for other course-focused working groups moving forward (see our 5-year plan). We are in the process of developing additional support structures, including a Learning Assistants program and greater course coordination for our multisection service

courses. Dr. Jesus Oliver, Dr. Julia Olkin and Dr. Shirley Yap are working on a Chancellor's Office course redesign project to infuse more active learning into Calculus I and recently received a grant (SEMINAL) to extend their work into pre-calculus and Calculus II. We are also establishing working groups to create curriculum for multiple versions of college algebra and Math for the Arts and Humanities that can support student success for all students regardless of preparation status.

b) Curriculum

The Department continues to a provide high caliber, creative undergraduate and graduate programs for our majors. Our BS degree is aligned with the Mathematical Association of America's 2015 Committee on Undergraduate Programs in Mathematics Curriculum Guide recommendations. We are working to improve recruitment into the major by incorporating innovative pedagogy, technology, and applications into our lower division courses. We are also introducing a new Mathematical Software course as part of the major under semesters. We believe such updates and innovations will strengthen the major and make it more attractive to students with a broader range of goals and interests. At the same time, we will continue to offer a relevant and rigorous program that produces students who are knowledgeable and prepared to enter teaching credential programs, graduate programs in mathematics and related fields, and the workforce in areas related to technology, education, and other fields that require technical and critical thinking skills.

Our new semester curriculum includes changes to the overall structure of our program, eliminating concentrations/options so that students will be able to move more efficiently through the degree and have an opportunity to be exposed to a variety of areas of mathematics based on their interest and department expertise. We developed new program learning outcomes, curriculum maps, And degree maps. Details can be found in our 5-year plan.

Our course sections and size have remained stable. With the move to semesters our scheduling will be more regularized so that students will be better able to plan. We have also discontinued all sub-plan options within the BS and MS. This will allow for greater flexibility. Under semesters classes will not be repeated as frequently so students will be forced to plan more carefully and to take a course when it is first offered after they have taken the prerequisites. Under quarters students would sometimes wait for a "favorite" instructor to appear on the schedule -- under semesters this will no longer be a viable strategy.

Selected recent curricular innovations
Most of our faculty are active in curricular innovation. We have faculty using Supplemental Instruction (SI), flipping classrooms, using active learning, Peer Instruction, ABCD colored response cards, peer instruction, and group activities. In terms of technology, we are using Desmos, Wolfram Alpha, Geogebra, Matlab, Webwork, and Mathematica in courses across the curriculum. Webwork (Yap)

We have developed new graduate courses in Optimization (Olkin), Non-Linear Wave Equations (Oliver), Fourier Analysis (Oliver) and Machine Learning (Kamalinejad), a new undergraduate course in Mathematical Modelling (Kamalinejad) and redesigned Math for Business and Social Sciences (Yap) and Mathematical Modelling (Yap).

c) Faculty

Since our last 5 year review we have completed 3 successful tenure track faculty recruitments. In 2012 we hired Dr. Ehsan Kamalinejad, in 2015 we hired Dr. Jesus Oliver, and in 2017 we hired Dr. Andrea Arauza Rivera, who will join the faculty in Fall, 2018. However, in the same period of time we have seen 4 retirements with a 5th at the end of this year, leaving us understaffed.

One challenge noted in our annual reports is recruiting and retaining quality regular faculty the the face of the high teaching load, high cost of living in the Bay Area, and salaries that do not compete with our local sister campuses. In addition, we struggle at times to generate sufficient student demand to provide course choices for our majors. With the move to semesters, we will be offering more courses per term than we are used to, which will strain our ability to staff courses and offer interesting electives. With the current level of staffing described above, we will hardly be able to cover our major or graduate courses. In fact, with the move to semesters and a base teaching load of 12 units, many of our tenure line faculty may find themselves with 4 preparations since doubling up on lower division courses would leave us without sufficient experienced staffing at the upper division and graduate levels. In addition, many innovations in our service courses may be negatively impacted since the regular faculty who are developing and implementing the new approaches will be needed at the upper division and graduate level. In particular, see later sections for a description of programmatic changes in entry level service classes through the calculus sequence.

We continue to try to increase opportunities for student research. Dr. Shirley Yap and Dr. Ehsan Kamalinejad have been working with students, both undergraduate and graduate, on research projects. Several faculty are focusing their professional efforts on STEM Education projects that impact our local K-12 community as well as the quality of instruction in our math courses. This work is not always 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 which brings significant funding and acclaim to our department and campus from surrounding communities. 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. Our most recent position descriptions have included an emphasis on the ability to work with undergraduates in research.

Selected recent professional activity

Dr. Julie Glass

• Appeared: Aksoy, S., Azzam, A., Coppersmith, C., Glass, J., Karaali, G., Zhao, X., Zhu, X., Coalitions and Cliques in the School Choice Problem, Involve, A Journal of Mathematics, Volume 8 Issue 5 (October 2015), pages 801–823.

• Submitted: Glass, J, Karaali, G. Matching Kids to Schools: The School Choice Problem, submitted for publication to *Mathematics and Social Justice: Perspectives and Resources for the College Classroom*, Mathematical Association of America Press

Dr. Kathy Hann
• Presented: "CSUEB Subject Matter Programs in Math and Foundational Math," CMC North Conference, December 2016
• Presented: "Pathways to Teaching Middle School Mathematics--Models and Issues" at the CMC North Annual Mathematics Education Meeting at Asilomar, 2016
• In Progress w/ Nada Djordjevich: "A study of the effectiveness of the Noyce program and the CSUEB Math and Science teaching credential programs on teaching in middle and high school high needs districts."

Dr. Ehsan Kamalinejad
• Submitted "IsoClustering: A Generalized Framework for Local Data Clustering".
• Presented at the Faculty Research Symposium at CSUEB.

Dr. Jesus Oliver
• Appeared: J. Oliver, "A Vector Field Method for Non-Trapping Spacetimes," Journal of Hyperbolic Differential Equations, 13 (2016), no. 4, 735-790. Submitted: J. Oliver, J. Sterbenz, "A Vector Field Method for Radiating Black Hole Spacetimes." Submitted to Analysis and PDE (June 2017).
• In Progress: "A Vector field Method for the Wave-Klein-Gordon System." Collaborator: Philippe LeFloch, Laboratoire Jacques-Louis Lions, Universite Pierre et Marie Curie, Paris, France.
• Presented Math/Stats Colloquium, San Jose State University, 2017
• Research In Paris, Institut Henri Poincare, Paris, France, 2017

Dr. Julia Olkin
• Workshop Presenter for incoming freshmen at Oakland High School with the goal of strengthening math skills and building math confidence.

Dr. Shirley Yap
• To appear: "Density of Local Maxima of the Distance Function to a Set of Points in the Plane," AWM-IMA Special Issue on Research in Computational Topology, Springer
• Submitted: A Continuity Sleight of Hand, to Mathematical Intelligencer
• Speaker: "Density of Anchor Points on Delaunay Triangulations," at AWM Symposium at UCLA, March 2017.

Service to the University: The department is very active in service at the college and university level and in state and national organizations in support of K-16 education. We have representatives on the College RTP and Curriculum committees, the General Education Subcommittee of CIC, Academic Senate, FAC and COBRA. We have had representatives on the Search Committee for the AVP of University Advancement and the Provost and Vice President for Academic Affairs. Dr. Olkin serves as co-chair of the Board of Directors of the STEM institute. Dr. Hann is a member of the California Association of Mathematics Teachers (CAMTE) Advising Committee and the Purposeful Recruitment, Exploration, and

Preparation (PREP) Initiative Task Force, the California Association of Mathematics Teacher Educators Advocacy Committee and the Mathematics Teacher Education Project (MTEP). Dr. Yap serves as our regional section governor to the Mathematical Association of America, is on the founding team of the East Bay Teachers' Math Circle, and as Director of the University Honors Program.

d) Funding and Support

Selected recent funded projects

Jointly funded: Dr. Julia Olkin, Dr. Jesus Oliver and Dr. Shirley Yap were awarded a CSU Chancellor's Office "Course Redesign with Technology" grant (2017-2018). They were also awarded Student Engagement in Mathematics through a Network for Active Learning (NSF SEMINAL) partner grant. The grant is to create, pilot, and refine a course redesign for pre-calculus, Calculus I and Calculus II in alignment with the definition of Active Learning Mathematics (ALM) in the SEMINAL Phase II RFP.

Dr. Julie Glass is campus lead on an Irvine Foundation funded project, "Bridging the Gap," that brings together a partnership among CSUEB, Peralta Community Colleges, Oakland Unified School District and Berkeley Unified School District. The goal of the project is to support student success across High School – Community College – University transitions. She is PI for the Greater Bay Area P20 Basic Skills Consortium (GBA K20BSC), a collaborative among Ohlone Community College District (lead), CSUEB, Berkeley City College, Chabot College, Diablo Valley College, Las Positas College, Mission College, Peralta Community College District, San Francisco State and San Jose State.

Dr. Kathy Hann serves as PI for the CSUEB Noyce Teaching Fellows Program and CSUEB Noyce Scholarship program. These grants provide scholarships and professional development for future math and science teachers committed to teaching in high needs schools. In addition, she submitted: Supporting Excellence, Effectiveness & Diversity in STEM Teacher Education Noyce Scholars Program, Track I. A $1.2 million proposal submitted to NSF in August 2017.

Dr. Ehsan Kamalinejad was awarded, together with five other faculty members from CSUEB and Fresno State University, a National Science Foundation FURST, Faculty and Undergraduate Research Student Teams, grant. So far the funding has supported a 1 month intensive research camp at CSU Fresno. This funding has supported the development of software that uses a HoloLens camera and depth camera for robust object detection. The software is also capable of recognizing people, more details can be found at http://ehsan-kamalinejad.pagecloud.com/projects2

Dr. Jesus Oliver submitted Faculty Support Grant to CSU East Bay (May of 2017). The proposal requested release time in order to establish collaborations with UC Berkeley and Stanford Math departments, as well as to work on a manuscript and turn it into a publication.

Dr. Julia Olkin is Co-PI on an NSF Faculty Learning Grant which works with a cohort of 12 teachers (7 from CSUEB and 5 from community colleges) to incorporate active learning strategies into STEM classes. She is also co-PI for the 2nd year of TEEM (Teaming for Effectiveness and Equity in Mathematics) working with K-3rd teachers in Hayward Unified. She continues to serve as PI for the

MSTI (Math and Science Teacher Initiative) grant to encourage undergrads to enter the credential program in STEM fields. Finally, she was awarded a grant from Warriors Community Foundation to run a one-week math program in Oakland for incoming 9th graders.

Dr. Shirley Yap received a Chancellor's Office Course Redesign with Technology grant for Math for Business and Social Sciences (Math 1810).

2.2. Assessment and Curriculum

a) Mathematics BS

Program Learning Outcomes (PLOs)

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

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

Curriculum maps can be found in Appendix G.

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 both required courses for all options in the major and required courses for the Applied and Teaching options. The exam questions were selected carefully to ensure they tested material that is essential in the courses.

Data Collection and Analysis: Final exams were collected by the department assessment coordinator. Each problem was scored by the undergraduate committee for readability, validity and fluency using the rubric found in Appendix D. Analysis and results can be found in Appendix E.

Summary of Assessment Results

Main Findings: Students perform uniformly well at the readability and validity level. The departments needs to find ways to increase performance at the fluency level.

Recommendations for Program Improvement: The department needs to work on setting and communicating to instructors and students the essential topics for its courses and how to include fluency assessment throughout the coursework.

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.

b) Mathematics MS Assessment

Program Learning Outcomes (PLOs)

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

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 and Analysis: Final exams were collected by the department assessment coordinator. Each problem was scored by the undergraduate committee for readability, validity and fluency using the rubric found in Appendix D. Data results can be found in Appendix E.

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.

2.3. Student Success

Graduation Rates: Graduation rate data can be found in Appendix B.i (Degree Data). Because our number of majors is so small, these data do not illuminate any significant trends, but, rather, display large fluctuations due to small numerical changes from one cohort to the next. That said, a summary of the data show that our 4-year Freshman graduation rates went from 8.3% for the 2006 cohort to 14.3% for the 2010 cohort while our 6 year graduation rates went from 41.7% to 35.7%. Our 2-year transfer graduation rate went from 30% to 28.6% and 4-year transfer graduation rate went from 60% to 71.4%. For our graduate student, we had a 2-year graduation rate of 71.4% in 2006 and 100% in 2010 and a 4-year graduation rate of 71.4% in 2006 and 100% in 2010. Whether or not these specific data are significant, we take the Graduation Initiative 2025 very seriously and understand the role Mathematics plays in meeting campus goals not just for our majors but for all students who we serve via GE and prerequisite courses, especially for STEM disciplines.

Achievement Gaps: Our largest achievement gap of 0.6 was in College Algebra, Math 1130. Other classes among the "top ten" include Abstract Algebra, Discrete Structures, Math for Future Elementary Teachers, and others. This shows that the achievement gap persists in Math classrooms across level and audience. Many of the strategies and projects described herein are meant to address our overall impact on institutional graduation rates.

Bottleneck Courses: Our top three bottleneck courses are College Algebra (Math 1130), Math for Business and Social Sciences (Math 1810) and Calculus I (Math 1304). Each of these courses are courses of many majors or, in the case of College Algebra, prerequisite to the required course. These are also courses that are the focus of our active learning coordinated course development teams. Plans for improving student success in these courses has been, and will continue to be, a strong focus in our department.

High Impact Practices: The description of strategies in the "Student" section of 2.1 above describes the significant efforts the department is making to address challenges in graduation rates and achievement gaps. Active learning approaches are being implemented across our curriculum by tenure-line and lecturer faculty. Our instructional staff are working together to provide consistency and quality in all of our classes.

Course redesign: Several funded projects, focused on service courses, were described in the "Student" section of 2.1 above. Specifically, our department faculty have received funding from the Chancellor's Office to redesign Math for Business and Social Sciences and Calculus I.

Advising: Since our last 5-year review, the department has established a process by which students are assigned to faculty advisors by last name. An announcement is sent out at the start of each quarter encouraging students to make an appointment with their faculty advisor to review their plans for coursework and to seek advice on career options. In addition, the department shares an SSP position with Computer Science to provide graduation checks and interface with the Office of the Registrar.

Academic Preparation: In preparation for the new Multiple Measures Placement protocol, we are developing a co-requisite model for underprepared students entering CSU East Bay starting in Fall, 2018. We have had faculty participating in several systemwide projects to support the creation of co-requisite courses. We will be initiating co-requisite "workshops" for College Algebra and for Math for the Arts and Humanities. Students will be enrolled in the course and co-req during orientation. We hope to cohort students in their math, co-req and Freshman Seminar/Student Success Seminar for their first term at CSU East Bay.

2.4. External Comparisons

Comparison for Degree Programs and Course Offerings to Other Institutions

Number of degrees awarded in 2014-15

Institution	Math Bachelor Degrees awarded	Math Master Degrees awarded
CSU East Bay	24	22
Sacramento State	38	8
Sonoma State (2012-13)	17	0
Chico State	28	4 (Math Education)

BS Degree Program Requirements

Institution	Units Required (Semesters)

CSU East Bay BS	49
Sacramento State BA	48
Sonoma State BS	54
Chico State BS	49

The data in the tables above shows that our program requirements and success are comparable to other similar institutions in the CSU. In particular, our MS degree has had significant success, which we attribute to flexible days/times for coursework and a robust teaching experience in our developmental coursework. We would like to increase our BS degrees and hope that modifications to our curriculum and new energy from junior faculty will help us attract strong majors to our program. Coursework comparison can be found in Appendix I.

2.5. General Program Discussion

a) Student demographics

Statistics for the Department of Mathematics on the ethnicity of student majors and graduates, and whether they started as native or transfer students, are displayed in tables in Appendix B.ii (Student Demographics). These data were obtained from the CSUEB Office of Planning and Institutional Research.

Of note in the provided tables is that our Black/African American and Hispanic enrollments have gone from 2.9% to 5.2% and from 19.6% to 26.9% respectively between 2012 and 2016. In fact, in 2016, the the largest demographic group in the major was Hispanic (at 26.9%) with White a close second at 24.6%. This increase in minority representation is promising, especially with the recent Hispanic Serving Institution (HSI) designation at CSUEB. We also had an increase in majors identifying as two or more races, from 2.9% in 2012 to 6% in 2016. Generally, our major reflects the overall diversity present at CSUEB.

b) Student level

Statistics for the Department of Mathematics on the number of degrees awarded and number of undergraduate and graduate majors are displayed in tables in Appendix B.i (Degree Data). These data were obtained from the CSUEB Office of Planning and Institutional Research.

Our overall undergraduate major headcount has increased from 71 in AY 2012-13 to 88 in AY 2016-17. However our graduate major headcount has gone from 66 to 45 in the same time frame. One promising trend is the increase in full-time students from 57% to 72%. With pressure from the Chancellor's Office to meet the aggressive graduation goals from the Graduation Initiative 2125, these increased numbers of full time students is encouraging.

c) Faculty and academic resource allocation

Statistics for the combined Department of Mathematics and Computer Science on the number of faculty and lecturers, ethnicity of faculty and lecturers, number of sections, average section size, FTES, FTEF, and SFR for undergraduate and graduate courses are displayed in tables in Appendix B.iii (Faculty and Course Data Math with CS). Disaggregated data was estimated for faculty headcount and FTEF only, but the estimations are not accurate, see Appendix B.iv (Faculty Data Math Estimates). These data were obtained from the CSUEB Office of Planning and Institutional Research. What we believe to be accurate numbers of regular faculty is included in the discussion below. Complete trend data was not available disaggregated for Mathematics alone.

In Fall, 2013, we had 8 full professors, 3 associate professors and 1 assistant professors. In Fall, 2016, we had 1 FERPer, 6 full professors, 3 associate professors and 2 assistant professors. These numbers, however, do not reflect the situation we face for Fall, 2018 at which time we anticipate having 2 FERPers (at 50% time), 6 Full Professors, 0 Associate Professors and 3 Assistant Professors. Thus we will have gone from 12 tenured/tenure track faculty to 9 tenured/tenure track faculty and 2 FERPers. This is a 20% decline in full time tenure line faculty in 5 years, while maintaining consistent or increasing enrollment of majors this reduction will impact our ability to maintain qualified instructors in our upper division major and graduate level classes.

According to the estimates provided, our overall headcount for instruction has gone from 33% lecturer, 29% tenured/tenure track faculty and 37% teaching associates in 2013 to 40% lecturer, 26% tenured/tenure track faculty and 34% teaching associates in Fall, 2016. These figures are suspect due to the fact that the headcount data for regular faculty was inaccurate in the provided tables.

The new budgeting process in the College of Science has allowed us to have greater autonomy in terms of department expenditures on graders, copies, and professional development, including travel. The impending budget shortfalls at the campus level will greatly impact our ability to continue to provide support in these areas and others.

d) Course data

Statistics for the combined Department of Mathematics and Computer Science on the number of courses and sections, average section size, FTES, FTEF, and SFR for undergraduate and graduate courses are displayed in tables in Appendix B.iii (Faculty and Course Data Math with CS). These aggregated data were obtained from the CSUEB Office of Planning and Institutional Research.

Faculty Diversity

In fall, 2018, the Department of Mathematics tenured/tenure line faculty will include 4 men and 5 women. The demographics will be 4 white, 1 asian\pacific islander, 2 hispanic and 2 other. Campuswide, in Fall 2016, the percentage of tenured/tenure track faculty in each of these categories is 56, 19, 10, and 9% respectively. Our entitled lecturers are mostly white and asian. We strive to recruit and retain highly qualified and diverse faculty who can inspire and motivate the students we serve.

Entering Student Characteristics

The percentage of transfer students vs. native students in the major varies from year to year. There are no significant visible trends. At this time, we do not have an institutional process for ensuring students have met prerequisites. If the University moves to using PeopleSoft to enforce prerequisites, we would be interested in investigating whether students who have completed prerequisite courses locally or in transfer fair better or worse as a group.

Course Distribution

In a typical Fall quarter (using Fall, 2015 as an example), we offer 3 graduate courses, 2 cross listed courses, 7 upper division major courses, 32 lower division course sections (service and for majors) and 40 sections of developmental math. These numbers have been fairly stable for the past 5 years. As noted earlier, and in the plan that follows, the developmental sections will no longer be offered starting in Fall, 2018. This will obviously seriously impact our overall FTEs and teaching opportunities for our graduate students.

According to the CSUEB Fact Book, FTES for Math alone in Fall, 2011, were 606.3 and SCUs were 8951. In Fall, 2016, FTES for math were 673.2 and SCU were 9957. Broken down by level we have the chart below for FTES. From these data we see a slight increase over time in FTES, much of which can be accounted for by pre-college level coursework. These pre-college FTES will no longer fall entirely to Mathematics starting in Fall, 2018.

FTES by Course Level

Math FTES	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016
PreCollege	260.9	281.1	284.7	262.3	331.1	301.9
Lower Div	270.9	254.5	256.9	269.9	271.2	308.8
Upper Div	61	61.1	60.6	63.3	54.9	47.6
Graduate	13.5	10.4	11.9	12.8	12	14.9
College Lev	345.4	326	329.4	345.9	338	371.3
ALL Total	606.3	607.1	614.1	608.2	669.1	673.2

Instruction by Faculty Status

Complete data disaggregated for Mathematics were not provided, but, in the sample term of Fall, 2015, 8 of 32 lower division courses were taught by tenured/tenure line faculty. All but one upper division, cross-listed, and graduate level courses were taught by tenured/tenure line faculty. We also typically offer 3 courses for liberal studies and/or single subject programs, all of which are taught by lecturers.

SFR data in Appendix B.iii (Faculty and Course Data Math with CS) is not disaggregated for Mathematics alone, but was provided for Math and Computer Science combined. With these data in hand, it is difficult to identify trends in Math classes independently. In general, our tenure/tenure track faculty teach between 4 and 12 WTUs per term. Our faculty have release from a variety of internal and external sources as described in the Faculty section above. We have contract lecturers with entitlements ranging from 8 units per quarter to as high as 15 units during some quarters. We also have had graduate student Teaching Associates who teach our developmental (pre-college) courses. Of note is that the implementation of Executive Order 1110 will have an impact on our teaching associate and lecturer FTEs as students shift from developmental coursework into baccalaureate level courses. In addition, the department anticipates a significant reduction in overall FTEs as it will no longer be the case that all students take their first year courses from Mathematics. Many will move to taking their first course from the Department of Statistics, or, perhaps over time, other departments that propose new general education quantitative reasoning/mathematics courses as described in EO 1100.

The table below, which includes more complete information, is taken from the Institution's Fact Book.

SFR by Faculty Role

SFR	Faculty Role	2012	2013	2014	2015
MATH	Tenured & Tenure Track	19.26	17.20	21.99	19.40
	Lecturer	27.09	28.62	30.05	29.19
	Lower Division	25.69	27.24	28.80	28.46
	Upper Division	21.60	18.64	21.85	20.26
	Graduate	14.08	9.08	16.02	12.57
	Total	24.87	25.12	27.43	26.96

GE, Service, and Major students and courses

A majority of our lower division courses primarily serve other departments. In particular, most STEM majors take at least one term of Calculus and all students in the College of Business and Economics must take Calculus I (Math 1304) or Math for Business and Social Sciences (Math 1810). This is typical for Departments of Mathematics, and we feel it brings a richness to the student experience to have a variety of majors in a single lower division course. Most of these courses also fulfill the GE B4 requirement. We have one course, the Nature of Math (Math 1110), that serves students from the Arts and Humanities wishing to simply fulfill the GE Area B4 requirement. We would like to be able to have more tenured/tenure line faculty teaching in these courses as we believe the students and faculty would benefit from the interaction. In addition, we believe they could be used to recruit new math majors who might not otherwise be exposed to our permanent faculty.

None of our major upper division courses fulfill any GE requirements. Typically our major and graduate level courses have only a few non-math majors, such as those from Physics, Computer Science or Engineering.

Concord Campus

We offer courses for a liberal studies cohort at the Concord campus. This consists of one section each of Math 2011, 4012, 4013, and 4014. These courses have been taught by long-term lecturers in recent years. One of these lecturers is moving across country this summer and the other may also leave the area soon. Finding appropriate instructional staff for these courses at the Concord location is a challenge.

Online Courses

We do not currently offer any courses online and don't anticipate a move in that direction in the near future. There is interest from the College of Business and Economics to provide their students with their Mathematics requirements online, and we have offered that required course online in the past and might consider doing so again in the future It is the policy and practice of Mathematics Departments across the CSU to require any online coursework to include a proctored cumulative final examination.

Graduate Program

Our overall graduate headcount has gone from 66 in AY 2012-13 to 45 in AY 2016-17. The significant drop in graduate enrollment is of concern. We were careful in the restructuring of the graduate major under semesters to create a program that can be completed in a timely manner while taking 2 courses per semester. We are concerned that the reduction in relevant work because of the changes to remediation practices at the system will further depress our graduate enrollments. One of the significant strengths of our graduate program has been the opportunity to teach classes similar to those taught in the community colleges -- where many of our graduate students seek employment after completing their MS degrees. On the other hand, our approach to addressing the needs of underprepared freshman will still allow graduate students some teaching experience via "co-requisite" courses. In fact, we hope to treat teaching in these courses as a sort of apprenticeship, allowing for more substantive training and, for successful graduate student Teaching Associates, the opportunity to advance to teaching college level courses in our standard service curriculum.

2.6. Faculty

Our goal is to maintain a balance in expertise in teaching and research among our regular faculty. We also value the impact of our established lecturer faculty and their contributions to instructional excellence and consistency, especially at the lower division. The following table summarizes our search efforts and results from the last five years. Copies of the new faculty requests for tenure-track faculty searches from the last five years can be found in Appendix C.

New Tenure Track Faculty Hires 2012-2018

Year of Search	New Hire	Specialization	Start Date
2012-2013	Ehsan Kamalinejad	Math Modeling, Optimization, and Machine Learning.	09/01/2012
2015-2016	Jesus Oliver	Partial Differential Equations and General Relativity.	09/01/2016
2017-2018	Andrea Rivera	Noncommutative geometry, operator algebras, analysis on fractals, fractals in nature, dynamical systems, Riemannian geometry.	08/24/2018

2.7. Resources

The department works closely with the Student Center for Academic Achievement (SCAA) and with General Education. These collaborations are mutually productive and aimed entirely at supporting student success. In particular, the SCAA runs the campuswide SI program and we have worked closely on implementation of Supplemental Instruction (SI) in courses through calculus. SI in math has been strengthened through open dialog about the needs of our program and the parameters of the SI program. Specifically, in mathematics classes the SI leaders support collaborative and active learning in the classroom as well as running traditional SI sessions outside of class time. This implementation has made the program meet the needs of Math faculty and students as well as conforming to the parameters of SI overall. Our collaboration with GE has traditionally been on enrollment and placement of freshman into developmental math. With the new policies in EO 1110, our collaboration has grown to include more coordination between math classes, corequisite math classes, and a required GE Area E Freshman Seminar course. We are excited to see how this coordinated effort can help support student success. In addition, we have been working with GE, EOP, and English to develop a pilot Early Start program for Summer, 2018. This will be a 4 week program combining Math, English and College Success curriculum.

2.8. Requirements

Our program requirements do not fall outside the typical minimum number of units for completion of a baccalaureate or master degree.

3. Plan

3.1. Curriculum

Major Program

We will begin implementation of our transformed semester curriculum in Fall, 2018. Our semester BS degree is aligned with the Mathematical Association of America's 2015 Committee on Undergraduate Programs in Mathematics Curriculum Guide recommendations in its structural, content and cognitive elements. These changes will be reflected in new program learning outcomes and new processes and procedures in the department. 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.

Specifically, the structure of the major will more clearly include a set of "core" courses required for all majors with sequences and electives more clearly connected and streamlined. Scheduling will be more transparent allowing for better planning and facilitation of graduation. Additionally, students will complete a capstone experience modeled on the High Impact Practice advocated by the AAC&U. The revised major was designed so that students interested in high school teaching are able to complete their BS in mathematics and their Single Subject Matter Program in Mathematics in tandem. These students will be qualified to enter a teaching credential program in mathematics without having to pass the three California Subject Examinations for Teachers (CSETs) in mathematics.

Planned content and cognitive changes will more clearly incorporate transformed outcomes and objectives which will be introduced, developed and mastered according to a new Curriculum Map, see Section 2.2 above. These outcomes and objectives will be communicated to students via departmental syllabi and through other department guides and publicity materials. The department is working also to systematically incorporate active learning into all its classes.

Some elements of our transformation are described below.

1) The use of technology for exploration, computation, motivation and visualization. Students will be introduced to and asked to use a variety of technological tools: e.g., Matlab, Mathematica, Maple, Geogebra, Sage, Python, Webwork, etc. Knowledge and facility with technology enhances teaching and learning and has significant benefits after college and beyond the classroom.

2) A focus on applications to other fields and within mathematical fields to explore, motivate and illustrate the theory and practice of mathematics and other mathematically-intensive fields. The application of mathematics to ideas and problems in a variety of areas will serve to deepen students'

understanding and appreciation of mathematical theory and also better prepare them for careers after graduation.

3) A capstone experience and other course work will help students develop the ability to work collaboratively, think independently, make connections and think beyond the standard course curriculum. Students will be guided to write and present complex mathematical ideas to an audience of peers.

4) Active learning will be infused throughout the curriculum,. The department will provide support and resources for implementation to all instructional faculty.

The elements of transformation described above are strongly in line with the Mathematical Association of America's Committee on the Undergraduate Major Curriculum Guide (2015 edition). This guide describes cognitive and content goals that span the breadth of undergraduate programs in mathematics and reflect ongoing comprehensive conversations and research by leaders in mathematics in higher education. The department will continue to use and adapt the recommendations in this guide while keeping a sharp focus on CSU East Bay's unique students and their needs as it develops a transformed program.

Service Courses

In several of our key gateway/bottleneck courses, we have established course teams who are working on creating materials and resources that support innovative instruction and consistency across sections. These elements include a weekly course schedule, annotated/curated syllabi, sample exams and syllabi, required and suggested course elements/standards, sample grading policies, sample grading rubrics/examples, model homework assignments (online and written), ideas for active learning and collaborative work, and a "shared experience" document. We are in the process of developing additional support structures, including a Learning Assistants program and greater course coordination for our multisection service courses. For College Algebra, Precalculus, and Math for Business with Calculus, we are piloting the use of a low-cost "subscription" textbook and online homework system called XYZhomework and XYZtextbooks. The high costs of class materials can pose a barrier to our students and we believe that identifying and selecting affordable solutions for classroom resources can help students succeed.

Underprepared Freshman

In response to new policies mandated by EO 1110, the Department of Mathematics is developing a co-requisite model for underprepared students entering CSU East Bay starting in Fall, 2018. The model will be developed for:

a) Math 115: College Algebra (co-req Math 15: College Algebra Workshop), serving all STEM and Business students, or any student who wishes to pursue a pathway that requires higher level algebra based coursework and
b) Math 118: Mathematics for the Arts and Humanities (co-req Math 18: Mathematics for the Arts and Humanities Workshop), serving students whose major is in the arts or humanities and who is drawn to project based learning, conceptual approaches to quantitative skills, and exploring patterns and ideas using quantitative methods.

For each of the paired courses, teams will be formed to develop and produce the deliverables described below.

Co-requisite course

- Weekly schedule coordinated with parent course
- Department syllabus
- Required course elements/standards
- Grading policy
- Ideas for active engagement and collaborative work
- Ideas for how to leverage co-req in support of parent course
- Worksheet and/or workbook

Elements coordinated with the "parent" course

- Side-by-side course schedules
- Communication plan between instructors
- Coordinated teaching strategies
- Ideas for use of common learning assistants/peer tutors/Supplemental Instruction Leaders
- Ideas for coordination with General Studies course and instructors

Early Start

The department will continue working with GE, EOP, and English to develop a pilot Early Start program for Summer, 2018. This will be a 4 week program combining Math, English and College Success curriculum.

3.2 Assessment

a) Updated Program Learning Outcomes (PLOs) effective Fall 2018

Mathematics BS Program Learning Outcomes

1. Apply the definitions, techniques and theorems of mathematics
2. Use mathematics to understand, explain and/or solve problems beyond a particular course
3. Creatively conjecture and rigorously write, analyze and critique proof
4. Communicate mathematics effectively

Mathematics MS Program Learning Outcomes

1. Evaluate and create proofs in graduate level mathematics using the fundamental definitions and theorems.
2. Create solutions to problems using techniques in graduate level mathematics.
3. Communicate Graduate Level Mathematics Effectively.

b) PLOs to Course and PLOs Institutional Learning Outcomes (ILOs) Curriculum Maps

Mathematics BS Curriculum Maps (A indicates courses in which the given PLO will be assessed)

Math BS Curriculum Map 1					
PLOs Aligned to Courses					
Course Name	Course #	PLO 1	PLO 2	PLO 3	PLO 4
Calc 1	130	I	I		I

Calc 2	131	I	I		I
Calc 3	230	D	D		I
Sophomore Math	210	D	D		I
Software	305		D		
Intro to proof	300	D		I	D
Algebra 1	320	M (A)		D	D
Analysis 1	330	M		D	D
Linear Algebra with Applications	310	M	M (A + ILO 1)	D	D
Senior Seminar	489	M		M	M (A+ILO 2 & 4)
Abst Alg II, Analysis II, Geometry	321, 331, 340			M (A)	
Numerical Analysis I, Linear Programming, Differential Equations I	370, 380, 375		M		

Math BS Curriculum Map 2				
PLOs Aligned to ILOs				
	PLO 1	PLO 2	PLO 3	PLO 4
ILO 1 (Thinking and Reasoning)	X	X	X	
ILO 2 (Communication)				X
ILO 3 (Diversity)				
ILO 4 (Collaboration)				X
ILO 5 (Sustainability)				

Mathematics MS Curriculum Maps

Math MS Curriculum Map 1			
PLOs Aligned to Courses			
	PLO 1	PLO 2	PLO 3
Real Analysis	I, D	I, D	I, D
Advanced Algebra	I, D	I, D	I, D
Numerical Analysis	I, D	I, D	I, D
Capstone	M (A + ILO 1)	M (A + ILO 1)	M (A + ILO 2)

Choose 2	M	M	M
Choose 2 electives	M	M	M
Math MS Curriculum Map 2			
PLOs Aligned to ILOs			
	PLO 1	PLO 2	PLO 3
ILO 1 (Thinking and Reasoning)	X	X	
ILO 2 (Communication)			X
ILO 3 (Diversity)			
ILO 4 (Collaboration)			
ILO 5 (Sustainability)			

c) Assessment Schedule and Process

PLO's 1 and 3 will be assessed in even years and PLO's 2 and 4 will be assessed in odd years for the Math BS. PLO's 1 and 3 will be assessed in even years and PLO 2 will be assessed in odd years for the graduate program. We will use the new process that is described in section 2.2 and was developed in 2015.

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

Sampling Procedure: The courses for each year's assessment will be chosen by the department during a Fall department meeting. For each course assessed, a final exam question will be identified as a typical problem for the course that assessed the given PLO. These problems will be chosen by the department during one of our monthly department meetings. The exam questions will be selected carefully to ensure they test material that is essential in the courses and for the programs.

3.3. Students Success

Our BS enrollment has increased slightly in recent years while our MS enrollment as decreased. It is not clear if these are significant trends or just the natural fluctuation in enrollment. We believe that our transformed semester curriculum will attract new students to the math major. In addition, we are committed to our programs that prepare K-12 teachers. A majority of our students come from the surrounding communities and come from public school systems. Many of these students want to stay in the bay area and serve their communities by returning to the high school classrooms where they were once students. They understand the challenges faced by the youth they will meet in these classrooms and are best positioned to lift them up and support them as they choose their own paths. This cycle of

motivation, challenge and inspiration is one that the CSU East Bay Mathematics Department has embraced and supported through grant work and simple hard work. Great mathematics teachers motivate, challenge and inspire. Having a great math teacher in high school can change lives by opening pathways to STEM careers and providing essential tools for productive citizenship. CSU East Bay is positioned to develop just such teachers who are committed to our region and are prepared to provide exceptional mathematics instruction in high school. We believe that our best mathematics majors make the best high school teachers. Math content, often perceived as static and uninteresting, can be brought to life through its connections to the familiar (what is seen in the high school classroom) and the new (ideas that deepen and expand the familiar).

Some goals in this area are:

- Model Best Practices: These pedagogies will be recognized promising practices aligned with common core strategies of problem solving, creative and critical thinking, and communication skills. These approaches are effective for college students and for the high school students they will ultimately teach. We will use high tech and no tech approaches such as smart boards and whiteboards, laptops and tabletops. Students will be asked to collaborate and to facilitate collaborations to present and evaluate to use critical thinking and to elicit critical thinking.

- Support our strongest students: Seek funding to expand scholarship opportunities to STEM students who have completed all major lower division requirements with a cumulative major GPA of 3.0 or higher who have a commitment to becoming teachers.

- Facilitate progression: Create smooth pathways to the teacher credential program at CSUEB.

- Collaborate: Develop cross-sector workshops to bring together current high school teachers, teacher credential students, undergraduate STEM majors, community college students and university professors to discuss and develop curriculum.

- Value faculty commitment: Provide support for professional development for university faculty to discover better ways to include relevant strategies and content in their classrooms.

- Assist leadership: Provide organizational support for programming and outreach.

3.4. Faculty

A majority of our lower division service courses are taught by lecturers. We believe that our majors and the students we serve in other majors would all benefit from having our full time tenure line faculty teach some of these courses. With the successful completion of our most recent search, we will still need more tenure track faculty to make this a reality. We intend on requesting another new tenure track hire for Fall, 2020.

In addition, our current faculty rarely teach topics courses in their areas of expertise. This separation between instructional assignment and professional interests makes it more difficult to maintain a successful research program and to attract students for research projects. We hope to

- Increase our ability to engage students in research and/or learning beyond our standard curriculum via independent studies and research opportunities.
- Have tenure track faculty teaching in our lower division service courses on a regular basis.
- Provide sufficient funding for travel and professional development, especially for pre-tenure faculty.
- Build community among faculty, both tenured/tenure track and lecturers.
- Develop a departmental RTP policy that encourages instructional and professional growth.

3.5. Resources

Campus budget challenges overall will impact our ability to support instructional and professional work. Resources for students and faculty described throughout this document such as graders, coordination, support for underprepared students, new curriculum for semesters, etc., all require ongoing financial support.

Specifically, ongoing professional development funds, funds for graders and equipment must be maintained at least at a constant level.

Our proposed Learning Assistant program is an integral component of our new co-requisite curriculum for underprepared incoming freshman. This program would provide embedded peer-tutors in the parent and co-req course as well as the Freshman Seminar all students take in their first year. This program would be in place of SI, which has proved to be ineffective with this student population in our obsolete developmental math program. The LA program requires a full time Student Service Professional (SSP III), a position which was approved, but remains vacant at this time.

4. External Reviewer's Report

External review
Department of Mathematics
CSU East Bay
2018

On March 27, 2018, I spent the day at the CSU East Bay Campus. While on campus, I met with Chair Julie Glass and Dean Jason Singley. I also met with the following groups of faculty, staff and students:

- Tenured faculty: Kathy Hann and Julia Olkin
- Probationary faculty: Ehsan Kamalinejad and Jesus Oliver
- Lecturers: Sue Benjamin, Sharon Buckley and Dorothy Fujimura
- Undergraduate and graduate students in Julia Olkin's Math 4841/6840 course, Topics in Optimization
- Staff members: Robyn Inouye and Janet Snyder

4. External Reviewer's Report

The Mathematics Department community's dedication to teaching and to their students is quite impressive. Here are a few of the commendable efforts in the department.

A significant component of the Department's academic assignment is teaching service courses, ranging from developmental math to some upper division courses. As a result of EO 1110, developmental math no longer exists and has been replaced with supported instruction in some form. The development and redesign of these courses has placed a significant burden on the CSU departments that offer area B4 courses, especially mathematics departments. At CSU EB, the course redesign is being handled by groups of tenured/tenure track faculty and lecturers. Participation of the faculty who are teaching the courses is essential to the success of these new courses.

Evidence of the faculty's consistent efforts in improving instruction in and out of the classroom are mentioned here.

- Most of the faculty are active in curricular innovation.
- The department is proactive in improving instruction by incorporating more active learning strategies in their courses. The faculty applied and received funding for improving instruction.
- The department has made significant efforts in course coordination, development of supplemental instruction and a Learning Assistants program.
- The faculty continue to develop new courses and redesign old ones meet student needs.
- Students have opportunities to work with faculty on research projects.
- Students also have opportunities to work on class projects which they seem to enjoy.
- Some graduate students are given teaching opportunities which not only prepares them for college level teaching but for other careers as well. Teaching is one of the best oral communications training for their students. Explaining complex ideas to others is a invaluable skill that is useful in both academia and industry. Many of the graduate

students used to teach Developmental Math. With the demise of Developmental Math, the department is now challenged with finding opportunities that would replace this vital experience that contributes to the education of both the teacher and students.

- The department has BS Mathematics and MS Mathematics degrees with three different options so students may select academic pathways that lead to their career goals. Most mathematics majors either work in industry or education.
- In small departments, offering a diverse set of courses could be problematic due to budgetary concerns over low enrolled classes. Their creative solution is to offer combined undergraduate and graduate classes.
- Some faculty focus on STEM education projects that improve the quality of instruction in K-16. Some faculty have applied and received grant support on STEM Education including CSU CO's Course Redesign with Technology, Irvine Foundation "Bridging the Gap", Noyce Teaching Fellows/Scholarship Programs, NSF's Faculty and Undergraduate Research Student Program, NSF Faculty Learning Grant.

Faculty

In general, the faculty, staff and students are very content with their work environment. The faculty are very supportive of their students and the students *love* the faculty. They seem to be a tight-knit group of faculty who share common goals and priorities.

Unlike other science departments that require expensive equipment, a math department's main need is personnel in the form of regular faculty, lecturers, TA's, tutors, student leaders for supplemental instruction and graders. Homework is essential to learning and feedback is critical. In 2016, graders were provided to faculty who requested them. I was surprised that this practice *started* in 2016.

Mathematics is alive and well and growing. Advances in mathematics need to be incorporated in the department's curriculum. It is essential that the department remain current. But the department is also tasked with providing quality math education to all students and not just their own majors. While both are important, finding faculty to do both puts a strain on department resources. Hiring and retaining new faculty is one way to accomplish this.

On of their challenges is recruiting and retaining quality regular faculty due to a high teaching load, high cost of living, and salaries that do not compete with other campuses. Lowering the number of preparations each semester (for all faculty) can help alleviate the amount of work produced by the high teaching load but this is not always possible.

Faculty should also be given the opportunity to teach courses in their areas of specialty so that students can benefit from the faculty's expertise. A faculty member expressed an interest in developing a colloquium series.

Faculty are also need support for research and professional development such release time for research, travel funding, colloquium series, summer funding and student support. While there are some funds available through local programs, there needs to be a commitment from the

university by providing consistent support for these activities. Said support should become a line item in the department budget.

This department put much energy into improving the classroom experience by participating in external programs, restructuring their foundational math program, developing new and effective teaching strategies. The department also needs to provide quality educational experiences to their majors. Many of their majors will pursue high school and college teaching careers. With all the demands of their service courses to the university, the department is feeling the strain in their upper division and graduate offerings. There is a very simple solution to this problem: hire new faculty.

In most universities, the math departments are underfunded. The monies generated by the math department's service courses usually far exceed the budgets allocated to the department. The administration should redirect some of that monies back to the department in terms of more faculty hires and instructional support which is essential to the success of the department and the students that they serve.

Students

As mentioned before, the math majors are generally happy with their education and their instructors. I met with a group of graduate and undergraduate students who were taking Math 4841/6840. They said "The faculty are great!". They mentioned that they enjoyed doing class projects and would like to do more. Some of them would like more opportunities for research. They also mentioned that they would like more tenured/tenure track professors. The students would like to teach in high school or at the college level or get a job in industry. Another student graduated from college 27 years ago and came back for a graduate degree at the urging and encouragement of her mentor and former professor; she attributes her successes to him. Two students would like to get their PhD's. A student loves the department so much that she would like to pursue a PhD so that she could come back and be part of the Mathematics community as a faculty member.

One complaint was that sometimes, classes they need for their degree are offered at the same time which could delay graduation. They also felt that they had to take too many GE courses. When asked about issues that concern them, the students mentioned family, work, health, traffic and parking. One student complained that one of their instructors did not give any homework.

Some students also expressed an interest in career advice and graduate school information. Perhaps the department can sponsor a sequence of conversations on industrial and teaching careers and PhD programs.

Curriculum

The Math department offers undergraduate and graduate degrees in mathematics with 3 options – (Pure) Math, Applied Math and Teaching which is in line with student goals. The campus move

to semesters is a good opportunity for the department to reconsider their offerings. The restructuring of the degrees will include the identification of core courses, a capstone experience, incorporation of active learning into all the classes, use of mathematical software, and a focus on applications. The redesign of their curriculum is in line the Mathematical Association of America's Committee on Undergraduate Major Curriculum Guide.

Service Courses

A considerable portion of the Department's instructional assignment is comprised of service courses for students outside their department as well as underprepared students. The department has started a more coordinated approach in their lower division courses. They employ high impact practices and use low cost textbooks when possible. They also developed teams of regular faculty and lecturers to redesign their lower division courses to meet the requirements of EO 1110.

Aspirational goals as well as instructional innovations reflect their thoughtful assessment of their curriculum. They provide a list of goals which include Model based practices, support for strongest students, facilitate progression, develop cross sector workshops, support faculty commitment.

Space

Since their last review, the Math Department is now located in one building although some offices are still located in different parts of the campus. An effort should be made to consolidate the offices in close proximity of each other. Also, I found it surprising that there seems to be no priority in class scheduling. At my institution, departments are given first priority in certain classrooms during the first round of scheduling. This may a be practice that the campus might consider implementing.

Conclusions

The Department's commitment to teaching and their efforts to improve the student experience through curricular and pedagogical innovations are commendable. Much energy is put into the implementation of their goals. But the service component of the department is overwhelming. The challenge is to find a balance for regular faculty to be involved in teaching and developing service courses, mentoring and teaching undergraduate and graduate math students and doing substantive work. The department seems to accomplish quite a bit despite its size. But unreasonable external pressure and expectations makes it challenging to keep faculty motivated in a difficult situation. Here is a list of my recommendations:

- Replace retiring faculty
- Increase the number of regular faculty ; recruit faculty who are active in research and are devoted to teaching and implementing high impact teaching practices
- Hire more lecturers as needed

- Provide research and professional development opportunities and funding including release time for research active faculty
- Provide more opportunities for student research and student projects
- Provide more instructional support i.e graders, supplemental instruction leaders
- Start a colloquium series and encourage faculty to disseminate their work by giving presentations at conferences and local meetings
- Incorporate Student research into the curriculum. Develop an elective student research course that can be part of a faculty member's teaching assignment.
- Help students find funding to attend conferences.
- Continue to design and implement high impact practices and active learning in all courses
- Consolidate office space and provide priority in class scheduling
- Work towards fulfilling their aspirational goals.

Reviewer:
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5. Program's Response

Response to Outside Reviewers Report
December 18th, 2018

Dr. Bem Cayco, Chair of the Department of Mathematics and Statistics visited CSU East Bay on March 27th, 2018. She submitted her report and findings on December 17th, 2018.

The Department of Mathematics is grateful for Dr. Cayco's time and thoughtful report. What follows is the Department's response to her findings and comments.

Instructional improvements

Dr. Cayco mentions some of the significant efforts the department is making to improve instruction. Several elements of these efforts that are noted are the involvement of both lecturers and tenure line faculty, offering a broad range of courses, multiple implementations that involve the use of embedded peer support (Supplemental Instruction (SI) and Learning Assistants (LAs), secured funding, and the role of graduate students. Each of these elements both adds to and challenges the department in this area. Bringing multiple constituencies together to collaborate and support one another is important to the department. Dr. Cayco's inclusion of this element reinforces this importance and will motivate the department to continue to enhance this aspect of mathematics instruction. Our upper division courses are all taught by tenure line faculty. We continue to struggle to cover all of our major courses while also ensuring that our service courses include and engage our tenure line faculty. The role of peers and graduate students is also important to our educational mission -- both for our majors (BS and MS) and for the student community as a whole. Again, including this in her report highlights the importance of these efforts. The department is happy to have the opportunity to launch the LA program along with a new Math Lab to support first year student success. These programs, prompted by EO 1110, were implemented in Fall, 2018, and the department will track their impact through a variety of planned assessment efforts.

Each of these efforts requires resources, both human and financial. Dr. Cayco points to the need to prioritize hiring of tenure line faculty who can teach our majors and enrich our pedagogical effort in our service courses.

Faculty

Dr. Cayco mentioned several areas of focus for faculty. She specifically noted the importance of graders to support faculty. She noted that the department started offering graders to ALL faculty (including lecturers) in 2016. This practice did take place earlier than 2016, but had been substantially scaled back during the budget cuts of the late 1990s and early 2000s. In 2016, with

new budgeting practices in the College of Science, the Department was able to extend graders to lecturers teaching classes that had a minimum of approximately 30 students. We hope to maintain this practice and to survey all faculty regarding the use of graders and the role of online vs. hard-copy homework. Dr. Cayco also mentioned the importance of tenure line faculty teaching in their area of expertise. This practice creates opportunities for creative instruction, enhancing of research opportunities for students, and the ability for faculty to bring together their research and teaching. The department prioritizes opportunities for junior faculty to teach topics courses in their area of expertise and is happy to have these efforts recognized by our outside reviewer. Mathematics research requires a strong foundation and also significant expertise in advanced content -- and so having opportunities for undergraduate and graduate research is a challenge.

Students

It is rewarding to hear that students appreciate and enjoy their course work and the faculty. Their interest in more opportunities for research is important feedback to the department. As mentioned above, this is something that we try to foster through offering topics courses and recognizing faculty efforts through RTP. We hope to increase these opportunities through careful hiring of tenure line faculty with accessible research programs. We have developed, with the help of a successful graduate student, a web page that includes information about how to apply for graduate school. We will work towards enhancing and improving opportunities for our graduate students (and undergrads) to learn about opportunities for advanced study and careers.

Curriculum

Our curriculum has significantly transformed since Dr. Cayco's visit. We streamlined our major by eliminated "options" and, instead, requiring students to complete a common "core" set of courses and then to choose areas of "depth" depending on their interests. These changes are responsive to the comments in Dr. Cayco's report. In terms of service courses, these have also been significantly transformed, in part in response to EO 1110 and also with our change to semesters. We appreciate Dr. Cayco's recognition of the significant efforts these changes take and the impact on the energy of the department. We are committed to continuing to work collaboratively with faculty and lecturers to support the students in these courses.

Space

We are excited about the new Math Lab and are grateful that, at this time, all our tenure line faculty are co-located in the SF building. As we anticipate additional tenure line hires, we are very hopeful that there will be a way to maintain this close connection, which has a strong

influence on our ability to work cohesively towards common goals. Having space for lecturers and graduate students that are in close proximity is also a goal. Dr. Cayco's comments about classroom space is also of great significance. Not only are math classes not scheduled in consistent locations, they are often scheduled in completely inappropriate rooms. Mathematics instruction has very specific requirements and scheduling math classes in rooms with odd shapes, minimal board space, and fixed seating impacts our ability to use best instructional practices. Any possibility of prioritizing classroom space based on instructional practice would be very welcomed.

Conclusions

The department would like to echo Dr. Cayco's call for increasing the number of regular faculty and prioritizing those hires to meet the needs of math majors and service students. Other areas in which feedback was welcomed were suggested improvement/encouragement for additional opportunities for student research, student funding for travel, improving/consolidating office space and classroom space, and continuing to support and encourage innovative pedagogy.

The department looks forward to incorporating Dr. Cayco's feedback as we move towards the goals outlined in our 5-year CAPR review.

6. Dean's Acknowledgement