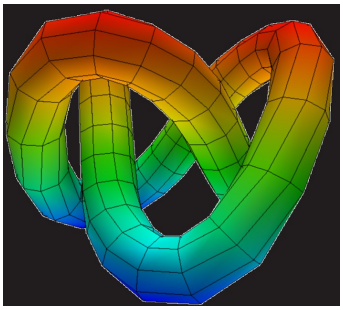
PROGRAM REVIEW MATHEMATICS
B.S. in Mathematics Program
M.S. in Mathematics Program
2016



Name of Degree: Mathematics, B.S., M.S.
Department: Mathematics and Applied Physics
Department chair: Ivona Grzegorczyk
Program/department website: math.csuci.edu

Reviewer names and affiliations:

Prof. Michael Krebs
Department of Mathematics
Loyola Marymount University

Prof. Helena Noronha
Mathematics Department
CSUN

Note the following document organization for CSUCI program review elements:

Chapter II -Element One - Defining Program Purposes and Ensuring Educational Outcomes
Chapter IV - Element Two - Achieving Educational Outcomes

Chapter III - Element Three - Developing and Applying Resources to Ensure Sustainability

Chapter V - Element Four - Creating an Organization Committed to Learning and Improvement

Table of Contents

I. Executive Summary 1

A. Progress on Action Plan 1

B. Summary of significant achievements and progress since last program review: 4

II. Program Purposes and Ensuring Educational Outcomes 4

A. History and Context 5

B. Program Mission and Goals 5

III. Developing and Applying Resources to Ensure Sustainability 9

A. Academic Program 9

B. Faculty 16

C. Department Staff and Administration 30

D. Funding and Expenditures 32

IV. Achieving Educational Outcomes. 32

A. Student Learning Assessment 32

B. Student Success: Enrollment, Retention, and Graduation 44

C. Student Engagement and Satisfaction 47

D. Graduate Success 47

V. Creating an Organization Committed to Learning and Improvement. 48

A. Future of the Field and Career Opportunities 48

B. Program Capacity 48

VI. Conclusions 49

A. Significant Findings 49

B. Looking Forward: Strategic Thinking 49

VII. Appendices 50

I. Executive Summary

The Mathematics department at CSUCI and its curriculum provide a strong and comprehensive undergraduate program in mathematics. Several options included in the program provide an opportunity for more focused and/or interdisciplinary training in pure, applied or industrial mathematics as well as mathematics education. CSUCI mathematics graduates are well prepared to enter the workforce in technical or interdisciplinary fields or as mathematics educators, and are also ready to pursue more advanced studies in mathematics. Our Master's degree program has also produced graduates who have done well in getting employment after graduation in industry, banking or research and development units. The mathematics department's faculty are talented teachers and successful researchers and professionals. All of our hires have attained tenure and promotion when eligible. With the growth of the Mathematics Program has come an increased opportunity for students to be engaged with faculty on research projects or internships in the community. As a service department, we have been able to meet increased student demand in our service courses as well as our major courses by reducing bottlenecks to graduation. We also have a good collaborative working relationship with many offices and constituencies on campus which enables CSUCI to most effectively meet the placement needs of all incoming and continuing students. This working relationship also allows us to experiment with more targeted supplemental experiences to increase student success in math courses. Lastly, critical to the functioning of our large department, is a competent staff that is able to handle the challenges associated to running this complex operation.

A. Progress on Action Plan

The previous self-study and site visit occurred in 2008-09. The department received commendations for its curriculum. The department also received commendations for the:

Quality the curriculum and the program faculty

Strong evidence of high-degree of dynamic faculty student interaction

Professional and scholarly productivity of the faculty

Increased integration of technology into the teaching of mathematics

Student activities and their involvement in research/problem solving with faculty

Informative web page

Program organization and financial structure that supports student activities and faculty scholastic efforts.

For details see Appendix B.

The review team also made several specific recommendations for improvement. Each of those recommendations is listed below as well as the results of attention given to those recommendations.

1. Reduce the percentage of mathematics classes taught by part-time and non-tenure track faculty significantly in the very near future.

Recommendation not met: In the last six years, there have been some efforts to hire additional mathematics faculty and to reduce outside loads of the existing faculty. Unfortunately, only 2 mathematicians were hired in over that time. Also, as being tenured, several faculty members got involved with university level activities (such as Interdisciplinary Center), major grants, STEM Center etc., taking them out of the classroom. Due to the university and program growth our percent of classes taught by TT faculty decreased further to less than 18%.

2. Revisit the hiring process with a view toward more of a process whereby new positions are granted to programs and competition is limited to within a single discipline. By all means retain the participation of other faculty outside the hiring program in order to achieve the goals of the interdisciplinary vision.

Recommendation not met: Mathematics Program has developed hiring program with a goal of improving the student to faculty ratio asking for hiring 9 faculty over 5 years. However, only two positions were granted to the program over the past six years (plus one starting in Fall 2016). As a consequence, the program ratio remains the highest on campus (i.e. is the worst, much above CI campus and CSU system ratios).

3. The Chair should create a regular meeting time for mathematics faculty meetings, on a schedule of at least once per month and should issue an agenda in advance of each meeting, populated by issues both from the Chair and from faculty solicitation.

This recommendation was met in the following way: the program meets at least three times a semester and agendas are send by email and updated before the meeting following faculty suggestions (at the beginning, in the middle and at the end of the semester). According to the program by-laws faculty members can call meetings as well. The chair sends very frequent program updates (with various program, college and university items), and there is an on-line follow-up if needed.

4. Improve classroom and computer lab situation for the mathematics program.

Recommendation not met: Although the program was assigned six classrooms they are insufficient to host all the math courses and there is a need for a room with a capacity for 45 students. Mathematics now has permanent laptops labs and one PC lab, but we already have problems with course scheduling and testing.

5. In addition to program level assessment, undertake small assessment studies to get snapshots on the health of the departments courses and its advisement practices.

Recommendation met by assessment of student improvement in calculus, statistics and courses for teachers, see Chapter IV.

6. Identify space for another computer lab somewhere near or within the Mathematics Program (without any classes scheduled into it) that could be utilized mostly (but not exclusively) by mathematics students. Also, set aside space for math and science students to discuss problems and socialize, with a few computers as well. The computers in those areas should be equipped with the specialized programs that math and science students need.

Recommendation partially met: The graduate student area has computers and a large corridor that is used for common tasks. However, there is still no place for undergraduate students to work and socialize together.

7. Reconsider the list of concentrations with an eye to deciding which are absolutely essential to the mission of the program and can be offered frequently enough to be practical options, and then reduce the total number of concentrations accordingly.

Recommendation not met: CSUCI and our program mission is to support interdisciplinary learning, hence the program leadership does not agree with this recommendation, as by reducing the number of options we reduce students' cross-disciplinary experiences, collaborations and modeling skills.

8. Institute a degree requirement of a "bridge" type proofs course, Introduction to Proofs, Introduction to Abstract Mathematics.

Recommendation met: new course MATH 310 Introduction to Proofs was developed and implemented in 2015 and is offered as an elective to math majors. MATH 300 Discrete Mathematics has been redesigned to act at transitions to upper-divison mathematics course.

9. Recommendation: Enforce attendance in MAT 399 courses. Try to find out why students do not attend, and restructure the content of the various sections so that students will have a good reason to attend. If the course is a glorified study hall, do not give graduation credit for it.

Recommendation met: Our study conducted in 2014 evaluated Math 399 courses and showed that they are very effective and improve students' performance, see Chapter IV.

10. Work with the university administration and governance bodies to make it clear that decisions involving the use of courses outside of the direct purview of the Mathematics Program must not made without direct consultation with the mathematics faculty. This principle applies to all programs within the university.

Recommendation not met: there are still some courses on campus without appropriate math content used for General Education B-4 math requirement (for example BIOL 203).

11. Last three recommendations summary: Determine an assessment scheme that will effectively evaluate the state of knowledge for this learning outcome for all mathematics majors, even those whose focus is on pure mathematics. Better define your assessments goals and be more detailed in the assessment (for example in the 'proofs' class).

Recommendation partially met: we conducted an effectiveness of mathematics learning study last year, see Chapter IV. We just started delivery of the 'proofs' class, hence assessment will be done probably in two years.

B. SUMMARY OF SIGNIFICANT ACHIEVEMENTS AND PROGRESS SINCE LAST PROGRAM REVIEW:

1. Developed and implemented a minor in *Foundational Mathematics* meeting the requirements and approved by California Commission on Teachers' Credentialing for middle school mathematics teachers.
2. Developed and implemented a minor in *Statistics and Data Analytics* that is open to all undergraduates regardless of the major and includes interdisciplinary applications. Developed and implemented two exploration-based data analytics courses MATH 398 and 408 for the minor.
3. Developed and implemented new transition course MATH 310 *Introduction to Proofs* that is included as an elective in the major and serves well all students, especially transfers.
4. In collaboration with Early Childhood Development faculty developed and implemented new transition course MATH 207 designated for pre-school teachers.
5. Collaborated with other programs on developing and implementing new Philosophy Minor.
6. Collaborated with Computer Science program on developing and implementing new Minor in Security Systems Engineering.
7. Collaborated with Computer Science, Physics and other programs and local Community Colleges and industry on developing and approval of new Mechatronic Engineering Major.
8. All tenure-eligible faculty received tenure and promotion. All faculty eligible and requesting promotion to full professor were successful.
9. Success in faculty and student research projects and publications.
10. Ability to handle service course demand .
11. Assessment of the graduate student thesis requirement, MATH 399 labs, and undergraduate learning progress.
12. Modification of Masters program requirements.

II. Program Purposes and Ensuring Educational Outcomes

A. History and Context

The Mathematics Department at CSUCI is 15 years old as it started when the university opened in 2001. The program offers a complete set undergraduate courses leading to a Bachelor of Science degree in mathematics. The department also offers minors in mathematics (started in 2002), statistics (started in 2015) and foundational mathematics (started in 2011 after the approval of the California Commission for Teacher Credentialing) as well as graduate Master of Science in Mathematics degree. The mix of pure and applied mathematics in these programs increases both the usefulness of and the demand for graduates with a degree in mathematics, as for several decades there is a significant national shortage of professionals with advanced mathematics skills. In addition, the Mathematics Department offers support courses that serve other program at the university. Note that our permanent as well as our qualified lectures teach graduate level courses depending on their specializations and demand.

Students have several option to specialize in and learn about interdisciplinary applications that include Biomathematics, Computer Science, Physics, Applied Physics, Actuarial Science/Economics, Business Management, Cognitive Science, Education, Applied Mathematics, and Pure Mathematics (see appendix A). The options give students a chance apply mathematics in interdisciplinary or advance contexts. Many of our graduates choose to continue to graduate school. Almost all of them find mathematics degree related employment within a year.

To facilitate our graduate students' schedule, we offer most of the courses after 5pm. After mastering three core courses, students have choice of electives and they select thesis topic following their interests either in pure, applied areas or mathematics educations. Most of them work as Graduate Teaching Assistants at CI gaining valuable experience for their future careers. In their second year, most of them work in local colleges as independent instructors. About 30% of math graduate students work for local industry. Every year, several MS graduates continue to Ph.D. programs.

The rich variety of courses offered by the department permits the undergraduates not only to obtain a broad exposure to those areas of mathematics which are fundamental to advanced mathematical study or secondary school teaching, but also in interdisciplinary areas of mathematics such as physical sciences, engineering, art, data analytics, business, management sciences, computer science, and operations research.

B. Program Mission and Goals

The University's Mission statement is:

Placing students at the center of the educational experience, California State University Channel Islands provides undergraduate and graduate education that facilitates learning within and across disciplines through integrative approaches, emphasizes experiential and service learning, and graduate students with multicultural and international perspectives.

Following the above our program's mission is the following:

Mathematics can be pursued as a scholarly discipline of an especially elegant and creative art form or it can be treated as a valuable tool in an applied discipline. Our program addresses both

needs. Students are given a strong background in mathematics and statistics as well as a substantial amount of interdisciplinary applications in physics, computer and information sciences, computer imaging, biostatistics, artificial intelligence, and/or business.

Careers

The mathematics major will prepare students for teaching careers, studies in graduate programs (in pure mathematics, applied mathematics, mathematics education, or the mathematical sciences) or for employment in high-tech and bio-tech industries, where mathematics-trained professionals with interdisciplinary expertise (science and business) are increasingly sought after.

CI Mission-Based Student Learning Outcomes:

CSU Channel Islands' graduates will possess an education of sufficient breadth and depth to appreciate and interpret the natural, social and aesthetic worlds and to address the highly complex issues facing societies.

Graduates will be able to:
Identify and describe the modern world and issues facing societies from multiple perspectives including those within and across, cultures and nations (when appropriate); and analyze issues, and develop and convey to others solutions to problems using the methodologies, tools and techniques of an academic discipline.

Following the above mission statement, we have developed program specific **Mathematics Program Learning Outcomes:**

Students graduating from the Mathematics program will be able to:

1. Demonstrate critical thinking skills by identifying, analyzing, and evaluating mathematical ideas and methods.
2. Demonstrate problem-solving skills by applying mathematical ideas and methods in various contexts and situations.
3. Demonstrate the ability to understand, evaluate, and create mathematical proofs.
4. Demonstrate the ability to evaluate and propose solutions to quantitative problems in the physical, biological, and/or social sciences.
5. Demonstrate knowledge of some of the current applications of mathematics in the sciences, industry, and/or education.
6. Demonstrate some of the technical skills currently employed in the sciences, industry, or education, such as the ability to use modern software.
7. Demonstrate cooperation skills by working effectively with others both inside and outside the classroom.

8. Demonstrate communication skills by expressing mathematical ideas in oral and written form.
9. Demonstrate a sense of exploration that enables one to pursue lifelong learning.

The program learning outcomes are also realized through the curriculum. Outcomes numbered 1, 2, 7, 8, and 9 are addressed and developed in every mathematics course taken by majors, and are all accomplished by the time students have completed the requirements for the major. The chart below ties Outcomes 6, 7, 8, and 9 to the courses required of all mathematics majors. (To determine how each course addresses the program learning outcome indicated, please refer to the course learning outcomes prominently featured in each course syllabus. Of course, these learning outcomes are further reinforced via the students' choices of emphases, electives, and co-curricular learning opportunities.

Required Course	Demonstrate the ability to understand, evaluate, and create mathematical proofs.	Demonstrate the ability to evaluate and propose solutions to quantitative problems in the physical, biological, and/or social sciences.	Demonstrate knowledge of some of the current applications of mathematics in the sciences, industry, and/or education.	Demonstrate some of the technical skills currently employed in the sciences, industry, or education, such as the ability to use modern software.
Lower Division				
Calc I	introduced	introduced	introduced	introduced
Calc II	introduced	developed	developed	introduced
Calc III	introduced	developed	accomplished	introduced
Logic	developed			
Linear Algebra	developed	developed	developed	introduced
Computer Science			developed	developed
2nd CS course			developed	accomplished
Phys 200		developed	developed	
2nd Phys course		developed	developed	
Upper Division				
Discrete	developed	introduced	introduced	
Diff'l Eq'ns		accomplished	accomplished	developed
History of Math			developed	
Prob/Stats	developed	accomplished	accomplished	developed
Real Anal	accomplished			
Complex	accomplished			
Colloquium			accomplished	
Emphases		accomplished		accomplished

Here are some more specific examples demonstrating support of the mission and learning outcomes:

1. All math majors must choose an option that either makes them apply mathematics in interdisciplinary context or focuses them on education or some more advanced topics.
2. Many courses in mathematics have interdisciplinary focus: MATH 330 Mathematics and Fine Art combine mathematics with creating artistic designs, MATH 331 History of Mathematics provides historical, educational and sociological background for development for mathematical thought and applications, 429 Operation research involves mathematical modeling in business contexts, MATH 448 Scientific Computing and MATH 354 Algorithms include applications in computer science, MATH 438 Philosophy of Math explores history and culture of mathematical thought, etc.
3. In support of the international mission Mathematics Program offered two project-based UNIV 392 courses on math, art and science. The first group students with two instructors traveled to Italy, where they visited Universite Rome Tres and Padova University and explored the history, culture and mathematics. In 2015, 20 of ours UNIV 392 traveled to Australia to visit Sydney and the University of Canberra and to explore architecture, political system, fauna and flora of this continent. Not all students were math majors, but all prepared projects on various topics related to the countries visited and included mathematical modeling and data analysis.
4. Many of our student research projects focus on local community service and recent examples include modeling fires around Ventura, predicting voting trends in Hispanic community, modeling survival of several animal spices, analysis of correlations between various plant populations on Santa Rosa Island.
5. All mathematics majors intending to teach have to take MATH 492 Internship course working at local schools. Other students often get internship at local industry, for example in actuarial companies, banking or data analysis.
6. Mathematics faculty constantly improves curriculum and pedagogy include activities and hands on explorations. For example, projects designed by two teams of our pre-calculus students won awards at the Mathematical Student Research Competition (MAA) in 2015.
7. Our curriculum incorporates appropriate technology at every level – form on-line based activities to advanced software like SAS, Matematica, Maple, SPSS, MatLab, etc.
8. One faculty recieved Center for Itegrative Studies grant to incorporate interdisciplinary, real-world activities in MATH 329 Advanced Statistics for Business and Economics. Another faculty prepared a proposal in conjunction with a Biology faculty member for the NSF program Interdisciplinary Training for Undergrads in Biological and Mathematical Sciences to carry out academic year research with biology and mathematics majors.

III. Developing and Applying Resources to Ensure Sustainability

A. Academic Program

Summary of the program degree requirements for **Bachelor of Science program in Mathematics**

The Bachelor of Science program in mathematics requires that all mathematics majors complete a comprehensive core of mathematical coursework representing a breadth in the discipline, coupled with upper-division courses arranged along thematic tracks to provide depth of understanding, see program chart in Appendix A. In this way, all of our mathematics majors are thoroughly grounded in the basic concepts and principles of undergraduate mathematics, with a deeper understanding of mathematics in selected areas that match the students' career aspirations.

Core: The core of our Bachelor of Science degree consists of the calculus and differential equations sequence (Math 150-151-250-350), Logic (Math 230), Linear Algebra (Math 240), Discrete Mathematics (Math 300), Probability and Statistics (Math 352), Real Analysis (Math 351), Complex Analysis (Math 450), History of Mathematics (Math 331) and Senior Seminars (Math 499) that serve as capstones courses and are taken by students twice (as Fall semester focuses on problem solving, and Spring semester focuses on projects and presentations skills).

Support Coursework: All students take a calculus-based freshman physics sequence (Phys 200 and 201) and Comp 105 or 150 and one more advanced computer science course depending on the chosen curricular path.

Options: As juniors, students select among different curricular paths beyond the core and all the options include courses from outside of the department. At this level students are ready to apply their knowledge to other fields. Options include: Digital Design, Biomathematics, Computer Science, Physics, Applied Physics, Actuarial Science/Economics, Business Management, Cognitive Science, Education, Applied Mathematics, and Pure Mathematics. Several students created their own options (such as Environmental Sciences and Political Science Applications). Since majority of the courses in the options are taught by other departments, most of them do not require program resources.

Electives in the program: Each student picks 3 advanced elective courses. Note that electives and option offerings cannot be double counted. Students intending to teach have to choose curriculum required by CCTC (Math 318, 330, 490 marked T in the elective box. Note that Math 393 Abstract Algebra is a required course in the Education Option). Other students can choose courses that count for their other majors, minors or options in LS. The electives add flexibility and assure enrollment in periodically offered section (usually on 2 on 3 semester rotations).

The applied and pure concentrations were motivated by student and faculty interest in providing well-defined curricular options for those students wishing to pursue advanced degrees or careers

involving fairly prescribed mathematical backgrounds. All curricular paths give students more flexibility in choosing support coursework from outside the major; in particular, both the general curriculum and the applied concentrations provide enough flexibility that a student may pick up a minor in a related field with a few additional courses beyond the parameters of these curricular paths. All courses to support these pathways are offered on a regular basis according our plan for course offerings.

So far, we have been pleased with the student response to our curriculum as the population spread well over the electives and options courses. We typically have around 100 majors, and we graduate 25-30 per year. About 40% intend to teach, 30% attends graduate schools, and 30% go to industry.

Capstone Experiences: Senior Seminar (Math 499) provides our students with two capstone experiences; in the Fall students solve advanced problems that prepare them for the National Putnam Competition in Mathematics, in the Spring students work on projects and give oral presentations, work is done individually or in small groups with a faculty adviser. Projects deemed meritorious by faculty are usually submitted for student conference presentations and/or competitions. Note we have at least several students scoring on the Putnam exam.

Currency: Our curriculum is in accordance with recent Committee on the Undergraduate Program in Mathematics recommendations. Our Single Subject Waiver Program is fully approved by the California Commission on Teacher Credentialing, and matches the CUPM recommendations for mathematics majors preparing to teach secondary school. Our program is also consistent with our mission, goals, and program student learning outcomes.

Complete Course Descriptions: Catalog descriptions of our courses and of our curricular paths may be found on the CSUCI catalog website: http://www.csuci.edu/academics/catalog-and-schedule/

Master of Science Program in Mathematics

Our Master of Science program is designed to prepare students for careers in the mathematical sciences. Our program is designed to accommodate various student schedule and most courses start after 5pm. About 50% of our graduate students are working professionals looking to augment their education and 50% are full-time students committed to finishing the program in two full years. Accordingly, we have designed our curriculum and teaching program to serve three principle career paths. First, we train future California community college teachers. Second, we prepare our graduates to enter Ph.D. programs in Mathematics. Third, we train students in applied areas (including statistics and engineering) as some of our students do enter industry directly upon graduation, often accepting employment at technology or finance companies. Recent data from AY 14-15 show that 30% of our graduates get positions at Community Colleges, 20% go on to Ph.D. programs, 50% find industrial employment.

MS in Mathematics Program Description from the CI catalog: Our MS in Mathematics program is interdisciplinary and innovative in nature and offers a flexible schedule with highly qualified faculty. The program is a result of cooperation between mathematics, computer science, and physics faculty and is designed to address the global need for people with advanced mathematical, analytical, and computational skills. Students are provided with a strong

background in mathematics and its applications as well as skills necessary to conduct independent research. The program incorporates interdisciplinary applications such as bioinformatics, actuarial sciences, cryptography, security, image recognition, artificial intelligence, mathematics education, and the philosophy of mathematics. Students' specializations depend on the electives chosen and on the final thesis/project conducted under the supervision of an advisor/mentor. An individual study plan can be designed to meet entry requirements for Ph.D. programs in mathematics or the mathematical sciences.

Graduate Curriculum: Our course work is designed to cover and enhance the material outlined in our program student learning outcomes.

Prerequisites for the program: The majority of the students admitted into the MS program have a bachelor's degree in mathematics or a closely related discipline. It is recommended that you have completed at least one semester in each of the following topics: real analysis, probability and statistics, and abstract algebra. Students lacking recommended prerequisites may be admitted conditionally and advised to take undergraduate courses necessary to prepare fully for the program.

Requirements for the Master of Science in Mathematics: - 32 units

Core Courses - *11 units of*

MATH 511 Functional Analysis (3)
MATH 512 Probabilistic Methods and Measure Theory (3)
MATH 513 Advanced Algebra (3)

And required two units of: MATH 599 Graduate Seminar (1)

Electives - *15 units**, Choose *at least two electives from the following list:*

MATH 570 Combinatorics (3)
MATH 582 Number Theory and Cryptography (3)
MATH 584 Algebraic Geometry and Coding Theory (3)
MATH 587 Markov Chains and Markov Processes (3)
MATH 588 Stochastic Analysis (3)
MATH 590 Graduate Topics in Mathematics

Choose at most three electives from the following list:

MATH 555 Actuarial Sciences (3)
MATH 565 Research in Mathematics Education (3)
PHYS 510 Advanced Image Analysis Techniques (3)
PHYS 546 Pattern Recognition (3)
COMP 554 Algorithms (3)
COMP 569 Artificial Intelligence (3)
COMP 571 Biologically Inspired Computing (3)

COMP 572 Neural Networks (3)
COMP 575 Multi-Agent Systems (3)
COMP 578 Data Mining (3)

**MATH 594 (Independent Study) and other graduate courses from mathematics or the mathematical sciences may be included with the graduate advisor's approval.*

Master's Thesis Concentration: 6 units

MATH 597 Master Thesis (1-6) *or* MATH 598 Master Project (1-6)

*Math 597/598 may be taken for a maximum of 9 units.

Before registering for the first unit of thesis (or project), full admission to the program must be obtained, at least one core course must be completed with a B- or better, a faculty thesis advisor arranged, and a thesis topic chosen for which the student is prepared to do research. Students are strongly advised to obtain the proper background in a relevant area of graduate-level mathematics before registering for any thesis units. A thesis committee of 2 to 3 faculty members must be formed before registering for the final unit of thesis. A non-faculty scientist or professional with relevant expertise may serve in place of a faculty member on a thesis committee (but not as a thesis advisor), subject to both the Director's and thesis advisor's approvals. A signed Thesis Units Request Form is required for registering for thesis units and is available on the Program webpage. Successful completion of the thesis requirement also requires (1) an oral thesis defense to the thesis committee, (2) a presentation of the thesis results to the campus community, (3) a signature page with signatures of acceptance from all thesis committee members, and (4) electronic submission of the thesis to the University Library for archiving.

Graduate Writing Assessment Requirement: Writing proficiency prior to the awarding of the degree is demonstrated by successful completion of at least **two** credits of MATH 597 (Master's Thesis) or MATH 598 (Master's Project) with a grade of B or higher.

Note that three core 500 level courses are required as they cover much of the classical advanced material in mathematics: analysis, algebra, and probability. These core courses are offered every third semester (hence the shortest possible time to graduate is three semesters). The seminars Math 599 are offered every semester and serve as project and presentation venues, with many outside speakers invited. All graduating students present their thesis at the end of the semester during the seminar.

MS Thesis Projects or Master's Thesis Emphasis - 6 units: All graduate students have to write thesis by taking Math 597 or 598. These courses may be taken for a maximum of 9 units. Before registering for the first unit of thesis or project, full admission to the program must be obtained, at least one core course must be completed with a B- or better, a faculty thesis advisor arranged, and a thesis topic chosen for which the student is prepared to do research. Students are strongly advised to obtain the proper background in a relevant area of graduate-level mathematics before registering for any thesis units. A thesis committee of 2 to 3 faculty members must be formed

before registering for the final unit of thesis. A non-faculty scientist or professional with relevant expertise may serve in place of a faculty member on a thesis committee (but not as a thesis advisor), subject to both the Director's and thesis advisor's approvals. A signed Thesis Units Request Form is required for registering for thesis units and is available on the Program webpage. Successful completion of the thesis requirement also requires (1) an oral thesis defense to the thesis committee, (2) a presentation of the thesis results to the campus community, (3) a signature page with signatures of acceptance from all thesis committee members, and (4) electronic submission of the thesis to the University Library for archiving.

Teaching Associate Program: Most of our students are offered positions as Teaching Associates (Graduate Student Instructors). Our ability to offer these is dependent on the number of basic and intermediate algebra courses we offer. The TA program is the major source of financial support for mathematics graduate students. We normally assign one course per semester to per students. Second year students offer teach additional Math 399 labs. The fact that we hire our graduate students as Teaching Associates where they are responsible for every aspect of their assigned course is a distinct advantage for them during their later job searches as the experience they gain from running entire courses on their own is a powerful resume enhancement. We have no doubt that our teaching program significantly impacts our job placement record. Comments from alumni regarding our TA program are very positive. There are one-day long training meetings during the week prior to the beginning of every semester run by the course coordinators and the department chair. The tutoring center (LRC) provides additional training on first Friday of classes. The program has plans to improve the TAs training in the future. More information about the MS in Mathematics degree can be found at this link http://ext.csuci.edu/ms-mathematics/thesis.htm

Course Learning Outcomes

All of our courses have learning outcomes that are available on the detailed course outlines under Mathematics: http://facultydevelopment.csuci.edu/assessment.htm

They are shared with faculty teaching courses and are placed on every syllabus. These outcomes are communicated to students either directly or on Blackboard or as hyperlink in syllabi.

Process used to revise and update curricular content

Major changes to core curricula always go through our program review and discussion. Recommendations are made and voted on. Detailed course outlines for lower-division service courses that are mostly taught by lecturers are very prescriptive on content, textbook, follow the CSU system and various accreditation requirements.

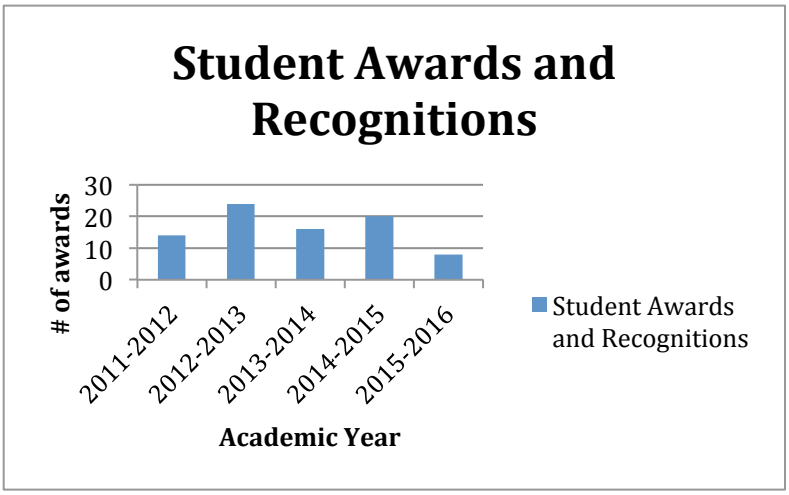
Co-Curricular Activities

Student Research Projects: Since majority of our faculty curry grants mathematics students have numerous opportunities to participate in research projects. Resent projects include imaging, sleep modeling, voting modeling, study and visualization of algebraic surfaces, and mathematics education projects. Every second year CSUCI Mathematics offers an 8-week summer research

program (NSF REU) recruits students from our campus, nationally and internationally. Many of these projects lead to research projects, poster presentations at regional meetings of the MAA, and occasionally, published articles. Math faculty also leads projects for ACCESO, and other campus wide grants. Graduate students all spend at least one year working on research or projects with faculty advisor before writing their thesis. Over all in the last six years we have between around 50 undergraduate and 35 graduate students working on research projects with mathematics faculty members.

Mathematical Competitions: CSUCI math majors have two opportunities to participate in mathematical competitions. Each Fall, we have around 20 participants in the William Lowell Putnam Mathematical Competition, and often 2-8 of our students score well on the test placing themselves in the top 50% nationally (occasionally we have a student scoring in top 10%). In the Fall, Math 499 seminar focuses on problem-solving preparing participants for Putnam Competition, which is held in December. Each school designates an official team of three students to represent the school, but all students who want may participate individually.

Each Spring our students compete in MAA Student Research Poster Competition and typically win awards for their research projects (last year 4 prizes won). The following graph summarizes student award recognitions in the field of mathematics over the five years. These include prizes at student competitions, best research poster awards and distinguished student paper recognitions. For example last year students won 4 prizes at received



Math Club: At CSUCI, we have an officially recognized Math Club that has been active in organizing social events for our math students and friends. Several times each year they arrange picnics, hikes, movie nights, game nights, soccer and Frisbee annual student/faculty games. They have run many different types of fund raisers including quarterly book and T-shirt sales. Many of the Math Club officers help out for math department events such as Open Houses, Career Days and local schools: Our Math Club collaborates with other Clubs on campus organizing events (especially with CS Girls Club, Physics Club, and CS Club).

Employment Opportunities during Studies: The department hires students to be graders, tutors, lab assistant, research assistants and workshop facilitators. Local industry, government and

education systems employ some of our students as well.

Pedagogy - *Learn by Doing Activities*

Learn by Doing opportunities appear throughout the curriculum and we collect certain sample activities on our web page as well as train new faculty and TAs in some of them. In particular, our research project experiences and co-curricular opportunities provide many venues for students to experience mathematics in a hands-on active way. These include leading learning activities in local schools, on-going faculty supervised projects, summer research programs, the TA and facilitator program, and the Math Club activities. In addition, some of our instructors have experimented with alternative pedagogical techniques, such as group work, and flipped and inquiry-based lectures. Besides using Blackboard, we also incorporate mathematical software (Maple, MatLab, SAS, SPSS and others), on-line homework systems (such as WebWorks and Applia), and computer-based activities into the courses.

Minors and Service Courses

We offer several minors in the Mathematics program that serve various populations.

Mathematics minor: which is relatively easy for many majors in sciences to complete and we try to streamline the minor for these majors in our curriculum by allowing double counting of certain courses. See Appendix C.

Foundational Mathematics minor: is designed for Liberal Studies students interested in teaching Middle School mathematics. The minor was approved by the California Commission on Teacher Credentialing as meeting the standards and gives students entry into mathematics credential programs without additional testing (CSET waiver). See Appendix D.

Statistics and Data Analytics minor: is a new minor that is designed for students of all majors interested in data analysis. Two new courses Math 398 and 408 introduce students to large data sets, statistical methods and software. The underlying computer languages used are R and Python.

Service courses: We offer remedial, pre-Calculus, and Calculus courses of various types to serve specific needs of other programs as well as several Upper Division Interdisciplinary courses such as History of Mathematics, Mathematics and Fine Arts, Philosophy of Mathematics. At the graduate level, we offer several courses that are of interest to students from other programs, especially imaging, data analysis and computational bioinformatics courses.

Summary and Reflection

In summary, offering various concentrations and interdisciplinary approaches has been successful and students get involved in research projects and other program activities. We have been able to handle unprecedented demand for our service courses. The program is looking at further curriculum improvements, for example by possibly including the proof course and/or abstract algebra into the program core. Unfortunately, we are a high unit program and have to carefully implement the modifications so we do not go over the 120-unit limit for undergraduates. We revised schedule for the MS program added stability to our course offerings and only small curricular changes to help improve the scope of our graduate offerings are considered. Additionally, we have the capacity to grow our graduate program, but we need to

plan carefully to make sure that we continue to recruit highly qualified applicants. Our survey data show that our BS and MS students easily find mathematics related position shortly after graduation.

B. FACULTY

We have 9 permanent mathematics faculty and 24 lecturers (majority of them with Ph.D. degrees) and about 20 Graduate Instructors – TAs . As the campus and program are still growing we heavily depend on our lectures and they are included in all aspects of our program (including administrative, curricular and organizational decisions). TAs usually teach developmental or introductory courses. Here is the list of the mathematics Faculty with degrees, research areas and contact information:

Tenure line faculty

Selenne Bañuelos, PhD USC, Mathematical Modeling, Linear Algebra
Assistant Professor, Math Lab Coordinator
Office: Bell Tower East 2811 Phone: (805) 437-3715 Email: "selenne.banuelos@csuci.edu"

Geoffrey Buhl, PhD UC Santa Cruz, Infinite-Dimensional Lie Algebras Vertex Operator Algebras
Associate Professor, General Education Chair
Office: Bell Tower East 2776Phone: (805) 437-3122Email: "geoffrey.buhl@csuci.edu"
URL:"ciapps.csuci.edu/FacultyBiographies/geoffrey.buhl":http://ciapps.csuci.edu/FacultyBiographies/geoffrey.buhl

Geoff Dougherty, PhD U of , Imaging, Pattern Recognition, Physics
Professor of Applied Physics and Medical Imaging
Office: Bell Tower East 2848, Phone: (805) 437-8990 Email: "geoff.dougherty@csuci.edu"
URL: "faculty.csuci.edu/geoff.dougherty/":http://faculty.csuci.edu/geoff.dougherty/

Jesse Elliott, PhD UC Berkeley, Algebra, Integer-Valued Polynomials
Professor, MS Director
Office: Bell Tower East 2758, Phone: (805) 437-2768 Email: "jesse.elliott@csuci.edu"
URL:"ciapps.csuci.edu/FacultyBiographies/jesse.elliott":http://ciapps.csuci.edu/FacultyBiographies/jesse.elliott

Cynthia Flores, PhD UCSB, Differential Equations
Assistant Professor, Graduate Seminar Coordinator
Office: Bell Tower East 2762, Phone: (805) 437-3716Email: "cynthia.flores@csuci.edu"
URL: "faculty.csuci.edu/cynthia.flores/":http://faculty.csuci.edu/cynthia.flores/

Jorge Garcia, PhD U of Madison-Wisonsin
Professor, Developmental Mathematics Coordinator
Office: Bell Tower East 2754, Phone: (805) 437-2769 Email: "jorge.garcia@csuci.edu"
URL: "faculty.csuci.edu/jorge.garcia/":http://faculty.csuci.edu/jorge.garcia/

Ivona Grzegorczyk, PhD UC Berkeley, Algebraic Geometry, Vector Bundles, Math Education
Professor & Program Chair, Advisor
Office: Bell Tower East 2756, Phone: (805) 437-8868 Email: "ivona.grzegorczyk@csuci.edu"
URL:"ciapps.csuci.edu/FacultyBiographies/ivona.grzegorczyk":https://ciapps.csuci.edu/FacultyBiographies/ivona.grzegorczyk

Alona Kryshchenko, PhD USC, Applied Mathematics, Statistics
Assistant Professor
Office: Bell Tower East 2814 Email: "alona.kryschchenko@csuci.edu"

Kathryn Leonard, PhD Brown U, Imaging, Shape and Pattern Recognition
Associate Professor, Interdisciplinary Center Director
Office: Bell Tower East 2782, Phone: (805) 437-3127 Email: "kathryn.leonard@csuci.edu"
URL: "faculty.csuci.edu/kathryn.leonard/":http://faculty.csuci.edu/kathryn.leonard/

Cynthia Wyels, PhD UCSB, Combinatorics
Professor, LSAMP Coordinator
Office: Bell Tower East 2780, Phone: (805) 437-3260 Email: "cynthia.wyels@csuci.edu"
URL:ciapps.csuci.edu/FacultyBiographies/cynthia.wyels:https://ciapps.csuci.edu/FacultyBiographies/cynthia.wyels

Full-time lecturers

Roger Roybal, PhD UCSB Functional Analysis, Moment Problems
Lecturer, Math Club Advisor
Office: Bell Tower East 1796, Phone: (805) 437-2741 Email: "roger.roybal@csuci.edu"
URL: "faculty.csuci.edu/roger.roybal/":http://faculty.csuci.edu/roger.roybal/

Brian Sittinger, PhD UCSB, Number Theory, Algebra
Lecturer
Office: Bell Tower East 2840, Phone: (805)437-2751, Email: "brian.sittinger@csuci.edu"
URL: "faculty.csuci.edu/brian.sittinger/":http://faculty.csuci.edu/brian.sittinger/

Matthew Wiers, MS U of Ohio, Statistics and Applications
Lecturer, Business Statistics Coordinator
Office: Bell Tower East 2840, Phone: (805) 437-2751 Email: "matthew.wiers@csuci.edu"

Part-time Lecturers

Aidas Banaitas, MS UCLA, Mathematics Education
Lecturer, Elementary Mathematics Coordinator
Office: Bell Tower East 1778, Phone: (805)437-2741 Email: "aidas.banaitis@csuci.edu"

Dylan Attwell-Duval, PhD McGill U, Algebraic Geometry
Bell Tower East 2762, Phone: (805) 437-8897 Email: dylan.attwell-duval@csuci.edu

Jennifer Brown, PhD U of Colorado, Boolean Algebra
Lecturer
Office: Bell Tower East 2762, Phone: (805) 437-8897 Email: "jennifer.brown@csuci.edu"

William "Bruce" Chaffee, MS UCSD, BS Princeton, Math Education
Bell Tower East 2762, Phone: (805) 437-8897 Email: "william.chaffee@csuci.edu"

Brooke Ernest, PhD UCSB, Math Education
Lecturer
Office: Bell Tower East 2215, Phone: (805) 437-2784 Email: "jessica.ernest@csuci.edu":

Benjamin Greenspan, MS UCLA, Statistics
Lecturer, Statistics Labs
Office: Bell Tower East 1145, Phone: (805) 437-2784 Email: "benjamin.greenspan@csuci.edu":

Phuoc Ho, PhD U of Kentacky, Differential Equations
Lecturer
Office: Bell Tower East 2844, Email: "phuoc.ho@myci.csuci.edu"

Delil Martinez, PhD U of Warrick, Statistics, Actuarial Sciences

Lecturer
Email: delil.martinez@csuci.edu

James McDonough, MS CSUCI, Algebra
Lecturer
Office: Bell Tower East 2816, Phone: (805)437-3751 Email: "james.mcdonough@csuci.edu":

Jessica Nasr, MS CSUN, Mathematics Education
Lecturer, Math 95 Coordinator
Office: Bell Tower East 2816, Phone: (805) 437-2740 Email: "jessica.nasr@csuci.edu"

Jarmila Nguyen, U of Palacky, Mathematics and Physics Education
Lecturer
Office: Bell Tower East 2816, Phone: (805)437-2740 Email: jarmila.nguyen@csuci.edu

Nathaniel Reid, MS U of Colorado, Analysis
Lecturer
Office: Bell Tower East 2816, Phone: (805) 437-2740
Email: "nathanael.reid@csuci.edu"

Ronald Rieger, MS UCLA, Operation research, Algorithms
Lecturer
Office: Bell Tower East 2807, Email: "Ronald.Rieger@csuci.edu"

Mamerta Santiago, MA CSUN , Mathematics Education
Lecturer
Office: Bell Tower East 2803, Phone: (805) 427-6058 Email: "mamerta.santiago@csuci.edu"

James Sayre, PhD UCLA, Statistics
Statistics Visiting Professor
Office: Bell Tower East, Phone: (805) 437-2785, Email: "james.sayre@csuci.edu"

Dennis Slivinski , PhD Vanderbilt, Logic, Philosophy
Lecturer
Office: Sage Hall 2152, Phone: (805) 437-2785 Email: "Dennis.Slivinski@csuci.edu"

Christina Soderlund, PhD UCLA, Topology, Fixed Point Theory
Lecturer
Phone: (805) 437-3751, Email: "christina.soderlund@csuci.edu"

Anna Tivy, MS CSUN, Math Education
Lecturer, Early Childhood Math Education
Office: Bell Tower East 2762, Phone: (805) 437-8897 Email: "anna.tivy@csuci.edu"

Philip West, MS CSUCI, Number Theory.
Lecturer
Office: Bell Tower East 2815, Phone: (805) 437-2784
Email: "phil.west711@myci.csuci.edu"

Peter Yi, PhD UCLA, Topology, Fixed Point Theory
Lecturer
Office: Bell Tower East 2836, Phone: (805) 437-2741 Email: "peter.yi@csuci.edu"

Aleksandra Stuczynska, MS U of Warsaw, Statistics
Statistics Lecturer
Office: Bell Tower East 2816, Phone: (805)437-3751 Email: "aleksandra.stuczynska@csuci.edu"

Alfonso Zamora Saiz, PhD U Complutense de Madrid, Algebraic Geometry
Lecturer, Undergraduate Seminar Coordinator
Office: Bell Tower East 2844, Phone: (805) 437-3995 Email: "alfonso.zamorasaiz@csuci.edu"

There are broadly four distinguished areas of specialization within our department. They are pure mathematics (comprising several sub-disciplines), probability/statistics, applied mathematics and mathematics education. The current composition is 7 permanent faculty in pure mathematics (14 including all lecturers), 2 (5 including lecturers) in probability/statistics, 5 in applied mathematics (7 including lecturers) and one (4 including lecturers) interested in Mathematics Education. The program has no permanent faculty in mathematics education with 6 lecturers working in this area. Lack of mathematics educators causes problems with student-teacher supervision, grant applications, communications with the Commission on Teacher Credentialing and our School of Education.

Our faculty is also quite diverse: we have 60% females (60% including all lecturers), which is much above the national average in mathematics or sciences, 30% Hispanic tenure-track faculty (over 20% including all lecturers, which is much above the national average and reflects well our campus location. We have an international representation having faculty with roots in Poland, Ireland, Czech Republic, Spain, Lithuania, Russia, Korea, Iran, Philippines, Mexico and Guatemala. Additionally, some of our TAs come from China, Japan, Chile, Hungary, India, Kazakhstan. We also have various religions and orientations represented in the program. This diversity serves well our collaborations and our students.

Need for future faculty hires

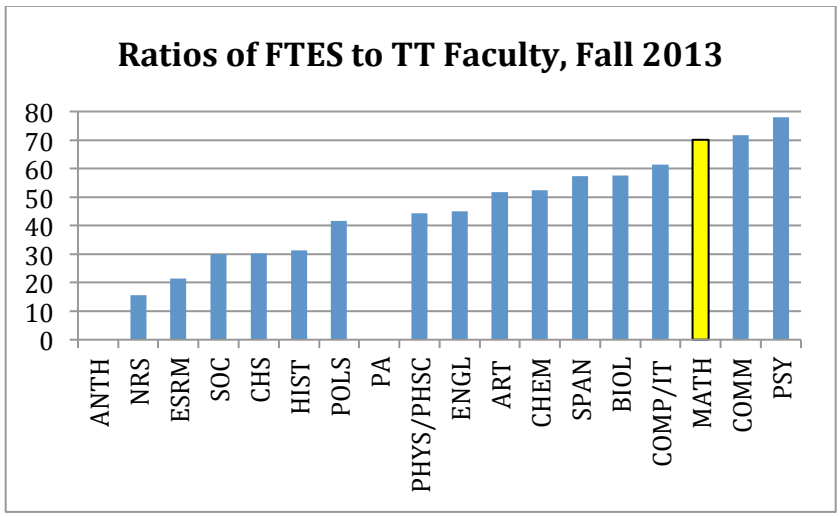
The Mathematics Program has acute needs in the areas of probability, statistics, analysis, applied mathematics, and mathematics education: lecturers in these areas are very hard to find. Our 8 tenure track (TT) faculty are very active, generating grants and working on various university projects (that includes for example Early Start Math Program, EOP Math, CCTC Teacher Preparation and internships, MS in Mathematics, STEM Center and Center for Interdisciplinary Studies). However, this further constrains the program in terms of TT faculty availability for program needs. In short, the current workload is unsustainable.

A four-year plan for hiring in our department was requested by the provost in 2014 to improve the overall faculty to student ratio across the campus (that is currently the highest in the CSU system). The following table shows the projections for the mathematics department based on the program FTES (which are close to 10% of the campus FTES). The plan predicted that in years 2014-2017 campus will hire 9 mathematicians. However, the expectations were not met and we hired two faculty in 2014 and one in 2016. Therefore, with the campus growth the faculty indicators for the mathematics program are among the worst on the campus. The 'Needed Hires' column shows what is the numerical shortage of positions in the Mathematics program, 'Requested New Faculty" shows the actual number of positions requested for specific years. Last column shows the actual number of hires from two approved searches. The current difference

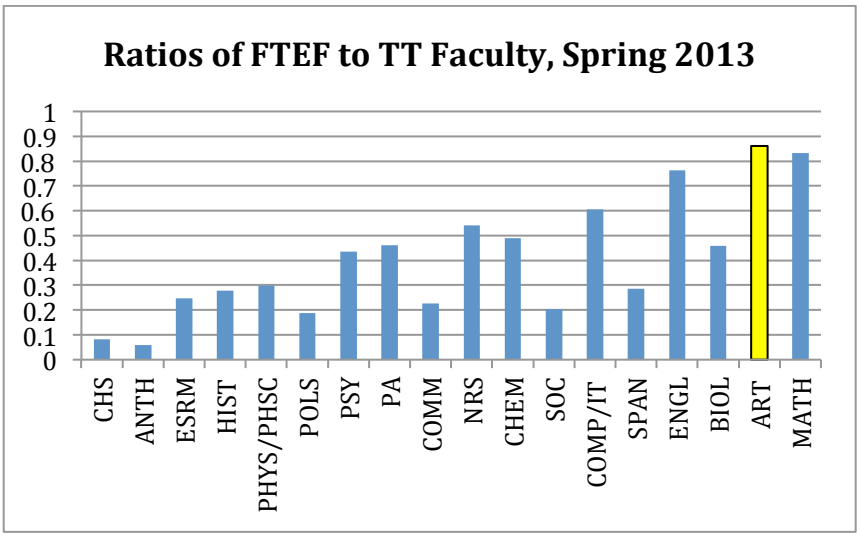
between the plan and the hires is 6 positions (taking into the account the fact that no new position was assigned to the mathematics program for 2017).

Hiring Plan Mathematics 2014-2018												
MATH	0.09	Fraction of Total CI FTES										
	FTES	FTES			TT		Number of					
	CI	A&S	MATH	WTUs	WTU	% TT	Hires					
AY2010				200	24	**12**	0					
AY2011				225	24	**11**	0					
AY2012	4500	3415	364	251	25	**11**	0					
AY2013	*5000*	*3700*	400	275	25	**9**	0		Requested		Program	
							Needed	New TT	New	Intergrated	Intergrated	Actually hired
PLAN 2014-2018							Hires	WTU	Faculty	WTU	Faculty	
AY2014	5500	4125	444	305	45	**25**	7.8624	20.00	**3**	20.00	9	2
AY2015	6000	4500	490	337	60	**30**	7.1243	14.0	**2**	34.00	11	0
AY2016	6500	4875	548	377	132	**35**	6.3703	14.0	**2**	48.00	13	1
AY2017	7000	5250	600	413	165	**40**	5.8182	14.0	**2**	62.00	15	
										Difference		6

The table predicts that in years 2014-2017 campus will hire 9 mathematicians. However, the expectations were not met and we hired two faculties in 2014 and one in 2016. Therefore, with the campus growth the faculty indicators for the mathematics program are among the worst on the campus. For example, the following graph compiled in 2014 (based on 2013 data) shows that Math has the second worse ratio of the FTES offered to TT Faculty. The situation did not improve in the past two years (and due to the recent hires in psychology and communication programs, mathematics ratio is probably the currently the worst on campus.

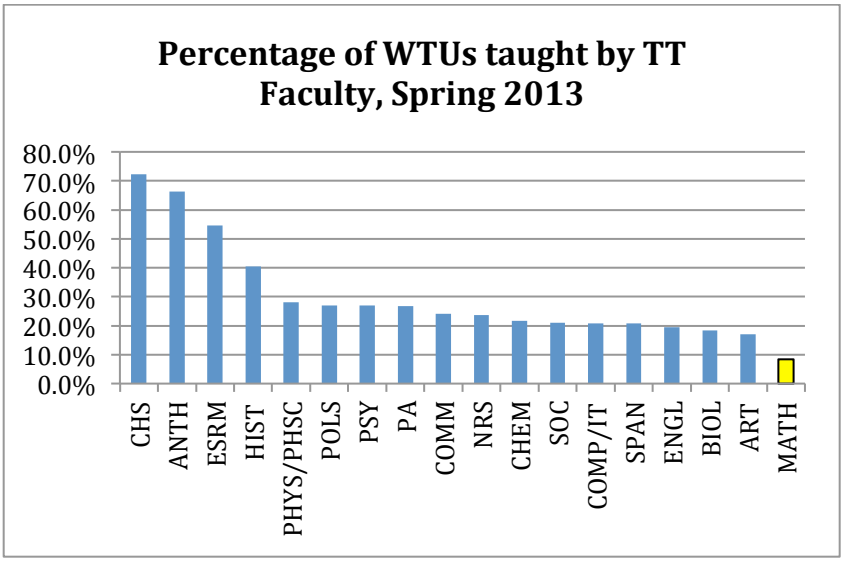


APR provided FTEF is the number of full-time faculty a program would ideally have to service its current offerings. The FTEF/ TT ratio is below; Math's relative position worsens in Fall 2014 and 2015 after last two rounds of hiring.



The majority of our lecturers hold Ph.D. degree and many of them teach graduate and upper division curriculum offerings and work on advanced student projects. However, Math Program employs 35-40 lecturers each semester (including about 20 TAs). Relative to our 9 TT faculty – several engaged in external-to-Mathematics responsibilities, this is arguably the most unbalanced situation among CI's Arts & Sciences programs.

The quality of student education depends on the available faculty, especially tenure track faculty who make long term investments in their teaching duties. Examining ratios of WTUs taught by TT faculty to all taught indicates an imbalance in Mathematics: fewer than 9% of Math's sections were taught by TT faculty in Spring 2013 and the trend continues in 2014, 2015 and 2016.



Student advising in the major, minors and courses also suffers without permanent faculty. Mathematics Program has typically around 100 majors and 60 minors and graduates around 30 students per year. We also advise numerous liberal arts math concentration students, credential candidates and students enrolled in various math courses. Note that actually, the majority of our advising comes from service courses. Simple calculations suggest that advising regarding general (service) math courses translates Math's 480 FTES into over 2000 heads, with perhaps 50% needing on average 15 minutes to discuss their math class and determine a best course of action. This yields over 250 hours per semester, the equivalent approximately to teaching five courses – in addition to major, minor, and concentration advising.

We hired a statistician who will start in Fall 2016 and we hope she will take over coordination of statistics courses as part of her duties. We are in an acute need for Mathematics Educators, as with the growth of CI campus the number of students interested in teaching mathematic at high school and middle school levels increased, hence demand for math education courses is growing, and the need to supervise student in this option and their internships is currently not met. Each graduating mathematics major needs to have pre-credential mathematics content evaluated before the program can issue the subject matter state certification.

Assigned Time

Assigned time in our department has been strictly given to those who have taken on important roles in the department. In addition to the 50 % department chair, the department gives assigned time to Advisor (3 WTUs per semester), Developmental Mathematics Coordinator (3 WTUs per semester), Graduate Program Director (3 WTUs per semester), Lab and Lab assistants Supervisor (3 WTUs per semester), CCTC coordinator (1.5 WTU per semester, which is permanently underfunded). These release time is not satisfactory and we fund form the program funds 94 and 95 course coordinators (2 WTUs per semester), statistics, pre-calculus and calculus coordinators (1-2 WTUs per semester depending on the faculty other duties). According to the CCTC rules, we should give at least 3 WTUs to the credential program coordinator per semester,

however we do not have these units in our base (and approximately 50% of our majors consider teaching mathematics).

All other assigned time comes from grants, senior project production, course section supervision, or other University assigned time. Following our by-laws, the graduate program director and developmental mathematics coordinators are appointed by the chair. Since we do not have mathematics educator the credential coordinator changes often and is appointed as well and sometimes a lecturer holds this position in our department.

Faculty Workloads

All our faculty are very busy and they dedicate a lot of their time to scholarship and working with students. Each semester every faculty is accounted for 12 WTUs, where typically 6 WTUs come from teaching, and the rest is associated with administrative functions, grants and buyouts. In the program base funding we have Developmental Mathematics Coordinator (3 WTUs per semester), Graduate Program Director (3 WTUs per semester), Lab and Lab assistants Supervisor (3 WTUs per semester), CCTC coordinator (1.5 WTU per semester), and Chair (6 WTUs per semester). These release time is not satisfactory and we fund form the program funds 94 and 95 course coordinators (2 WTUs per semester), statistics, pre-calculus and calculus coordinators (1-2 WTUs per semester depending on the faculty other duties).

Faculty Scholarship and Professional Engagement, Teacher-Scholar Model

Our department's definition involves accomplishments in scholarship (with and without student coauthors), successful grant applications, undergraduate research, professional development activities, student research projects, and presentations at professional conferences.

Faculty scholarship and professional development

See also Appendix G

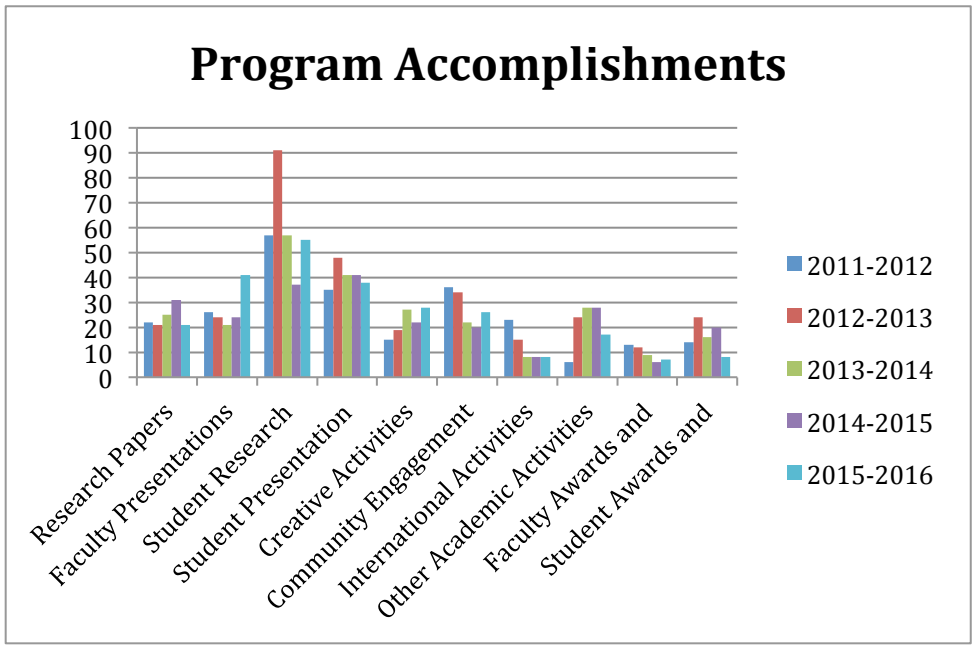
Our faculty members are very active in various areas of research and majority of them can involve undergraduate and graduate students. All of the TT faculty hired came to us with a track record successful professional scholarship. They regularly present their research at professional conferences nationally and internationally, conduct research and consulting activities, publish in mathematical journals. The program has several long term grants, some of them interdisciplinary and/or collaborative. Majority of our lecturers hold Ph.D. degrees and we strongly support their scholastic activities, research projects (especially involving students) and publishing efforts. Many of them are involved in research, applies for grants, present their results at conferences and some of their student projects were awarded recognitions (including for achieving interesting results with lower division students). All eligible math faculty apply for campus mini-grants and UNIV 492 Student Research courses.

Additionally, to meet demand for research projects every semester we offer individual or team based Math 487 and 494 research courses with various faculty.

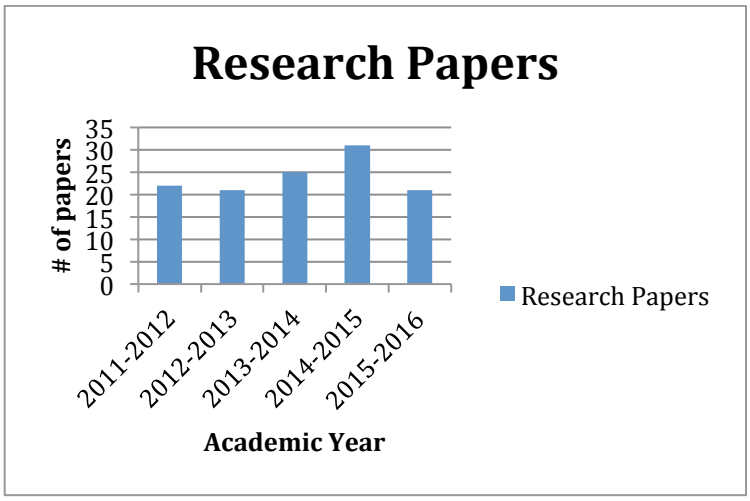
Faculty can use grant funding for course buyouts as well. This way they can dedicate more of their time to their scholastic activities. For example, our faculty served as PIs or Co-PIs on the following grants: NSF Carrier, NSF Noyce, NSF REU, Keck grant, GATES, CURM, CI professional development Mini-grants, LSAMP, PUMP, HIS, ASSESSO and other campus-wide

grants (such as HIS- STEM). Supported by the campus policy, we offer each faculty member $1,200 per year in professional travel support. This can be used for conferences or collaborations. Program supports additional faculty activities through CERF funding and grants' overhead.

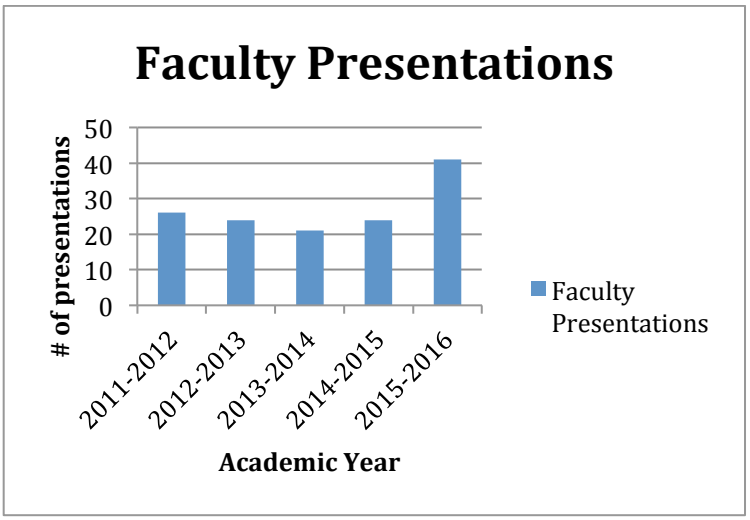
The following represents overall faculty accomplishments in various categories over the last five academic years. Many of the research activities involve students.



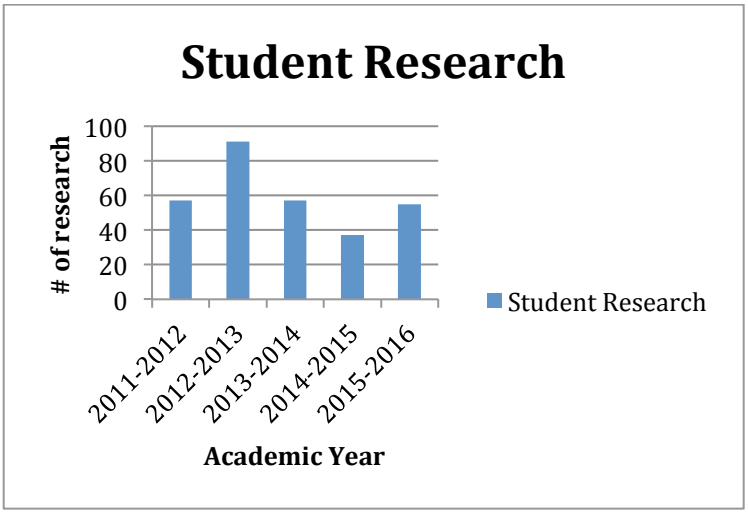
The next graph shows the number of research papers published by faculty in professional journals over the last five years. The areas of research include number theory, algebra, algebraic geometry, differential equations, mathematical modeling, and mathematics educations. Some of the publications involved student collaborations.



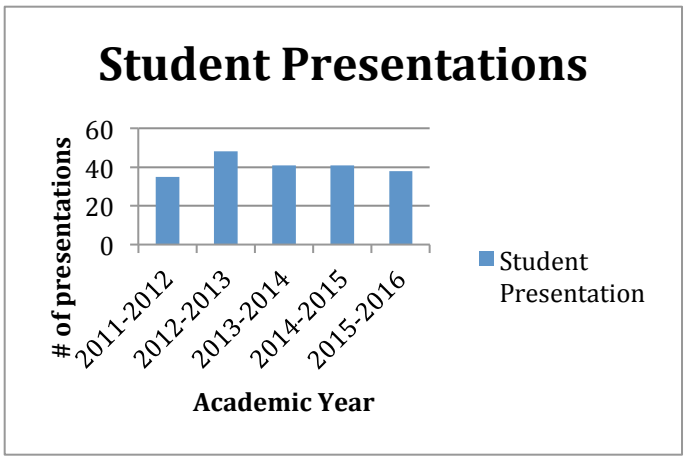
Additionally, our faculty actively disseminates their research results through seminar talks, presentations (national and international conferences) and other activities. The following graph presents number of professional presentations in the last five years.



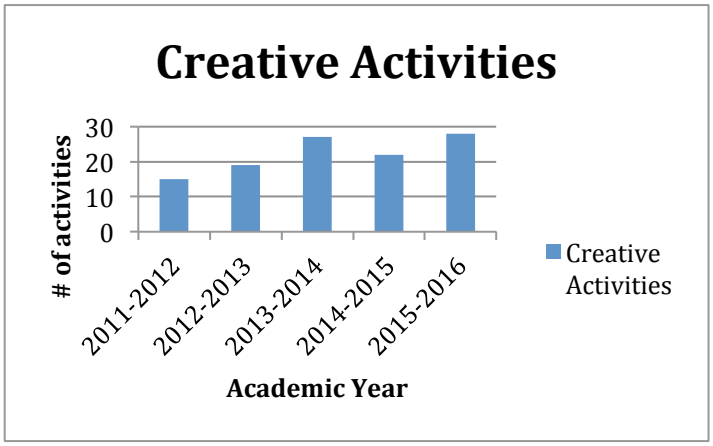
Following the CSUCI mission, the program is supporting hands-on experiential learning through various activities. The following chart presents numbers of faculty supervised student research projects, many of which were accepted for presentation at various conferences (including SAGE Research Student Conference on CI campus, Mathematical Association of America Student Research Poster Competition, American Mathematical Society Student Research Competition at JMM, Posters at Capitol for young researchers, SACNAS for young Chicano/Hispanic and Native American scientists as well as other professional conferences (some of them at international venues, such as Italy, Mexico and Canada).



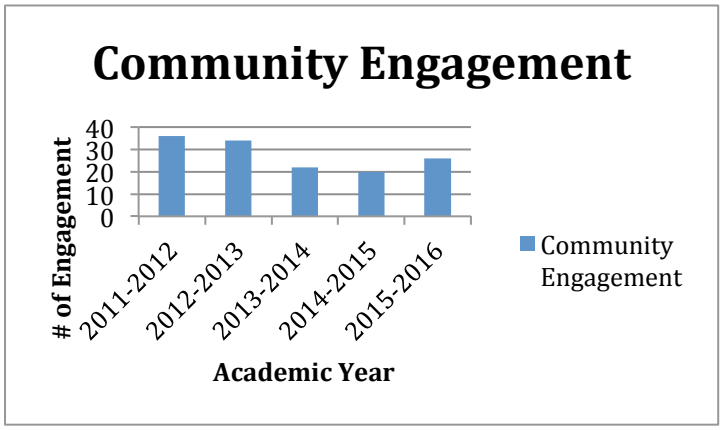
The following graph summarizes the number of student presentations at local, national and international conferences.



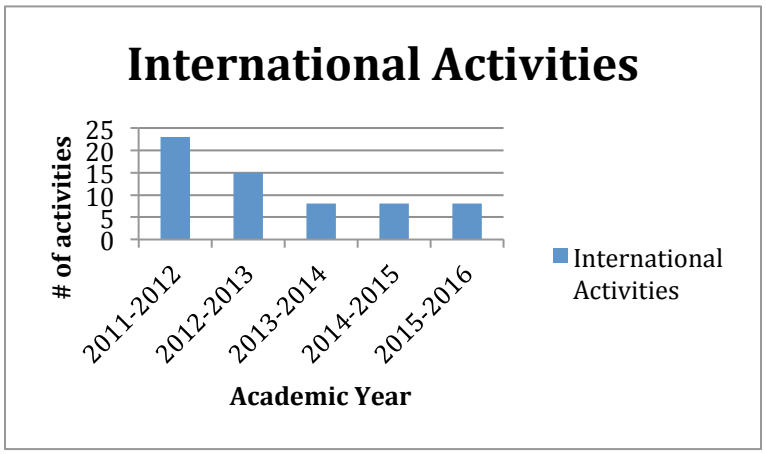
Every semester our faculty is involved in various other creative activities that include for example serving on professional boards, scholarship boards, on journal review boards, collaborations on industrial projects and leading math clubs or delivering workshops for teachers in local schools. For example, faculty collaborates with the University Preparatory School, Pleasant Valley and Thousand Oaks High Schools Districts and schools. One faculty worked with film studios on synchronous programing of 400 small drones for an artistic presentation. For example, three math faculty have participated in the university-wide Critical Friends Group since its inception in S'07, one participated in a university-wide Teaching Circle during S'07, majority regularly carry out Mini-Grant projects, and four are members of the regional NExT program. All attend workshops and sessions at conferences designed to further their teaching and/or their scholarship.



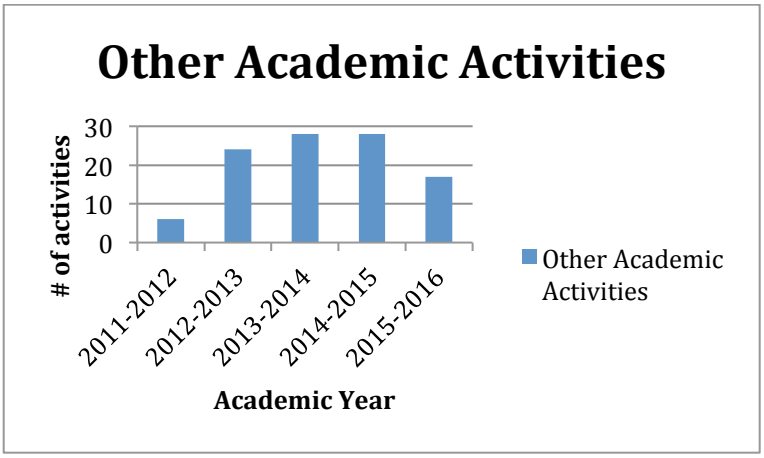
Our faculty is involved in local community Faculty community engagements (serving on academic panels, business boards, school boards, committees, giving popular lectures and concerts, collaborating with community colleges, publishers, government, etc.) For example our faculty served as reviewers for International Journal of Mathematics, Psychology of Mathematics Education, SIAM publications, and as the chief editor for Teaching Children Mathematics. They collaborated with Ventura, Oxnard, Moorpark, Santa Barbara and Pierce community colleges, with local navy, and Ventura County offices.



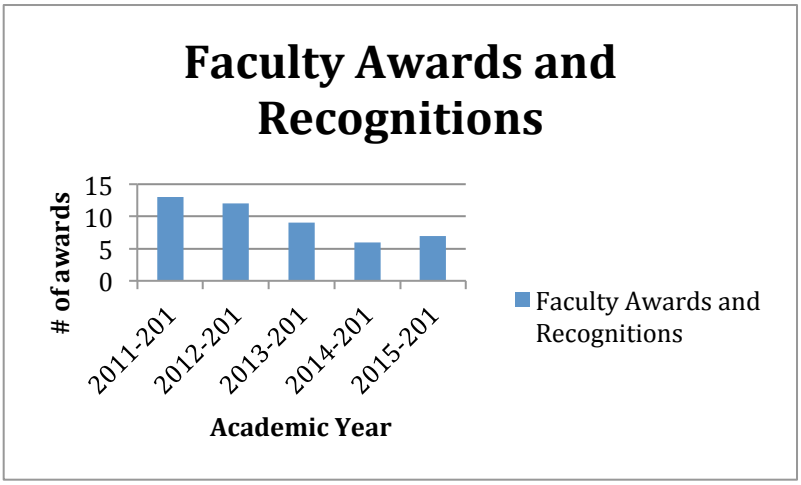
Several of our faculty has professional international ties that include collaborations, conference organizing, facilitating international student internships and conference participation, and similar international activities that are summarized below. For example, for the past four years 2-3 of our mathematics/physics majors go to CERN, Switzerland for 10-week summer internship, 12 math majors visited and presented at the University Roma Tres in Italy, 14 math majors participated in a conference at University of Canberra, Australia. Note that number of student international activities has declined over the past several years due to the decreased connections with Mexico (travel there is restricted by the US State Department) as well as decline of the university funding for these activities. The chart below display reported faculty international activities.



Other academic activities displayed below include organizing conferences, serving as reviewers for journals, judging competitions, collaborations with teachers, math clubs at local schools, mathematical game design, etc. Faculty served on various scientific boards and positions of responsibility including: the board of California Section of Mathematical Association of America (1 Chair, 1 Secretary), 1 is on board of local IEEE, 2 are on board of B&PT, 1 serves as Senate vice-Chair.



Research, mentoring and teaching activities of our mathematics faculty attract awards and recognitions locally, nationally and internationally. For example in the past six years, our faculty has won two national MAA teaching awards, several SAGE mentoring awards, two Business and Technology Leadership Award recognition of papers, mentions on grants awarded, etc. The graph shows the numbers for the past five years. For student awards see chapter IVB.



Hiring Process

CSUCI is using a cohort hiring process described here. Once awarded a position for the administration each program forms Disciplinary Search Committee, that screens candidates and interviews selected group on SYPE. Then only three candidates are chosen to visit campus. Campus visits are organized by administration and include candidates from all disciplines at the same time. All candidates and campus community meet at meals and everyone is invited to the job presentations. There is an interdisciplinary activity that puts 4-5 candidates from various disciplines together in a room with a task of designing an interdisciplinary, undergraduate course for students. The rest of the time is spend on interviews and with the program faculty. The system is very rigid and does not give programs any flexibility, often resulting with loosing excellent potential faculty.

Mentoring and Professional Development

Our department does not have a formal mentoring program for new faculty, however all of them are included and advised from day one. The chair meets with new faculty to explain aspects of the job related to RPT and policies and procedures related to instruction. In the first semester of employment faculty develop their Personal Development Plans following the approved programs standards.

Department staff also serves as a resource. All new full-time faculty are given offices in the same building that houses all of the other full-time faculty, so new faculty are in close proximity to more seasoned department members.

Evaluation of faculty follows program standards based on the university established procedures. This is in accordance with collective bargaining agreement found here: http://www.calstate.edu/LaborRel/Contracts_HTML/CFA_CONTRACT/2014-2017/.

Professional Development Plans (PDPs)

All probationary faculty develop and annually update their professional plans as part of the RPT process following the Mathematics Program Standards, that expect excellent performance in teaching, research and certain level of service. Three research publications are expected for tenure. Faculty under review have their professional plans vetted by departmental RPT (sub)committees, the department chair, and the dean of the college. Recommendations are part of the review process. Associate professors update their plans and are reviewed after year 3 in rank and every 5 years after that. Full professors undergo post-tenure review every 5 years.

Recruiting and retaining diverse faculty

Currently, our tenure-track consists of 3 men and 5 women. For perspective, the latest 2013 data compiled by the American Mathematical Society on new US citizen PhDs in Mathematics reports a ratio of 73% men, 27% women. This ratio has been stable over the last decade. In our last tenure-track search, the applicant pool consisted of 95 applicants. 17% of the applicants were women. From that pool, we selected 31 applicants to look at more carefully. Of those candidates, 40% were women. We further narrowed the pool to a list of 12 phone interview candidates. 33% of the phone interview candidates are women. We requested on-campus interviews with 3 candidates, 2 of which were women. In the end, we made an offer one woman, which she has accepted.

We do not have any special programs within the department to recruit or retain diverse faculty beyond those required or provided by the University. However, our previous search resulted with hiring two Hispanic female mathematicians. Our department has very good diversity record, see chapter III B.

Summary and Reflection

In general, the needs for tenure track instructions in our program are not being met and majority of our courses are taught by lecturers and TAs. Note that campuses compatible in size to CSUCI typically employ around 20 tenure track mathematics. In addition, many of our faculty are getting significant grant/service/research buyouts of their teaching responsibilities. It is often

difficult to find qualified substitute lectures to replace this loss in teaching on an intermittent basis.

C. Department Staff and Administration

Staff

Currently, we have one full-time staff positions shared with the Computer Science, Physics and IT programs. Our Business Analyst Ms. Jacky Connell (permanent position) is in charge of all the office issues, including faculty support, scheduling, purchasing, travel approvals, etc. While she is very competent and is able to handle the challenges of running a large department, supporting students and faculty in four majors and several minors as well as 15% of all the courses offered on campus translates to enormous workload. The following table shows the division of workload among Arts and Sciences analysts. It is clear that our office is severely understaffed. Last academic year when Ms. Connell was on maternity leave the office had no staff (except for a student assistant) for four months. Currently, she is back in the office on the half-time basis. This situation is unacceptable.

The following table compares workload for various program support offices on campus. Our office (under Jacky) is highlighted in yellow, showing the largest workload on campus. It is worth to notice that typically mathematics programs at CSUs (even on campuses smaller than CI) do not share office staff with other academic units, and typically employ 2-3 people plus students assistants.

*Numbers based on Fall 2015

Row Labels	Sum of Personal Total	Sum of Majors	Sum of FTES14/15
Alison	**64**	**255**	**509.12**
Chicano Studies	5	15	52.87
History	13	112	204.12
Political Science	9	128	172.4
UNIV	37	0	79.73
Carmen	**48**	**597**	**764.88**
Communication	13	382	234.8
English	23	171	356.22
Spanish	12	44	173.86
Ceaser	**28**	**937**	**573.83**
Psycology	28	937	573.83
Hilda	**38**	**295**	**467.86**
Art	25	245	339.95
Performing Arts	13	50	127.91
Jacky	**101**	**388**	**782.6**
Computer Science/IT	29	284	202.06
Math	61	80	466.7
Physics	11	24	113.84
Jessika	**72**	**738**	**600.19**
Biology	30	620	368.49
Chemistry	38	118	202.73
Geology	4	0	28.97
Mia	**28**	**543**	**429.37**
Anthropology	7	54	101.24
ESRM	7	119	81.43
Sociology	14	370	246.7
Grand Total	**379**	**3753**	**4127.85**

Currently, we have one temporary administrative assistant (Mr. Chris Bombara) and his work makes a lot of difference. He deals with the front desk issues, paperwork, faculty, administrative and student requests, etc. We have asked the provost office to move his appointment to a permanent position, but we still waiting for the approval.

We also have one student assistant (Megan, ASA II), who is very helpful supporting the office staff.

Program organization and procedures

Mathematics Program is organized by bylaws that describe program procedures and voting schemas, RTP process, committees, etc... The duties of the following officers are described in the document as well.

1. Chair of Mathematics and Applied Physics (elected)
2. Coordinator of Applied Physics Program
3. Director of Master of Science in Mathematics
4. Program Advisor
5. Developmental Math Coordinator
6. Lab Coordinator

Program faculty meets at least three times a semester (before each semester starts, at the end of each semester, and in sometimes the middle). However, faculty meets more often to address specific issues as needed (for example to work on program modifications, hiring committees, major grant discussions, etc.) Chair sends weekly/bi-weekly updates by email, and faculty has numerous discussions on-line. We also use Google docs for team document editing. For bylaws see Appendix F.

The Mathematics and Applied Physics Department holds departmental meetings to discuss major decisions. The Department will make every effort to achieve consensus. If consensus is impossible, a simple majority vote will institute Robert's Rules of Order. Announcement of an upcoming meeting involving an official vote is circulated in advance, and any faculty unable to attend may communicate his or her vote in advance of the meeting.

Summary and Reflection

Our office is severely under-staffed and we need at least one additional permanent position there. We recently reviewed our office staff structure and made a proposal for new positions. We hope that the restructure achieves our goals of providing more efficient functioning of the department office, as well as a reinforced team-spirit environment where administrative responsibilities are more equitably distributed.

D. Facilities, Equipment, and Information Resources

Not much changed in the last six years. Although the program was assigned six classrooms, they are insufficient to host all the math courses and there is a need for a room with a larger cap (for over 40 students). Mathematics has now permanent laptops labs and one PC lab, but we already have problems with course scheduling and testing.

Equipment and technology vs. program needs

As the current economy demands highly skilled, technology based mathematical thinking our mathematics courses relay heavily on technology. To assure the quality of instructions we need more computer labs. Especially our numerous statistics and business sections need access to

professional software to deal with data analysis and mathematical modeling. Since everything is relatively new, existing spaces are adequately provisioned right now, with several white boards in each room. Funds to maintain the spaces are handled at the university level.

Information and technology resources

Mathematicians need access to scientific journals and software and at this time our library has provided sufficient support. We ask to keep the on-line access to scientific journals and sites intact in the future.

Summary and Reflection

Currently, our program biggest issue is the shortage of computer labs. We are lacking in collaborative space for faculty/student research as well as extra office space to temporarily house visiting scholars.

D. Funding and Expenditures

Our state-based funding meets our faculty salary obligations for the last six years and we receive small operational budget. Note that our staff expenditures are located in the dean's office. We have a modest CERF funding and some grants overhead that we can use as discretionary fund for the faculty and students' needs.

We have not been engaged in significant fundraising efforts as a department, although individual faculty groups have had meeting with our director of advancement with ideas for specific fundraising initiatives. Success in the area has been limited. We'd like to extend and enhance this program with additional private outside support.

Summary and Reflection

Beyond increases in salary obligations, our operating budgets have been relatively stable and insufficient to cover all program needs. We would like to include additional funding for equipment, course coordinators, assessment studies, web page supervision, student/faculty projects, and faculty research. We would like to start some fundraising efforts in collaboration with the university foundation.

IV. Achieving Educational Outcomes

A. Student Learning Assessment

Assessment in Mathematics Program and recent results

1. The department currently requires two capstone experiences MATH 499 for graduation. For the last several years this courses served as the exit evaluations of our Program Learning Outcomes through problem solving, independent and team-based projects, and presentations. Each Fall students concentrate on problems solving and presentations, each Spring they concentrate on mathematics projects and opportunities. All students are being evaluated and overall all our seniors meet and/or excide program Learning Outcomes.

2. The latest assessment effort conducted in Fall 2015 focused on students' understanding of calculus. We used two embedded questions with graphs representing velocity of two different cars and ask students to interpret them and to predict distances at various times. Answering the questions required no calculations, and numerical estimates were easy to make. Understanding and interpretation of graphs, and educated decision making are fundamental skills in mathematics (and are included in our first two PLO's). Students in pre-calculus and first calculus courses were used as pre-test sample (at the middle of the semester), and students in calculus II and III sections served as post-test sample. While overall average score on the pre-test was 18% and just two students out of 145 scored higher than 25%, which means almost all of them could not interpret even the basic properties of the graphs provided. The posttest mean was around 60% and all students scored at least 25%, while 20% of this sample of 80 received a perfect score. (Unpaired) T-test results show significant improvement in the post- test results over the pre-test results, both for overall scores and for each individual questions. We did further analysis of each question to figure out the obstacles students had, (see Appendix I). Overall, the results show that at the end of calculus sequence meets the expected learning outcomes.

3. Math 318 Elementary Mathematics for Secondary Teachers course evaluated students' readiness to teach certain assigned high school topics (i.e. evaluating first, third and last of our Program Learning Outcomes). Each presenter worked on different project, prepared a written report and power point presentation, lesson plan and taught the class for about 15 minutes. Each presentation was discussed and scored by a rubric by (several) faculty and participating students. Overall students performed very well and met/exceeded the expected standards.

4. Evaluating effectiveness of Math 399 Labs. Between January 2013 and June 2015 we offered 50 sections of technology-based labs MATH 399 to supplement instructions in selected high-enrollment, high-stakes courses: Pre-calculus, Calculus, Statistics and General Education Mathematics. Typically we offered 10 sections of the labs per semester: 2 sections of Pre-calculus/ Business Calculus labs with an average total enrollment of about 90 students per semester, 2 Calculus labs with an average total enrollment of about 65 students per semester, 2 Statistics sections with labs with an average total enrollment of about 80 students per semester, 1 lab section for general education of Mathematics and Fine Arts with 10-15 students, 2 sections supporting more advanced mathematics courses, enrolment is 20-40 and 1 section for all topics with flexible time with the typical enrollment of 15-20 students. Average total enrollment per semester is 270 students. Total enrollment over the five semesters is 1550 students.

Data analysis showing impact of the supplementary labs - all courses.

We considered data from the last 8 semesters, Fall 10 - Spring 14. During 3 of these semesters students who enrolled in pre-calculus, calculus, statistics and some more advanced mathematics courses have received additional learning materials and had access to additional lab assistants funded by the grant. During the 8 semesters, 5790 students were enrolled in the course sections, and 2285 enrolled voluntarily in supplementary MATH 399 labs, i.e. 40%. The mean grade for all enrolled students was C+, (numerically 2.48 with a standard deviation of 1.4), while the mean for students attending the supplementary labs were B- (2.7, with a standard deviation of 1.3). Hence students who attended labs performed better (at least by .3 of the grade). Below is the table summarizing the grades distributions (see also Figure 1 and 2).

	Total enrollment	Enrolment in labs	Course grades for total enrollment	% of course grades for students attending labs
A = 4	1790	855	30%	37%
B = 3	1555	587	27%	27%
C = 2	1144	425	20%	19%
D = 1	418	131	7%	5%
F/W = 0	924	287	16%	13%

Note that a significantly higher percent of students attending the labs received A's, fewer of them failed or received a D in the course (which often is considered as a not passing grade). Therefore we can conclude that attending the supplementary labs helps all students, improves their grades, and reduces failing rates. Figure 1 shows the distribution of all grades in the courses that were offering supplementary labs MATH 399. Note that the failing rate is 16%, but the total of not passing grades that includes D is 25%, i.e. about one quarter of students do not master the material so they count their course grade as satisfactory.

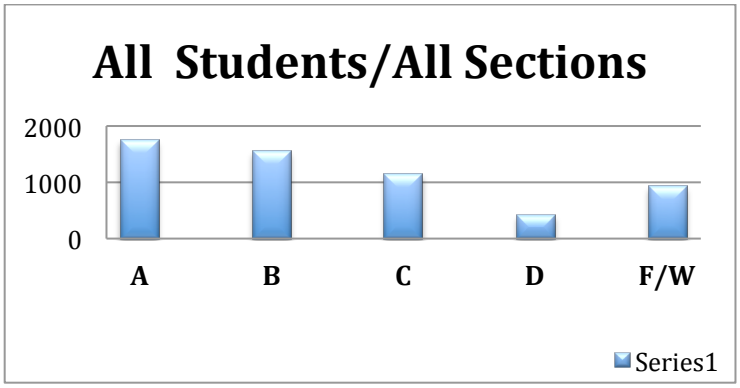


Figure 1. Grades distribution in all courses over last 8 semesters.

Figure 2 compares percentages of specific grades, red are the students that attended the labs, and blue shows all students in the courses.

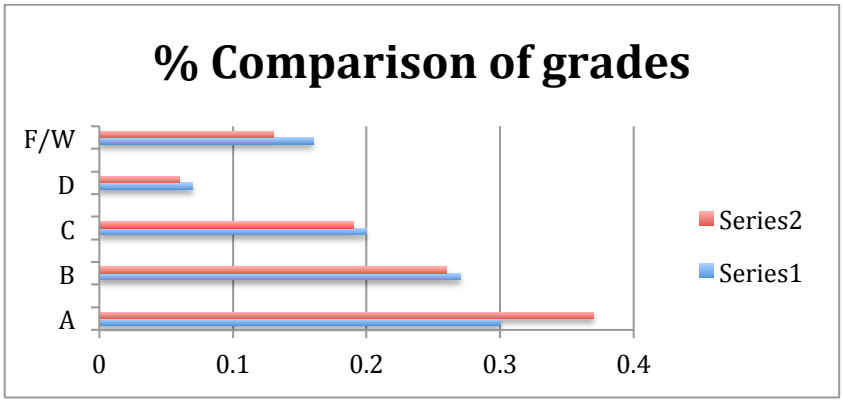


Figure 2. Series 2, red– attended labs. Series 1, blue- all students.

Data analysis showing impact of the supplementary labs on students in pre-calculus courses.

We considered data from the last 8 semesters, Fall 10 - Spring 14. Total enrollment in pre-calculus courses was 947 and 392 students attended the supplementary labs, slightly over 40%. The following table summarizes students' final grades over the last 8 semesters. Note that (except the very first semester) the average grade is around C, while students attending the labs have an average grade above C+.

	ALL MEAN	N	N -399	399 MEAN	
FALL 10	2.595744681	95	20	3	FALL 10
SPRING 11	2.025974026	80	55	2.1	SPRING 11
FALL 11	1.826086957	105	24	2	FALL 11
SPRING 12	1.8	94	40	2	SPRING 12
FALL 12	1.906077348	105	59	2	FALL 12
SPRING 13	1.716666667	120	50	2.2	SPRING 13
FALL 13	1.964285714	194	80	2.44	FALL 13
SPRING 14	1.811688312	154	64	2.24	SPRING 14
	TOTAL	947	392		

Table 1. Mean grades and enrollment for pre-calculus courses.

Note also that while enrollment in pre-calculus courses is increasing, the enrollment in the labs is not. This may be due to the fact that no extra sections of labs are being currently offered to the students due to the lack of lab space and funding. The graphs in Figure 3 display the data for students who attended labs (in red) vs. all students in pre-calculus courses.

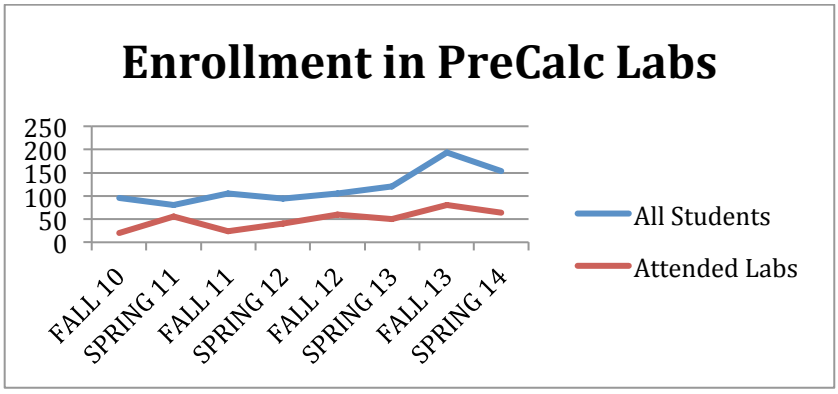


Figure 3. All pre-calculus enrolment vs. pre-calculus lab enrollments.

Figure 4 shows that students attending the labs consistently perform better than all students enrolled in pre-calculus. Note that additional materials introduced during the last 3 semesters and additional student assistants in the labs further improve grades of students attending the labs. Hence there is a need for continuous funding for more lab time and more student assistants for pre-calculus courses.

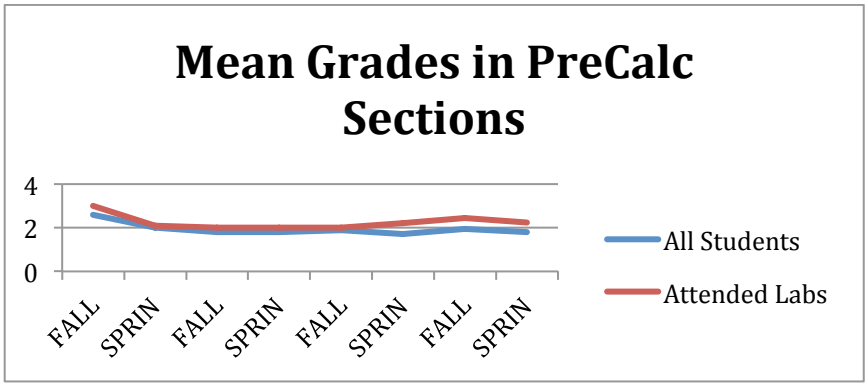


Figure 4. Pre-calculus students attending labs receive better grades.

Data analysis – calculus courses.

We considered data from the last 8 semesters, Fall 10 - Spring 14. Total enrollment in calculus courses (excluding Business Calculus that will be analyzed later) was 1126 and 328 students attended the supplementary Math 399 labs, slightly below 30%. The following table summarizes the data and shows that every semester students attending the labs outperform all students who's average scores are either slightly above or below the grade C. The mean grade for students attending the labs is above C, and often close to B (depending on the semester).

	ALL MEAN	N	N -399	399 MEAN
FALL 10	2.205128205	117	12	2.92
SPRING 11	2.395833333	95	26	2.55

FALL 11	1.953488372	129	35	2.14
SPRING 12	1.8	100	25	2.4
FALL 12	2.579545455	175	54	2.6
SPRING 13	2.092307692	165	54	2.5
FALL 13	1.965909091	177	55	2.3
SPRING 14	1.487951807	168	67	2.0
	TOTAL	1126	328	

Table 2. Calculus data

The graphs in Figure 5 display the data for students who attended labs (in red) vs. all students in calculus courses. Even though the students attending labs outperform the entire group, the average grade for both groups went down. This may be due to the fact that with increased enrollments many students are entering calculus too early, without taking pre-calculus or other preparatory courses. CSUCI has no math testing facilities that would advise students about better course placements.

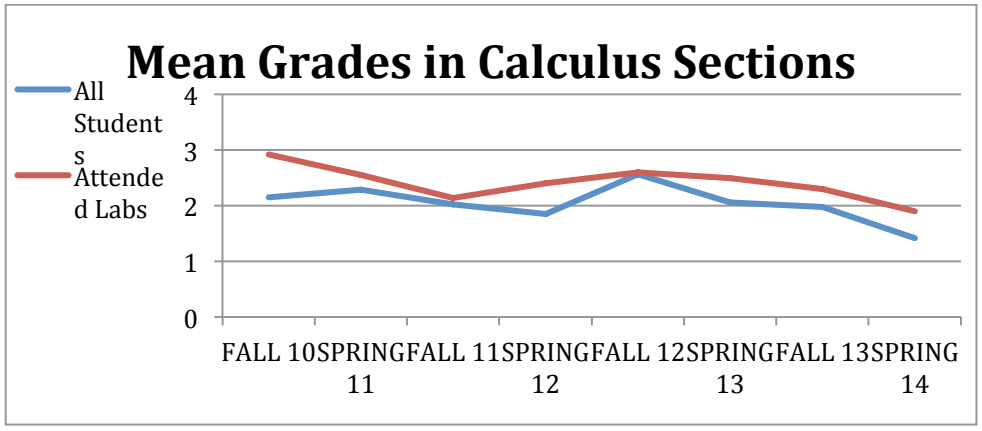


Figure 5. Calculus sections. Students attended the labs do better.

Note that students in the calculus lab sections very favorably evaluated their usefulness and instructors. They really liked the new materials developed for lab use.

Figure 6 displays enrollment in calculus courses. Note that while enrollment in calculus courses is increasing, the enrollment in the labs is not consistent. This may be due to the fact that no extra sections of labs are being currently offered to the students due to the lack of lab space and funding.

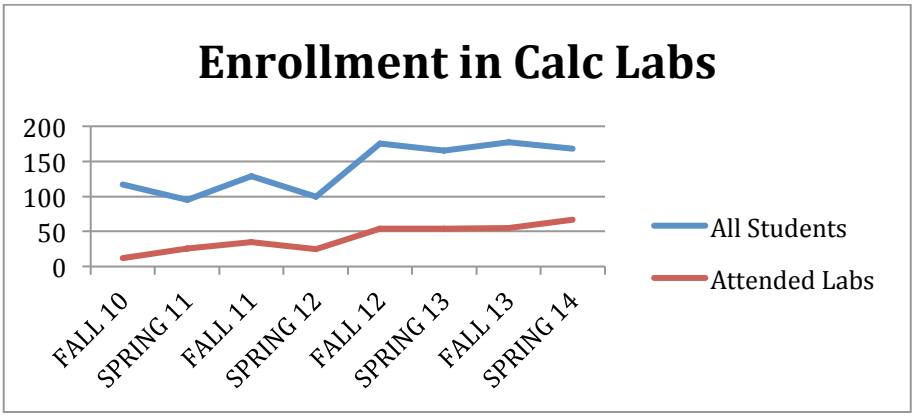


Figure 6. Calculus enrollment vs. enrollment in calc labs.

Data analysis showing impact of the supplementary labs on students in business calculus courses.

We considered data from the last 8 semesters, Fall 10 - Spring 14. Total enrollment in business calculus courses was 679 and 226 students attended the supplementary Math 399 labs, slightly above 33%. The following table summarizes the data and shows that every semester students attending the labs outperform all students. The overall average grade for each semester is between C and C+. The mean grade for students attending the labs is above C+, often close to B, and above B in the Spring 13 semester.

	ALL MEAN	N	N -399	399 MEAN
FALL 10	2.418604651	86	20	2.6
SPRING 11	2.273809524	84	17	2.28
FALL 11	2.618556701	101	21	2.9
SPRING 12	2.126984127	63	27	2.2
FALL 12	2.672566372	113	34	2.95
SPRING 13	2.273972603	73	34	3.2
FALL 13	2.129411765	84	43	2.8
SPRING 14	2.413333333	75	30	2.8
	TOTAL	679	226	

Table 3. Business Calculus summary of data: grades and enrollments

The graphs in Figure 7 display the data for students who attended labs (in red) vs. all students in business calculus courses.

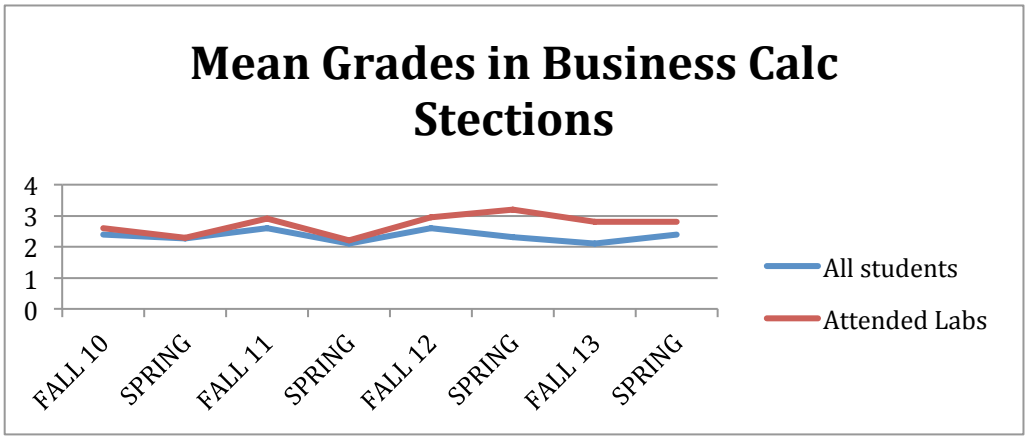


Figure 7. Calculus sections. Students attended the labs do better.

The students attending business calculus lab sections outperform the entire group. They very favorably evaluated their usefulness and instructors, and liked the new materials developed for lab use. Note that the average grade for these students is consistently close to a B.

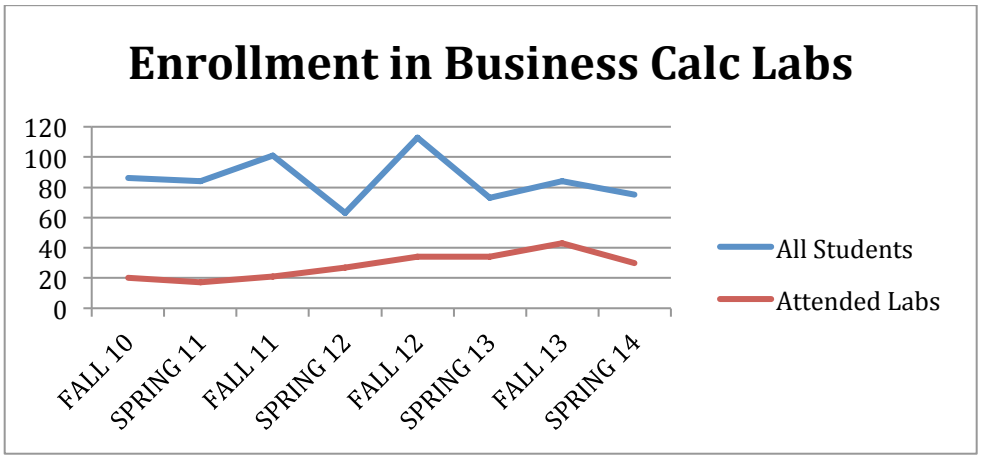


Figure 8. Enrollment in business calculus courses and labs.

Note that enrollment in business calculus courses is not increasing even though the number of business and econ students increased significantly over the last 4 years. Students may be choosing to take the course over the summer at a community college or choose specialization that does not require calculus. The enrollment in the labs, especially over the last 4 semesters is consistent, but relatively low. This may be due to the fact that these students are vey busy outside of school, and cannot attend labs at the scheduled hours.

Data analysis showing impact of the supplementary labs on students in statistics courses.

We considered data from the last 8 semesters, Fall 10 - Spring 14. Total enrollment in statistics courses (biostats and business stats) was 1382 and 506 students attended the supplementary Math 399 labs, i.e. around 37%. The following table summarizes the data and shows that every semester students attending the labs outperform all students. The overall average grade for each semester is between C and C+. The mean grade for students attending the labs is above C+, often close to B, and above B in the Spring 13 semester.

	ALL MEAN	N	N -399	399 MEAN
FALL 10	2.471014493	138	46	2.71
SPRING 11	2.450704225	141	65	2.71
FALL 11	2.793333333	148	47	3.14
SPRING 12	2.8625	159	54	2.9
FALL 12	2.837988827	178	72	3.12
SPRING 13	2.792134831	177	80	2.9
FALL 13	2.706806283	190	70	2.8
SPRING 14	2.581673307	251	72	2.8
	TOTAL	1382	506	

Table 4. Grades and enrollments for statistics courses.

The graphs in Figure 9 display the data for students who attended labs (in red) vs. all students in statistics courses. The students attending lab sections outperform the entire group and their average score is close to B, which is an outstanding performance. Students evaluated help obtained on the course projects and statistical software very positively, praised instructors and the new materials.

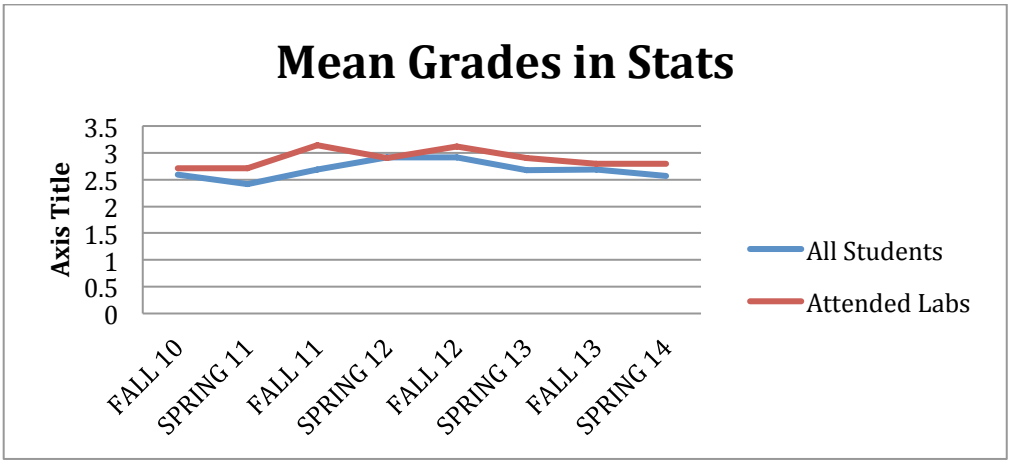


Figure 9. Average grades in statistics courses.

Figure 10 displays enrollment in statistics courses and labs. Note that enrollment in statistics courses is increasing dramatically, but the enrollment in the labs, especially over the last 4 semesters is consistent. This is caused by the fact that no extra sections of labs are being

currently offered (even though the demand is increasing) due to the lack of lab space and funding.

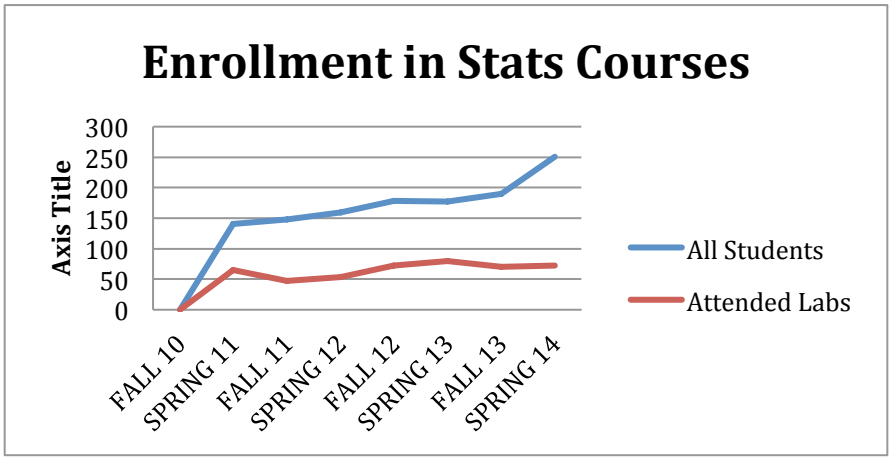


Figure 10. Enrollment in statistics courses and labs.

Data analysis showing impact of the supplementary labs on students in more advanced mathematics courses.

CSUCI offered two lab sections for students enrolled in courses beyond calculus II (linear algebra, probability, differential equations, abstract algebra, etc.) help. These sections were led by an experienced math faculty with help from math seniors and graduate students to improve learning experiences for more advanced students (mostly mathematics and science majors). We analyzed data from the last 8 semesters, Fall 10 - Spring 14. Total enrollment in advanced math courses was 1561 and 548 students attended the supplementary labs, i.e. around 35%. The following table summarizes the data and shows that every semester students attending the labs outperform all students enrolled in more advanced courses. Typically the overall average grade for each semester is around B, while the mean grade for students attending the labs is around B+ (except for the semester in Fall 12), when all the grades were lower).

	ALL MEAN	N	N -399	399 MEAN
FALL 10	2.614035088	171	71	2.8
SPRING 11	3.17877095	179	80	3.3
FALL 11	2.787709497	180	41	3
SPRING 12	3.109004739	211	80	3.2
FALL 12	2.653631285	180	52	2.9
SPRING 13	3.014218009	210	71	3.4
FALL 13	3.057291667	196	85	3.2
SPRING 14	3.136170213	234	68	3.3
	TOTAL	1561	548	

Table 5. Data for more advanced math courses.

The graphs in Figure 11 display the data for students who attended labs (in red) vs. all students in advanced math courses.

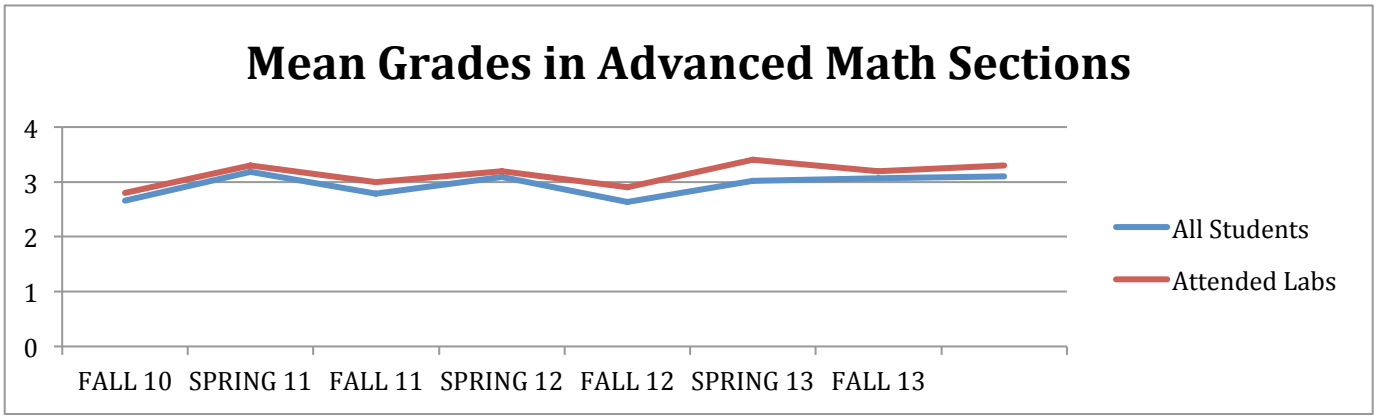


Figure 11. Advanced mathematics courses average grades.

Note that the students attending lab sections outperform the entire group consistently, and during the last 3 semesters their mean grade is at least B+, which is an excellent result. Students attended the labs consistently, studied individually and in groups, used appropriate software. They have evaluated help obtained in the labs very positively and praised instructors for their knowledge.

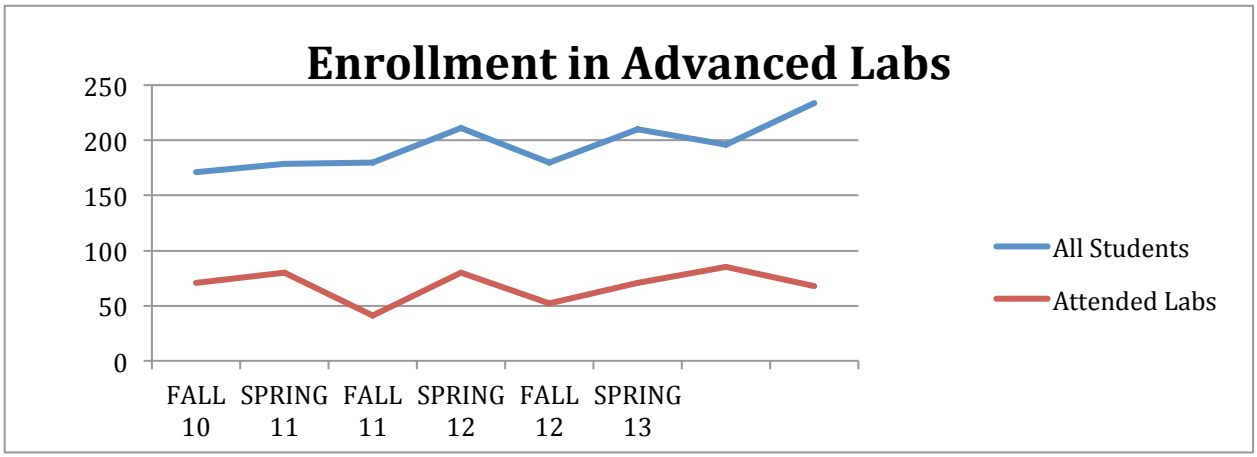


Figure 12. Advance labs and courses enrollment summary.

Note that while more students sign up for advanced courses, the lab attendance does not change much. This is probably due to the limited hours for the labs that conflict with students' schedules.

Summary of the results on Math 399 Labs.

Across all the courses involved in the grant students attending labs outperform the general population attending the courses. To adequately staff the labs for these courses we had to move some funding around to be able to fund several additional student assistant positions. Hence in any future budget we will plan for more support lab assistants and some additional funds for their supervision. The overall data analysis from the last five semesters (with additional funding from

the Gates grant available for lab assistants and new materials) are especially encouraging, as the results of lab attendees are consistently improving. The failing and low-grade rates (D or below) are decreasing for students attending the labs. Since the grades for pre-calculus courses are the lowest, we suggest that all students in these sections should attend the supplementary labs. To increase the number of students in the labs, the schedule should be more flexible and offer more sections for students to attend. There is a need for additional funding for lab assistants and faculty. The data suggests that supplementary instructions in a lab setting serve well students of all levels and skills (as not only passing rates increase, but also the number of excellent grades increase).

Masters Program assessment

Each student at our graduate mathematics under a supervision of an advisor has to write thesis, that include an original element (such as a proof, new example, data analysis, experiment calculations). Graduating students are required to make presentations to the entire department and answer questions. Presentations are scheduled at the end of each semester and are attended by faculty, students and their family and friends. In special sessions, thesis committees review students' papers, discuss them, ask for improvements and approve final versions. This process assures the quality of students work and evaluates students performance on program learning outcomes.

Meaningful results from assessments

The assessment done in this review period yields good results, supporting our interactive, activity-based pedagogy. The Math 399 Labs turned out to be effective at every level, hence we plan to continue offering them. Our assessment results seem to bear the most fruit when they are conducted multi-year, hence we plan to repeat the above outcome evaluations for the next several years. We have been pleased that our initial ideas for areas that should be assessed have aligned with areas of wider departmental interest including those of our students. The main difficulty is that improvements and solutions can take many years to implement.

Recommended improvements

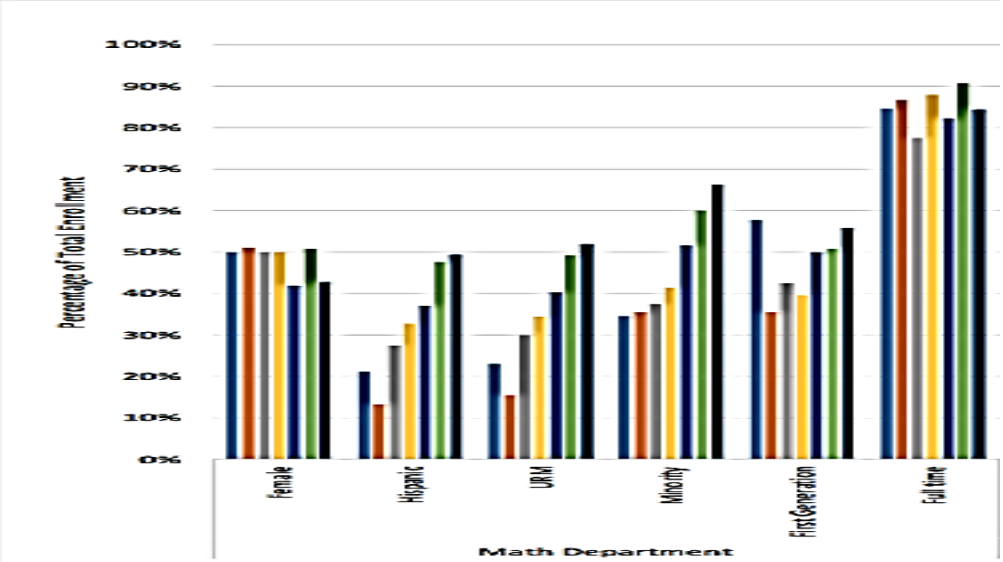
We have to rely exclusively on IR for data and this often causes delays and not very useful data points. We need to build an internal ability to analyze departmental data to help with assessment. We have also begun to use internet survey tools which allowed us to solicit wider input. The biggest challenge is that high quality assessment activities require significant time and a consistency of those in the department conducting assessment.

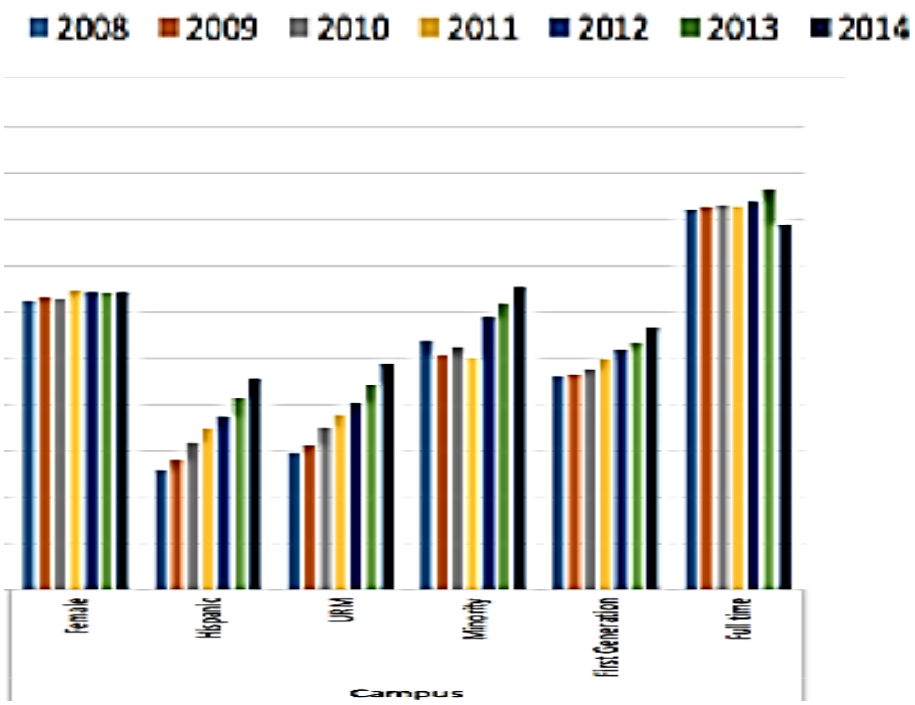
Summary and Reflection

Our assessment shows that our teaching strategies are effective, the supplementary labs are helpful and the program meets and exceeds student outcomes. We are planning on conducting regular assessment activities to implement changes that will have positive impact on our program.

B. Student Success: Enrollment, Retention, and Graduation

1. First-time Freshman (FTF). Unsurprisingly, our FTF cohorts are the strongest ever, matching the general trend at CSU. We usually get 15-20 freshmen, while the sophomore and junior classes are 25-35. The ideal size of our program would be 40 FTF per year. Recent data from IR indicate that our major is about 45% women and 41% URM. Comparing our major to college and university diversity data indicates that our program seems to be attracting a diverse student body. The chart below presents the percentage of total enrollment of different groups in the math department and on campus. Our focus here is on the female and Underrepresented Minority (URM) student groups in mathematics and on campus.
2. The following chart indicates that the average percentage of enrolled URM students in mathematics from 2010 to 2014 is 41%, which is also the percentage of URM students at CSUCI. Our goal is to achieve the same consistency when we focus on the group of students that identify themselves as female and URM.





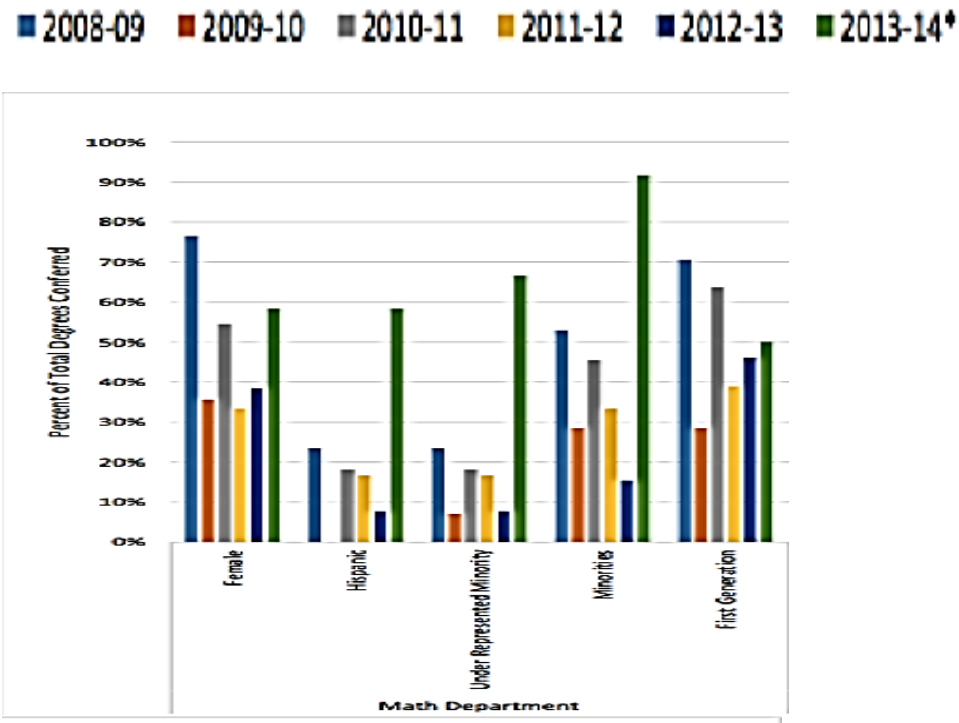
3. The average percentage of enrolled Female students at CSUCI from 2010 to 2014 is 64%. Whereas the average percentage of enrolled Female students in mathematics for the same period is 47%. The percentages from the previous departmental assessment have changed slightly – 62.7% for enrolled female students at CI and 44.8% for enrolled female math majors. There has been some improvement since our last assessment but as we can see there is still room to grow in our efforts to make these percentages reflect those of the university.

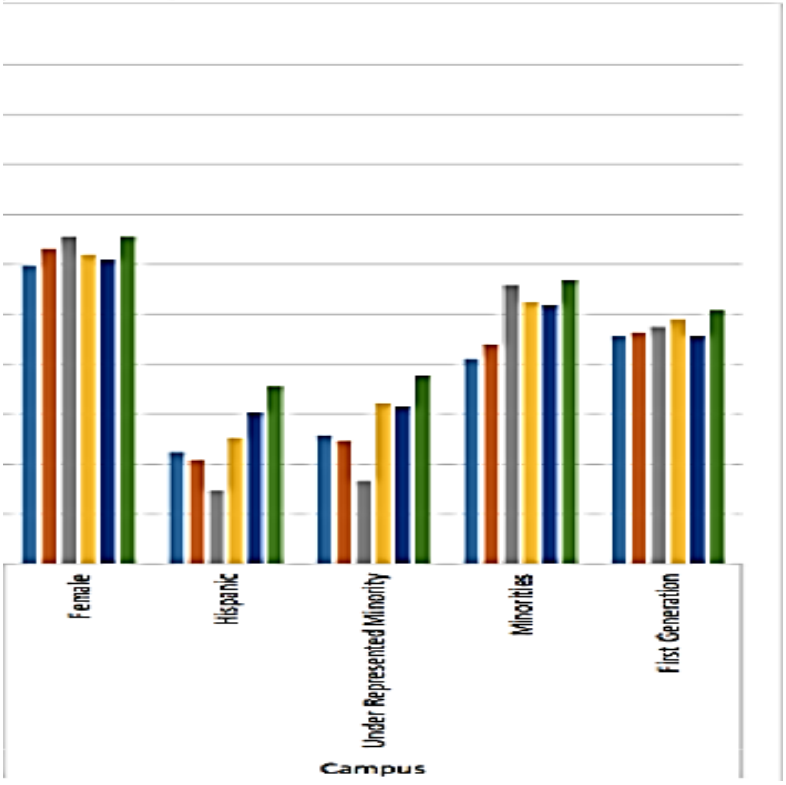
Data was provided (not shown in the chart above) to inform us on the headcount of Female URM students enrolled at CSUCI and in the math department. Although we have a good representation of Underrepresented Minority students and a fair representation of female students in enrolled in the mathematics department, the table below shows that there is a large pool of undergraduate underrepresented minority female students that we can reach.

Enrollment of URM Female Students

Year	2010	2011	2012	2013	2014
Math	7	9	11	17	19
CSUCI	867	1090	1528	1528	1920

4. Degree Groups





The chart above shows the percent of total degrees conferred of different groups in the mathematics department and on campus. We will once more focus on the data for female students and underrepresented minority students.

The average percentage of degrees conferred for female students in mathematics is 44% from 2009 to 2014* (not including those graduating Summer 2014). The average percentage for female students on campus is 63.6% for the same period. For the Underrepresented Minority group, the average percentages are 23.4% and 28.8% for math and campus, respectively. The data provided on student retention and graduation does not have the information to look at the success rates for these groups.

Summary and Reflection

Our diversity rates among students are above campus and nation averages. We need more stability in our FTF cohorts so that scheduling the lower and upper-division curriculum becomes more predictable.

C. Student Engagement and Satisfaction

We often involve the math club and its officers in the campus events for new students, open houses, and parent and family weekend. The department chair meets occasionally with the math club president to solicit feedback on issues of student interest. Recently, student feedback has helped with the design of the new graduate student area. Student input has also been instrumental in vetting proposals related to the possible restructuring of the capstone experiences. Sometimes we survey our students asking for their perspectives on the program.

Summary and Reflection

Students seem to be satisfied with their experience at CSUCI. The previous program review supported this finding as well. Students are involved in departmental activities and are consulted when their input is needed. Based on student feedback, we have made the math minor more flexible and we have added or modified some of the options.

D. Graduate Success

Employment and Graduate Education

Typically our students find position in local schools, companies, or go on to graduate schools. A Southern California median starting salary of $65,000 for BS mathematician and shortage of employees with analytical skills make it easy for our students to find positions within three month from graduation. About 40% of our students choose graduate school and 60 % take jobs (it is based on information for years 2010-14). Our MS students often take community college positions (40%), others find employment in government, software industry, finance, banking and engineering.

Feedback from alumni.

We organized Facebook and Linked-in groups for all our students and alumni. We update them on the program issues and invite them to talks and events. Occasionally, we invite alumni to

campus to give presentations to our students in Math 499 to talk about their experiences post-graduation. Lately, we have averaged around two visits to the class by alumni each year. We also have coordinated alumni visits with our Math Club. As examples, one our most recent alumni visits were from a graduate who is just graduated from a Ph.D. program in mathematics in differential geometry, and another alumni who works as a mathematician for the Navy base.

Summary and Reflection

We need a better mechanism to contact and survey our graduating students and alumni than is currently available.

V. Creating an Organization Committed to Learning and Improvement.

A. Future of the Field and Career Opportunities

The Mathematics Department sees itself serving in a similar role within CSUCI for the next 15 years – as a core program for all science and engineering programs, supporting social sciences and statistics related majors and minors, as well as a vital player in research, interdisciplinary collaborations and students activities. However, it is expected that the number of mathematics majors will increase in a manner commensurate with the projected growth in overall enrollment at CSUCI and the demand for STEM majors by industry. We expect some expansion of the Master's Program, as the demand for highly mathematically trained employees is predicted to increase. In the long term, the Bureau of Labor Statistics predicts that the entry level degree for mathematics professionals will eventually be the Master's degree. The increasing prominence of data science, computers, applications to medicine and sciences, as well as financial applications may require us to rethink aspects of our applied mathematics concentration.

B. Program Capacity

At this point in time, we have been barely meeting the needs for resources to meet demand for our undergraduate program as well as our service obligations. We especially need more faculty release time for various program needs and more computers for the classrooms. Moreover, expected enrollment growth and increased demand for STEM professionals, including teachers, will require additional faculty and resources. Right now, we can increase the size of our Master's degree program with little additional cost. However, our ability to offer financial support in the form of TA appointments is becoming more limited. Increasing our Master's degree program will require targeted recruitment efforts to attract qualified applicants.

VI. Conclusions

A. Significant Findings

Program Strengths

1. We have a strong and comprehensive undergraduate curriculum in mathematics. Our three concentrations provide an opportunity for more focused training in pure and applied mathematics as well as mathematics education.
2. Our graduate program produces graduates who have done very well in getting teaching positions and industry positions.
3. We are currently able to offer most graduate students TA positions which give them "learn-by doing" experience in the classroom as well as needed financial support.
4. We have been able to hire and retain high-quality faculty who are talented teachers and successful researchers and professionals. All recent eligible hires have been successful at attaining tenure and promotion.
5. We have been able to meet increased student demand in our service courses as well as our major courses by reducing bottlenecks to graduation.
6. Students activities and research are currently supported.
7. We provide the opportunities for students to be engaged in research with faculty.
8. We provide each faculty member with $1,200 per year of travel funds to use as they please for scholarly activities.
9. We have good collaborative working relationship with many offices and constituencies on campus which enables CSUCI to most effectively meet the placement needs of all incoming and continuing students. This working relationship also allows us to experiment with more targeted supplemental experiences to increase student success in math courses.

Areas for Improvement

1. Our ability to offer more resources for faculty to be successful in the area of scholarship needs to be augmented.
2. Our program needs to integrate some of the newer growth areas of applied mathematics such as data science and engineering applications.
3. We should focus additional attention to the graduate program in the near future so that we are prepared to meet the expected increase in demand for Master's degrees in mathematics.

B. Looking Forward: Strategic Thinking

Goals for the next six years

1. Introduce uniform freshmen placement testing.
2. Work with administration on improving the computer lab situation.
3. Balance office staff's workload.

4. Provide enhanced opportunities for our best students using advancement activities.
5. Provide faculty of all ranks more time to focus on professional and scholarly activities.
6. Focus on improving and possibly expanding our graduate program.
7. Continue to work with other constituencies on campus in developing targeted programs to improve student success in mathematics using strategic data.
8. Find additional space to facilitate faculty/student collaboration and research activities.

Issues to be addressed in the action plan

1. Use the results of our assessments of senior project, senior seminar and assessment result as a basis of a discussion of our undergraduate curriculum.
2. Remove unnecessary bottlenecks in the undergraduate major by possibly reworking some of the existing course structures.
3. Create a GRE workshop for majors intending to go to graduate school.
4. Develop a viable plan to provide faculty of all ranks more time to focus on professional and scholarly activities.

VII. Appendices

A. Math Program Curriculum Chart
B. Program Review 2009
C. Math Minor
D. Foundational Minor
E. Statistics and Data Analytics Minor
F. Program by-laws
G. Faculty CVs
H. Program Flyer
I. Calculus Assessment Summary