

El Camino Community College

PROGRAM REVIEW 2019

MATHEMATICAL SCIENCES

CM2 – MATHEMATICS FOR GENERAL ED



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TABLE OF CONTENTS

Contents

SECTION 1 Overview of the Program.....	3
SECTION 2 Analysis of Research Data	9
SECTION 3 Curriculum	35
SECTION 4 Assessment of Student and Program Learning Outcomes (SLOs & PLOs).....	40
SECTION 5 Analysis of Student Feedback.....	49
SECTION 6 Facilities and Equipment.....	60
SECTION 7 Technology and Software	64
SECTION 8 Staffing.....	67
SECTION 9 Direction and Vision	73
SECTION 10 Prioritized Recommendations	76
Appendix A.....	80
ALIGNMENT GRIDS.....	81
Appendix B.....	82
SLO/PLO TIMELINES	86
Appendix C	87
6-YEAR CURRICULUM COURSE REVIEW TIMELINE	88

SECTION 1

Overview of the Program

A) Provide a brief narrative description of the current program, including the program's mission statement and the students it serves.

The General Education Mathematics Program at El Camino College consists of six courses that serve students on different tracks: Nature of Mathematics (Math 120), College Algebra (Math 130), Finite Mathematics for Business and Social Sciences (Math 140), Elementary Statistics with Probability (Math 150), Honors Elementary Statistics and Probability (Math 150H), and Calculus for Business and Social Sciences (Math 165). Over the past four years, the program has served an average of 4,375 students with 120 sections offered per year. The mission of our program is to teach students the importance and relevance of mathematics in the complex world of today. We strive to provide a variety of course offerings and up-to-date curricula to help our students transfer efficiently and successfully to their desired universities.

All of the courses in our program may be used to satisfy the General Education Mathematics requirement for transfer to a university and to fulfill the Mathematics Competency component of the A.A. or A.S. degree; however, some of the courses also serve as prerequisites and fundamental courses for certain types of majors. College Algebra (Math 130) serves as a prerequisite for Calculus for Business and Social Sciences (Math 165). Math 140 is primarily designed as an elective for business majors to satisfy the CSU Transfer Model Curriculum, while Math 150 is often taken by business, social science and nursing majors. Math 120 is the only course truly designed for general education mathematics and it is a course typically taken by liberal arts majors.

B) Describe the degrees and/or certificates offered by the program.

There are no degrees or certificates offered in the General Education Mathematics Program.

C) Explain how the program fulfills the college's mission and aligns with the strategic initiatives.

The mission of El Camino College is to make a positive difference in people's lives by providing a comprehensive educational programs and services that promote student learning and success in collaboration with our diverse communities.

The goals and objectives of the General Education Mathematics Program are to emulate the goals and objectives of the college as a whole: to offer a quality, comprehensive educational program and services to ensure the educational success of our diverse community of students. Below are the ways that we align with the strategic initiatives:

STRATEGIC INITIATIVES

- 1. Student Learning:** We have and will continue to support student success by using a variety of teaching methodologies within our classes. Given that many of these students will be majoring in fields that use mathematical thinking as part of their jobs, it is essential that they master those concepts in the General Education Mathematics Program which emphasize applications of math in the workplace.

2. **Student Success and Support:** Because of the implementation of AB 705, we have created two corequisite courses which will be implemented in Fall 2019. Fundamental Skills for Elementary Statistics (Math 150S) is a support course for students who are enrolled concurrently in Math 150, and Fundamental Skills for College Algebra (Math 130S) is a support course for students who are concurrently enrolled in Math 130. Both corequisite courses are intended to help the students who may have deficiency in the development math skills needed for success in transfer-level math courses.
3. **Collaboration:** In developing new curriculum, we have consulted with Ken Key (Counseling Office), Dr. Jean Shankweiler (Vice President of Academic Affairs), Lori Suekawa (Articulation Office), and Lavonne Plum (Curriculum Advisor).
4. **Community Responsiveness:** In addition, we have also aligned our newly created corequisite courses with institutions (Mira Costa College, Cuyamaca College and Mount San Antonio College) which are responsible for piloting corequisite courses in California.
5. **Institutional Effectiveness:** Student learning outcomes will continue to be assessed and close communication by those within the program will allow for any changes necessary to ensure student success and the vitality of our program. We currently have 100% compliance rate in SLOs.
6. **Modernization:** We strive to obtain funding to support faculty development and facility and technology to meet the needs of students and faculty.

D) Discuss the status of recommendations from your previous program review.

Status of Previous Recommendations from 2014 Program Review:

Recommendation 1: The General Education Mathematics Program highly recommends creating a one-semester Business Calculus Course to make it easier for those students who transfer to CSUs. This will reduce the number of units required for most Business majors from 7 units to 5 units. Since we typically offer 11 sections of Math 160 (4-units ~ \$10,500) and 3 to 4 sections of Math 161 (3-units ~ \$8,000) per year, our current cost is either \$139,500 or \$147,500. If we do eliminate Math 161 and increase Math 160 from 4 to 5 units, our projected cost of offering 11 sections of a 5-unit Math 160 is \$143,000. This would result in either an increase of \$3,500 or a decrease of \$4,500 per academic year.

Status: Completed

Notes/Comments: We now offer 13 sections of a 5-unit, Math 165 (Calculus for Business and Social Sciences) each year.

Recommendation 2: We also recommend that faculty computer laptops be replaced by Spring 2015 to keep up with classroom technology.

Status: Completed

Notes/Comments: Although we finally got our laptops replaced at the end of Spring 2016, a lot of them already have problems and we may need newer laptops sooner than later.

Recommendation 3: Hire a full-time technician to supervise and maintain all of the technological equipment in the classrooms, labs and faculty workrooms in MBA. Depending on education and experience, the annual salary including benefits is approximately \$80,000.

Status: Not yet started

Notes/Comments: We moved into the new MBA building in January 2013. Each classroom is equipped with a computer, document camera, and projection system. The current problem that we are facing is that we do not have a technician maintaining the software and computers on a regular basis. Therefore, if equipment breaks down, no one is there to immediately assist faculty and students.

Recommendation 4: The General Education Mathematics Program recommends that the College provide students and faculty the bare necessities, such as:

Classrooms: erasers, pencil sharpeners, emergency landline phones

Common areas: printers, scanners, clocks, pencil sharpeners, dry erasers

Status: Completed

Notes/Comments: All of these items were purchased and installed during a 5-year span with the clocks finally installed in Fall 2018.

Recommendation 5: Increase number of sections of Math 150 by offering additional sections of evening, weekend, and/or hybrid classes, scheduling the dedicated classrooms efficiently, and

offering more sections during the summer sessions. We can start by offering 50 sections per year and then increase (or decrease) as necessary.

Status: Active

Notes/Comments: This is ongoing due to AB 705.

Recommendation 6: The statistics instructors would like to explore the possibility of adding a lab component to our current Math 150 course. Since each section of this course requires a common set of manipulatives, technological equipment and statistical software, we recommend that Math 150 have three to four dedicated classrooms and schedule the times for Math 150 before scheduling other courses.

Status: Abandoned

Notes/Comments: Due to AB 705, we must offer corequisite courses starting Fall 2019. We will run out of math classrooms in MBA and must expand to the other side of campus.

Recommendation 7: Funding should be established to maintain existing equipment and purchase new equipment (document readers, laptops, computers) and software as needed, retain currency (license renewals of *Mathematica*, *Scientific Notebook*), and provide for new and innovative technologies (tablet PCs, SMART boards, InterWrite pads, clicker sets) in the classrooms, computer labs, tutoring center, and faculty offices.

Status: Active

Notes/Comments: Computers in the classrooms have slowly been replaced; however, some document cameras still need to be replaced. Licenses of *Mathematica* and *Scientific Notebook* are being renewed annually. Newer

faculty laptops will be needed soon to replace the current ones. Laptop carts have been purchased to use in the classrooms. There have not been any technological improvements in the Math Study Center.

Recommendation 8: Hire a full-time tutoring coordinator in our Math Study Center to plan, develop and coordinate a comprehensive tutoring program to support students and student success in the Mathematical Sciences Division. Depending on education and experience, the annual salary including benefits is approximately \$90,000.

Status: Active

Notes/Comments: The position of the full-time tutoring coordinator was approved by ECC; however, the hiring process has been delayed due to errors in minimum qualifications in the job announcement.

Recommendation 9: We recommend hiring 5 full-time faculty in the next 4 years to teach Statistics (Math 150) and College Algebra (Math 130) to accommodate increasing enrollment in Mathematics 150, to improve the low success rates in Math 130, and for students who attend summer sessions. The average cost of hiring a full-time faculty member including the cost of health care and pension is approximately \$90,000/year.

Status: Active

Notes/Comments: Due to AB 705, the number of transfer-level math courses have increased especially in Statistics (Math 150). We will continue to need more instructors to teach Math 150.

Recommendation 10: Renew the campus license of Minitab for Statistics classes

Status: Completed

Notes/Comments: This was completed in Spring 2015.

Recommendation 11: We also recommend continuing to offer at least one

section of Finite Mathematics every semester, as it satisfies the Transfer Model Curriculum Model for CSUs and General Education Requirements for UCs and other private colleges.

In the past 4 years, we offered only one section per year, but it always had robust enrollment with 35 to 36 students enrolled per section. We would like to increase slowly to 2 sections

each semester, one in the morning and one during the afternoon or evening.

Status: Completed

Notes/Comments: We have been offering one section of Math 140 every semester; however, enrollment has been down. Hopefully, enrollment will go up in Fall 2019 with AB 705 fully implemented. If not, we will go back to offering just one section per year.

Recommendation 12: Purchase four classroom sets of forty TI-84 graphing calculators for students in the General Education Mathematics Program.

Status: Completed

Notes/Comments: This was completed in Spring 2015.

Recommendation 13: Funding for professional development workshops or conferences be provided to focus on using iPad technology in General Education Math Courses.

Status: Active

Notes/Comments: Our professional development funding has increased due to AB 705.

Recommendation 14: Increase the number of sections of the other courses in the program and continue to add sections each semester as long as the fill rates warrant it.

Status: Active

Notes/Comments: This is ongoing due to AB 705.

Recommendation 15: In order for SLO assessment to become more meaningful, there needs to be more robust participation by the poorly compensated CM2 part-time faculty. If they were paid more, they would be stretched less thin and have more time that they could devote to constructing SLO assessment instruments, conducting assessments, analyzing data, and discussing improved teaching methods with their colleagues. It would be difficult to place a cost estimate on this recommendation, though a 5% salary increase for each of the next three years would certainly help.

Status: Active

Notes/Comments: The part-time instructors got a small raise but not enough to improve on time spent on SLO assessment.

Recommendation 16: It is recommended that part-time faculty participate in TracDat training sessions. Though part-timers in CM2 will probably not be called upon to write SLO reports, by attending the sessions they will become more immersed in the SLO process and be provided opportunities to discuss SLO assessment with their colleagues. Since there are so many TracDat training sessions scheduled throughout the semester, it is possible that more PT instructors will have a chance to attend some of them.

Status: On hold

Notes/Comments: This is on hold due to AB 705.

Recommendation 17: Another recommendation is to ask students where their stumbling block is located when they are learning a certain skill or concept. If based on an SLO assessment, the target success rate is far above what students actually learned, so the students themselves may be able to provide insight into the problems that they are having. This may be conducted as informally as a classroom discussion following an exam or more formally as a student survey, in which students explain their difficulties when being assessed for an SLO.

Status: Abandoned

Notes/Comments: This is abandoned due to level-up by AB 705. Many of the students are having problems since they're not ready for transfer-level math courses. We're currently busy creating corequisite courses to help them remedy their deficiencies in developmental math. Many students are expected to not pass transfer-level math courses on their first try. Success rates have already begun to plummet this semester.

Recommendation 18: Dedicate additional lecture rooms in MBA exclusively for the Division of Mathematical Sciences.

Status: Not yet started

Notes/Comments: Due to AB 705, we must offer corequisite courses starting Fall 2019. We will run out of math classrooms in MBA and must expand to the other side of campus.

Recommendation 19: Convert an existing office to a faculty library for storing references and teaching tools.

Status: Abandoned

Notes/Comments: We have been hiring full-time instructors every year and will soon run out of offices for part-time instructors.

Recommendation 20: Cancel the low-demand Eight-Week Mid-Semester Session, and replace it by either restoring the Winter Session or offering additional sections of the canceled courses at the start of the regular semester.

Status: Completed

Notes/Comments: Winter Session was restored in January 2017.

SECTION 2
Analysis of Research Data

A) Head count of students in the program

CM2, the General Education Mathematics Program, had a head count of 3127 students in 2014-15 and, since then, this count has dropped but remained steadily around 2900 students for the subsequent three years (see Figure 1).

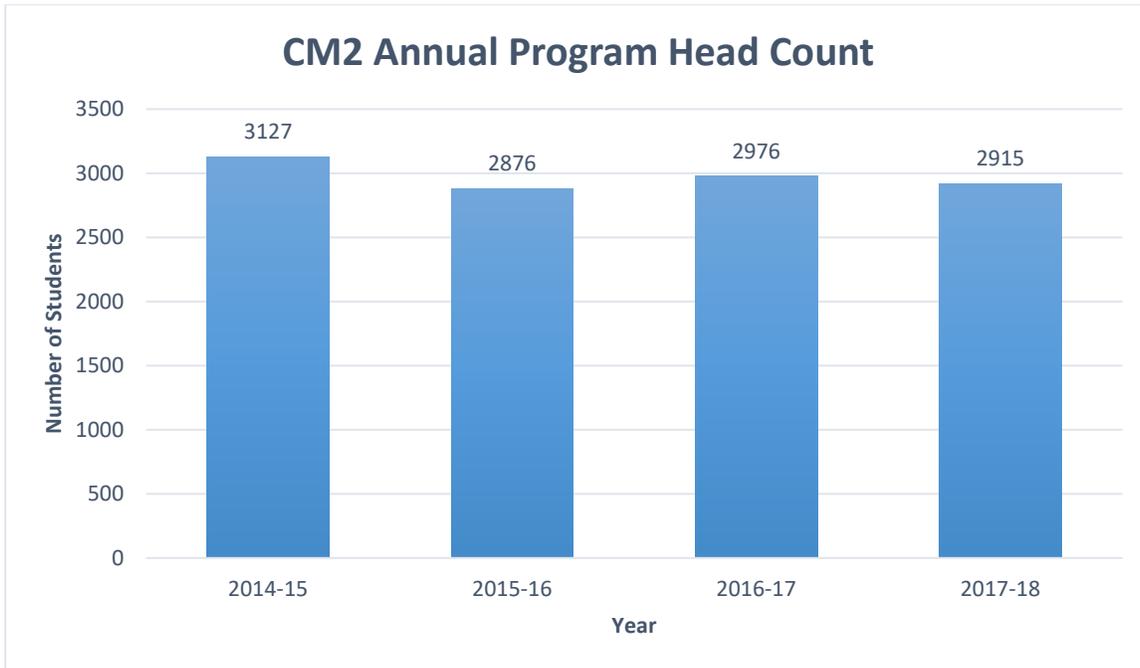


Figure 1: CM2 – General Education Mathematics Program – Annual Head Count

Despite this drop off, the number of sections offered has remained relatively the same, at around 120 classes, over this four-year period (see Figure 2). The largest difference was between 2014-15 and 2015-16, which was still only 7 sections across all of summer, fall, winter, and spring. The seat count across these years has also been close, at around 4400 students, and differed by at most about 300 students between years.

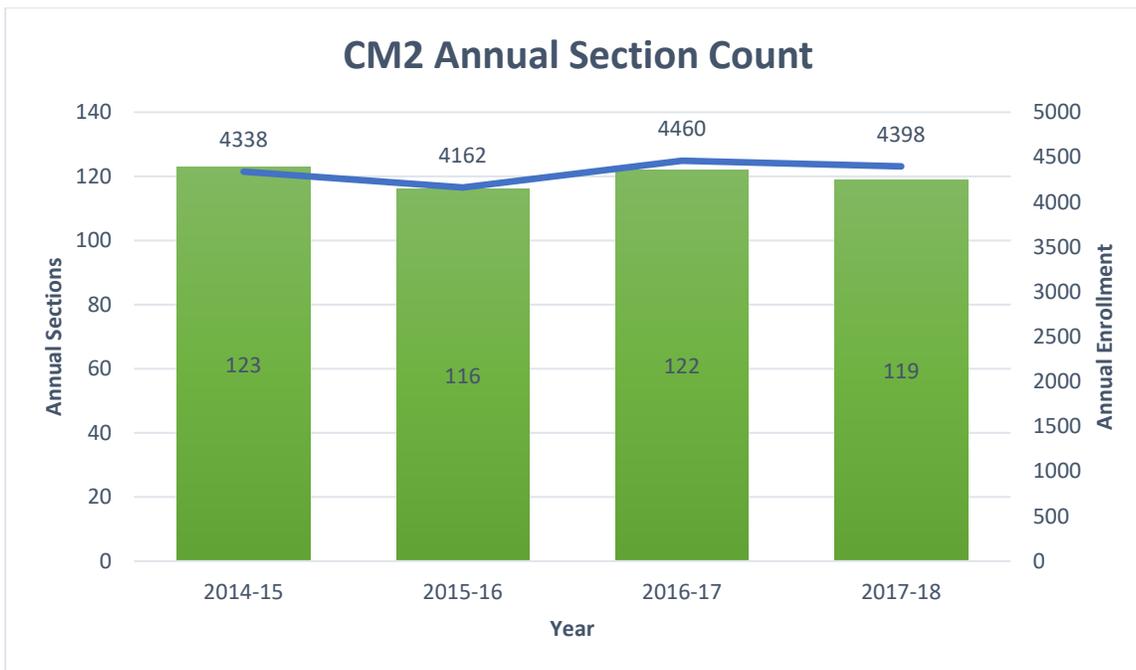


Figure 2: CM2 – General Education Mathematics Program – Annual Section Count

Figure 3 gives the seat count for the program by course and by year. Courses listed with a “DE” at the end are a distance education version of the respective course. All other courses without any additional designation are on campus.

Math 140 tended to have the lowest seat count as there is usually only one section offered in fall and one in spring. The highest seat count belongs to Math 150, which accounts for a large percentage of the student population taking General Education Mathematics classes (see Figure 4). Note that the gray boxes are years in which a course was not offered.

CM2 Distribution of Students by Seat Count					
Year	2014-15	2015-16	2016-17	2017-18	Total
Math 120	398	370	313	271	1352
Math 130	961	645	574	520	2700
Math 130 DE		40	77	94	211
Math 140	44	51	38	26	159
Math 150	2290	2288	2604	2665	9847
Math 150 DE	110	359	446	447	1362
Math 160	462	75			537
Math 161	73	44			117
Math 165		290	408	375	1073
Total	4338	4162	4460	4398	17358

Figure 3: General Education Mathematics Program – Distribution of Students by Seat Count

Figure 4 contains the same data as Figure 3, but presented in terms of percentage of students for each year. From 2014-15 to 2017-18, the percentage of students taking Math 150, as compared to all of the CM2 courses for each respective year, has risen from 52.8% to 60.6%. At the same time, Math 150 DE has grown from 2.5% to 10.2%. Both the total and percentage of students in CM2 courses taking Math 120, 130, and 140 has been dropping slowly. Math 130 did pick up a distance education version during this time period which has grown, but, in general, there are still fewer students taking Math 130. This may be due to more

majors requiring statistics rather than just any transfer-level math course. It could also be that since Math 80, Intermediate Algebra for STEM, has been added as a prerequisite, students not required to take Math 130 are opting for a different course at the transfer level. Math 165, for the three years of its existence, has accounted for around 8% of the CM2 students.

CM2 Distribution of Students by Percentage of Program					
Year	2014-15	2015-16	2016-17	2017-18	Total
Math 120	9.2%	8.9%	7.0%	6.2%	7.8%
Math 130	22.2%	15.5%	12.9%	11.8%	15.6%
Math 130 DE		1.0%	1.7%	2.1%	1.2%
Math 140	1.0%	1.2%	0.9%	0.6%	0.9%
Math 150	52.8%	55.0%	58.4%	60.6%	56.7%
Math 150 DE	2.5%	8.6%	10.0%	10.2%	7.8%
Math 160	10.7%	1.8%			3.1%
Math 161	1.7%	1.1%			0.7%
Math 165		7.0%	9.1%	8.5%	6.2%

Figure 4: General Education Mathematics Program – Distribution of Students by Yearly Percentage

B) Course grade distribution

Figures 5-11 contain the grade distributions for seven current (including two distance education) and two deactivated CM2 courses over the past four years. The two deactivated courses, Math 160 and 161, were merged to form Math 165, which was first offered in 2015-16.

The grade distribution for each class is displayed in the bar graphs below and is broken up by grade and is color coded: A (green), B (dark blue), C (yellow), D (gray), F (orange), and W (light blue). The percentage of students receiving a particular grade is placed over the corresponding region in the bar graph.

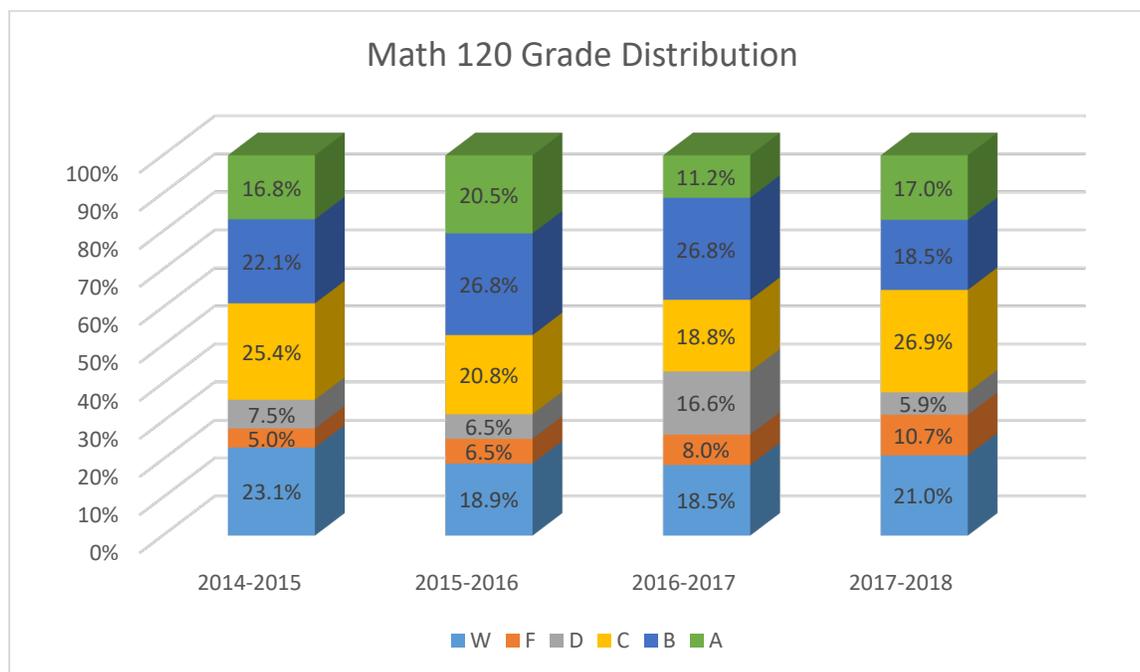


Figure 5: Math 120 Grade Distribution, 2014-15 through 2017-18

The grade distribution in Math 120, Nature of Mathematics, is fairly consistent from year to year, with a slight uptick in student success in 2015-16, followed by a small drop in 2016-17 (see Figure 5). Overall, about 10-20% of the students are earning A's, 20-25% are earning B's, 20-25% are earning C's, 15-25% are not passing the class, and about 20% are withdrawing. Student success for this class is fairly high, as most students that stick with the class do end up passing.

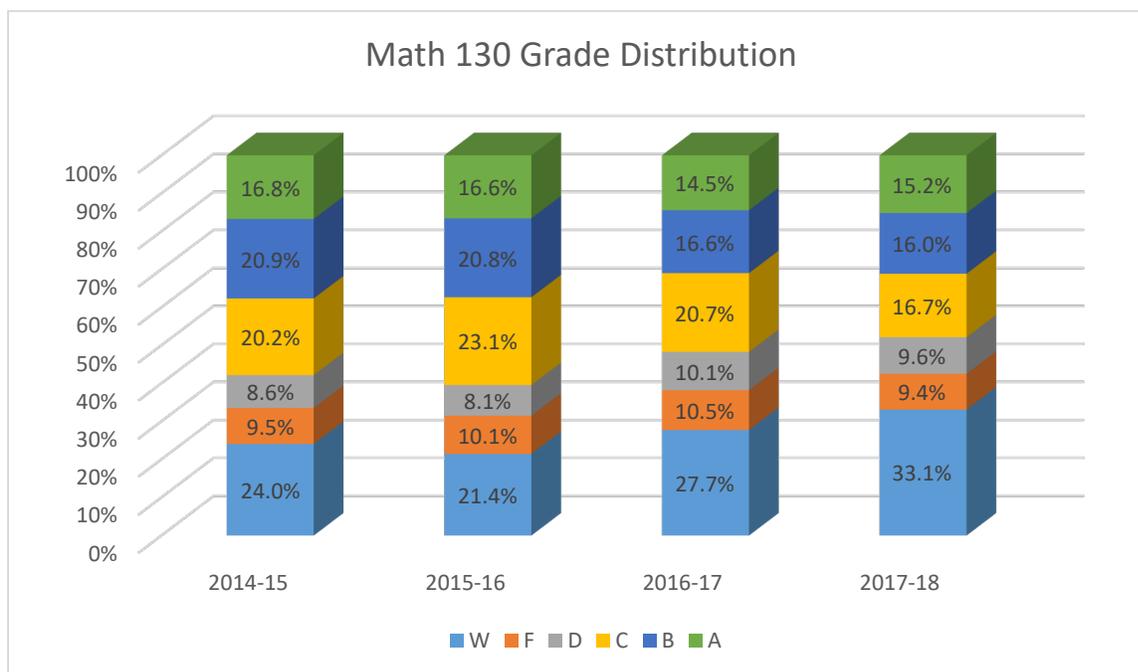


Figure 6: Math 130 Grade Distribution, 2014-15 through 2017-18

The grade distribution for Math 130, College Algebra, is shown in Figure 6. The percentage of A's earned has been consistent over the four-year period at around 15-16%. The percentage of B's however did change, from around 21% in 2014-15 and 2015-16 to around 16% in 2016-17 and 2017-18. Similarly, the percentage of C's dropped a bit, albeit a year later, from around 21% in 2014-15 through 2016-17 to around 16% in 2017-18. The percentage of D's and F's both remained around 8-10% for all four years considered.

The most significant change in the Math 130 grade distribution can be seen in the withdrawals. After a dip from 24.0% in 2014-15 to 21.4% in 2015-16, the number of withdrawals has increased to 27.7% in 2016-17 and peaked at 33.1% in 2017-2018. This may signify that students are coming into this class less prepared than in previous years. However, since Math 80 (Intermediate Algebra for STEM) was made a prerequisite for this class since the last program review, this shouldn't be the case. It may also mean that students are withdrawing in order to take a different transfer-level math course after trying Math 130, since Math 130 is only necessary for students heading to Math 165.

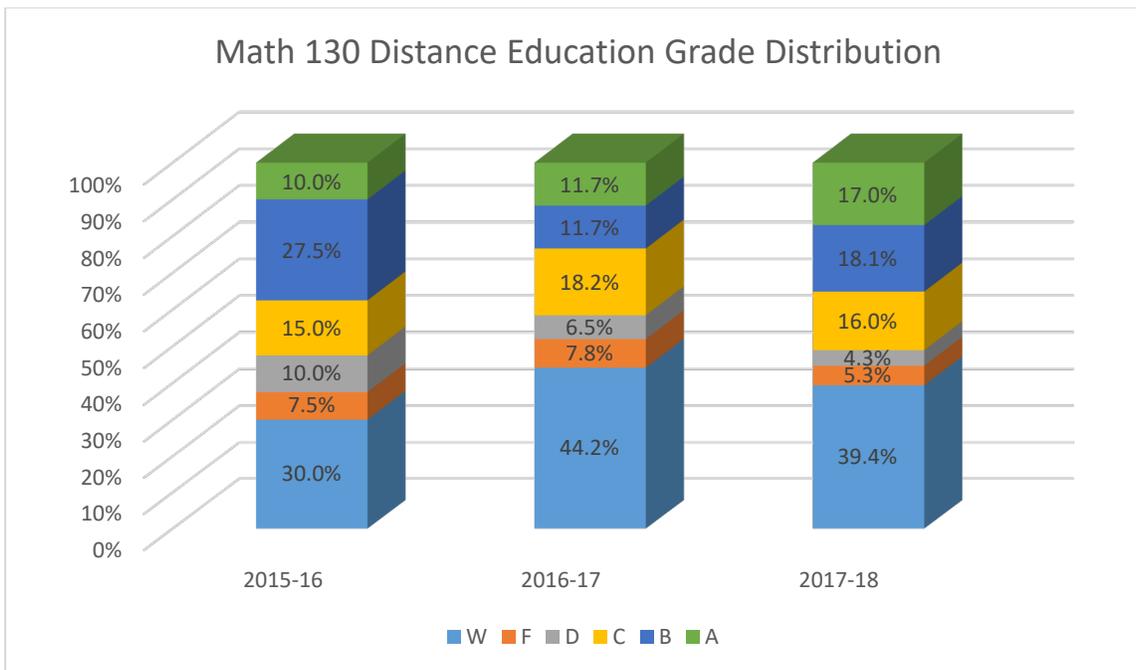


Figure 7: Math 130 Distance Education Grade Distribution, 2014-15 through 2017-18

Math 130 DE, over its three years of existence, has produced success rates that are noticeably lower than its on-campus counterpart. The percentage of D's and F's is relatively low, but the withdrawal rate is very high, accounting for about 40% of the students enrolled over the most recent two years. Since College Algebra is a review of intermediate algebra topics with a few new topics added in, this class can move very quickly and can appear early on to be much easier than it actually is. Given that this is a distance education course, it may be that students find the pacing or topics in the latter parts of the class to be too difficult to handle outside of a classroom setting.

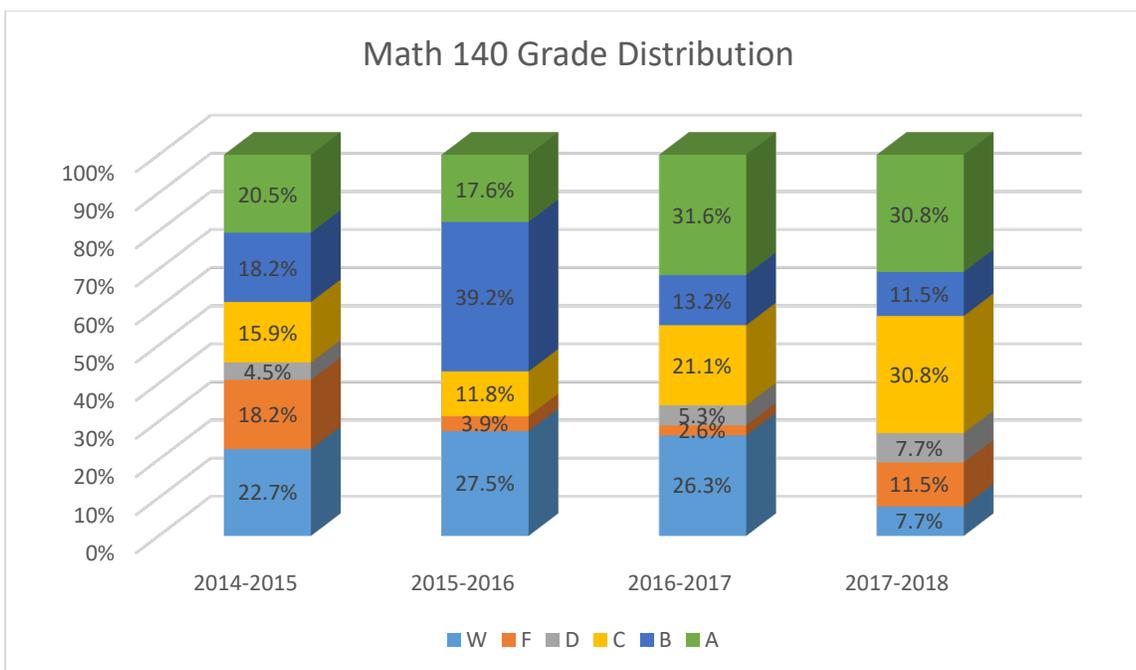


Figure 8: Math 140 Grade Distribution, 2014-15 through 2017-18

The Math 140, Finite Mathematics, grade distribution varies from year to year due to the small sample size, since there is typically only one section of it offered per semester and even those sections don't always fill (see Figure 8). The percentage of A's has increased from around 19% in 2014-15 and 2015-16 to around 31% in 2016-17 and 2017-18. Outside of a spike of 39.2% of students earning B's in 2015-16, the percentage of B's has been trending downward, from 18.2% in 2014-15 to 11.5% in 2017-18. After a slight drop from 2014-15 to 2015-16, the percentage of C's has been going up, with a high of 30.8% in 2017-18. The percentage of D's in small over all four years at around 5-6%. The percentage of F's was very low across 2015-16 and 2016-17, with higher percentages in 2014-15 and 2017-18. Across the first three years, the withdrawal rate was up around 25%, and dropped precipitously to 7.7% in 2017-18.

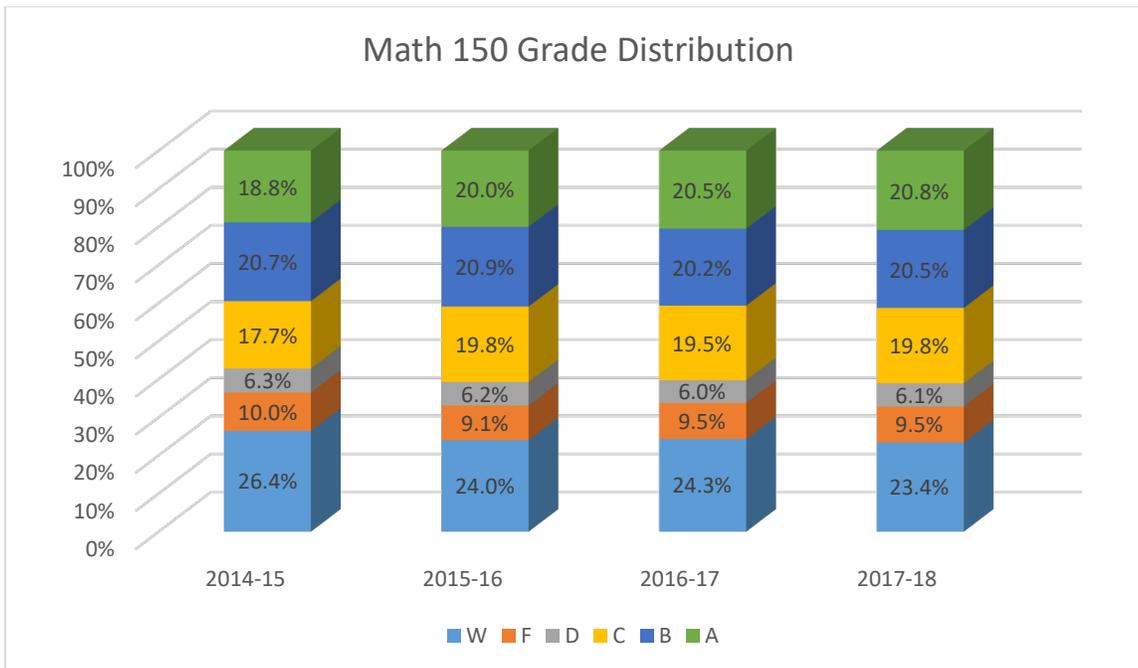


Figure 9: Math 150 Grade Distribution, 2014-15 through 2017-18

Out of all courses in the CM2 catalog, Math 150, Elementary Statistics with Probability, has the most students by far and, possibly due to having such large sample, also has the steadiest results grade-wise (see Figure 9). Across all four years, the percentage of A's, B's, and C's are consistently around 20% each, D's at 6%, F's at 9%, and W's at 25%.

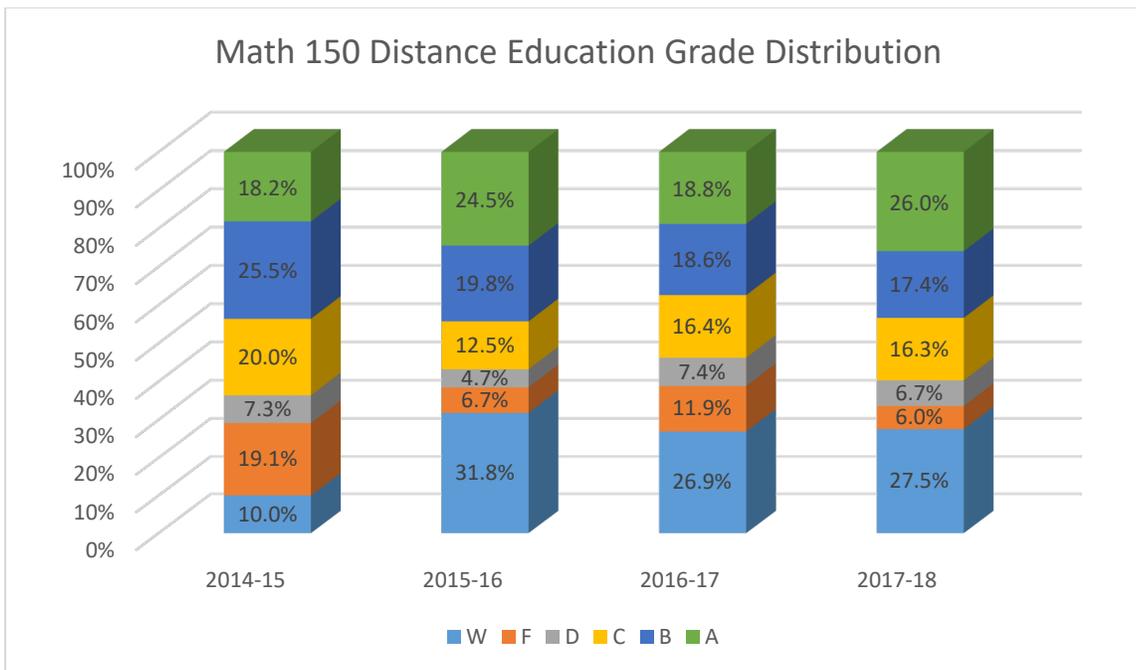


Figure 10: Math 150 Distance Education Grade Distribution, 2014-15 through 2017-18

Math 150 DE grade distribution is similar to that of Math 150 for the three most recent school years. Among the differences, M150 DE has a higher percentage of A's, lower percentage of B's and C's, and a withdrawal rate that is a few percent higher than the on-campus version of the course.

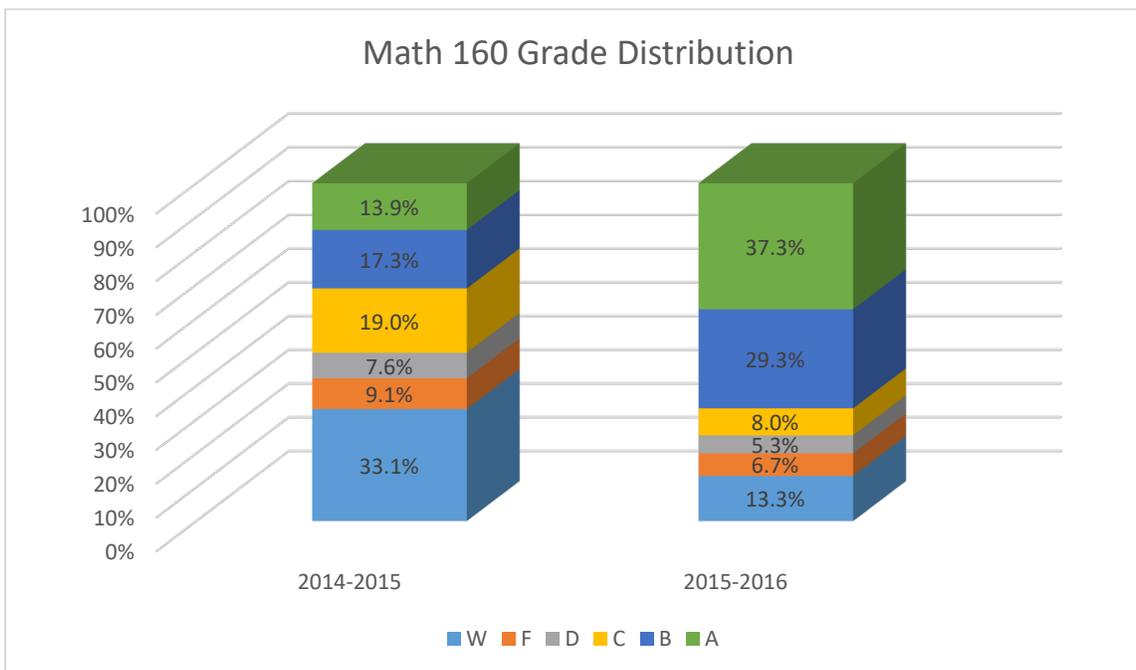


Figure 11: Math 160 Grade Distribution, 2014-15 through 2017-18

Math 160, Calculus for Biological, Management and Social Sciences I, was last offered fully in 2014-15 but had a few residual sections which carried over into 2015-2016, during which its replacement, Math 165, was introduced. The small number of sections offered in 2015-16 saw greater success compared to 2014-15 but this may be due to two reasons. One is that 2015-16 had a small sample size and is thus subject to greater

variation in the average results and, second, many of the students taking Math 160 in 2015-16 may have taken it previously and either failed or withdrawn. Any student newly coming to calculus would likely have taken Math 165 instead.

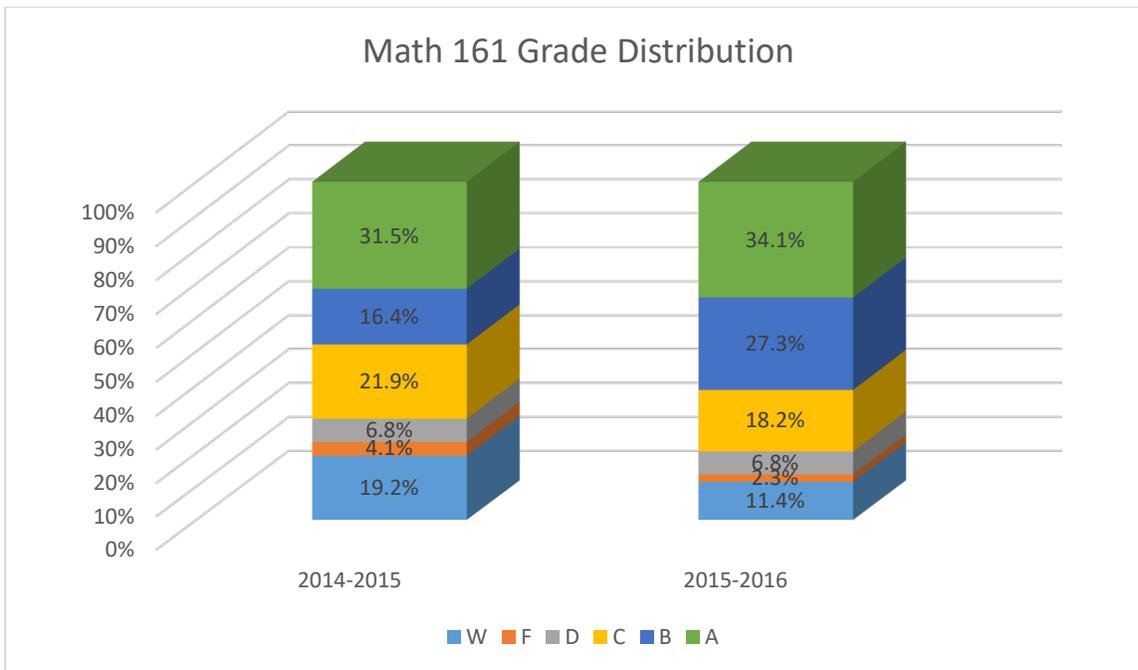


Figure 12: Math 161 Grade Distribution, 2014-15 through 2017-18

Math 161, Calculus for Biological, Management and Social Sciences II, is the second half of the now deactivated Business Calculus sequence. Similar to Math 160, fewer sections were offered in 2015-16 since Math 165 had come along as a replacement for both courses. Once again, the percentage of A's, B's, and C's is up in 2015-16 for likely the same reasons: small sample size and students retaking the course. In this instance, it would make sense for any student who had already either completed Math 160 or not passed Math 161 to take the 3-unit Math 161 rather than take the 5-unit Math 165 to complete Business Calculus.

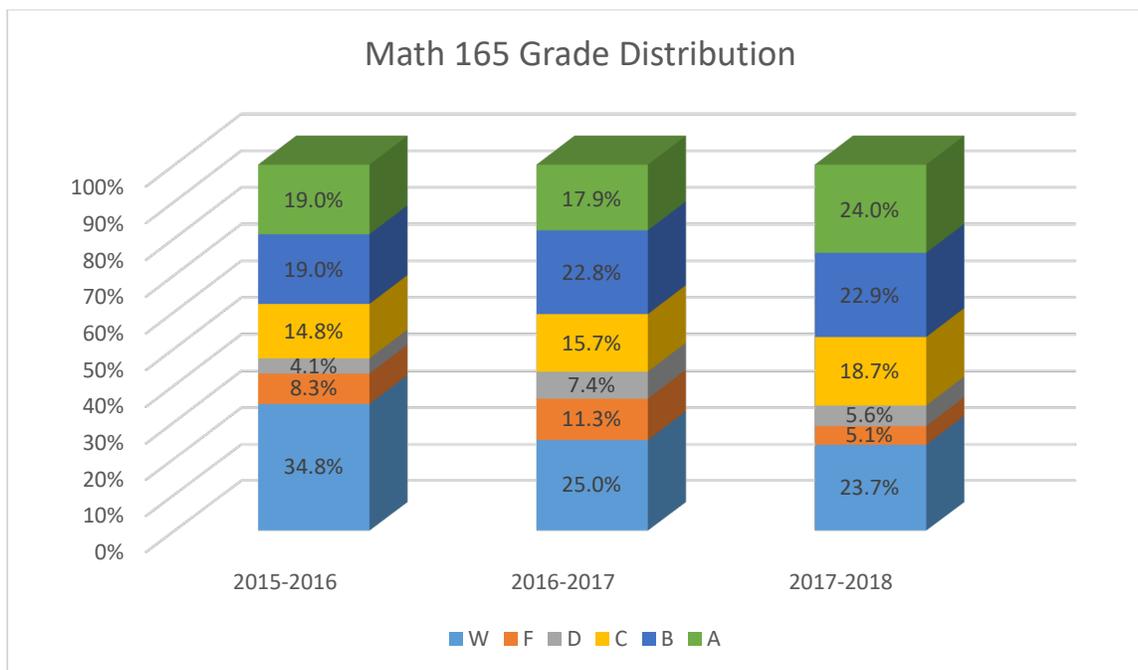


Figure 13: Math 165 Grade Distribution, 2014-2015 through 2017-18

Over the past three years during which Math 165, Calculus for the Biological, Management and Social Sciences, has been offered, the percentage of A's, B's, and C's has steadily increased (see Figure 13). The percentage of D's and F's show no discernible trend. However, the percentage of withdrawals has decreased from 34.8% in 2015-16, the inaugural year of Math 165, to 23.7% in 2017-18. The behavior of the grade percentages over this period of time could be attributed to several factors. First, as instructors have become more familiar with the course and specific topics that students struggle with, they have had the opportunity to adapt their teaching methods appropriately. Second, over this same time period, the percentage of students passing Math 130, which leads into Math 165, has dropped. Considering the two courses as a sequence, having fewer students pass Math 130 means a smaller but potentially stronger group moving on to Math 165, leading to a higher level of success in this course.

C) Success rates (Discuss your program's rates, demographic success characteristics and set a success standard for your program.)

Success is defined as receiving a grade of A, B, or C for the course. The three characteristics to be considered for the demographics are gender, ethnicity, and age range.

For all four years, the pass rates for both males and females are in the range of 60% (see Figures 14 and 15). The success rate by gender is close enough in each year to indicate that we are meeting the needs of both groups of students equally.

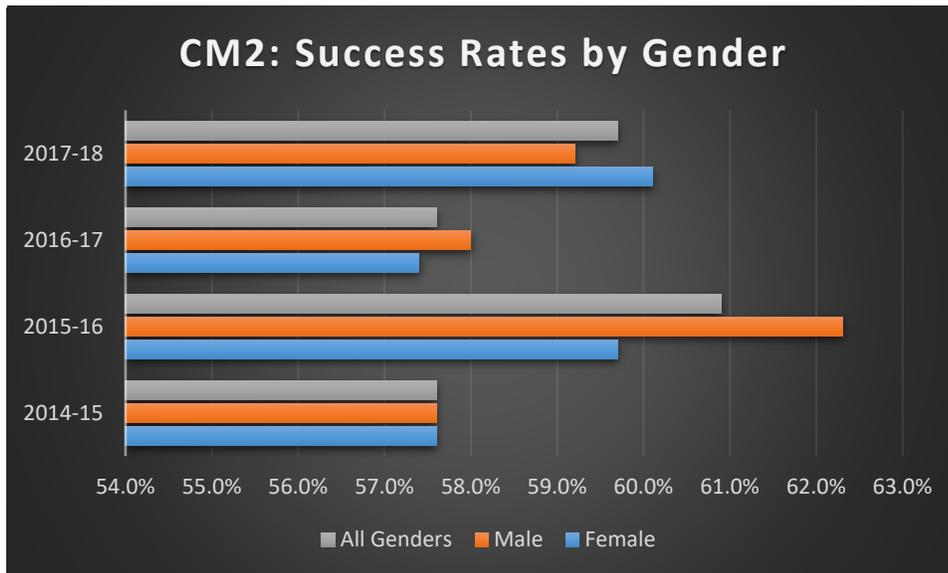


Figure 14: CM2 Demographic Success by Gender

For Figure 15, and subsequent tables in this section, any rate below average for that year will be highlighted in yellow. In two of the three years, female students came in below average in terms of success. However, this is insignificant for two reasons. First, in averaging the results from any two groups of data, one will always be above average and one will be below, unless they tie. Second, in each case, the percentage beneath the average is at most 1.2%, which can be considered insignificant.

Gender	2014-15	2015-16	2016-17	2017-18
Female	57.6%	59.7%	57.4%	60.1%
Male	57.6%	62.3%	58.0%	59.2%
All Genders	57.6%	60.9%	57.6%	59.7%

Figure 15: CM2 Demographic Success by Gender

For the success data based on ethnicity, there were two groups that performed below the yearly averages for all four years: African Americans and Hispanics (see Figures 16 and 17). The differences here are significant, with the African American population never surpassing a 50% success rate for all four years. The Hispanic population does slightly better, with success rates north of 50%. In contrast, the Asian and White populations are closer to 70% success, with Asian students slightly above this mark and White students just below.

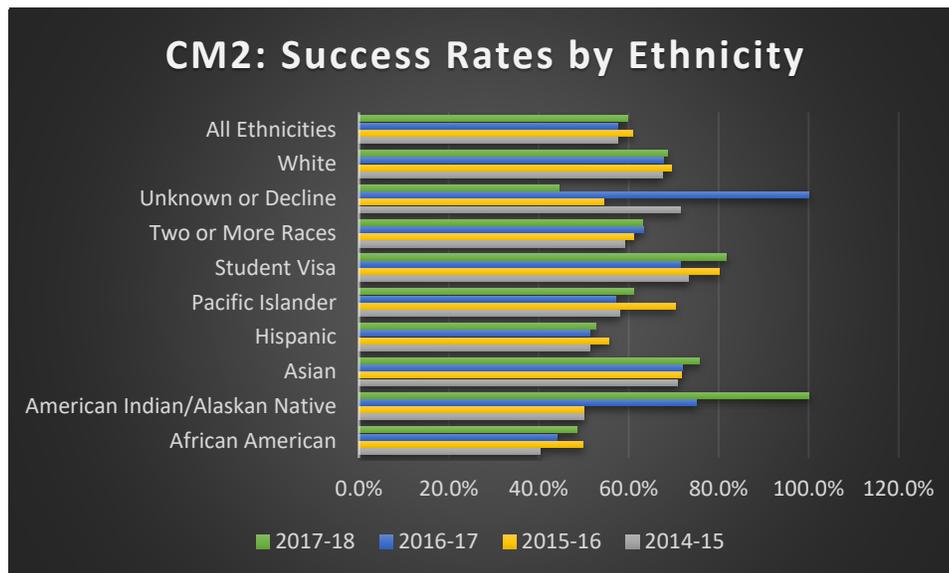


Figure 16: CM2 Demographic Success by Ethnicity

Other than the two groups that fall below the average over all four years, three other groups are also below average for at least one year. American Indian and Alaskan Native students are below the average success rate in 2014-15 and 2015-16. However, this could be solely due to a small sample size for this group. Pacific Islander students came in below average in terms of success for 2016-17, but only by 0.5%, which is negligible and were above average for the other three years. Finally, students with an unknown or unreported ethnicity were below average in two of the four years. However, with no additional information, it is hard to draw a conclusion on this result.

While not an ethnicity, students attending El Camino College on a student visa performed very well in CM2 courses, having success that was on par with Asian and White students. This may be due to these students having a higher level of motivation, shown in coming to another country to study, and possibly better preparation in their home country.

CM2 Demographic Success Characteristics by Ethnicity				
Ethnicity	2014-15	2015-16	2016-17	2017-18
African American	40.4%	49.7%	44.0%	48.4%
American Indian/Alaskan Native	50.0%	50.0%	75.0%	100.0%
Asian	70.8%	71.8%	72.0%	75.7%
Hispanic	51.4%	55.6%	51.4%	52.7%
Pacific Islander	57.9%	70.4%	57.1%	61.1%
Student Visa	73.2%	80.2%	71.6%	81.7%
Two or More Races	59.1%	61.0%	63.2%	63.1%
Unknown or Decline	71.4%	54.5%	100.0%	44.4%
White	67.5%	69.4%	67.7%	68.6%
All Ethnicities	57.6%	60.9%	57.6%	59.7%

Figure 17: CM2 Demographic Success by Ethnicity

For the age-based success rates, two age groups scored below average in success for all four years: 20-24 year olds and 50 year olds and up. Students just out of high school, in the 17-19 year old range, routinely were successful in their CM2 math courses about 60% of the time. This may be due to not having any layoff in terms of their mathematical education. The same is true for the 25-29 and 30-49 age groups. It is harder to

find a definitive explanation for the success of these groups, but these may be students who have worked for a few years and are returning to college to get a higher degree or even a degree in a different field.

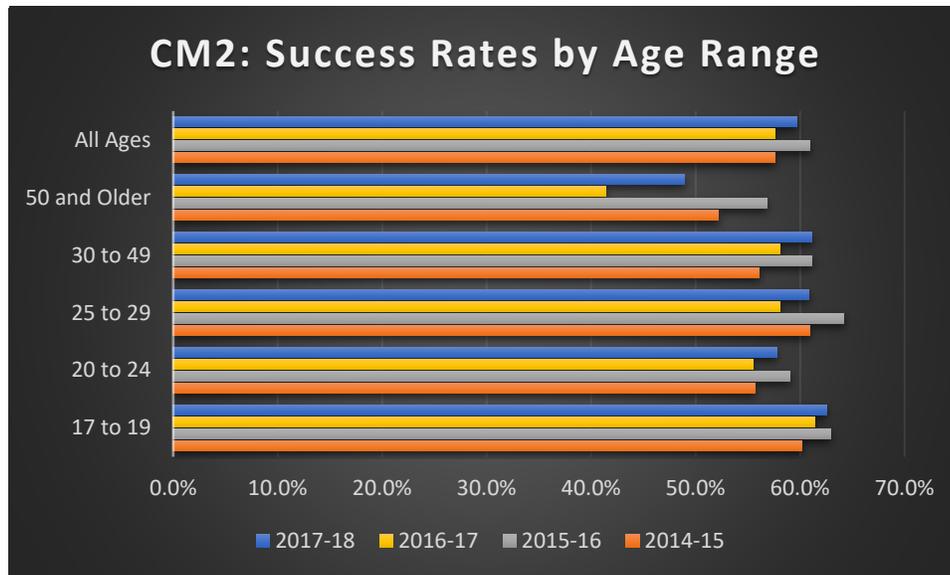


Figure 18: CM2 Demographic Success by Age Range

The cause of the two groups that underperformed relative to the average could be due to several reasons. First, for the 20-24 year olds, many of these students may have taken time off between high school and college. For such students, a layoff of a year or two could dull their skills in mathematics to the point where they struggle to readjust to it. For other students, they may have a difficult time with math and are stuck repeating the same level, unable to pass the course they have reached. For either reason, the upcoming support courses should be of use to sharpen their skills and give them additional exposure to the material in order to have a better chance of passing the class.

CM2 Demographic Success Characteristics by Age				
Age Range	2014-15	2015-16	2016-17	2017-18
17 to 19	60.2%	62.9%	61.4%	62.5%
20 to 24	55.7%	59.0%	55.5%	57.8%
25 to 29	60.9%	64.2%	58.1%	60.8%
30 to 49	56.1%	61.1%	58.1%	61.1%
50 and Older	52.2%	56.8%	41.4%	48.9%
All Ages	57.6%	60.9%	57.6%	59.7%

Figure 19: CM2 Demographic Success by Age Range

For the 50 years old and up group, there could be several factors contributing to lower than average success rates. It could be that many of these students are coming back to college after a long time away or may be trying college for the first time at a later age. It also may be that some students are taking courses out of personal interest and are not planning on using a grade in the class towards a degree, certificate, or transfer. Finally, it may just be more difficult in general for students to learn mathematics at a later age.

The overall success rates, by course and year, for CM2, the General Education Mathematics Program, are shown in Figure 20. Again, the gray regions represent years in which those courses were not offered. Note that the over this four-year period, the success rate has been around 60% or just slightly below. There are small fluctuations from year to year, but no distinct pattern.

Math 150 is the biggest course in terms of offerings from CM2 and, as such, the success rates of the program mirror the success rates of this course, also at around 60%. Of the current courses still being offered, Math 140 has the highest rate of success, followed closely by Math 120. Both of these courses tend to have a small number of sections offered, so these results may be due to those small samples. In addition, both of these courses have varied and mostly unrelated topics, meaning that if a student struggles with one topic in the course, it will not really affect their ability to do well with another topic. The current course with the least success among students is Math 130, both for on campus and distance education. As mentioned earlier, this class is a precursor to Math 165 and as the percentage of students passing Math 130 dropped, the success rate of students in Math 165 went up. So it may just be that Math 130 is doing a better job of discerning who will eventually be able to find success in Math 165.

General Education Mathematics Program Success Rates					
Course	2014-15	2015-16	2016-17	2017-18	Course Success Rate
Math 120	64.3%	68.1%	56.9%	62.4%	63.2%
Math 130	57.9%	60.5%	51.7%	47.9%	55.3%
Math 130 DE		52.5%	41.6%	51.1%	47.9%
Math 140	54.5%	68.6%	65.8%	73.1%	64.8%
Math 150	57.2%	60.8%	60.3%	61.1%	59.9%
Math 150 DE	63.6%	56.8%	53.8%	59.7%	57.3%
Math 160	50.2%	74.7%			53.6%
Math 161	69.9%	79.5%			73.5%
Math 165		52.8%	56.4%	65.6%	58.6%
Program Success Rate	57.6%	60.9%	57.6%	59.7%	

Figure 20: General Education Mathematics Program Success Rates, 2014-15 through 2017-18

Based on these results, a reasonable goal for success would be to stabilize at 60% or above. The program as a whole has been very close to this in three of the four years and exceeded it in one. With the addition of support courses for Math 130 and Math 150, in compliance with AB 705, the hope is that this will not only help incoming students that are no longer required to satisfy the prerequisite but will also help students in general that may enter these courses without adequate preparation.

Figures 21 and 23 contain the success rates for the individual fall and spring semesters over the same time span. Note that the data in Figure 20 included these semesters as well as winter and summer classes.

General Mathematics Education Program Success Rates - Fall Terms					
Course	2014	2015	2016	2017	Course Success Rate
Math 120	64.2%	55.3%	58.5%	65.3%	61.0%
Math 130	58.1%	60.9%	56.1%	38.6%	55.3%
Math 130 DE			52.3%	53.2%	52.8%
Math 140	54.5%	57.1%	60.9%	76.5%	61.4%
Math 150	53.4%	61.5%	58.0%	56.2%	57.3%
Math 150 DE	68.0%	48.9%	52.0%	54.7%	53.0%
Math 160	53.7%				53.7%
Math 161	78.3%	82.4%			80.7%
Math 165		47.3%	52.9%	65.0%	55.5%
Program Success Rate	56.3%	59.0%	56.5%	55.7%	

Division Success Rate	54.3%	53.8%	54.0%	53.9%
College Success Rate	67.6%	68.0%	68.8%	69.3%

Figure 21: General Mathematics Education Program Success Rates, Fall 2014-17

Compared to each year as a whole, the success rates in the fall terms tended to fluctuate. This may be due to much smaller samples, especially for classes such as Math 120 and 140. Year to year, success in the fall hovered around 56%, which is slightly better than the division success rates, but not quite as high as for the entire college.

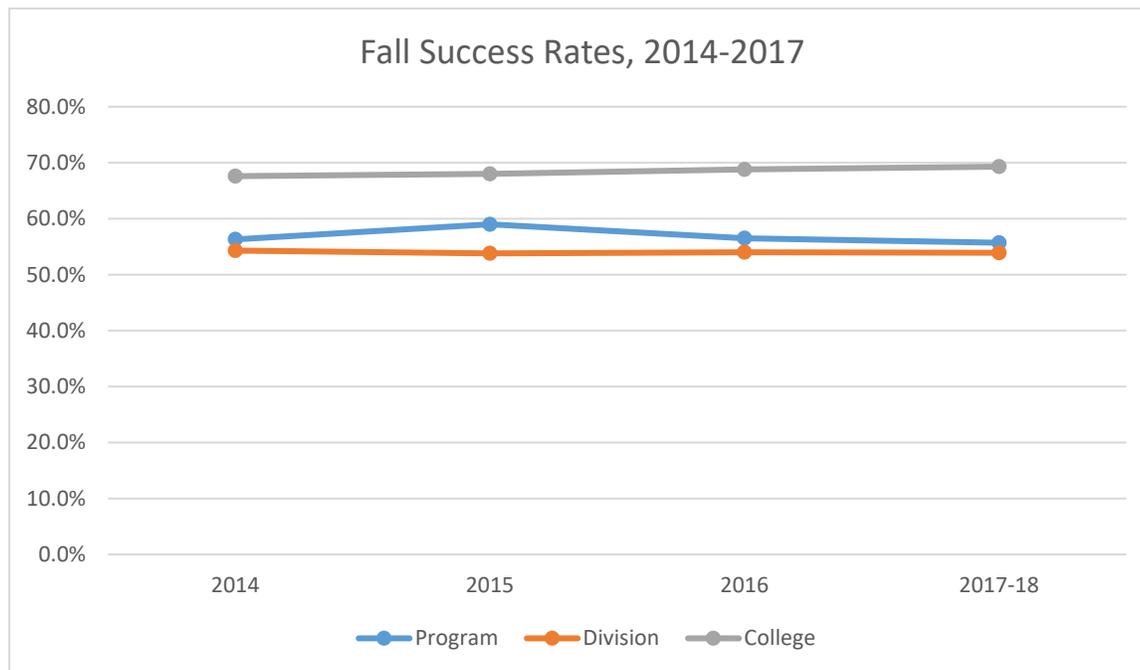


Figure 22: Fall Success Rates for the CM2 Program, Division, and College, 2014-17

General Mathematics Education Success Rates - Spring Terms					
Course	2015	2016	2017	2018	Course Success Rate
Math 120	62.1%	73.8%	56.8%	60.2%	63.7%
Math 130	60.0%	55.0%	48.4%	45.7%	53.7%
Math 130 DE		52.5%	27.3%	46.9%	42.9%
Math 140	54.5%	76.7%	73.3%	66.7%	68.4%
Math 150	56.6%	56.2%	59.1%	60.7%	58.2%
Math 150 DE	62.4%	61.5%	55.3%	64.7%	60.6%
Math 160	45.6%				45.6%
Math 161	66.0%	70.0%			66.7%
Math 165		57.2%	56.0%	69.8%	61.0%
Program Success Rate	57.1%	58.6%	56.5%	60.0%	
Division Success Rate	54.5%	54.4%	52.5%	54.1%	
College Success Rate	68.0%	69.5%	69.3%	70.3%	

Figure 23: General Mathematics Education Program Success Rates, Spring 2015-18

The success rates among the spring semesters are slightly higher than in fall for five of the seven current CM2 courses. The success rate by year is on par or higher for three of the four years as compared to fall. For

spring semesters, most students will likely have also taken classes that previous fall and may be better prepared for the rigors of college math courses, thus giving a small boost to the success rate. Again, the CM2 courses have higher success rates than the division but are still below the college rates. Being lower than the college success rates, which is a trend both the spring success data as well as the retention data, is likely due to math courses being more difficult than an average college course in another division.

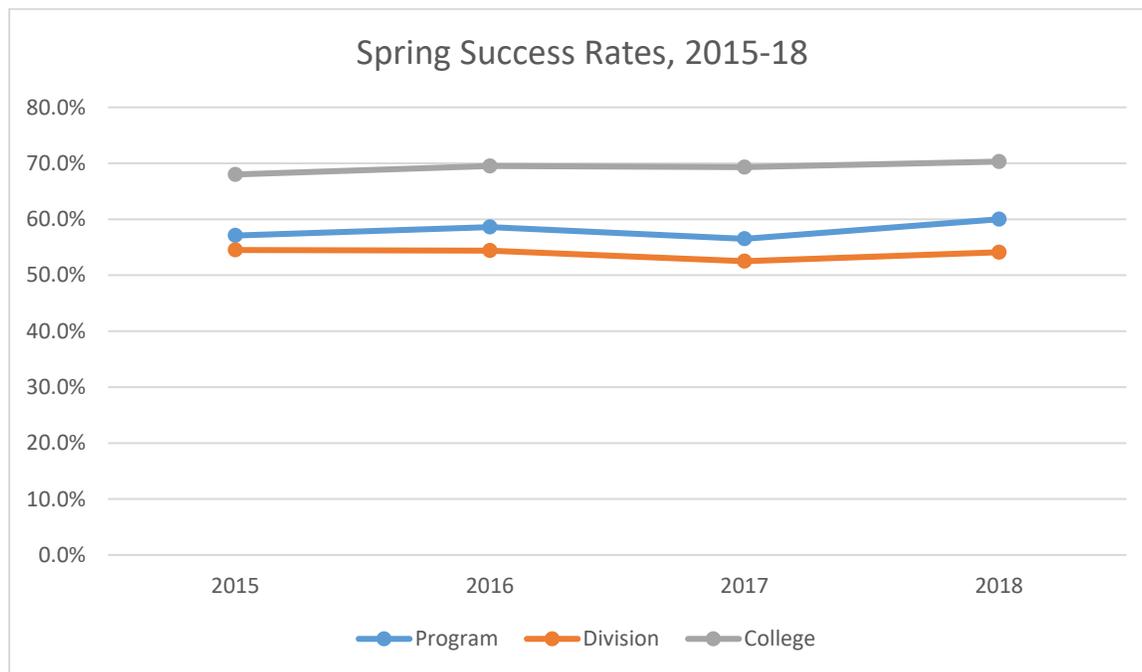


Figure 24: Spring Success Rates for the Program, Division, and College, 2015-18

D) Retention rates (if applicable, include retention based on placement method)

Figure 25 contains the retention rate by year and by course for 2014-15 through 2017-18.

General Education Mathematics Program Retention Rates					
Course	2014-15	2015-16	2016-17	2017-18	Course Retention Rate
Math 120	76.9%	81.1%	81.5%	79.0%	79.5%
Math 130	76.0%	78.6%	72.3%	66.9%	74.1%
Math 130 DE		70.0%	55.8%	60.6%	60.7%
Math 140	77.3%	72.5%	73.7%	92.3%	77.4%
Math 150	73.6%	76.0%	75.7%	76.6%	75.5%
Math 150 DE	90.0%	68.2%	73.1%	72.5%	73.0%
Math 160	66.9%	86.7%			69.6%
Math 161	80.8%	88.6%			83.8%
Math 165		65.2%	75.0%	76.3%	72.8%
Program Retention Rate	74.3%	75.7%	75.0%	74.9%	

Figure 25: General Mathematics Education Program Retention Rates, 2014-15 through 2017-18

Over this four-year time period, the retention rates have been relatively steady at around 75%. Out of the current classes, Math 120 and 140 have the highest retention rates. These are typically classes that are taken by students needing a transfer-level math course, but no specific math course for their given major. These classes also tend to be less intense mathematically, so students that don't have a strong math background are still capable of doing well in them. As noted earlier Math 130 DE has a very low retention rate, at around 60%. Of the on campus courses, Math 165, the sole remaining calculus course in CM2, has the lowest retention rate. This is the most difficult courses of those considered here, so it makes sense for it to have a low rate of retention.

Much like with the success data, the retention rates for Math 150 have been fairly steady, at about 75% each year. The retention rate for Math 130 has gone down over this period of time, while Math 165 has gone up and the possible reasons for this behavior have been speculated about earlier.

General Mathematics Education Program Retention Rates - Fall Terms					
Course	2014	2015	2016	2017	Course Retention Rate
Math 120	76.7%	72.0%	82.2%	78.2%	77.1%
Math 130	73.9%	77.5%	74.1%	63.1%	73.1%
Math 130 DE			65.9%	62.9%	64.2%
Math 140	68.2%	61.9%	65.2%	100.0%	72.3%
Math 150	72.5%	76.4%	72.2%	71.3%	73.0%
Math 150 DE	96.0%	63.2%	69.0%	69.1%	68.8%
Math 160	71.3%				71.3%
Math 161	87.0%	88.2%			87.7%
Math 165		57.3%	67.6%	80.9%	69.2%
Program Retention Rate	73.6%	73.5%	72.0%	71.5%	
Division Retention Rate	N/A	75%	75%	75%	
College Retention Rate	N/A	82%	83%	83%	

Figure 26: General Education Mathematics Program Retention Rates, Fall 2014-17

The fall retention rates in Figure 26 show similar results to the overall data, with Math 120 having the highest retention. Math 130 DE and Math 165 again have the lowest. For all four years, the program retention rates are slightly below the division retention rates (the division and college retention rates for Fall 2014 were not available in the data supplied by Institutional Research). Compared to the college retention rates, the CM2 rates by year are about 10% below. The rates being slightly lower than the division rates may be due to students sticking with the course initially and later realizing how difficult some of these courses can become towards to end.

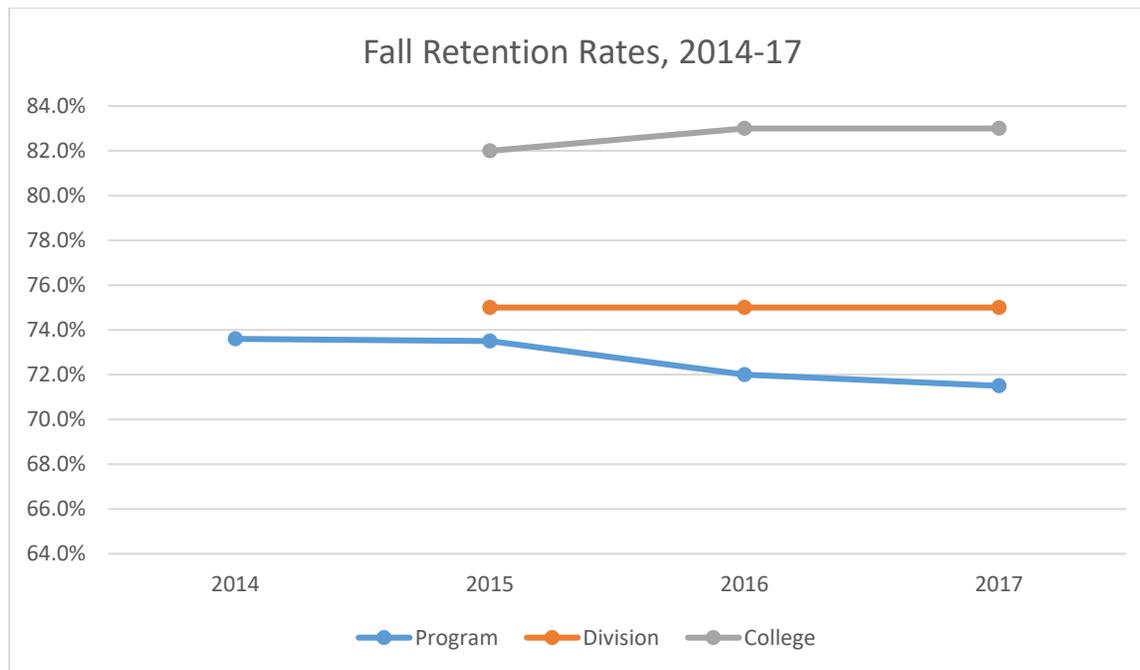


Figure 27: Fall Retention Rates for the Program, Division, and College, 2014-17

General Mathematics Education Retention Rates - Spring Terms					
Course	2015	2016	2017	2018	Course Retention Rate
Math 120	71.8%	84.5%	79.1%	79.6%	78.5%
Math 130	76.0%	73.6%	73.8%	65.5%	72.9%
Math 130 DE		70.0%	42.4%	56.3%	57.1%
Math 140	86.4%	80.0%	86.7%	77.8%	82.9%
Math 150	72.3%	71.4%	74.6%	77.9%	74.1%
Math 150 DE	88.2%	71.2%	76.4%	75.9%	76.1%
Math 160	59.9%				59.9%
Math 161	78.0%	90.0%			80.0%
Math 165		71.7%	77.1%	75.3%	74.7%
Program Retention Rate	72.6%	73.0%	74.9%	75.7%	
Division Retention Rate	74%	74%	73%	73%	
College Retention Rate	81%	82%	82%	83%	

Figure 28: General Education Mathematics Program Retention Rates, Spring 2015-18

Figure 28 contains the retention rates for the spring semesters. While retention rates have gone down over the past four fall semesters, these rates have increases over the spring semesters. This may be due to students retaking a class after dropping in fall and being better prepared for it in spring. The CM2 spring retention rates exceed those of the division in the past two years, but are still a few percent below the college rates.

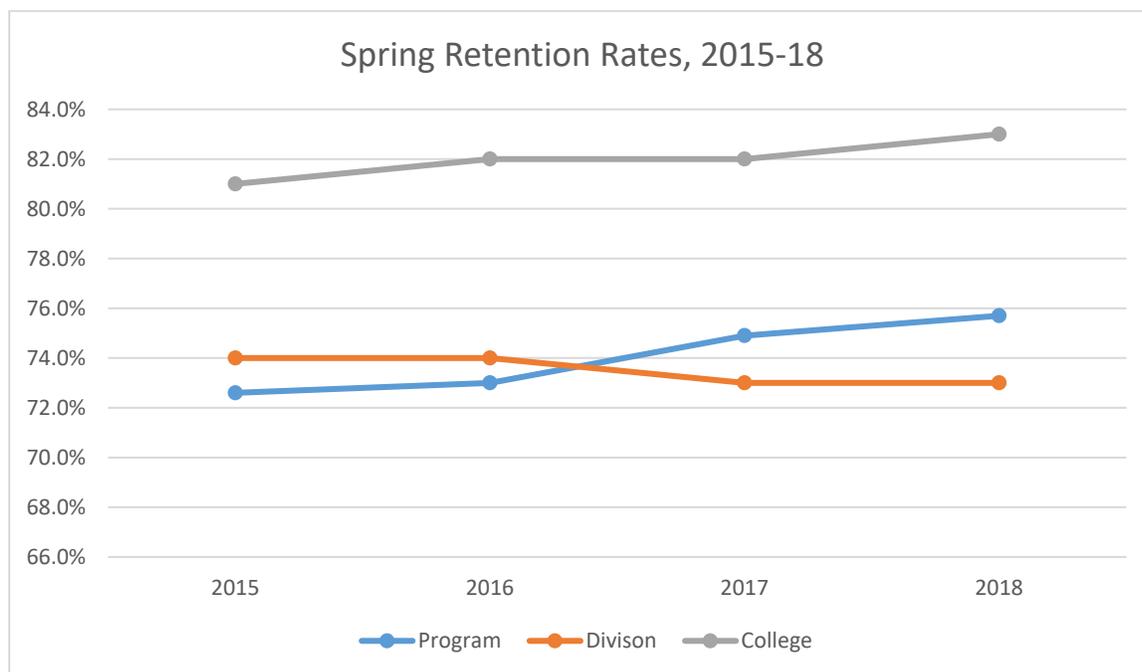


Figure 29: Spring Retention Rates for the Program, Division, and College, 2015-18

E) A comparison of success and retention rates in face-to-face classes with distance education classes

Distance education success rate shows significant fluctuation from term to term perhaps due to the teaching method or instructor in charge. Currently, both full time and part time faculty are teaching distance education classes. We have a small sample of students in these distance education classes, making it harder to notice trends. The different format can definitely affect success and retention rates for students. In particular, students will quickly realize the need for extra self-discipline and motivation to complete the course with far less face-to-face instruction.

Due to the high volume of students and demand, the Math 150 Elementary Statistics course has consistently opened sections through Distance Education. Most majors especially in business, economics, nursing, and life sciences require Statistics to transfer to a 4-year college.

Looking at success rates (Figure 14 and Figure 15) in the Math 150 face-to-face vs. distance education sections, face-to-face had about a 5% higher success rate in the fall compared to distance education, but in the spring semesters, distance education had about a 2% higher success rate.

Math 150 Fall Terms – Face-to-Face and Distance Ed Comparison – SUCCESS RATE					
	2014	2015	2016	2017	
MATH 150	53.6%	61.5%	58.0%	56.2%	57.3%
MATH 150 - DISTANCE ED	68%	48.9%	52%	54.7%	52.1%

Figure 30: A Comparison of Math 150 Face-to-Face and Distance Ed Success Rate (Fall terms)

Math 150 Spring Terms – Face-to-Face and Distance Ed Comparison – SUCCESS RATE					
	2015	2016	2017	2018	
MATH 150	56.6%	56.2%	59.1%	60.7%	58.2%
MATH 150 - DISTANCE ED	62.4%	61.5%	55.3%	64.7%	60.6%

Figure 31: A Comparison of Math 150 Face-to-Face and Distance Ed Success Rate (Spring terms)

Below (Figure 16 and Figure 17) is a comparison of face-to-face Math 150 retention rates to distance education instruction:

Math 150 Fall Terms – Face-to-Face and Distance Ed Comparison – RETENTION RATE					
	2014	2015	2016	2017	
MATH 150 – Face – to - face	72.5%	76.4%	72.2%	71.3%	73.0%
MATH 150 - DISTANCE ED	96%	63.2%	69%	69.1%	68.8%

Figure 32: A Comparison of Math 150 Face-to-Face and Distance Ed Retention Rate (Fall terms)

Math 150 Spring Terms – Face-to-face and Distance Ed Comparison – RETENTION RATE					
	2015	2016	2017	2018	
MATH 150 – Face – to - face	72.3%	71.4%	74.6%	77.9%	74.1%
MATH 150 - DISTANCE ED	88.2%	71.2%	76.4%	75.9%	76.1%

Figure 33: A Comparison of Math 150 Face-to-Face and Distance Ed Retention Rate (Spring terms)

The retention rates have a similar pattern as the success rates. Fall retention rates are about 4% higher for face-to-face instruction than distance education, while the spring retention rates are 2% higher for distance education courses. Again, this inconsistency could be due to smaller sample sizes of distance education students. It may also be evidence that the Math 150 distance education has been a benefit to students, accommodating the large demand of Math 150 students while maintaining similar success and retention rates as a face-to-face Math 150.

The Math 130 distance education was added in Spring 2016. Math 130 is a prerequisite for Math 165 (previously Math 160), which is required for business majors.

For the fall terms, the distance education method of instruction had about a 5% higher success rate than the face-to-face delivery. In the spring terms, the face-to-face instruction method had approximately a 7% higher success rate. Again, this discrepancy could be due to small sample size of the distance education students.

Math 130 Fall Terms – Face-to-Face and Distance Ed Comparison – SUCCESS RATE			
	2016		2017
MATH 130	56.1%	38.6%	48.0%
MATH 130 - DISTANCE ED	52.3%	53.2%	52.8%

Figure 34: A Comparison of Math 130 Face-to-Face and Distance Ed Success Rate (Fall terms)

Math 130 Spring Terms – Face-to-Face and Distance Ed Comparison – SUCCESS RATE				
	2016		2017	2018
MATH 130	55%	48.4%	45.7%	49.7%
MATH 130 - DISTANCE ED	52.5%	27.3%	46.9%	42.9%

Figure 35: A Comparison of Math 130 Face-to-Face and Distance Ed Success Rate (Spring terms)

Below (Figure 36 and Figure 27) is a comparison of face-to-face Math 130 retention rates to distance education instruction:

Math 130 Fall Terms – Face-to-Face and Distance Ed Comparison – RETENTION RATE			
	2016		2017
MATH 130	74.1%	63.1%	69.0%
MATH 130 - DISTANCE ED	65.9%	62.9%	64.2%

Figure 36: A Comparison of Math 130 Face-to-Face and Distance Ed Retention Rate (Fall terms)

Math 130 Spring Terms – Face-to-face and Distance Ed Comparison – RETENTION RATE				
	2016		2017	2018
MATH 130	73.6%	73.8%	65.5%	70.9%

MATH 130 - DISTANCE ED	70%	42.4%	56.3%	57.1%
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Figure 37: A Comparison of Math 130 Face-to-Face and Distance Ed Retention Rate (Spring terms)

The face-to-face method had higher retention rates for both fall and spring semesters than the distance education classes, with about a 5% higher retention rate in the fall and about a 14% higher rate in the spring. Again, this could be due to smaller sample size of the distance education courses, along with the increase need for student discipline and motivation in distance education courses.

F) Enrollment statistics with section and seat counts and fill rates

Collecting enrollment data, we combine student participation in the General Education Math courses for the academic terms from 2014-2018 in the table (Figure 38). The winter term was added in the 2016-2017 year. Note that almost 57% (almost 65% including distance education) of the program participation originates in the Math 150 face-to-face sections.

Gen Ed Math Program - Total Enrollments					
Course	2014-15	2015-16	2016-17	2017-18	Totals
MATH 120	398	370	313	271	1352
MATH 130	961	645	574	520	2700
MATH 130 – DISTANCE ED		40	77	94	211
MATH 140	44	51	38	26	159
MATH 150	2290	2288	2604	2665	9847
MATH 150 - DISTANCE ED	110	359	446	447	1362
MATH 160	462	75			537
MATH 161	73	44			117
MATH 165		290	408	375	1073
TOTAL	4338	4162	4460	4398	17358

Figure 38: General Education Program Total Enrollments 2014-18

Math 140 continues to decrease enrollment since CSULB no longer requires the course for business majors. Math 120 also shows decreasing enrollment, while all other courses increased their enrollment totals. Math 160 and 161 were deactivated, as shown in Figure 38 enrollment totals. The replacement course, Math 165 which is the one semester business calculus course, began in year 2015-16. There was a slight decrease in the Math 165 enrollment in the 2017-2018, but this could be due to the fact that Math 165 was not offered in the Winter 2018 term, despite being offered in the Winter 2017 term with 26 students enrolling.

The following chart (*Figure 39*) displays our annual program participation. These numbers were taken from directly from the Institutional Research Program Review Data. It should be noted that these totals are different than the totals for each school year from *Figure 38*.

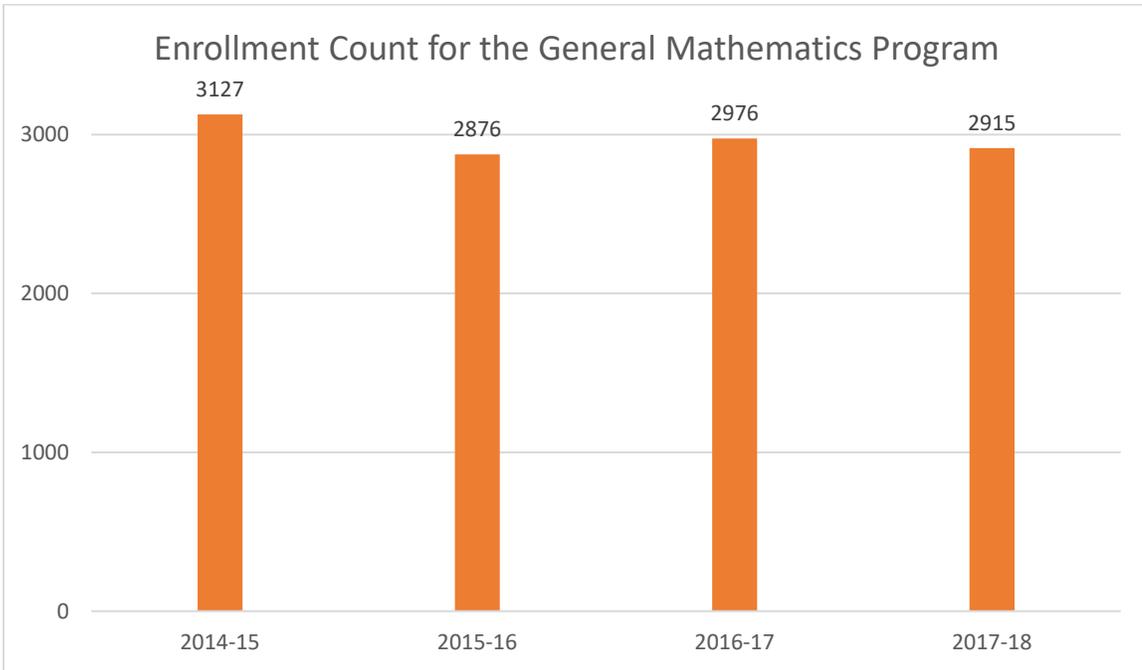


Figure 39: Enrollment counts for the General Mathematics Program

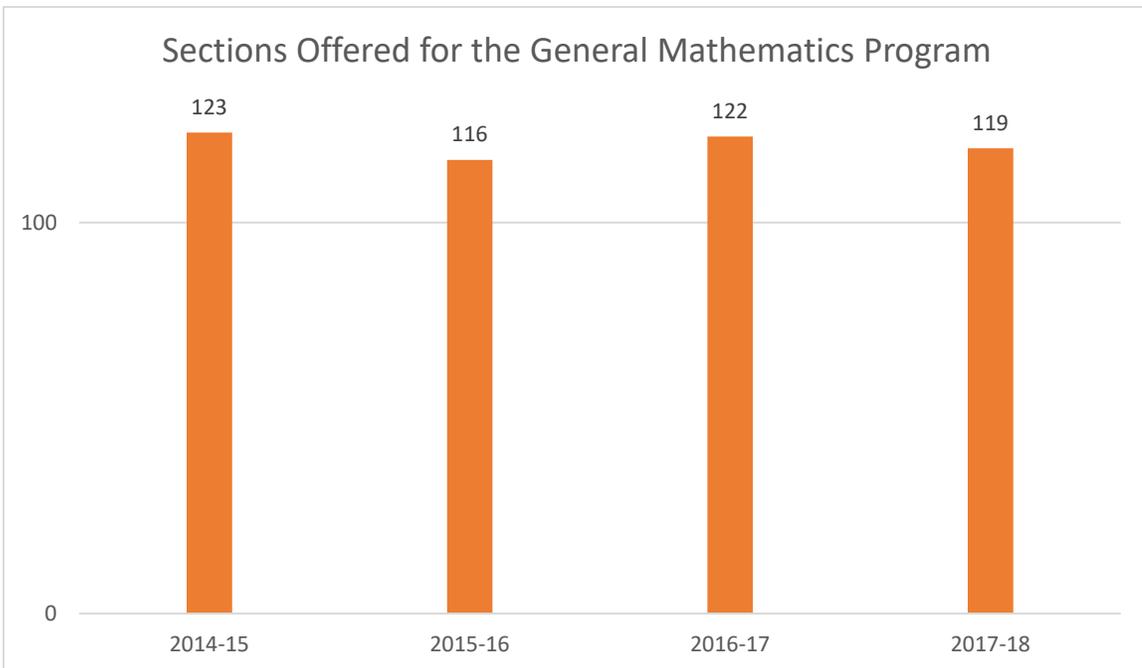


Figure 40: Sections offered for the General Mathematics Program

There was an increase of sections offered compared to the last four year cycle, which was recommended on the previous program review. With the increase of sections offered, the section fill rates are now below capacity, at about 70% each year, which is about 2 – 3% below the average fill rates for all El Camino College programs. See figure 41.

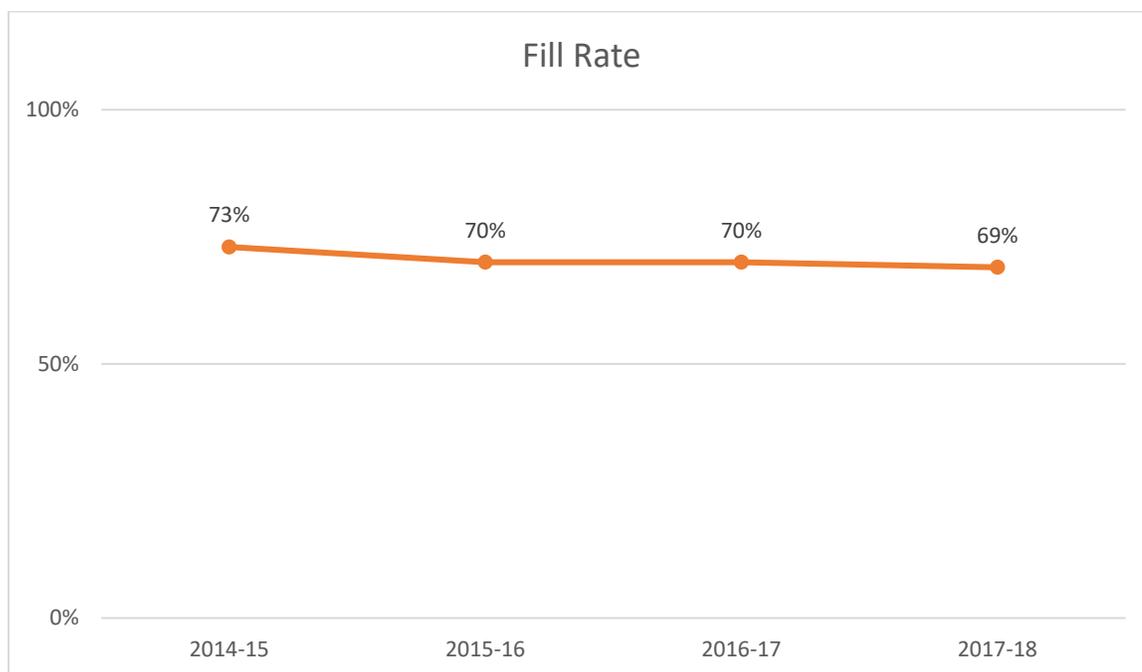


Figure 41: Fill rates for the General Mathematics Program

G) Scheduling of courses (day vs. night, days offered, and sequence)

All courses in the program have sections offered throughout the day. Roughly three-quarters of the sections are during the day, 20% in the evening, and a small amount on the weekends, with zero weekend courses offered in 2017-18.

The Math 150 distance education course added large lectures, which helps accommodate the large demand of Math 150 students. The Math 150 hybrid course was also added in the summer and winter terms, beginning with summer 2018.

Below is a chart of the fill rates for day vs night classes, as well as weekend courses. The fill rates tend to be highest for day classes, about 10% lower for evening classes, and a drop over the four year period for weekend courses.

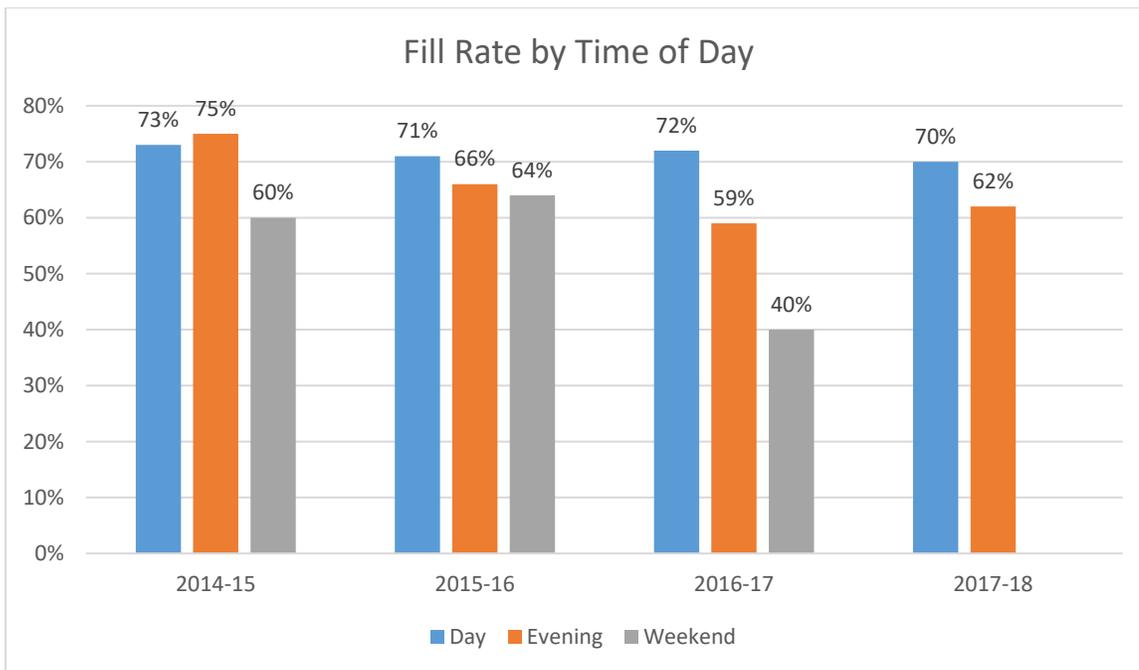


Figure 42: Fill Rate by Time of Day for General Mathematics Program

H) Improvement Rates (Course success by placement method, if applicable)

There are two different tracks within the General Mathematics Education Program:

1. Stand-Alone Courses - Courses which are not prerequisites to other courses within the program
 - a. Math 120
 - b. Math 140
 - c. Math 150
 - d. Math 150 – DE

2. Sequential Courses - Courses which serve as pre-requisites for other courses in the program
 - a. Math 130 (pre-requisite for Math 165)
 - b. Math 165

Since Math 120, Math 140 and Math 150 are stand-alone courses, we will not consider those in these analyses. The charts below reflect the transition to a two-semester business calculus series (Math 160 and Math 161) to a one-semester business calculus course (Math 165).

General Mathematics Education Program Success Rates - FALL TERMS					
<i>Course</i>	<i>2014</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>Course Success Rate</i>
MATH 130, including DE	58.1%	60.9%	55.4%	42.4%	55.0%
MATH 160	53.7%				53.7%

MATH 161	78.3%	82.4%			80.7%
MATH 165		47.3%	52.9%	65.0%	55.4%

Figure 43: A Comparison of Math 130, 160, 161, 165 Success Rates (Fall terms)

General Mathematics Education Program Success Rates - SPRING TERMS					
<i>Course</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>2018</i>	<i>Course Success Rate</i>
MATH 130	60.0%	54.6%	45.7%	45.9%	52.7%
MATH 160	45.6%				45.6%
MATH 161	66.0%	70.0%			66.7%
MATH 165		57.2%	56.0%	69.8%	61.0%

Figure 44: A Comparison of Math 130, 160, 161, 165 Success Rates (Spring terms)

As shown in *Figures 43 and 44* above, the success rates for Math 130 have a 3% difference between the spring and fall semesters. The success rates for Math 165 showed significant improvement over the years in both fall and spring terms, which could be attributed to the fact that it is a new course.

D) Additional data compiled by faculty.

Due to the immense volume and detailed nature of the already collected data, we feel we have compiled a very complete analysis of our program’s status over the past 4 years using the current data. No additional data has been collected.

J) List any related recommendations.

- 1) Given the decline in success over the last three years in Math 120 and Math 130, additional support in some form may change this trend. A number of sections of Math 130 are being linked with Math 130-S, a one-hour support course, to help students who have not met the previous prerequisite for the course and may be entering the class underprepared. Other sections of Math 130 may benefit from having a supplemental instruction course paired with them. For Math 120, there is currently no support course nor is there supplemental instruction. With the advent of AB 705, students will be taking the course far less prepared than in previous years and will need additional support to help their chances of success. A one-hour support course for Math 120 is recommended to help not only with the current dropping pass rate but also with incoming students that do not meet the old prerequisite of Math 73 or 80.
- 2) The Math 165 course was offered in the Winter 2017 term, but it was not offered in the Winter 2018 term. The winter 2017 course had 26 students, which is a 74% fill rate. This is higher than average for the General Mathematics Program. It is recommended to continue to offer Math 165 in the winter.
- 3) Due to low enrollment (26 students for the entire 2017-2018 year), it is recommended to offer one section of Math 140 just once a year in fall.

- 4) The large lecture Math 150 hybrids accommodates the high demand of the Math 150 students. Since there will be even more demand for Math 150 due to AB 705, it is recommended to continue to offer large lecture hybrids of Math 150.
- 5) One section of the Math 150 hybrid was offered in the Summer 2018 term (with 31 students) and two sections of Math 150 hybrid were offered in the Winter 2019. There are currently two Math 150-hybrids being offered in Summer 2019, both full with a full waitlist. It is recommended to offer at least three Math 150 hybrids in the summer and winter sessions.
- 6) Due to the large demand of Math 150, it is recommended to have a room dedicated for Math 150. This could help with scheduling and help organize all material for Math 150 students, including statistical technology.

SECTION 3 Curriculum

Review and discuss the curriculum work done in the program during the past four years, including the following:

A) Provide the curriculum course review timeline to ensure all courses are reviewed at least once every 6 years.

We currently have six courses in the General Education Mathematics Program and all have been reviewed within the past six years. Below is the timeline for our 6-year review cycle, including the two courses (Math 160 and Math 161) that were inactivated in 2016-2017 and also the newly created Math 150-H (Fall 2016) and Math 165 (Fall 2015). Our program review in Spring 2018 was rescheduled to Spring 2019 due to request from the Academic Program Review Committee.

Course	Last Course Review	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6	
		FA 16	SP 17	FA 17	SP 18	FA 18	SP 19	FA 19	SP 20	FA 20	SP 21	FA 21	SP 22
Math - General Education	May, 2014				P delayed	P delayed	P	P					
MATH-120	2015-2016											X	
MATH-130	2013-2014							X					
MATH-140	2013-2014							X					
MATH-150	2015-2016											X	
MATH-150 H	2016-2017	X											
MATH-160	2016-2017	X Inactive											
MATH-161	2016-2017		X Inactive										
MATH-165	2015-2016												X

B) Explain any course additions to current course offerings.

Math 165 (Calculus for Business and Social Sciences):

Since numerous local community colleges (including Long Beach, Los Angeles, Orange Coast, and East Los Angeles) offer a singular Business Calculus course, we decided to combine Math 160 (Calculus I for Biological, Management and Social Sciences) with Math 161 (Calculus II for Biological, Management and Social Sciences) to create a one-semester 5-unit Business Calculus course called Math 165. This essentially reduced the number of units required for most Business majors from 7 units to 5 units and has allowed a seamless transfer of

Business majors from ECC to the CSU system. We now offer 13 sections of Math 165 (Calculus for Business and Social Sciences) each year.

Math 150-H (Honors Elementary Statistics and Probability):

El Camino College's mission is to provide excellent comprehensive educational programs that promote student learning and success. By creating Math 150-H, we will help further our college's goals by providing a more comprehensive mathematics course offering. The HTP, Honors Transfer Program, is a strong program at El Camino College that promotes student success by challenging them to think more critically in their college courses. The introduction of Math 150-H will allow the HTP to offer an honors mathematics course and in return help the HTP students transfer to the UC system. We currently offer one section of Math 150-H every semester.

Math 150-S (Fundamental Skills of Elementary Statistics):

This one-unit corequisite course was created in Fall 2018 to satisfy the requirement of AB 705. It is designed as a review of the core prerequisite skills and concepts needed to be successful in Math 150 (Elementary Statistics and Probability). It is intended for students who “leveled up” (skipped to a transfer level course without satisfying the prerequisites) and are enrolled concurrently in Math 150. The implementation of this course in Fall 2019 will allow Math 150 classes to focus on and explore new topics in statistics to a greater extent rather than devote time in class to covering prerequisite topics.

Math 130-S (Fundamental Skills of College Algebra):

This one-unit corequisite course was created in Fall 2018 to satisfy the requirement of AB 705. Its intent is to strengthen and supplement the algebraic skills needed for success in Math 130 (College Algebra). It is intended for students who “leveled up” (skipped to a transfer level course without satisfying the prerequisites) and are enrolled concurrently in Math 130. The implementation of this course in Fall 2019 will allow Math 130 classes to focus on and explore new topics in College Algebra to a greater extent rather than devote time in class to covering prerequisite topics.

Math 120-S (Fundamental Skills for Nature of Mathematics):

Math 120 Subcommittee is currently investigating the option of creating a Math 120-S for the students who leveled up to Math 120 (Nature of Mathematics), since instructors have reported that, in general, student performance has plummeted compared to previous semesters. A Math 120 survey (see Section 5 Analysis of Student Feedback – (c) Other Relevant Survey) was distributed this semester to all six sections of Math 120. Out of 125 students, more than half (64 students) indicated that they leveled up to this course by skipping Math 73 (Intermediate Algebra for General Education) or Math 80 (Intermediate Algebra for BSTEM). Orange Coast College is currently creating a support course for their Math 100 (Liberal Arts Math) which is the equivalent of our Math 120. We highly recommend that CM2 create a similar support course in the near future which includes the topics of exponential functions and the laws of logarithms, so the Math 120 students can survive the finance section of the course.

C) Explain any course deletions and inactivations from current course offerings.

Math 160/161 (Calculus I and II for the Biological, Management and Social Sciences):

Since we started offering Math 165 (5-units) in Fall 2016, we inactivated Math 160 (4-units) in Fall 2016 and Math 161 (3-units) in Spring 2017 to cycle off the students on the Math 160/161 track.

Math 140 (Finite Mathematics):

Finite Math is currently one of the courses listed on the latest CSU Transfer Model Curriculum for business administration majors. Students who satisfy the TMC have priority to be considered for admission to CSUs. We have been offering one section of Math 140 every semester since 2014; however, enrollment has been down in recent years. Hopefully, enrollment will go up in Fall 2019 with AB 705 fully implemented. If not, we will go back to offering just one section in fall semesters per year.

D) Describe the courses and number of sections offered in distance education. (Distance education includes hybrid classes.)

Currently, depending on enrollment, the General Education Mathematics Program offers 1 to 2 sections of Math 130 (College Algebra) and 8 to 9 sections of Math 150 (Statistics) as hybrid courses during the fall and spring semesters. The hybrid classes have similar retention rates as the regular classes, and also share similar success rates. The classes only meet once a week to accommodate the students who are unable to attend classes more than once a week. If demand rises, we plan to offer more hybrid sections to meet students' needs.

E) Discuss how well the courses, degrees, or certificates meet students' transfer or career training needs.

1. Have all courses that are required for your program's degrees and certificates been offered during the last two years? If not, has the program established a course offering cycle?

Although there are no degrees or certificates offered in the General Education Mathematics Program, all of our active courses have been offered during the last two years.

2. Are there any concerns regarding program courses and their articulation to courses at other educational institutions?

There are currently no concerns regarding articulation with any of the courses in the General Education Mathematics Program. In Fall 2015, we decided to combine Math 160 and Math 161 into a single 5-unit Business Calculus course (Math 165) to make it easier for Business Majors to transfer to the CSUs.

Math 165 not only articulates with all CSUs and local private transfer schools, but it also completely satisfies the CI-D requirements. Our goal is to make sure that we keep our courses current to meet the requirements of the 4-year colleges and the demand of our student population.

3. **How many students earn degrees and/or certificates in your program? Set an attainable, measurable goal related to student completion of the program's degrees/certificates.**

N/A

4. **Are any licensure/certification exams required for program completion or career entry? If so, what is the pass rate among graduates? Set an attainable, measurable goal for pass rates and identify any applicable performance benchmarks set by regulatory agencies.**

N/A

F) List any related recommendations.

1. The General Education Mathematics Program highly recommends creating a one-unit, co-requisite course, Math 120-S (Fundamental Skills for Nature of Mathematics) for Math 120 (Nature of Mathematics) in the near future. Due to AB 705, more than half the Math 120 students in Spring 2019 were leveled up without having proper prerequisite skills to be successful. It is important that we create a Math 120-S to help those students who are deficient so they have a better chance to pass this course. We typically offer 12 sections of Math 120 per year. If we were to offer 5 to 6 sections of Math 120-S (\$2,625 per section), it will cost approximately \$15,750.

Fiscal Impact: An increase of \$15,750 per academic year.

2. We also recommend offering only one section of Math 140 per year if enrollment continues to drop in Fall 2019. **Fiscal Impact:** -\$10,500/section.

SECTION 4

Assessment of Student and Program Learning Outcomes (SLOs & PLOs)

A) Provide a copy of your alignment grid, which shows how course, program, and institutional learning outcomes are aligned. (This will be Appendix A.)

SEE APPENDIX A

B) Provide a timeline for your course and program level SLO assessments. (This will be Appendix B.)

SEE APPENDIX B

C) State the percent of course and program SLO statements that have been assessed.

We have assessed 100% of our course SLOs and program PLOs over the past four years.

D) Summarize the SLO and PLO assessment results over the past four years and describe how those results led to improved student learning. Analyze and describe those changes. Provide specific examples.

We begin by looking at SLO results for each of our CM2 courses offered over the past 4 years.

SLO Assessment Summary - Math 120 - Nature of Mathematics							
Term	SLO Number	SLO Statement	Score 3	Score 2	Score 1	Score 0	Success Rate (scoring 2 or 3)
Spring 2015	SLO #4	Solve Application Problems Solve application problems using basic counting principles, permutations, combinations, probability, expected value and frequency distribution.	69% (76)	7% (8)	16% (18)	7% (8)	76%
Spring 2016	SLO #1	Solve Loan Problems Apply techniques of simple and compound interest to solve loan and annuity problems.	40% (55)	16% (22)	33% (46)	11% (15)	56%
Spring 2017	SLO #2	Solve Application Problems Using Graphical Methods Solve application problems using graphical methods such as: 3-ring Venn diagrams, truth tables, Euclidean,	36% (48)	37% (49)	19% (26)	8% (11)	73%

		Riemannian and Lobachevskian geometries.					
Spring 2018	SLO #4	Solve Application Problems Solve application problems using basic counting principles, permutations, combinations, probability, expected value and frequency distribution.	61% (52)	12% (10)	19% (16)	8% (7)	73%

Our Nature of Mathematics course continues to serve as an important course for our non-STEM majors. We saw consistent success rates for the most part with the exception of the Spring 2016 assessment (falling to a 56% success rate). This does not come as too much of a surprise as the topic of loan problems and compound interest is notoriously challenging. Several instructors have commented on a continuing need to supplement course material with additional practice on finance related application problems. As a result of the assessment, our follow up actions call for instructors to emphasize problem solving strategies and perhaps turn to group work and other activities to help train students to think critically when solving these finance mathematics problems (a crucial component for the course). The course contains a lot of challenging material (especially for non-STEM students) and in light of AB 705, there is a concern that students may place into the course without sufficient prerequisite knowledge. We will continue to monitor the success rates of future assessments.

SLO Assessment Summary - Math 130 - College Algebra							
Term	SLO Number	SLO Statement	Score 3	Score 2	Score 1	Score 0	Success Rate (scoring 2 or 3)
Spring 2015	SLO #4	Solve Application Problems Solve college algebra level application problems and use technology.	53% (153)	25% (72)	13% (37)	9% (26)	78%
Spring 2016	SLO #1	Solve Nonlinear Inequalities Solve nonlinear inequalities and a variety of equations such as: polynomial, rational, radical, exponential, and logarithmic.	45% (87)	23% (44)	21% (41)	11% (21)	68%
Spring 2017	SLO #2	Solve Problems using Graphical Methods Solve problems using graphical methods involving a variety of functions, such as: polynomial, rational, radical, exponential, and logarithmic.	43% (83)	11% (22)	28% (55)	17% (33)	54%

Spring 2018	SLO #4	Solve Application Problems Solve college algebra level application problems and use technology.	34% (48)	20% (28)	25% (35)	21% (29)	54%
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Success rates definitely fluctuate more dramatically in the Math 130 – College Algebra course. While in Spring of 2015 and 2016, we met our target for success, the later assessments in 2017 and 2018 fell short. Many instructors commented on several teaching strategies to help bolster student understanding of these notoriously tough topics – graphical methods and application problems. Many have worked on developing extra student worksheets to help students practice on using graphical reasoning to solve problems in college algebra as well as group activities to help bolster their understanding and critical thinking skills. Using technology in the classroom continues to be a suggestion from instructors as well – such as displaying graphical calculator output to analyze more complicated functions or using other software packages such as Wolfram Mathematica. One instructor utilized this software and commented on seeing improved understanding when students took an active role in constructing the graphical images and presented their ideas to the class in short presentations.

SLO Assessment Summary - Math 140 - Finite Mathematics for Business and Soc Sci							
Term	SLO Number	SLO Statement	Score 3	Score 2	Score 1	Score 0	Success Rate (scoring 2 or 3)
Spring 2015	SLO #4	Use of Finite Mathematics Techniques Solve application problems using finite mathematics techniques.	73% (11)	20% (3)	0% (0)	7% (1)	93%
Spring 2016	SLO #1	Use of Gauss-Jordan Use the Gauss-Jordan technique to solve systems of linear equations.	64% (16)	32% (8)	4% (1)	0% (0)	96%
Spring 2017	SLO #2	Use of Matrices Solve problems using matrices.	21% (3)	29% (4)	21% (4)	29% (3)	50%
Spring 2018	SLO #4	Use of Finite Mathematics Techniques Solve application problems using finite mathematics techniques.	25% (2)	50% (4)	37.5% (3)	12.5% (1)	75%

The small sample sizes for Math 140 assessments continue to present a challenge in analyzing the SLO results (usually only 1 section of the course is offered each term). However it is encouraging to see consistently strong success rates. We did see the Spring 2017 assessment result in a lower success rate (50%) below our target. The instructor mentioned a need to re-evaluate how to teach matrix methods. In addition to assigning more problems for practice and slowing the pace of the course for the particular topic, the use of extra practice worksheets and group problem solving helped to strengthen their understanding.

Specifically, using matrices to solve problems related to systems of equations and problems in linear programming can be challenging for students. We will continue to monitor further SLO assessments on the topic to see if success rates improve.

SLO Assessment Summary - Math 150 - Elementary Statistics with Probability							
Term	SLO Number	SLO Statement	Score 3	Score 2	Score 1	Score 0	Success Rate (scoring 2 or 3)
Spring 2015	SLO #4	Confidence Intervals and Hypothesis Testing Compute the confidence intervals and conduct hypothesis testing for a variety of parameters, and perform non-parametric hypothesis testing.	51% (331)	26% (167)	16% (104)	8% (52)	77%
Spring 2016	SLO #1	Computing and Interpreting Various Measures From data or bivariate data, compute statistics and develop displays of the data that illustrate the measures of central tendency, variation, relative position, and correlation. Interpret the displays in context.	52% (568)	27% (292)	13% (142)	8% (81)	77%
Spring 2017	SLO #2	Probability Compute probability of an event by applying the basic assumption in classical probability and using addition rule and multiplication rule for contingency tables.	35% (331)	42% (393)	16% (154)	7% (70)	76%
Spring 2018	SLO #4	Confidence Intervals and Hypothesis Testing Compute the confidence intervals and conduct hypothesis testing for a variety of parameters, and perform non-parametric hypothesis testing.	38% (273)	27% (191)	23% (166)	11% (81)	65%

Success rates in our most popular course, Math 150 – Statistics with Probability, continue to be a major focus of our SLO assessments. Setting a target of 70% success for our SLO assessments, we only saw the assessment in Spring of 2018 fall below the mark (at 65%). Many instructors commented that it did not come as a surprise as the topics of hypothesis testing in statistics is notoriously challenging for many students. Unique to the statistics course is the emphasis on critical reading and interpreting a multitude of word problem types throughout the course. In order to successfully solve these hypothesis testing problems, students need to be familiar with a new set of vocabulary in addition to perform a variety of computations using formulas (of course also making the decision as to which formulas are appropriate). It is often the

culminating topic on the elementary statistics course and can take getting used to. Several instructors have commented that continuing to develop student worksheets and group activities helps to strengthen student understanding of the topic and helps them engage in the material. We strive to use current data and examples from a variety of fields including politics, life sciences and social sciences to make the material relevant and interesting.

SLO Assessment Summary - Math 165 - Calculus for Business and Social Sciences							
* For Spring 2015 - SLO 4 was assessed for Math 160 and 161 (before combining into 165)							
Term	SLO Number	SLO Statement	Score 3	Score 2	Score 1	Score 0	Success Rate (scoring 2 or 3)
*Spring 2015 (Math 160)	SLO #4	Using Calculus, Solve Application Problems Solve calculus-level application problems and use technology.	44% (64)	26% (38)	15% (22)	14% (20)	70%
*Spring 2015 (Math 161)	SLO #4	Solve Application Problems Using Calculus Use single-variable and double-variable calculus methods to solve application problems from relevant disciplines, including economics.	38% (15)	38% (15)	15% (6)	8% (3)	77%
Spring 2016	SLO #1	Compute and Interpret Derivatives Determine limits, classify types of continuity of functions, use derivatives to find increments, rates of change and tangent lines, and compute first and second derivatives of functions including partial derivatives.	48% (54)	14% (17)	18% (21)	23% (27)	60%
Spring 2017	SLO #2	Compute and Interpret Integrals Evaluate integrals and improper integrals using a variety of methods, including substitution and by parts.	35% (29)	28% (23)	26% (21)	11% (9)	63%
Spring 2018	SLO #4	Solve Application Problems Using Calculus Use single-variable and multi-variable calculus methods to solve application problems in business and economics, including marginal revenue, marginal profit and marginal cost.	43% (52)	41% (50)	14% (17)	1% (3)	84%

We seem to get pretty consistent SLO success rates over the past few years. In Spring 2015, we offered our last sections of Math 160 and Math 161 – when our Business Calculus sequence was split into 2 semesters. Since combining them into a single Math 165 course (5 units), success rates continue to hover around the

60-70% range. We continue to develop ways to integrate relevant data and real life examples into the course (it is calculus for business after all) and present topics such as supply/demand curves, profit/revenue/cost models, and compound interest models to engage students in the material and prepare them for university study in economics and finance. We did not meet our target for success in Spring of 2016 with a 60% success rate assessing students in applying partial derivatives of functions. The topic is notoriously challenging as it is usually covered toward the conclusion of the course and is a topic that combines much of the knowledge from the entire course outline. Instructors have commented on actions taken to improve student understanding of these tougher topics including designing worksheets, reinforcing important algebra prerequisite skills (often in need of review), and having students work in groups to solve challenging problems and explain their reasoning and logic. As a result of using these teaching tactics, we continue to monitor the SLO results in the future.

We now summarize and analyze our PLO assessment results:

In Spring 2015, we assessed our PLO #2: Analytical and Computational Skills Students will be able to analyze and solve application problems involving business, the social sciences, and/or biological sciences using analytical and computation skills.

Students from 55 sections of the CM2 mathematics classes that were offered at the El Camino campus were assessed. From the total number of 1250 students, 110 (9%) scored 0, 187 (15%) scored 1, 303 (24%) scored 2, and 650 (52%) scored 3. Since scores of 0 and 1 correspond to students being unsuccessful, there were 297 (24%) who did not master the skills for this SLO. Since scores of 2 and 3 correspond to students being successful, there were 953 (76%) who did master the skills for this PLO.

A 76% success rate is quite good for students in CM2 courses. The target of a 70% success rate was met and exceeded. The next time that students are assessed for this PLO, the problems could be modified and made more challenging.

Since the student success rate for PLO #2 is 76%, the next time that this PLO is assessed, more challenging problems will be used. For example, in Math 130, in addition to constructing an exponential growth function modeling population growth, students will be asked to determine the year that the population will reach a specified number.

We also assessed this PLO in our recent Spring 2018 assessment cycle with the following results:

We assessed a total of 1068 students.

Score of 3 - 427 students (40%)

Score of 2 - 283 students (26%)

Score of 1 - 237 students (22%)

Score of 0 - 121 students (11%)

Overall, we attained a 66% success rate for this assessment cycle (that is, students that scored a 2 or 3 on the assessment rubrics). This falls short of our target of 70% success. However, taking notice of our action from the previous assessment cycle, this provides us with more information as to the areas students struggle. The topics were particularly challenging this time around and gives us room to improve and refine our teaching strategies to help students master these difficult concepts.

In particular, the statistical hypothesis testing from Math 150 and optimization problems from Math 165 caused the most difficulty for students. This is not surprising due to the challenging nature of these topics. The statistics and calculus courses require students to not only engage in multi-step computational methods but require students to learn entirely new vocabulary. These transfer level courses are notoriously challenging and require students put in a lot of time working on problem sets.

Many instructors commented on a need for tutoring services and support for students. Students that were successful in their assessments were often the ones completing their homework problems diligently. Group work and in-class activities also contribute to stronger student understanding and engagement with the material. We continue to also emphasize the incorporation of technology (internet resources, graphing calculators for example) to bring real world relevance to the applications being studied.

In Spring of 2017, we assessed our PLO #1 statement: Graphical Methods Students will be able to analyze and solve application problems involving business, the social sciences, and/or biological sciences using graphical methods.

Across all the CM2 courses administered during Spring 2017, we have the following results for PLO #1 (Graphical Methods):

Total Students Assessed: 1371

Scoring a '3' – 36% of students (or 494 students) – Demonstrate complete understanding of the problem being assessed.

Scoring a '2' – 36% of students (or 491 students) – Demonstrate most understanding of the problem being assessed.

Scoring a '1' – 19% of students (or 263 students) – Demonstrate some understanding of the problem being assessed.

Scoring a '0' – 9% of students (or 123 students) – Demonstrate no understanding of the problem being assessed.

Overall, we have attained a 72% success rate (that is, scoring a 2 or 3 on the assessment). This meets our target for success of 70% or higher.

Overall, the CM2 courses mostly reached this target success rate individually, but some courses have higher success rates than others. We can try to make the success rates more even across the courses as well as improve the PLO success rates. To reach these goals, instructors across our CM2 courses have commented on many methods that are helping students learn the concepts quickly as well as methods that they can try to help improve student success.

Here are some methods that instructors feel are helping students learn the material better in class.

1. Provide similar problems on study sheets.
2. Go over Powerpoint examples in class and point them online for students to review.
3. Use a combination of going over things by hand and using the graphing calculator to solve problems.
4. Using student instructors (SI coaches) for peer help.
5. Tie the problems into real-world applications in business and biology.

Here are some suggestions from instructors on how we can improve student success in CM2 courses.

1. Provide more of a variety of questions from my own sources and not rely solely on the textbook and the

associated MyMathLab questions.

2. Give students more time to digest the material before testing them on it.
3. Require stronger prerequisite courses for Math 140.
4. Create activities with similar wordings to train students to pay attention to every word in each question.
5. Bring in charts from real-world materials like journals and ask students to interpret the charts in their own words.
6. Make videos to help teach the material to students so they can watch them when they need review.

E) Describe how you have improved your SLO/PLO assessment process and engaged in dialogue about assessment results.

Our Division Learning Outcomes committee continues to explore and reevaluate our SLO/PLO assessment processes.

- To help acquaint new (and current) faculty with the newly designed TracDat system, we continue to encourage them to attend the training sessions led by IT as well as any Professional Development workshops specializing in using TracDat.
- We continue to meet regularly with our DLOACC committee to discuss ways to get 100% faculty participation in our assessments – including polling all course faculty for their opinions on a fair and complete assessment problem for the current SLO and posting the SLO statements and rubric clearly in our mailroom as well as disseminating by email and to the division.
- In addition to distributing SLO problems for our courses at the very start of the term, we are starting to send out previous terms' action statements to faculty early on as well so that we may get their feedback for the follow ups and suggestions for further actions that may help improve SLO success rates.
- Within our Division's course committees, we continue to emphasize the use of SLO data to help develop teaching strategies and explore new ways to engage students and increase their understanding of notoriously challenging topics (especially when the results fall below our target of success).
- We continue to emphasize that assessments that do not meet minimum target of success are not something to be dismayed about – but rather opportunities for us to learn and grow as educators. We continue to open dialogue in meetings regarding assessments that do not meet minimum standards and discuss ways to improve student performance.

F) List any related recommendations.

We offer the following recommendations to help improve our SLO assessment processes:

- 1) Offer more TracDat training sessions for faculty and offer compensation for part-time faculty as well to attend the sessions. Too often we find faculty (full and part-time) not versed in the reporting system and often have to consult the few faculty that are familiar.

- 2) When setting actions and follow-ups for SLO and PLO assessments, we would like to get more part time faculty involved. However, finding time to meet with the large numbers of part time faculty is virtually impossible given their schedules and different formats of classes (online, hybrid, etc...). Thus, using an email based dialogue could be helpful in getting feedback from part time faculty regarding SLO/PLO actions and follow-up results.

SECTION 5

Analysis of Student Feedback

In the spring semester of 2019, the General Education Math Program distributed a survey to students who were enrolled in courses that were part of the program.

A) Describe the results of the student survey in each of the following areas:

1. Student Support

The most popular campus resources that students in the General Education Math Program who were surveyed use are counseling services and the Math Study Center. MESA and Supplemental Instruction are used the least. (See Figure 1.) This could be due to the fact that MESA is for STEM students and SI is provided mostly for developmental math courses.

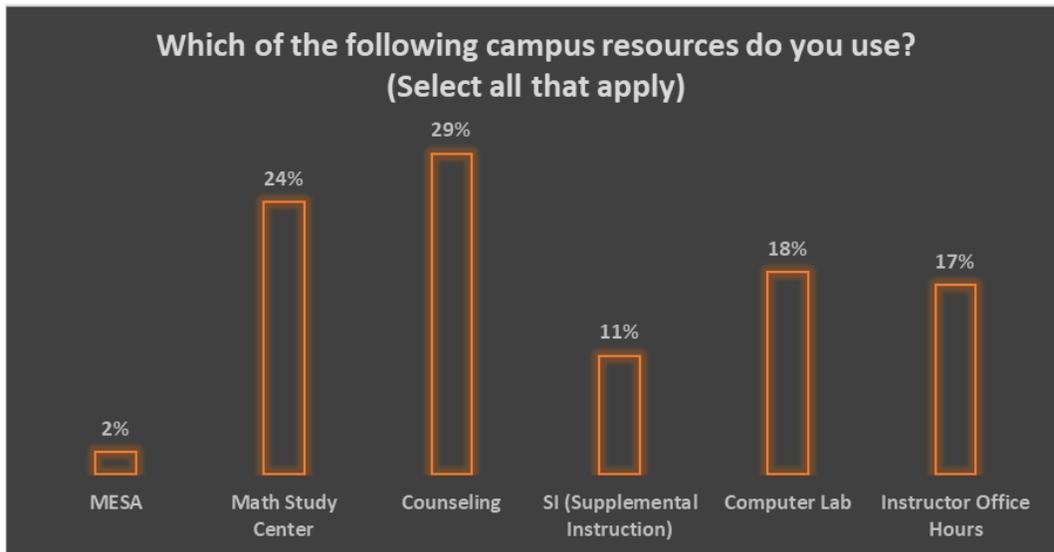


Figure 45

About half of the students surveyed were satisfied with the Math Study Center and felt that the tutors in the Math Study Center were able to answer their questions. (See Figure 46.) However, about 30% of students who were surveyed disagreed or strongly disagreed with the fact that there were enough tutors in the Math Study Center to get their questions answered in a timely manner.

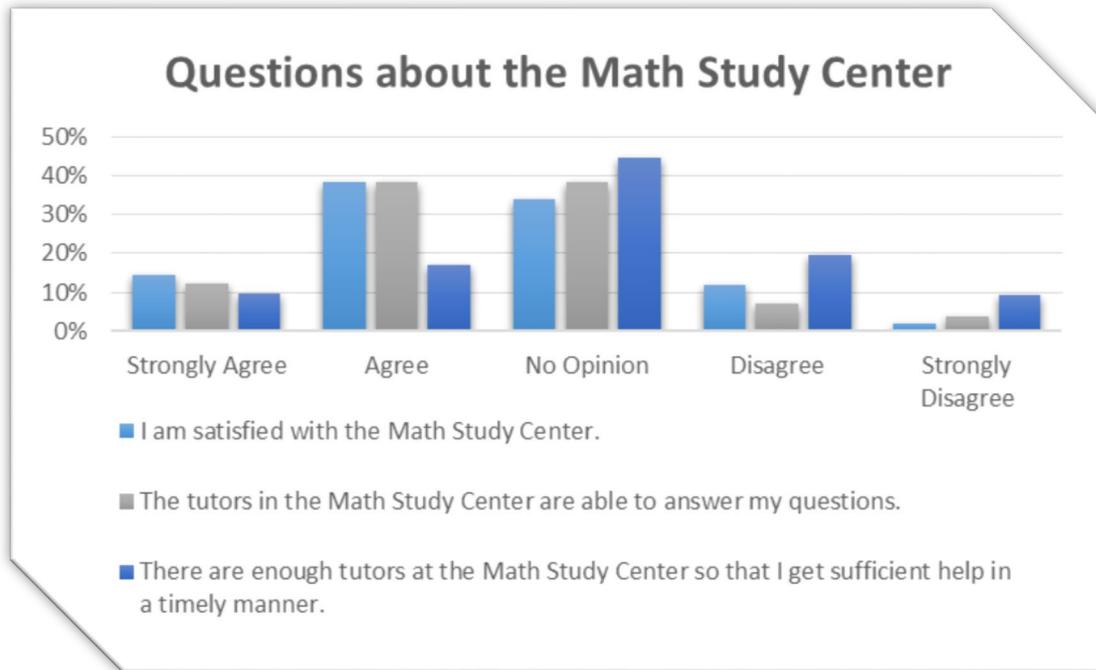


Figure 46

In terms of improvements that students would like to see at the Math Study Center, over 40% of students surveyed suggested having more tutors. At least one-fifth of students surveyed also wanted to have a larger work space and longer hours. (See Figure 47)

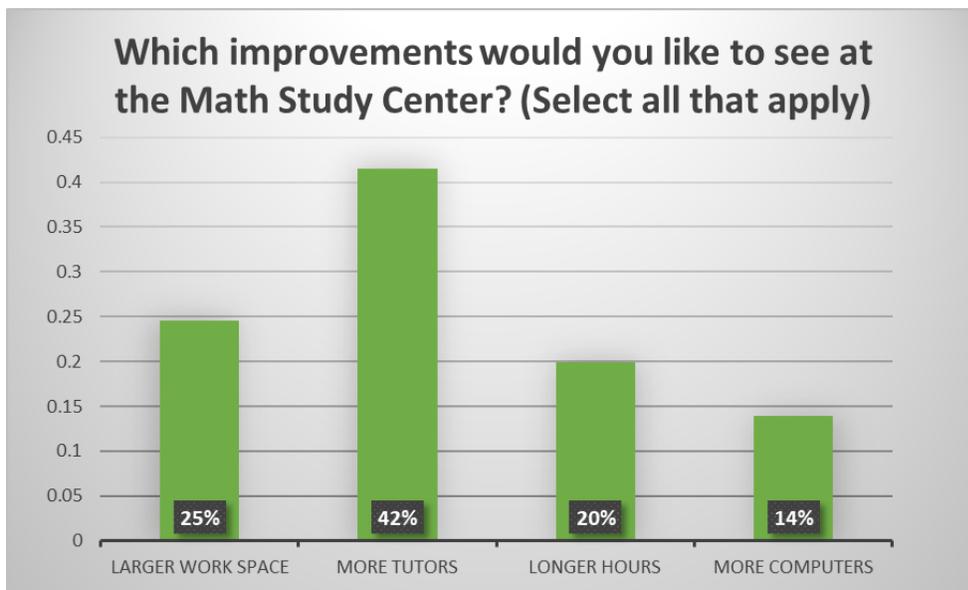


Figure 47

2. Curriculum

Most (78%) of students surveyed were enrolled in Math 150 (Elementary Statistics with Probability). Math 165 (Calculus for the Biological, Management and Social Sciences) and Math 130 (College Algebra) were tied as the next more popular courses. Math 140 (Finite Mathematics) was the least popular course. (See Figure 48.) In addition, 60% of students said that they “leveled up” to their current math course, and about 55% strongly agree or agree that they feel adequately prepared for their current math course.

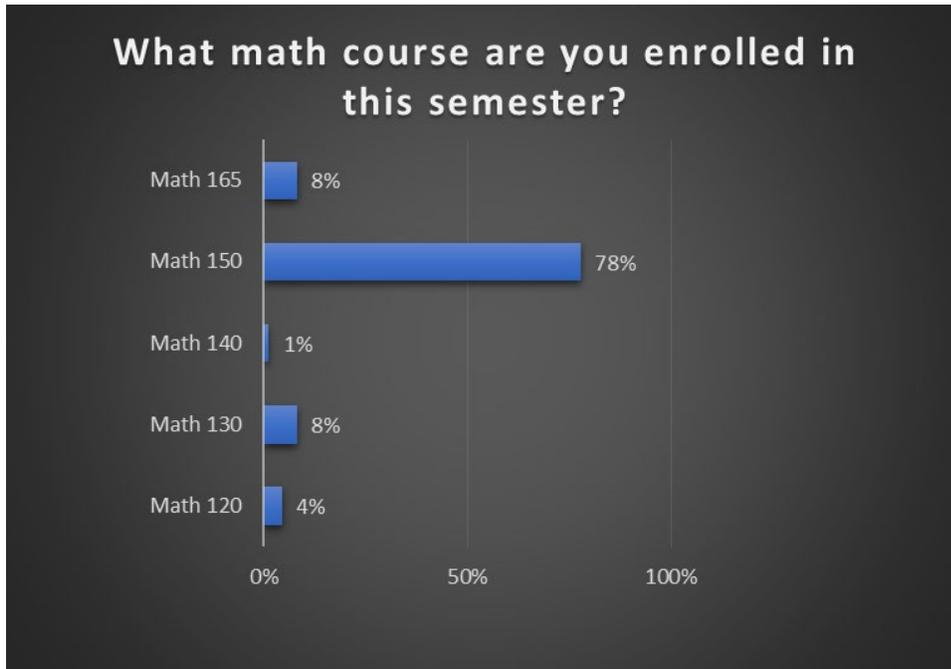


Figure 48

Not surprisingly, most (76%) of students surveyed planned on completing Math 150 at El Camino. Some also planned on completing Math 165 and Math 130 at El Camino. Not many planned on completing Math 190 (Single Variable Calculus with Analytic Geometry I) and Math 191 (Single Variable Calculus with Analytic Geometry II) at our school. (See Figure 49.) This makes sense, since Math 190 and Math 191 are STEM courses and the student who were surveyed were mostly in non-STEM math courses.

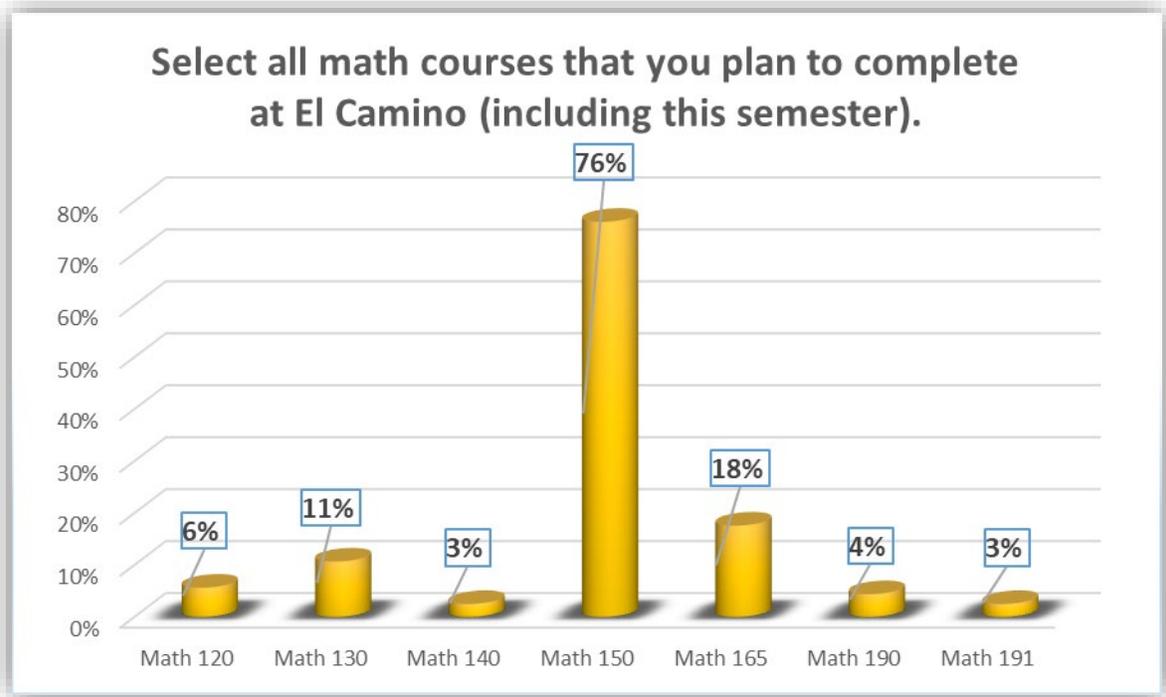


Figure 49

In terms of class format, 77% of students surveyed prefer the traditional format (all class meetings on campus). Roughly the same amount (10% and 13%) of students surveyed had the same interest in hybrid and fully online courses. (See Figure 50.)

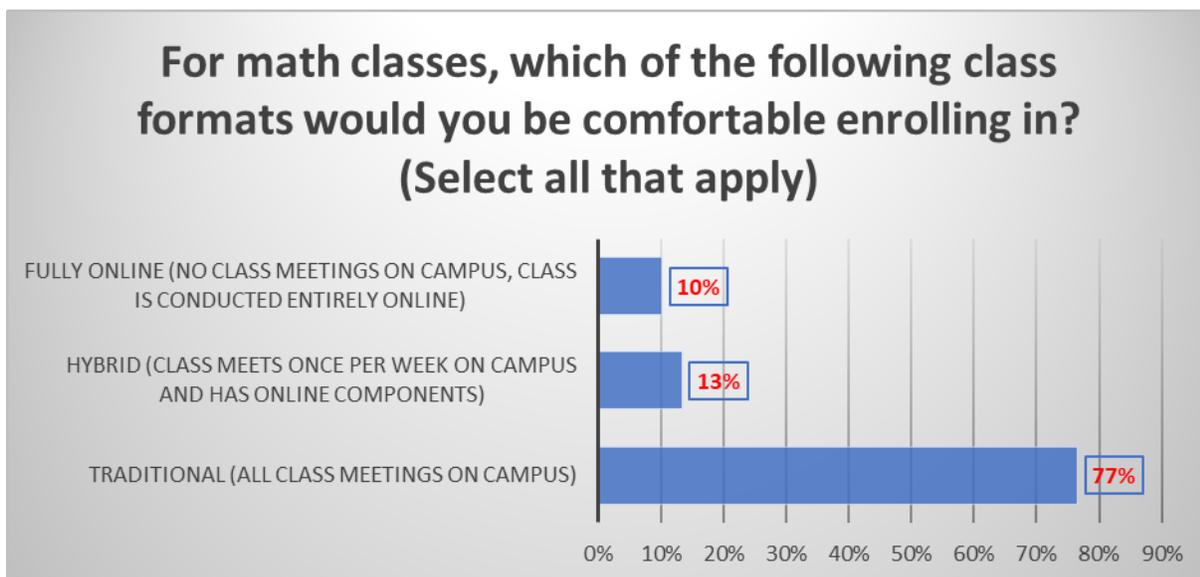


Figure 50

Other results that may be of intrigue are that 58% of the students surveyed prefer hardcover or loose-leaf textbooks while 22% prefer electronic (pdf or online) textbooks. About 20% have no preference.

3. Facilities, Equipment, and technology

Most students (83%) surveyed strongly agree or agree that they are satisfied with the buildings and classrooms used by the division. (See Figure 7.) Only 7% strongly disagree or disagree with this statement. However, note that 25% of students surveyed wanted a larger work space in the Math Study Center. (See Figure 47.)

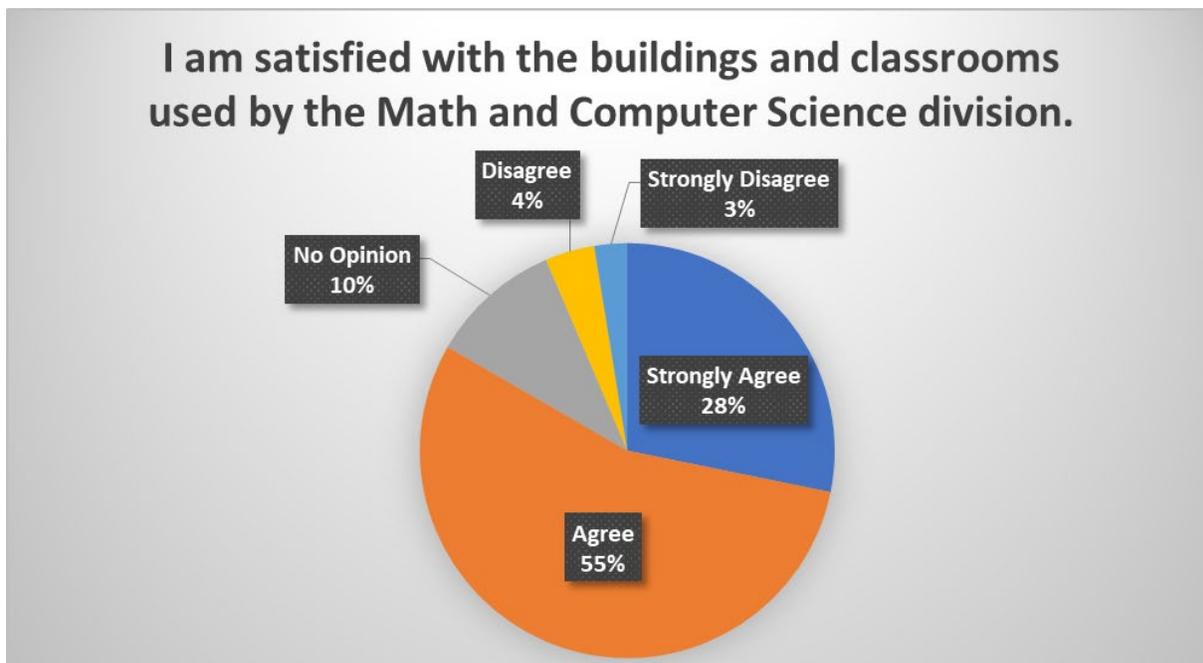


Figure 51

A majority of students surveyed (63%) strongly agree or agree with the statement that they are satisfied with the computers and software used by the division. Only 9% strongly disagree or disagree with this statement. (See Figure 52.) However, note that 14% of students surveyed wanted more computers in the Math Study Center. (See Figure 47.)

I AM SATISFIED WITH THE COMPUTERS AND SOFTWARE USED BY THE MATH AND COMPUTER SCIENCE DIVISION.

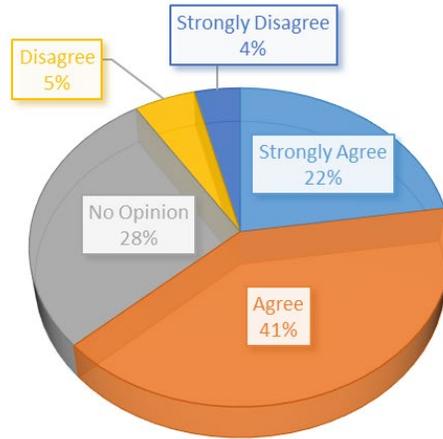


Figure 52

4. Program Objectives

About 70% of students surveyed agree or strongly agree that there are an appropriate number of math sections available at ECC. About 75% agree or strongly agree that the math courses are scheduled on days and times that are convenient for them. Moreover, about 80% agree or strongly agree that they have been able to register for the classes that they need in the Math and Computer Science division. (See Figure 53.)

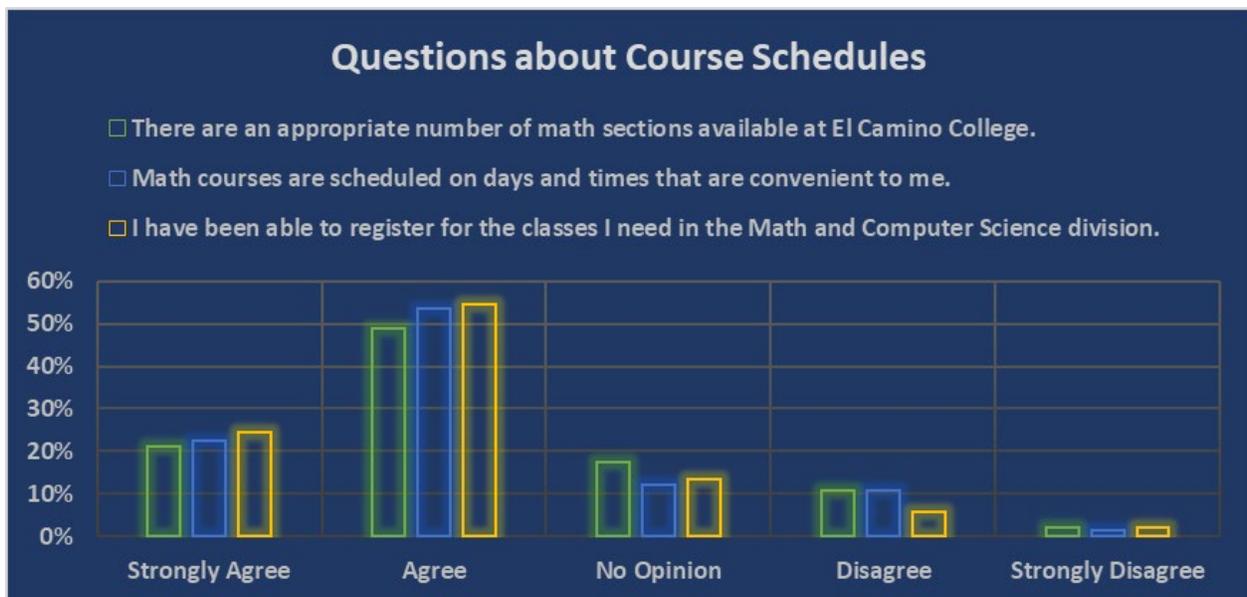


Figure 53

Of the small amount of students who said that they couldn't enroll in a math course in a previous semester, 44% said they could not enroll in Math 150, 17% said they could not enroll in Math 165, and 17% said they could not enroll in Math 130. This is consistent with the popularity of the courses.

About 31% of students surveyed who were unable to enroll in a math class in previous semesters said that the reason was because the class was offered at times that conflicted with their other classes. About

17% said that not enough sections of the course were offered, and 10% said that their registration was too late.

Many students surveyed prefer to enroll in late morning classes, but early morning and early afternoon classes are also popular. Late afternoon and evening classes attract the least amount of students. (See Figure 54.)

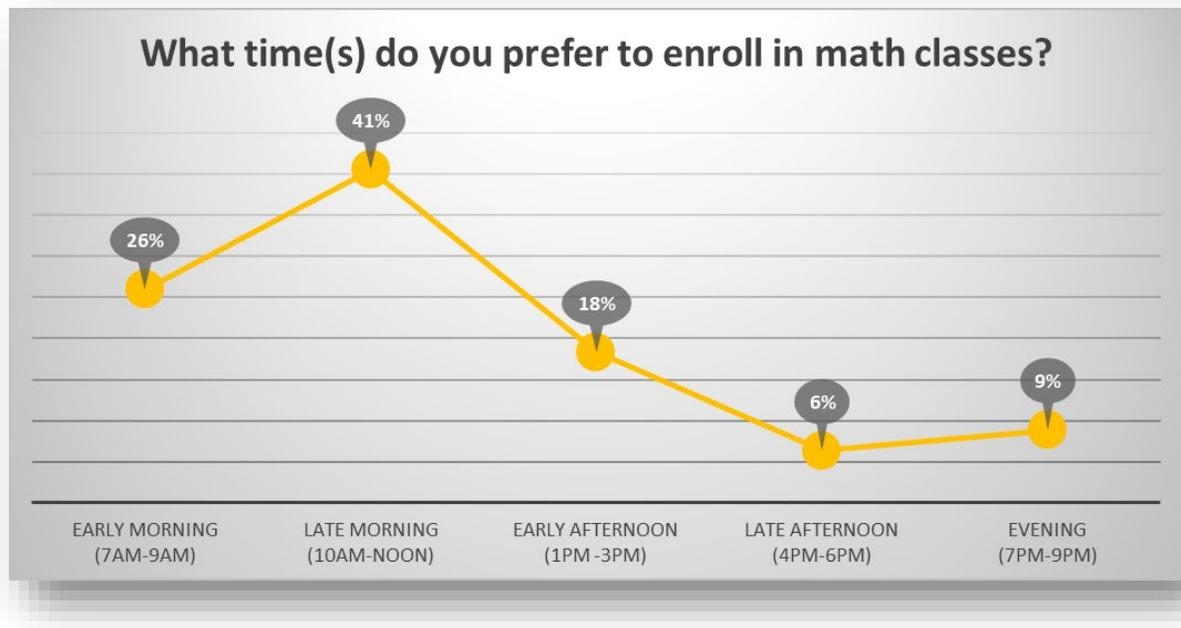


Figure 54

The most popular intended major for students surveyed is Business/Economics (27%). However, Nursing/Health Science/Healthcare Administration (15%) and Social Sciences (15%) were also popular. (See Figure 55.)

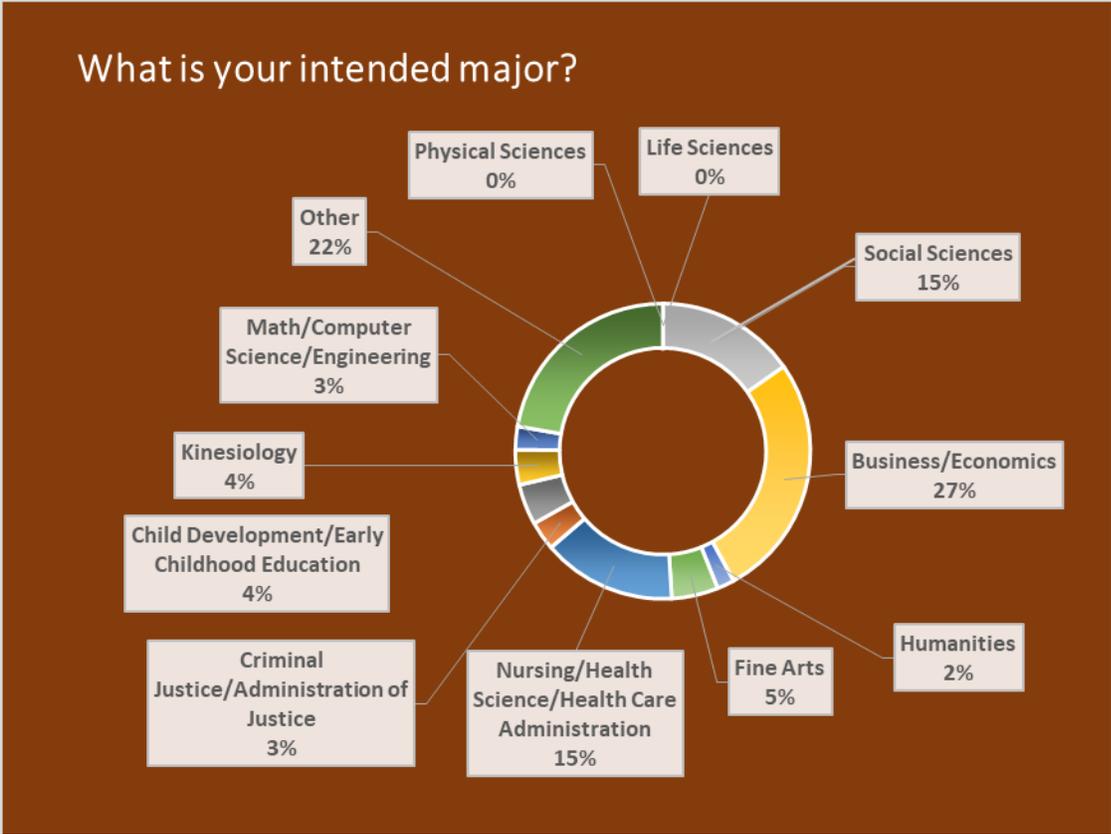


Figure 55

Most students surveyed want to transfer to a California State University (62%), with the majority of those students intending to transfer to Cal State Long Beach or Cal State Dominguez Hills. Another 15% desire to transfer to a University of California campus, with roughly half (7%) intending to transfer to UCLA. (See Figure 56.)

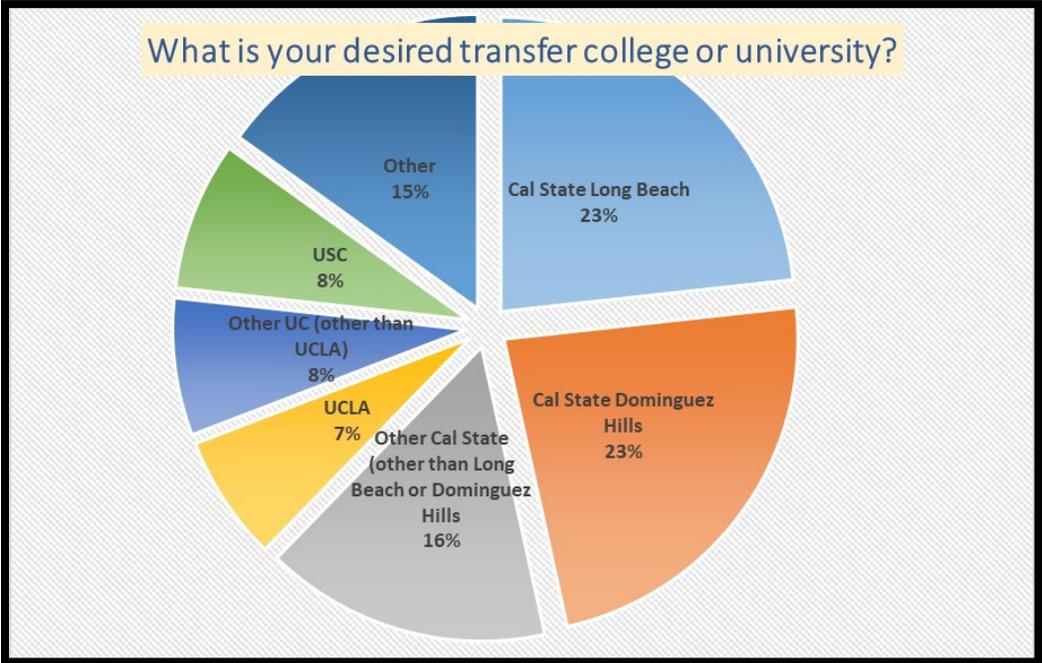


Figure 56

B) Discuss the implications of the survey results for the program.

As the survey showed, almost one-quarter of the students rely on the Math Study Center for extra help outside of class and Professor's office hours. With such a large number of students in the program relying on the Math Study Center, we should aim to provide everything the center needs to maximize student success.

These improvements should include (but are not limited to):

- Hiring more qualified tutors (40% surveyed recommended)
- Expanding the work space area within the center (25% surveyed recommended)
- Installing more computers in the center (14% recommended)

In addition to these, we should also look into hiring more statistics tutors. With 76% of the students planning on taking Math 150 (Statistics) at ECC, the need for the Math Study Center to have as many statistics tutors as possible is paramount. With the passage of AB705, an extraordinary number of students have "leveled up" to Math 150 which makes the need for more specialized tutors even more important.

One of the other issues the survey shines light on is the scheduling and availability of classes. While 75% strongly agree or agree that the math courses are scheduled on times and days that are convenient to them, there was a small percentage who could not enroll in classes due to lack of convenient times, classes filling, or conflicts with their other classes. What the survey points out is that 41% of the students prefer late morning (10am-noon) classes. If that time slot is the one which works the best for most students, we should try to maximize the number of popular classes being offered at that time. With 76% of students aiming to complete Math 150 at ECC, we should not only offer as many sections of this class as possible, but we should also make sure that we can offer it during time slots that work the best for our students. This clearly is inhibited by classroom availability and the scheduling of other popular classes. However, it should be a priority of the department to try to accommodate this recommendation as best as they possibly can within the parameters of scheduling and classrooms.

C) Discuss the results of other relevant surveys.

In the spring semester of 2019, the Math 120 Subcommittee distributed a short survey in mid-semester to all six sections of Math 120 (Nature of Mathematics) for the purpose of responding to the following questions:

1. Do you feel that your previous math course adequately prepared you for Math 120?
2. Did you level-up to Math 120 by skipping the prerequisite courses of Math 73 (Intermediate Algebra for General Education) or Math 80 (Intermediate Algebra for STEM)?

The results of questions 1 and 2 are tabulated in *Table 1* below.

Adequately Prepared for Math 120?	Did You Level Up?
86 YES 33 NO	64 YES 61 NO
119 Total Responses	125 Total Responses

Table 1: Math 120 Survey Results

Analysis of Table 1: Out of 119 students who responded to question 1 on the survey, approximately 28% indicated that they do not feel that their previous math course adequately prepared them for Math 120. Furthermore, 51% of the 125 students, who responded to question 2 on the survey, indicated that they leveled up to Math 120 due to AB 705.

In addition to the survey results, enrollment in Math 120 plummeted without having a co-requisite course to support the students in Spring 2019. At the beginning of Spring 2019, only three out of six Math 120 sections were filled. At the end of Spring 2019, four out of six Math 120 sections have enrollment below 50%. One instructor reported that perhaps only five students would end up passing his class. This demonstrates that although students may have felt they were adequately prepared for Math 120, the results indicate otherwise.

AB 705 mandates that California community colleges must maximize the probability that a student will enter and complete transfer-level course within a one-year time frame. The General Education Mathematics Program already created co-requisite courses for Math 130 (College Algebra) and Math 150 (Elementary Statistics) in Fall 2018 because these courses impact the largest number of students in our program. Our next step is to create a co-requisite course for Math 120 (Nature of Mathematics) in Fall 2019, so liberal arts majors can maximize their chances of passing their last math class before transferring to a 4-year university.

D) List any related recommendations.

1. The General Education Mathematics Program highly recommends creating a one-unit, co-requisite course, Math 120-S (Fundamental Skills for Nature of Mathematics) for Math 120 (Nature of Mathematics) in Fall 2019 to meet the mandate of AB 705. We typically offer 12 sections of Math 120 per year. If we were to offer 5 to 6 sections of Math 120-S (\$2,625 per section), it will cost approximately \$15,750.

Fiscal Impact: An increase of \$15,750 per academic year.

3. The General Education Mathematics Program highly recommends hiring more qualified tutors for the Math Study Center. Specifically, it would benefit the students in our program if the priority was on hiring statistics tutors. This will help us meet the higher demand caused by AB705.

Fiscal Impact: If tutors were paid a more competitive wage of around \$15/hour this would be around a \$5 per hour increase. Considering that our center is open for approximately 40 hours a week with usually around 5 tutors at anytime this would be an increase of \$1000 per week for around \$16,000 per term.

3. The General Education Mathematics Program recommends looking into additional work space or classrooms that might be used as an “overflow” for the Math Study Center during peak days and times.

Fiscal Impact: No fiscal cost.

4. The General Education Mathematics Program recommends the purchase and installation of 5 additional computers in the Math Study Center. These would also be available as replacements for the current ones.

Fiscal Impact: A one-time cost of ~\$2500.

5. The General Education Mathematics Program recommends scheduling as many Math 150 classes during the late morning (10-noon) time slot as possible.

Fiscal Impact: No fiscal cost.

SECTION 6 Facilities and Equipment

A) Describe and assess the existing program facilities and equipment.

The General Education Mathematics Program is one of the several programs that are part of the mathematics department at El Camino College. The MBA building houses the Division of Mathematical Sciences, as well as the Business Division and Allied Health. This building contains 22 offices designated for full-time instructors, as well as 8 additional offices currently designated for part-time instructors. As the mathematics department grows, the part-time offices will need to convert to full-time math faculty offices. Since the mathematics department serves more than 10,000 students each semester, it will be imperative to continue to have available office space for part-time instructors. Given the demand for new instructors due to increased enrollments, retirements and attrition, the amount of office space will not be adequate for the long-term faculty needs of the growing Math Department. Additional space will be necessary due to the high seat fill rate and demand for courses in the General Education Mathematics Program. With the new assembly bill 705 (AB 705), more math courses that are part of the General Education Mathematics Program will be offered to satisfy the requirement that an entering student entering can complete transfer level math courses within a one year timeframe.

Each classroom in the new MBA building has a computer, a projection system and a document reader; however, there will still be a need for up-to-date technology (hardware and software) for instructors and for the classroom. This equipment includes, but is not limited to, faculty laptops, tablet PCs, wireless mouse, classroom clicker sets, classroom and department sets of graphing calculators and other equipment. Please see *Section 7 Technology and Software* for more details.

The MBA building also houses the Math Study Center, a place where students can receive free tutoring for all math courses. The center can currently accommodate about 60 students at any one time. The center also has a few computers available for students to use and also makes 24-hour rentals of calculators.

At the front of the MBA building there is a small freeform study space for students. There are several whiteboards located in this area as well as some desks for students to use. This area is usually very busy as students often gather here for study groups, tutors use this area to work with several students at once especially when the center is full, and instructors sometimes hold office hours and review sessions here.

B) Explain the immediate (1-2 years) needs related to facilities and equipment. Provide a cost estimate for each need and explain how it will help the program better meet its goals.

Classrooms: Every classroom in the MBA building is equipped with a computer, a document reader, and a projector. However, none of the rooms have graphing calculators. With an increase enrollment in statistics courses, students will need to have access to graphing calculators. With the increase enrollment in Math 150, Elementary Probability and Statistics, it is highly recommended to have four to five dedicated classrooms since this course requires a common set of manipulatives, technological equipment and statistical software. At this time, it is recommended that the mathematics department purchase 200 TI-83 or TI-84 graphing calculators to serve five of our classrooms. Each calculator costs approximately \$120. The total approximate cost for 200 graphing calculators is \$24,000. Please refer to *Section 3 Curriculum* for further details.

In addition, many of our classrooms have white boards installed all around the classroom, but dry erasers are still scarce in some of the classrooms. It is challenging to have a group of students collaborate and show their

work on the board, and then waste valuable class time just to wait for an eraser to become available. We recommend that there should be a dry eraser per white board to encourage class participation, and that the math department provide at least 6 dry erasers per whiteboard classroom. A typical EXPO dry eraser costs approximately \$2.50. However, at www.officesupply.com, CLI marker board eraser, a multi-purpose eraser, costs only \$0.87 each. This eraser also works well on standard chalk boards. If we order 6 CLI multi-purpose erasers for every Math classroom, it would only cost $\$0.90 \times 6 \times 31 = \167.40 plus free shipping for bulk purchase. Although some classroom may not need 6 new erasers, having spare whiteboard erasers to immediately replace worn out ones is always a plus for students and faculty. This same logic also applies to whiteboard markers. While most whiteboard rooms have enough markers for faculty to use these markers rapidly dry out and are certainly not enough for the students to use when working on problems themselves. It is therefore recommended that a large surplus of markers be purchased so that faculty are not restricted in having their students work and learn collaboratively. A bulk set of 52 dry erase markers can be purchased for around \$30 online. This would then mean to keep a supply of 52 markers per term for each white board room there would be a cost of around $\$30 \times 15$ rooms (only whiteboard rooms need this) = 450 dollars per semester.

Also faculty would like to see a backup supply of pencil sharpeners purchased. Our rooms are currently equipped with wall mounted sharpeners but some are broken or do not work correctly. Sharpeners are essential since some students come to our classes using pencils for notetaking and exams. They use pencils with the assumption that they can sharpen them when needed. Not having functioning sharpeners means that our students are interrupted in their working and studying by simply not having appropriate writing implements. When asked about replacing the sharpeners the response is always that we don't have any extra. Therefore, a number should be purchased to replace the malfunctioning ones and have a few left over for future needs. Wall mounted sharpeners can be purchased for around \$25 a piece. We propose buying ten to replace those that are currently in need of repair and still have a backups. This would cost around a total of \$250.

Finally, we would like to propose buying additional clocks for the MBA building. It was from the last program review that we were able to finally have clocks installed in the hallways of MBA which has been very helpful. Unfortunately, the issue now is that some of the clocks in the classrooms are malfunctioning and reading the wrong times. Some of the clocks are off by minutes, some by hours and some do not function at all. The problem with this is not just that it is an inconvenience but also that it seriously disrupts student learning. Some students arrive late to class thinking they are on time thus missing important information. Sometimes classes run overtime because professor sees the wrong time on the clock leading to students being late for their next class. Wall clocks only cost around \$25 so purchasing a set of 10 for backups and replacements would cost around \$250 and give everyone, students and faculty more peace of mind.

Faculty Workrooms:

Currently, there are two faculty workrooms with three computers each that are shared by math and business faculty. It is highly recommended that each workroom be equipped with at least two top of the line HP printers. Each HP printer costs between \$600 and \$700. The total cost for four HP printers is approximately between \$2400 and \$2800.

Faculty are also allowed to use the photocopier in the division office with a limit of 200 copies per semester. This is impractical especially considering the new support courses we are offering. Many support courses require Just-in-Time materials that instructors may need to create on short notice. This means that instructors will be unable to make classroom copies using the copy center. The limit of 200 copies per semester should be raised to 1000 copies per semester so that faculty are able to respond to their students needs more effectively

with appropriate materials. The cost of this assuming around 2 cents per copy would be $800 \times 2 \text{ cents} = 16$ dollars per instructor. With around 40 instructors this would be a cost of 640 dollars per term.

Moreover, we highly recommend that each faculty workroom have a scanner attached to each of the three computers. Scanners are good to forward class notes, activities, and other course related materials to the students and/or the copy center. Having one scanner per workroom makes it difficult to use when the mathematics department consists of 106 faculty members (47 full-time and 59 part-time). The estimated cost for a high quality scanner is approximately \$900 each. Currently, the second floor workroom currently two scanners and the third floor has one working scanner. For three additional scanners the cost is approximately \$2700.

Math Study Center:

It should be considered as the study center continues to grow in popularity that it may require more space. This could be perhaps a secondary classroom that is used for overflow students.

C) Explain the long-range (2-4+ years) needs related to facilities and equipment. Provide a cost estimate for each need and explain how it will help the program better meet its goals.

Math faculty continuously engage in conversations with their colleagues or read books that may generate new ideas on how to present math content. Unfortunately, due to copy limitations in the math office these new ideas are sometimes not brought to fruition since waiting for copies from the copy center may not align with the semester schedule for covering the content. Currently, all faculty in the math department are only allowed 200 copies per semester. We recommend that a faculty member who has a full-teaching load be allowed to make 1000 copies per semester, and 500 copies per semester for faculty that have less than a full teaching load. The total cost for the increase in copies per semester is approximated as follows: $[\$.07 \text{ (per copy)} \times 1000 \text{ (copies)} \times 47 \text{ (full-time faculty)}] + [$.07 \text{ (per copy)} \times 500 \text{ (copies)} \times 59 \text{ (part-time faculty)}] = \$5,355$.

With the current Assembly Bill 705, we will need additional classrooms for the sole use of the mathematics department. The limited space that we currently have will limit the flexibility and quantity of courses that we can offer with the additional support that our students need. Furthermore, the high seat fill rate and demand for courses in the General Education Mathematics Program makes it a necessity for the math department to have additional classrooms in the MBA building.

Finally, with the expansion of our program, we will need to have office space for a faculty library to store references and teaching tools. Since faculty offices do not have adequate storage space, we recommend that both the second and third floor of the MBA building have a dedicated library room that will have textbooks and other resources for classroom use.

D) List any related recommendations.

1. The General Education Mathematics Program recommends that the College provide students and faculty the bare necessities such as:

Classrooms: Erasers and Texas Instrument (TI-83 or TI-84) Calculators

Fiscal Impact: $\$168 + \$24,000 = \$24,168$

Workrooms: Printers and Scanners

Fiscal Impact: \$5,500

2. We recommend that Math 150 have four to five dedicated classrooms, since each section of this course requires a common set of manipulatives, technological equipment, and statistical software. **Fiscal Impact:** \$0

3. Funding should be established to maintain all equipment (document readers, laptops, computers), retain currency (license renewals of *Mathematica*, *Scientific Notebook*), and provide for new and innovative technologies (tablet PCs, calculator sets) in the classrooms, computer labs, tutoring center, and faculty offices. We estimate that this will cost between \$150,000 and \$200,000. **Fiscal Impact:** Estimated between \$150,000 and \$200,000

4. Dedicate additional classrooms in MBA exclusively for the Division of Mathematical Sciences. **Fiscal Impact:** \$0

5. Convert an existing office to a faculty library for storing references and teaching tools.

Fiscal Impact: \$0

6. Wireless mice for all full-time faculty with El Camino laptops.

Fiscal Impact: $47 \times \$35 = \$1,645$

SECTION 7

Technology and Software

A) Describe and assess the adequacy and currency of the technology and software used by the program.

In today's classroom, technology and software are essential tools for teaching and learning mathematics. Not only is technology used for teaching presentations, but is often used to design, implement, and assess curriculum. With the rapid growth of the internet and technology, instructors are able to access various resources that help support mathematics instruction and enhance the students' conceptual understanding of mathematics. Moreover, by combining technology and software with real-world applications, the students will not only gain a deeper understanding of mathematics, but can also build their self-confidence, and hopefully develop an appreciation of the mathematics content that is being introduced in the course.

During the past few years the General Education Mathematics Program and the Mathematics Department have integrated all available technology and software into their classrooms and full time faculty laptops. In each classroom, the followings are installed:

- 1) A document reader;
- 2) *Excel*;
- 3) *Mathematica 9.0*;
- 4) *Scientific Notebook 5.5*;
- 5) Texas Instruments graphing calculators;
- 6) Minitab;
- 7) SPSS;
- 8) Online homework (*Webassign, MyMathLab*);
- 9) GeoGebra.

In each full time faculty's lap top, the followings are installed:

- 1) *Excel*;
- 2) *Mathematica 9.0*;
- 3) *Scientific Notebook 5.5*;
- 4) Texas Instruments graphing calculators;
- 5) Minitab;
- 6) SPSS;
- 7) Online homework (*Webassign, MyMathLab*);
- 8) GeoGebra.

It is necessary to maintain and update these software regularly. For example, Wolfram's *Mathematica* requires an annual maintenance renewal of approximately \$8,000 per year ECC owned laptop licenses, home-use licenses. All other software requires funds for upgrade regularly.

The Developmental Mathematics Program continues to rent Texas Instruments (TI) graphing calculators through the TI-84 Calculator Loan Program, but these are primarily used for students in developmental courses (59 sections, about 2400 students). Purchasing additional graphing calculators for students taking courses in the General Education Mathematics Program would be very beneficial since the 541 calculators that are used by the students in the developmental courses are not enough now. For example, as of spring, 2019, there are 59 sections of math 150 (Elementary Statistics), less than 10 calculators per section, only 25% of students per section are serviced.

B) Explain the immediate (1-2 years) needs related to technology and software. Provide a cost estimate for each need and explain how it will help the program better meet its goals.

With the implementation AB 705, the number of sections in Math 150 is over 60 in fall 2019. With 541 calculator we have currently, there are only 10 calculator per section of 35-40 students. To increase the level of service to our students, we need more calculators. Please see the table below for improved service to our students and suggested number of calculators/estimated costs:

Level of service	More calculator needed (5% defective)	Estimated costs
15 calculator, 37.5% per section	310	\$37130 - \$46463
20 calculator, 50% per section	620	\$74340 - \$92945

C) Explain the long-range (2-4+ years) needs related to technology and software. Provide a cost estimate for each need and explain how it will help the program better meet its goals.

1. We also recommend that faculty computer laptops be replaced by spring 2022 to keep up with classroom technology. **Fiscal Impact:** \$1,500 per new laptop for FT faculty
3. Funding for professional development workshops or conferences be provided to focus on using iPad technology in General Education Math Courses.

Fiscal Impact: Anywhere from \$3,000-\$5,000 per semester.

D) List any related recommendations.

It is essential that our students in the General Mathematics program have exposure and access to a variety of technological resources. When preparing our students for a modern workplace, technological resources (for students and faculty) will help enrich the learning experience and expose students to applications related to different fields including life sciences, economics, social sciences, business, management, etc...

1. Due to the dramatic increase in Math 150 sections (we are at over 62 sections of Math 150 this current Fall 2019 term), it will be crucial that we increase the available graphing calculators for student to rent for our calculator lending program. (This is in addition to our proposal for more class sets.) An additional set of 150 calculators will help significantly in meeting this dramatic increase in demand.

Fiscal Impact: Estimated between \$12,000 and \$15,000. (estimated at \$80-\$100 per calculator)

2. We also recommend that faculty computer laptops be replaced by Spring 2015 to keep up with classroom technology. **Fiscal Impact:** \$1,500 per new laptop for FT faculty
3. Renew the campus license of Minitab for Statistics classes. **Fiscal Impact:** \$3,500 per year

SECTION 8
Staffing

A) Describe the program’s current staffing, including faculty, administration, and classified staff.

The Mathematical Sciences Department currently has 42 full-time faculty members and 56 part-time faculty members. Since 2014, there have been 10 full-time hires and the loss of 5 full-time hires due to attrition, retirements and other factors. The chart below shows the full-time and part-time staffing for the General Education Mathematics Program from Fall 2014 through the most recent semester, Spring, 2019.

General Education Mathematics Program

Current Staffing

Number of Sections Offered

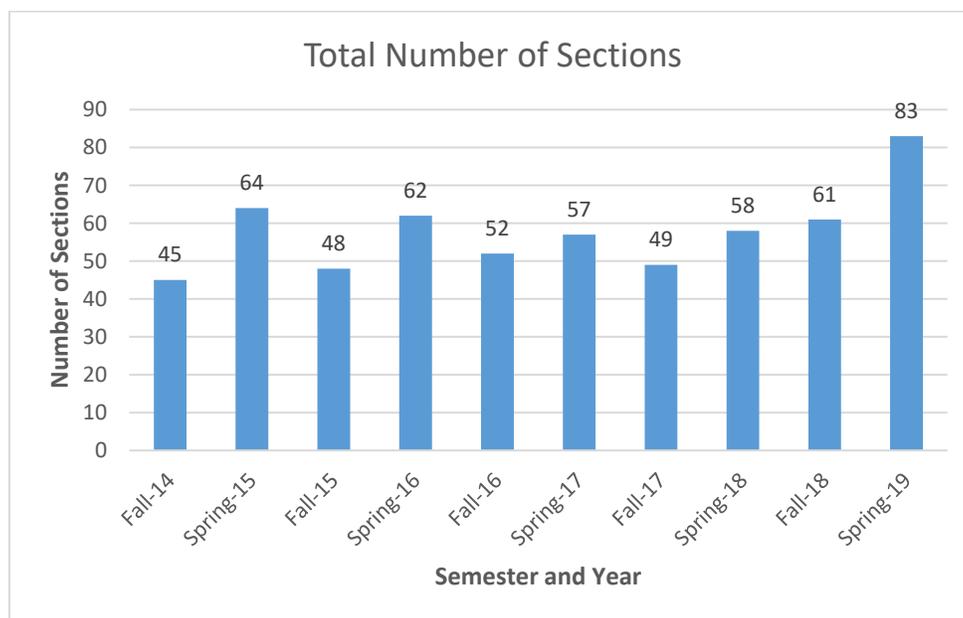
(Full Time/Part Time)

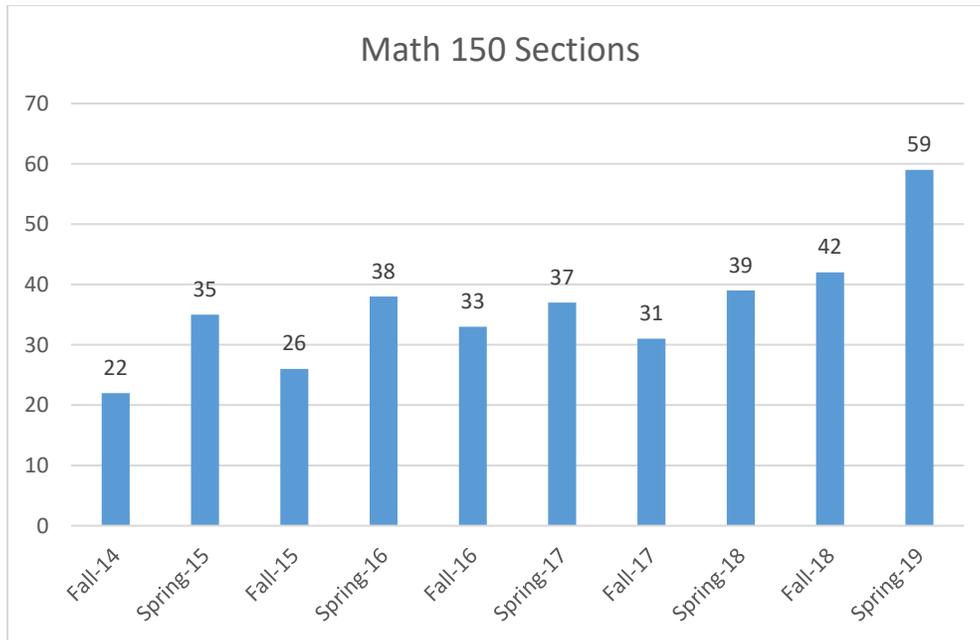
Fall 2014 – Spring 2019

	MATH 120		MATH 130		MATH 140		MATH 150		MATH 160		MATH 161		MATH 165		Total Sections
	FT	PT													
Fall-14	1	4	2	9	0	1	9	13	2	3	0	1	0	0	45
Spring-15	2	4	2	12	0	1	15	20	4	2	0	2	0	0	64
Summer-15	2	0	2	3	0	0	8	3	1	1	0	0	0	0	20
Fall-15	0	5	4	6	1	0	14	12	0	0	0	2	3	1	48
Spring-16	0	6	3	8	0	1	15	23	0	0	0	1	1	4	62
Summer-16	1	1	3	0	0	0	8	7	0	0	0	0	2	1	23
Fall-16	0	4	3	6	1	0	9	24	0	0	0	0	4	1	52

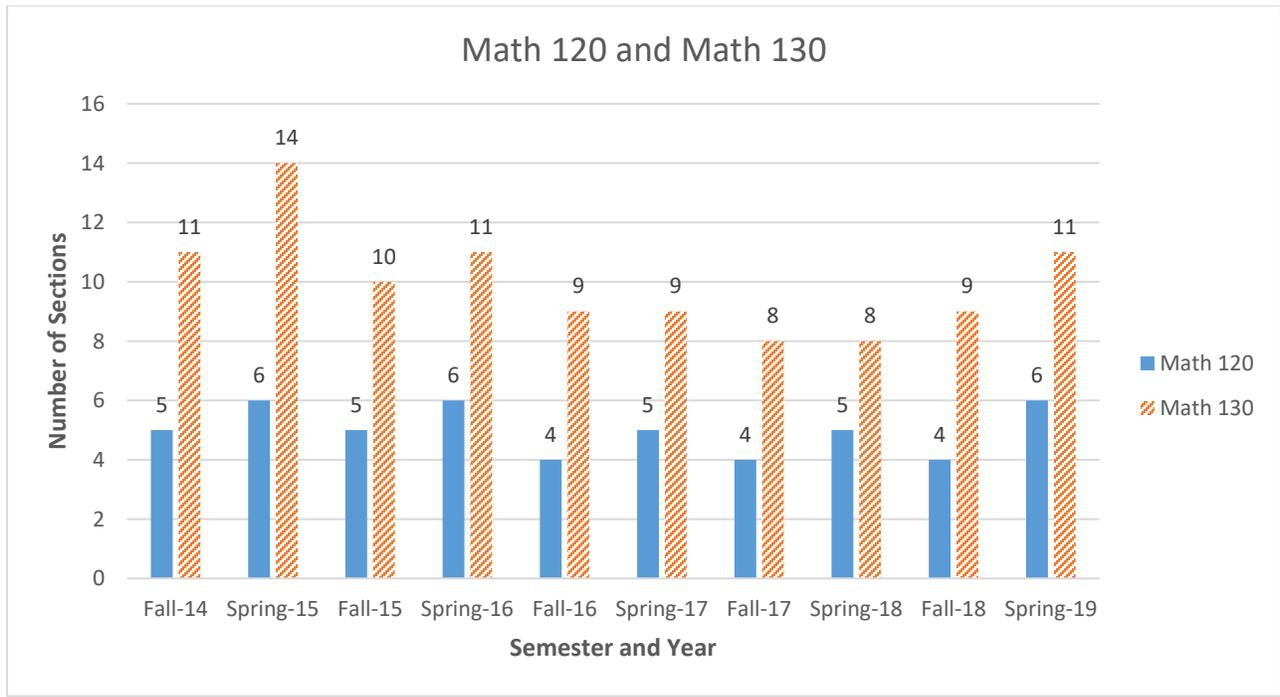
Winter-17	0	0	2	0	0	0	3	2	0	0	0	0	0	1	8
Spring-17	0	5	1	8	1	0	13	24	0	0	0	0	1	4	57
Summer-17	0	0	3	0	0	0	5	8	0	0	0	0	1	0	17
Fall-17	0	4	1	7	1	0	10	21	0	0	0	0	3	2	49
Winter-18	0	0	2	0	0	0	3	4	0	0	0	0	0	0	9
Spring-18	0	5	1	7	1	0	16	23	0	0	0	0	3	2	58
Summer-18	0	0	3	0	0	0	9	5	0	0	0	0	1	1	19
Fall-18	0	4	2	7	0	1	18	24	0	0	0	0	4	1	61
Winter-19	0	0	2	0	0	0	6	3	0	0	0	0	0	1	12
Spring-19	2	4	0	11	0	1	25	34	0	0	0	0	4	2	83
Fulltime/Part Time	8	46	36	84	5	5	186	250	7	6	0	6	27	21	687
Course Totals	54		120		10		436		13		6		48		687
% FT	15%		30%		50%		43%		54%		0%		55%		39%

The staffing data above was obtained from the official schedule of classes offered between Fall 2014 and Spring 2019.

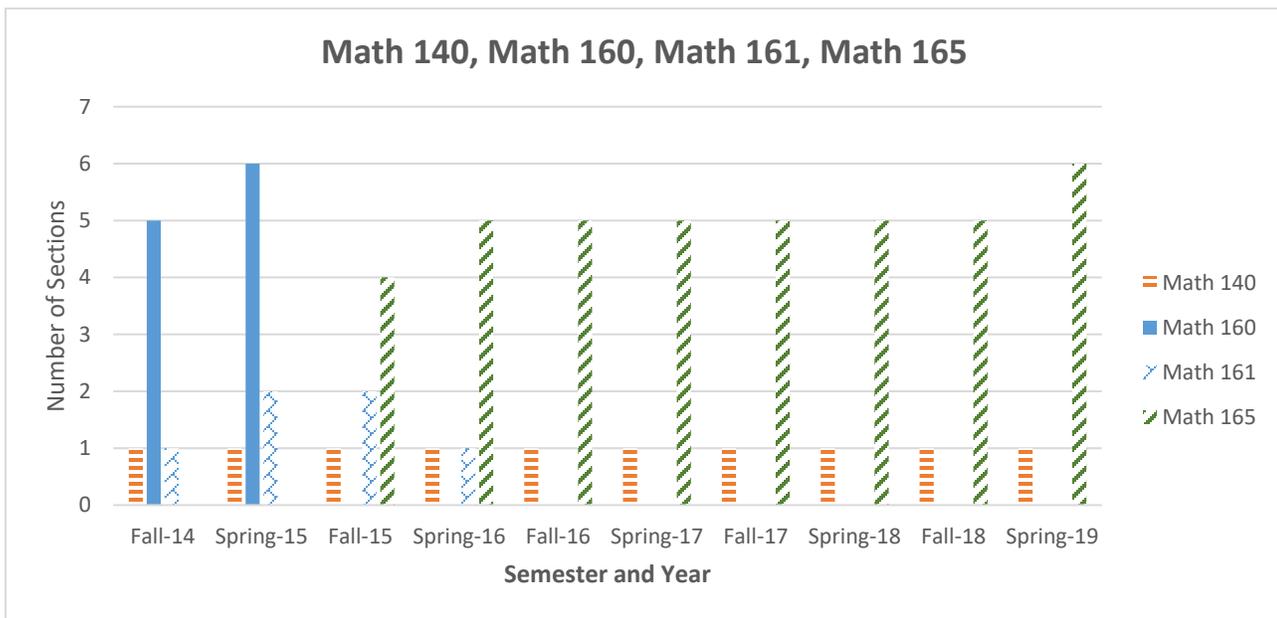




The total number of sections per year offered by the General Education Mathematics Program has remained essentially constant from 2015 – 2018. During the spring 2019 semester there has been a significant increase in the numbers of sections the General Education Mathematics Program offers due to the increase of Math 150 sections. As the department prepared for the implementation of AB 705, the department piloted the “leveling-up” concept which allowed students to place themselves in a college level course. Math 150 is the required transfer level classes for many of our students who transfer to a four-year university and thus Math 120 and Math 130 have both had a decrease in the number of sections offered. In spite of this, we predict the number of sections for both of these classes to increase significantly on account of AB 705.

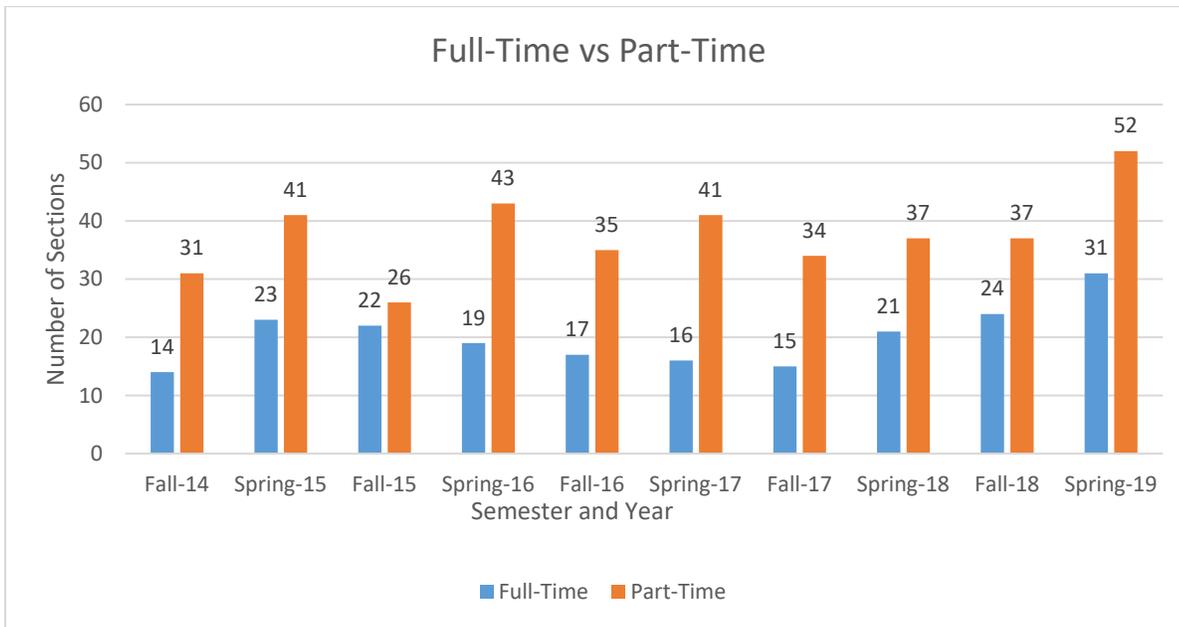
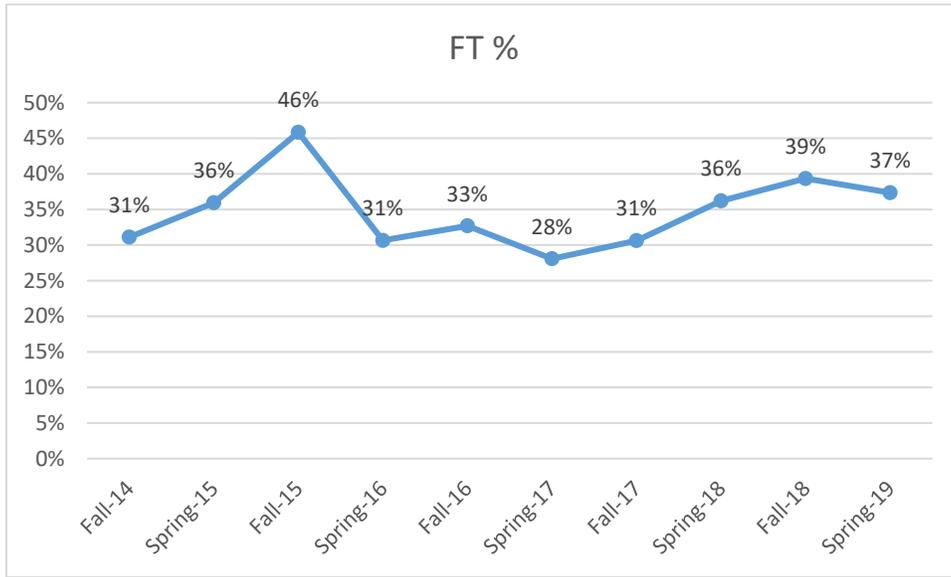


There are no significant changes in the number of sections of Mathematics 165. Both Mathematics 160 and 161 were deactivated. The last semester that Math 160 was offered was Summer 2015. The last semester that Math 161 was offered was Spring 2016.



The overall percentage of courses taught by full-time instructors for the General Mathematics Education Program is 39%.

As AB 705 nears, we predict the number of students taking classes in the General Education Mathematics Program will increase and so we hope to increase the number of full-time faculty teaching these classes.



B) Explain and justify the program's staffing needs in the immediate (1-2 years) and long-term (2-4+ years). Provide cost estimates and explain how the position/s will help the program better meet its goals.

Program/Department's current needs

- The California Community Colleges require that 67% of all sections be taught by full-time faculty. Within the General Education Mathematics Program, this percentage is currently 39%. Also, additional sections of Mathematics 150 were added after schedules of classes were published (3 additional sections in Spring 2018, 3 additional sections in Winter 2019, and 10 additional sections in Spring 2019). It is clear that additional faculty need to be hired to bring this percentage closer to the required number. Also, with AB 705 being fully implemented in Fall 2019, it is expected that fewer developmental courses will be offered and that more full-time faculty who can teach general education Math courses (especially Math 150) will be needed. We recommend that 4 full-time faculty members be hired to teach Math 150. The expected cost for hiring a full-time faculty member including the cost of health care and pension is approximately \$90,000/year.
- With the implementation of AB 705, it is recommended that a faculty facilitator be hired to assist/train new instructors who are teaching Math 150, 150S and Math 130, 130S. There will not be any expected additional cost for a faculty facilitator if a faculty member receives released time.
- It is also strongly recommended that additional supplemental instruction coaches and/or classroom tutors be hired to assist the increasing number of General Education Mathematics courses as well as all of the support courses (Math 130S and Math 150S).
- In addition, more classrooms need to be available for increasing enrollment in General Education Mathematics courses and the support courses. There will not be any expected cost for this.
- Lastly, faculty have experienced technical issues with document cameras, projectors, speakers as well as computer software due to everyday usage and lack of maintenance. Since a large majority of faculty use the equipment in every class it is important to maintain the upkeep of the equipment so to not disrupt instructor's classes. The process we currently have to repair equipment takes a couple of days to resolve and instructors then have to improvise their lectures. We are asking for a full-time (or a part-time) staff member from ITS or Media Services to upkeep equipment and update computer software on a timely manner. Depending on education and experience, the annual salary for a full-time staff is \$80,000 including benefits.

Program/department's future needs

As noted, the demand for Mathematics 150 has grown significantly and will be expected to grow due to AB 705. Assuming the trend continues, hiring committees must ensure that staffing for the course is adequate. Also, the University of California and the California State University and College systems have capped enrollment, and due to that factor as well as due to increased cost, students are increasingly attending community colleges as a way of saving money for their first two years of college. At the same time many students attending these 4-

year college are attending community colleges as a way to squeeze in extra classes at a lower cost. A significant portion of the summer session enrollment can be attributed to students from other colleges and universities.

C) List any related recommendations.

1. We recommend that 5 full-time faculty need to be hired capable of teaching Math 150 and Math 130 in the next 4 years due to increasing enrollment in Math 150 and because of increasing enrollment in community colleges in general. **Fiscal Impact:** The average cost for hiring a full-time faculty including the cost of health care and pension is approximately \$90,000/year. Therefore, \$450,000 for hiring 5 full-time faculty including cost of health care and pension
2. More classrooms need to be available for the increasing enrollment in Math 150. The number of additional classrooms is at the discretion of the Administration. **Fiscal Impact:** \$0
3. Hire a full-time technician to supervise and maintain all of the technological equipment in the classrooms, labs and faculty workrooms in MBA. **Fiscal Impact:** Estimated cost including benefits is approximately \$80,000.
4. Hire a full-time tutoring coordinator in our Math Study Center to plan, develop and coordinate a comprehensive tutoring program to support students and student success in the Mathematical Sciences Division. **Fiscal Impact:** Estimated cost including benefits is approximately \$90,000.

SECTION 9

Direction and Vision

A) Describe relevant changes within the academic field/industry. How will these changes impact the program in the next four years?

There have been several large changes as of late that directly impact our program. First, is the passage of AB-705. With increased focus on having students enroll in transfer level mathematics courses as soon as possible, enrollment in many CM2 courses has grown significantly. Many of our courses are at the first transfer level available to students so this growth was expected. Nevertheless, it has been large with for example Math 150 growing from around 42 sections in Fall 2018 to now over 60 sections in Fall 2019. We would like to continue to see more full-time faculty hired that are capable of teaching statistics courses so that students who enroll in Math 150 benefit from having full-time instructors. Also, considering the limited space/classrooms that the mathematics department has access to, finding places for these 60 sections was and will continue to be difficult. Therefore, CM2 advocates for more space being made available to the mathematics department and will investigate a fully online version of Math 150.

Furthermore, since students are enrolling in transfer level courses sooner than before additional support courses have necessarily been developed. So far we have created a support course for both Math 130 and Math 150. We are in the process of also building a support course for Math 120. These support courses are essential in making sure that our students have the best possible chance of succeeding in these courses. We will certainly need to analyze and revise these support courses to make them as effective as possible over the next few years.

Outside of direct educational policy another broader change is that more and more fields are becoming data driven. We are finding ourselves in an era where access to data has become unprecedented. With modern technology, especially connectedness through the internet, the amount of information available for

individuals both casually and professionally has never been larger. This means that fields like statistics, data analysis, and data visualization are all becoming necessary components to a wide variety of fields and indeed are becoming necessary general skills for the adult population. This places our program in a unique position of being able to supply our students with the skills and knowledge that will make them competitive in a wide variety of fields and professions. This also helps explain why we have seen such a steady rise of enrollment in Math 150, students are aware that they need these skills in the emerging data driven world of today.

Finally, educationally there has been a new emphasis on guided pathways and meta-majors at El Camino with the hope of directing students to broader disciplines rather than forcing them to immediately pick one specific field. While this might initially sound limiting for mathematics once again our classes are put into a unique position. Courses like Math 120, 140 and 150 are general education math courses that relate to a wide variety of other disciplines and fields. It is important in our courses that we continue to focus on the general skills (especially of data analysis) that can be applied to all these fields so students have the analytic abilities necessary to succeed in their chosen disciplines.

B) Explain the direction and vision of the program and how you plan to achieve it.

There are three main pieces for the future of CM2 over the next few years.

First, we recognize that we will need to continue supporting the increase of statistics courses. This will certainly require more full-time faculty with an emphasis on having a statistics background. Statistics is a specialized branch of mathematics and since it is a topical course it also requires constant attention by its faculty to be updated and taught with current examples and data. This can only be achieved with additional full-time faculty members who will be dedicated and interested in this area.

Second, considering the increased emphasis in statistics not only at the community college level we will explore creating additional statistics courses for students that may need something more for their major. An example of this is that statistics is now becoming required for computer science majors at many universities. However, their required statistics course is a calculus based course unlike our Math 150. Therefore, we will investigate creating some additional specialized statistics courses to better serve our student population. Similar to this, to accommodate the increase in Math 150 enrollment we will also explore creating a fully online Math 150 so that our severely limited classroom space does not negatively impact our program's growth.

Third, we will continue to support additional resources for our Math Study Center. Once again many of our courses are specialized math courses so we need to make sure we have tutors available that can aid our students as most efficiently as possible. To be competitive our study center needs not only a full-time coordinator but the pay for the tutors must be increased. Only then can we be assured of having the best quality tutors and hence providing the best quality support for our students.

C) List any related recommendations.

1. Develop a 1-unit support section for Math 120
2. Continue to support students in Math 150 by increasing the amount of calculators available through the calculator loan program.
3. Hire a full-time coordinator for the Math Study Center so that our center can be as efficient and helpful as possible for our students.
4. Investigate possible expansions for the Math Study Center to accommodate peak hours of student traffic.
5. Hire more tutors for the Math Study Center with an emphasis on statistics to accommodate the higher Math 150 enrollment

6. Hire additional full-time faculty with an emphasis on statistics to best serve students in the modern data driven age.
7. Locate more classroom space for math classes to accommodate the higher enrollment in CM2 classes following AB-705

SECTION 10
Prioritized Recommendations

A) Provide a single, prioritized list of recommendations and needs for your program/ department (drawn from your recommendations in sections 2-8). Include cost estimates and list the college strategic initiative that supports each recommendation. Use the following chart format to organize your recommendations.

	Recommendations	Cost Estimate	Strategic Initiatives
1.	A one-hour support course for Math 120 is recommended to help not only with the current dropping pass rate but also with incoming students that do not meet the old prerequisite of Math 73 or 80. From Sections 2, 3, 5, 9	6 sections at \$2,625 per section will be ~\$15,750	A, B
2.	Due to the dramatic increase in Math 150 sections (we are at over 62 sections of Math 150 this current Fall 2019 term), it will be crucial that we increase the available graphing calculators for student to rent for our calculator lending program. (This is in addition to our proposal for more class sets.) An additional set of 150 calculators will help significantly in meeting this dramatic increase in demand. From Sections 2,7,9	At btw \$80 to \$100 per calculator this would be ~ \$12,000 to \$15,000	A, B, C, F
3.	Hire a full-time tutoring coordinator in our Math Study Center to plan, develop and coordinate a comprehensive tutoring program to support students and student success in the Mathematical Sciences Division. From Sections 8, 9	~\$90,000 per year including benefits	A, B, D
4.	We recommend that we hire 5 full-time faculty who are capable of teaching Math 150 and Math 130 in the next 4 years due to increasing enrollment caused by AB 705. From Sections 8, 9	~\$450,000 overall (at \$90,000 per faculty member)	A, B, E
5.	The General Education Mathematics Program recommends looking into additional work space or classrooms that might be used as an “overflow” for the Math Study Center during peak days and times. From Section 5, 6, 9	None	A, B, C, E
6.	Funding should be established to maintain all equipment (document readers, laptops, computers), retain currency (license renewals of <i>Mathematica</i> , <i>Scientific Notebook</i>),	~\$150,000 to \$200,000	A, B, E, F

	and provide for new and innovative technologies (tablet PCs, calculator sets) in the classrooms, computer labs, tutoring center, and faculty offices. From Sections 6, 7		
7.	The General Education Mathematics Program recommends that the College provide students and faculty the bare necessities including: Whiteboard/Chalkboard Erasers Whiteboard Markers Printers and Scanners for Workrooms Functioning Clocks Functioning Pencil Sharpeners Increased Copy Limit to 1000 copies per semester From Section 6	Erasers ~ \$200 for sets of 6 for each classroom Markers~ \$450 for a set of 50 for each classroom Printers/Scanner~\$2500 for 4 to be purchased for workrooms Clocks~\$250 for 10 to be purchased Pencil Sharpeners ~\$250 for 10 to be purchased Copy Limit~\$640 for limit to be increased to 1000 copies per semester	B, E, F
8.	The General Education Mathematics Program highly recommends hiring four more qualified tutors for the Math Study Center. Specifically, it would benefit the students in our program if the priority was on hiring statistics tutors.	At 25 hours per week (and \$15/hour an increase	A, B, D, F

	<p>This will help us meet the higher demand caused by AB705.</p> <p>From Section 5, 9</p>	<p>to be more competitive with other jobs) per tutor this would be ~\$6000/term for one tutor, for a total of \$24,000</p>	
9.	<p>Dedicate additional classrooms in MBA exclusively for the Division of Mathematical Sciences.</p> <p>From Sections 6, 8, 9</p>	None	E
10.	<p>Hire a full-time technician to supervise and maintain all of the technological equipment in the classrooms, labs and faculty workrooms in MBA.</p> <p>From Section 7, 8</p>	~\$80,000 per year (including benefits)	C, F
11.	<p>One section of the Math 150 hybrid was offered in the Summer 2018 term (with 31 students) and two sections of Math 150 hybrid were offered in the Winter 2019. There are currently two Math 150-hybrids being offered in Summer 2019, both full with a full waitlist. It is recommended to offer at least three Math 150 hybrids in the summer and winter sessions. CM2 will also explore a fully online option for Math 150 to possibly accommodate the increased enrollment.</p> <p>From Section 2</p>	At 1 additional 4-unit section per term this would be ~\$10,500	A, B, E
12.	<p>The Math 165 course was offered in the Winter 2017 term, but it was not offered in the Winter 2018 term. The winter 2017 course had 26 students, which is a 74% fill rate. This is higher than average for the General Mathematics Program. It is recommended to continue to offer Math 165 in the winter.</p> <p>From Section 2</p>	At 1 additional 5-unit section per winter this would be ~\$13,000	A, B
13.	<p>Due to low enrollment (26 students for the entire 2017-2018 year), it is recommended to offer one section of Math 140 just once a year in fall.</p> <p>From Section 2, 3</p>	One less 4-unit section would be ~-\$10,500	E

14.	The large lecture Math 150 hybrids accommodates the high demand of the Math 150 students. Since there will be even more demand for Math 150 due to AB 705, it is recommended to continue to offer large lecture hybrids of Math 150. From Section 2	None	A, B, E
15.	Purchase and install 5 additional computers in the Math Study Center. From Section 5, 7	At ~\$800 per computer this will be ~\$4000	A, B, F
16.	The General Education Mathematics Program recommends scheduling as many Math 150 classes during the late morning (10-noon) time slot as possible. We recommend that Math 150 have four to five dedicated classrooms, since each section of this course requires a common set of manipulatives, technological equipment, and statistical software. From Section 2, 5	None	C, E
17.	Convert an existing office to a faculty library for storing references and teaching tools. From Section 6	None	C, E
18.	When setting actions and follow-ups for SLO and PLO assessments, we would like to get more part time faculty involved. However, finding time to meet with the large numbers of part time faculty is virtually impossible given their schedules and different formats of classes (online, hybrid, etc...). Thus, using an email based dialogue could be helpful in getting feedback from part time faculty regarding SLO/PLO actions and follow-up results. From Section 4	None	C, D, E
19.	Wireless mice for all full-time faculty with El Camino laptops. From Section 6	At \$35 per mouse with ~47 faculty this will be ~\$1645	F
20.	Offer more training sessions for faculty related to SLO data collection and inputting and offer compensation for part-time faculty as well to attend the sessions. Too often we find faculty (full and part-time) not versed in the reporting	~\$200 for workshop leader compensation	E, F

	system and often have to consult the few faculty that are familiar. From Section 4		
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B) Explain why the list is prioritized in this way.

The list above is prioritized based on a combination of frequency of the recommendations mentioned in the program review, cost estimates, immediate needs, and long-term needs. Committee CM2 also met on September 12th, 2019 and voted unanimously to approve these recommendations as they were written and ordered.

Appendix A
ALIGNMENT GRIDS

MATHEMATICAL SCIENCES

Institutional (ILO), Program (PLO), and Course (SLO) Alignment

Program: Math (GE and Non-Science Majors)	Number of Courses: <b style="color: red;">6		Date Updated: <b style="color: red;">5.12.2018		Submitted by: Susanne Bucher, ext.	
ILOs	1. Critical Thinking <i>Students apply critical, creative and analytical skills to identify and solve problems, analyze information, synthesize and</i>	2. Communication <i>Students effectively communicate with and respond to varied audiences in written, spoken or signed, and artistic forms.</i>	3. Community and Personal Development <i>Students are productive and engaged members of society, demonstrating personal responsibility, and community and social awareness through their engagement in campus</i>	4. Information Literacy <i>Students determine an information need and use various media and formats to develop a research strategy and locate, evaluate, document,</i>		
SLO-PLO-ILO ALIGNMENT NOTES:						
<i>Mark boxes with an 'X' if: SLO/PLO is a major focus or an important part of the course/program; direct instruction or some direct instruction is provided; students are evaluated multiple times (and possibly in various ways) throughout the course or are evaluated on the concepts once or twice within the course.</i>						
PLOs			PLO to ILO Alignment			
			1	2	3	4
PLO #1 Graphical Methods Students will be able to analyze and solve application problems involving business, the social sciences, and/or biological sciences using graphical methods.			X	X		X
PLO #2 Analytical and Computational Skills Students will be able to analyze and solve application problems involving business, the social sciences, and/or biological sciences using analytical and computation skills.			X	X		X

SLOs	SLO to PLO Alignment (Mark with an X)		COURSE to ILO Alignment			
	P1	P2	1	2	3	4
MATH 120 Nature of Mathematics: SLO #1 Solve Loan Problems Apply techniques of simple and compound interest to solve loan and annuity problems.		X				
MATH 120 Nature of Mathematics: SLO #2 Solve Application Problems Using Graphical Methods Solve application problems using graphical methods such as: 3-ring Venn diagrams, truth tables, Euclidean, Riemannian and Lobachevskian geometries.	X					
MATH 120 Nature of Mathematics: SLO #3 Analyze Voting System Analyze voting systems, methods of apportionment and representation to further the understanding of the political process.		X	X	X		X
MATH 120 Nature of Mathematics: SLO #4 Solve Application Problems Solve application problems using basic counting principles, permutations, combinations, probability, expected value and frequency distribution.	X	X				
MATH 130 College Algebra: SLO #1 Solve Nonlinear Inequalities Solve nonlinear inequalities and a variety of equations such as: polynomial, rational, radical, exponential, and logarithmic.		X				
MATH 130 College Algebra: SLO #2 Solve Problems using Graphical Methods Solve problems using graphical methods involving a variety of functions, such as: polynomial, rational, radical, exponential, and logarithmic.	X		X	X		X
MATH 130 College Algebra: SLO #3 Solve Problems Using Sequences and Series Solve problems using sequences and series.		X				
MATH 130 College Algebra: SLO #4 Solve Application Problems Solve college algebra level application problems and use technology.	X	X				
MATH 140 Finite Mathematics for Business and Social Sciences: SLO #1 Use of Gauss-Jordan Use the Gauss-Jordan technique to solve systems of linear equations.		X				
MATH 140 Finite Mathematics for Business and Social Sciences: SLO #2 Use of Matrices Solve problems using matrices.		X				
MATH 140 Finite Mathematics for Business and Social Sciences: SLO #3 Use of Geometrical Approach Solve linear programming problems using the geometrical approach.	X		X	X		X
MATH 140 Finite Mathematics for Business and Social Sciences: SLO #4 Use of Finite Mathematics Techniques Solve application problems using finite mathematics techniques.	X	X				

SLOs	SLO to PLO Alignment (Mark with an X)		COURSE to ILO Alignment			
	P1	P2	1	2	3	4
MATH 150 Elementary Statistics with Probability: SLO #1 Computing and Interpreting Various Measures From data or bivariate data, compute statistics and develop displays of the data that illustrate the measures of central tendency, variation, relative position, and correlation. Interpret the displays in context.	X					
MATH 150 Elementary Statistics with Probability: SLO #2 Probability Compute probability of an event by applying the basic assumption in classical probability and using addition rule and multiplication rule for contingency tables.	X	X				
MATH 150 Elementary Statistics with Probability: SLO #3 Central Limit Theorem Use the Central Limit Theorem to compute probabilities concerning the distribution of the sample means and comparing these to the probabilities of the related random variable.	X	X	X	X		X
MATH 150 Elementary Statistics with Probability: SLO #4 Confidence Intervals and Hypothesis Testing Compute the confidence intervals and conduct hypothesis testing for a variety of parameters, and perform non-parametric hypothesis testing.	X	X				

SLOs	SLO to PLO Alignment (Mark with an X)		COURSE to ILO Alignment			
	P1	P2	1	2	3	4
Math 165 Calculus for Biological, Management and Social Sciences: SLO #1 Compute and Interpret Derivatives Determine limits, classify types of continuity of functions, use derivatives to find increments, rates of change and tangent lines, and compute first and second derivatives of functions including partial derivatives.		X				
Math 165 Calculus for Biological, Management and Social Sciences: SLO #2 Compute and Interpret Integrals Evaluate integrals and improper integrals using a variety of methods, including substitution and by parts.		X				
Math 165 Calculus for Biological, Management and Social Sciences: SLO #3 Sketch Graphs of Functions Identify the intercepts, asymptotes, relative extrema, inflection points, and concavity, and use this information to sketch graphs of functions.	X		X	X		X
Math 165 Calculus for Biological, Management and Social Sciences: SLO #4 Solve Application Problems Using Calculus Use single-variable and multi-variable calculus methods to solve application problems in business and economics, including marginal revenue, marginal profit and marginal cost.	X	X				
Math 150H Elementary Statistics with Probability: SLO #1 Computing and Interpreting Various Measures From data or bivariate data, compute statistics and develop display of the data that illustrate the measures of central tendency, variation, relative position, levels of scale/measurement and correlation. Interpret the displays and statistics in context.	X					
Math 150H Elementary Statistics with Probability: SLO #2 Probability Compute the probability of an event by applying the basic assumptions in classical probability (including sample space) and use the addition rule and multiplication rule for contingency.	X	X				
Math 150H Elementary Statistics with Probability: SLO #3 Central Limit Theorem Use the Central Limit Theorem to compute probabilities concerning the distribution of the sample mean and compare these to the probabilities of the related random variable.	X	X	X	X		X
Math 150H Elementary Statistics with Probability: SLO #4 Confidence Intervals and Hypothesis Testing Compute confidence intervals and conduct hypothesis testing for a variety of parameters (for 1 and 2 populations) in applied settings. Make statistical conclusions using analytic and/or graphical techniques, including critical regions.	X	X				

Appendix B
SLO/PLO TIMELINES

SLO Timeline Worksheet
(2015 - 2019)

Division: Mathematical Sciences

Program: MATH (G.E. & NON-SCIENCE MAJORS)

Course and SLO #	SP 2015	SU 2015	FA 2015	SP 2016	SU 2016	FA 2016	SP 2017	SU 2017	FA 2017	SP 2018	SU 2018	FA 2018	SP 2019
PLO #1				X						X			
PLO #2	X						X						X
MATH 120 - SLO #1	X			X									X
MATH 120 - SLO #2							X						
MATH 120 - SLO #3													
MATH 120 - SLO #4										X			
MATH 130 - SLO #1	X			X									X
MATH 130 - SLO #2							X						
MATH 130 - SLO #3													
MATH 130 - SLO #4										X			
MATH 140 - SLO #1	X			X									X
MATH 140 - SLO #2							X						
MATH 140 - SLO #3													
MATH 140 - SLO #4										X			
MATH 150 – SLO #1	X			X									X
MATH 150 – SLO #2							X						
MATH 150 – SLO #3													
MATH 150 – SLO #4										X			
MATH 150H – SLO #1													X

Course and SLO #	SP 201 5	SU 201 5	FA 201 5	SP 201 6	SU 201 6	FA 201 6	SP 201 7	SU 201 7	FA 201 7	SP 201 8	SU 201 8	FA 201 8	SP 201 9
MATH 150H – SLO #2													
MATH 150H – SLO #3													
MATH 150H – SLO #4													
MATH 165 – SLO #1	X			X									X
MATH 165 – SLO #2							X						
MATH 165 – SLO #3													
MATH 165 – SLO #4										X			

Appendix C
6-YEAR CURRICULUM COURSE REVIEW TIMELINE

APPENDIX D

CAREER AND TECHNICAL EDUCATION (CTE) SUPPLEMENTAL QUESTIONS

CTE programs must conduct a full program review every 4 years. The comprehensive program review includes responses to the CTE supplemental questions below. Every two years (once between full program reviews) these supplemental questions must be answered and submitted to Academic Affairs for posting on the College website.

Use labor market data, advisory committee input/feedback, and institutional and program-level data to respond to the following questions:

- 1. How strong is the occupational demand for the program?** In your response, describe any changes in demand over the past 5 years and discuss the occupational outlook for next 5 years. Provide applicable labor market data (e.g., US Bureau of Labor Statistics, Employment Development Department) that address state and local needs.

- 2. How does the program address needs that are not met by similar programs in the region?** In your response, identify any distinctive components of the program (e.g., curriculum, facilities, resources) and/or describe any unique contributions the program or its students/graduates make to the community served.

- 3. What are the completion, success, and employment rates for students in the program?** In your response, identify the standards set by the program and discuss any factors that may impact completion, success, and employment rates among students in the program. Describe the status of any action plans for maintaining/improving rates relative to such benchmarks.

- 4. List any licensure/certification exam(s) required for entry into the workforce in the field of study and report the most recent pass rate(s) among program graduates.** In your response, identify any applicable performance benchmarks set by regulatory agencies and describe the status of any action plans for maintaining/improving pass rates relative to such benchmarks.

- 5. Are the students satisfied with their preparation for employment? Are the employers in the field satisfied with the level of preparation of program graduates?** Use data from student surveys, employer surveys, and other sources of employment feedback to justify your response.

- 6. Is the advisory committee satisfied with the level of preparation of program graduates? How has advisory committee input and feedback been used in the past two years to ensure employer needs are met by the program?** Describe the status and impact of any advisory committee recommendations.

California Education Code 78016 requires that the review process for CTE programs includes the review and comments of a program's advisory committee.

Provide the following information:

- a. Advisory committee membership list and credentials.
- b. Meeting minutes or other documentation to demonstrate that the CTE program review process has met the above Education Code requirement.