2021-2022 Comprehensive Instructional Program Review - Physics, Astronomy, and Engineering (PAE) Latest Version

2021-2022 Comprehensive Instructional Program Review

Program Overview and Goals

Mission and Alignment : Version by **McLarty-Schroeder, Janet** on **02/15/2022 17:50**

The mission of the Physics and Astronomy Department is threefold. First, we provide a wide variety of rigorous introductory courses which satisfy the physical science breadth requirements (both with and without laboratories) for university bound transfer students. Second, we identify and encourage students majoring in astronomy, physics and engineering. Third, we provide classes and encouragement for students pursuing majors or careers that build on a solid foundation of physics knowledge (i.e., engineering, computer sciences,etc.).

Explain how your program supports the College's Mission.
Our program exemplifies high-quality instruction and our goal is more comprehensive and streamlined programs. We also offer programs to further students' learning opportunities and connections to other schools, industry, and agencies (such as NASA). Our students leave our programs prepared with the knowledge and skills they need to further their educational journey and be productive members of our local and global communities.

Degrees and Certificates : Version by **McLarty-Schroeder, Janet** on **01/31/2022 20:19**

List the degrees and certificates the program offers as well as the number of units or courses required to complete the program.

- Engineering, Associate of Science Degree

MAJOR REQUIREMENTS		
CHEM 111	General Chemistry	5
MATH 170	Analytic Geometry and Calculus I	4
MATH 190	Analytic Geometry and Calculus II	4
MATH 225	Calculus III	5
PHYS 201	Engineering Physics	4
PHYS 202	Engineering Physics	4
Total Degree Requirements		26

Complete the following: (1) major requirements, (2) the A.A. Degree General Education requirements, and (3) electives to achieve a minimum of 60 units.

- Engineering: Electrical Specialty, Associate of Science Degree

MAJOR REQUIREMENTS		
MATH 170	Analytic Geometry and Calculus I	4
MATH 190	Analytic Geometry and Calculus II	4
MATH 225	Calculus III	5
PHYS 201	Engineering Physics	4
PHYS 202	Engineering Physics	4
Specialty Requirements		
Select three courses from the following:		
CHEM 111	General Chemistry	5
CIS 180	Programming in C/C++	3.5
ENGR 110	Introduction to Engineering	2
ENGR 215	Circuits	3
ENGR 215L	Circuits Laboratory	1
ENGR 250	Linear Algebra and Differential Equations	5
PHYS 203	Engineering Physics	4
Total Degree Requirements		27-35.5

Completion of a minimum of 60 semester units to include (1) the courses listed above, (2) the completion of a CSUGE or IGETC pattern of general education requirements, and (3) a grade of "C" or better in all courses required for the major.

- Engineering: Aerospace and Mechanical Specialty, Associate of Science Degree

MAJOR REQUIREMENTS		
CHEM 111	General Chemistry	5
MATH 170	Analytic Geometry and Calculus I	4
MATH 190	Analytic Geometry and Calculus II	4
MATH 225	Calculus III	5
PHYS 201	Engineering Physics	4
Specialty Requirements		
Select three courses from the following:		
CHEM 112	General Chemistry	5
CIS 180	Programming in C/C++	3.5
ENGR 110	Introduction to Engineering	2
ENGR 112	Engineering Graphics	3
ENGR 210	Materials Science and Engineering	4
ENGR 220	Programming and Problem-Solving in MATLAB	3
ENGR 235	Statics	3
ENGR 240	Dynamics	3

ENGR 245	Strength of Materials	3
ENGT 131	Design Fundamentals Including 3D Modeling	3
ENGR 138	Introduction to Engineering Design Using AutoCAD	4
ENGR 250	Linear Algebra and Differential Equations	5
PHYS 203	Engineering Physics	4
Total Degree Requirements		34-40.5

Completion of a minimum of 60 semester-units to include (1) the courses listed above, (2) the A.A. degree general education requirements, and (3) a grade of “C” or better in all courses required for the major.

- Physics, Associate of Science Degree For Transfer (AS-T)

COMMON LOWER-DIVISION REQUIREMENTS

PHYS 201	Engineering Physics	4
PHYS 202	Engineering Physics	4
PHYS 203	Engineering Physics	4
MATH 170	Analytic Geometry and Calculus I	4
MATH 190	Analytic Geometry and Calculus II	4
MATH 225	Calculus III	5
Total Units for the Major		25

Complete 60 CSU-transferable units to include: (1) the common lower division requirements and (2) the Associate of Arts degree general education requirements for transfer to CSU (Plan B) or for IGETC (Plan C). Double-counting courses in GE and the major is permissible. Students are not required to complete any additional local requirements. All 60 units are CSU-transferable. Students must earn a minimum grade of “C” or “Pass” in all courses required for the major or area of emphasis. An overall minimum 2.0 grade point average is required for all courses used in the degree.

Six-Year Program Goals : Version by **McLarty-Schroeder, Janet** on **02/15/2022 17:50**

We will have enough full-time faculty, facilities, and equipment to support the number of students that we service. We currently have 4 full-time and 11 adjunct faculty to serve more than 500 students in our majors and students who need physics as part of more than a dozen other degrees on campus. All PS and ENGR courses are currently taught by adjunct faculty. About half of ASTR and 38% of PHYS are adjunct faculty. We would like to add at least 2 full-time faculty (1 physics and 1 engineering). In addition, we have 1 physics and 1 astronomy lab but no engineering lab or workspace. The addition of an engineering lab for circuits and other classes, an engineering lab for materials related classes and an engineering storage space.

We will be adding a 200-level course in Computational/Numerical Modeling. This course will be part of a new major in applied physics. We are looking to increase job opportunities for students who major in physics. Several of our neighboring 4-year institutions, like UCLA and UCI, offer computational physics as part of the requirements for their applied physics degree.

We would like to see the Cerritos College Physics, Astronomy, and Engineering Department provide a complete pathway for all students to earn degrees and transfer to the schools of their choice. We would also be able to support students through additional personnel and services from the college to provide connection to internships, research, and bridge opportunities. Providing additional opportunities on campus would streamline the ability of our students to gain experience in the fields of our department. We would also have someone maintaining our social media presence to communicate with students and the community about the wonderful opportunities they have available to them within and through our department.

Action Plans and Timelines

1. Increase opportunities for students in physics
    1. Create new full-time positions and hire additional full-time instructors. - We will continue to request these positions and will fill them as allowed by the college. - We need to hire due to high student demand and a small number of full time faculty to run the classes. We have difficulty finding quality adjunct faculty. We want to hire 2 full time faculty: one for physics and one for engineering. These would both be growth positions. We apply for FHP every year and continually look for adjunct faculty.
    2. Create new courses and degree - We will be adding a 200-level course in Computational/Numerical Modeling. This course will be part of a new major in applied physics. We are looking to increase job opportunities for students who major in physics. Several of our neighboring 4-year institutions, like UCLA and UCI, offer computational physics as part of the requirements for their applied physics degree. - Curriculum - 3 years
    3. Invite women scholars to meet with students so that we can increase women opportunities in physics. - 1 year and ongoing
    4. Announce periodic information through our classes about internship opportunities. (Ongoing)
2. Broaden/increase communication with students and community about department and interdisciplinary offerings and opportunities
    1. Increase communication using various modalities, such as email, canvas, and social media. - As time allows if no outside help is provided.
    2. Increase awareness of student opportunities in physics, astronomy, and engineering. - Sporadically ongoing.
    3. Increase transfer awareness. - Work with the transfer center to create an information module for canvas. - 1 year
3. Develop and streamline engineering program
    1. Work on pathways to 4-year schools. - As time allows
    2. Hire a full time engineering instructor. - We will continue to request these positions and will fill them as allowed by the college. - We need to hire due to high student demand and a small number of full time faculty to run the classes. We have difficulty finding quality adjunct faculty. We want to hire 2 full time faculty: one for physics and one for engineering. These would both be growth positions. We apply for FHP every year and continually look for adjunct faculty.
    3. Find dedicated engineering facilities. - We have 1 physics and 1 astronomy lab but no engineering lab or workspace. The addition of an engineering lab, and an engineering storage space. - We will continue to request this (This has been requested and funds have been attempted through grants multiple times in the last cycle.)
    4. Explore ABET mock review. - As time allows
4. Increase/continue student opportunities
    1. Continue NASA Community College Aerospace Scholars (NCAS). - Ongoing yearly
    2. Continue to mentor students in challenges such as Micro-g Neutral Buoyancy Experiment Design Teams (Micro-g NExT) . - Ongoing with student interest and college support
    3. Find and communicate internship opportunities, bridge programs, research, etc. to students. - As time allows and communication avenues become available
    4. Explore options for more opportunities on campus (Research, Challenges, Partnerships with industry and 4-year schools, Partnerships with California Space Grant Consortium) - Ongoing

Program Goal	College's Goals Supported (Goal A - Goal F)	Status (not started; in progress; on hold; cancelled; completed; continued)	Action Plans/Timelines/Resource Needs
Increase opportunities for students in physics	Goal A: Strengthening the Culture of Completion; Goal E: Upgrading Educational Infrastructure; Goal F: Enhancing Organizational Effectiveness	In Progress (Goal 12 from last program review)	Create new full-time positions and hire additional full-time instructors in physics and engineering. Create a new course in computational/numerical modeling and a degree in applied physics. Invite women scholars to meet with students so that we can increase women opportunities in physics. Announce periodic information through our classes about internship opportunities.
Broaden/increase communication with students and community about department and interdisciplinary offerings and opportunities	Goal D: Improving Internal and External Communication	Not Started (This has some aspects of Goal 4 from the last program review, but is more detailed.)	Increase communication using various modalities, such as email, canvas, and social media. Increase awareness of student opportunities in physics, astronomy, and engineering. Increase transfer awareness.
Develop and streamline engineering program	Goal A: Strengthening the Culture of Completion; Goal B: Ensuring Program Alignment by Strengthening Partnerships; Goal E: Upgrading Educational Infrastructure	Continued (Goals 10, 12, & 13 from last program review have been incorporated here.)	Work on pathways to 4-year schools. Hire a full time engineering instructor. Find dedicated engineering facilities. Explore ABET mock review.
Increase/continue student opportunities	Goal A: Strengthening the Culture of Completion; Goal B: Ensuring Program Alignment by Strengthening Partnerships; Goal D: Improving Internal and External Communication; Goal E: Upgrading Educational Infrastructure; Goal F: Enhancing Organizational Effectiveness	Continued (Goal 15 from last program review. Progress has been made.)	Continue NCAS. Continue to mentor students in challenges such as Micro-g NExT. Find and communicate internship opportunities, bridge programs, research, etc. to students. Explore options for more opportunities on campus (Research, Challenges, Partnerships with industry and 4-year schools, Partnerships with CaSGC).

Assessment Report and Data Analysis

Assessment Report (Part 1: Assessment Table) : Version by **McLarty-Schroeder, Janet** on **01/31/2022 20:19**

Course by SLO	Expected Performance	Performance

Assessment Report (Part 2: Assessment Responses) : Version by **McLarty-Schroeder, Janet** on **01/31/2022 20:19**

Explain the frequency (i.e., when and how often) and content of assessment process (e.g., planning, data collection, and results) for the program (e.g., department meetings, advisory boards, etc.). Also, describe the process for reviewing and discussing outcomes data.
SLO data is collected for every class, every semester. This has not always been the case, for a while we only gathered data once a year for each class and SLO. We will gather data every semester moving forward.

Our department has monthly meetings and we discuss SLOs in at least half of the meetings. Toward the beginning of the semester, eLumen SLO data is distributed to all faculty in the department for review. Then, at a department meeting near the beginning of the semester, we review the data and discuss any successes or deficiencies that we see, either in individual classes or in the overall programs. From there, we discuss processes or actions that might address deficiencies. When appropriate, we develop an improvement plan and implement it.

Describe the process for development of plan for improvement and summarize the changes that discipline faculty plan to implement based on the analysis of the student learning and program effectiveness. Provide specific examples.
As stated in the previous question, instructors are encouraged to look at their own data and then we discuss overall data at department meetings. When we find an area for improvement, we discuss in and then develop and improvement plan.

In Spring 2021, during a department meeting we discussed an SLO for PHYS 202 (about solving advanced problems in electrodynamics) where the data indicated we could use improvement. After discussion, an improvement plan was suggested that included more lecture time, demonstrations, and related problem solving to make the subject less abstract to the students. After some effort, the department chair input the improvement plan into eLumen. It is still in progress and we should get data in fall 2021.
Three years ago, it was noted that online classes (at the time ASTR 103) have poor retention, which also leads to poor success numbers. After much discussion of online classes and methods to increase retention and success, a method that included higher “touch” (personalized interaction with the instructor) was implemented. Although not entered into eLumen, the improvement was taken on by the instructor and has seen an increase in success rates discussed later in this report.

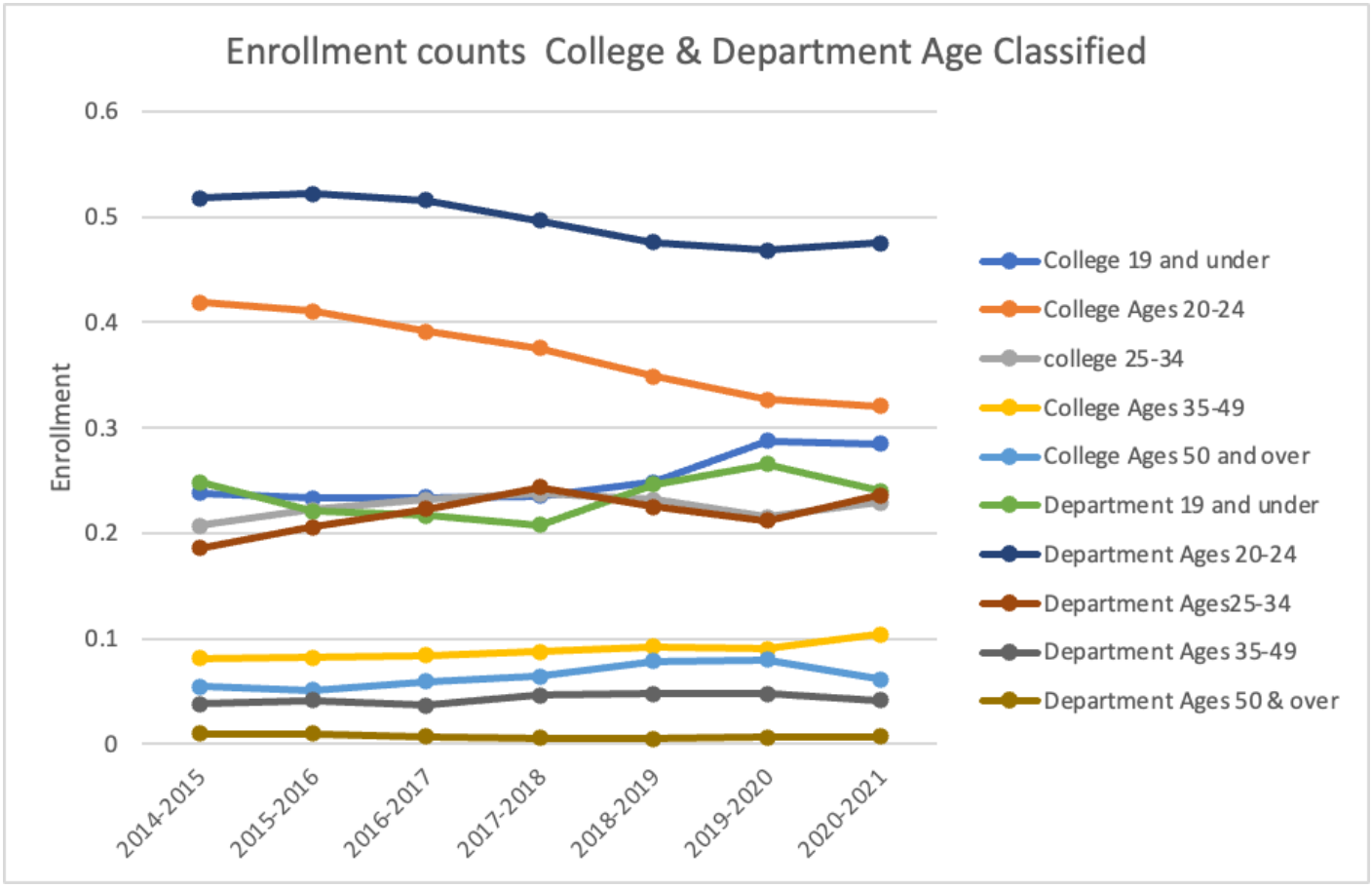
Data Analysis of Program Data : Version by **McLarty-Schroeder, Janet** on **02/15/2022 17:50**

Describe your student demographics (race/ethnicity, gender, age, and others that might be relevant). Consider the following questions when writing your response:

- How do the demographics of your program and its related courses compare with the college as a whole?

- Have they changed over time?

Demographics by AGE:

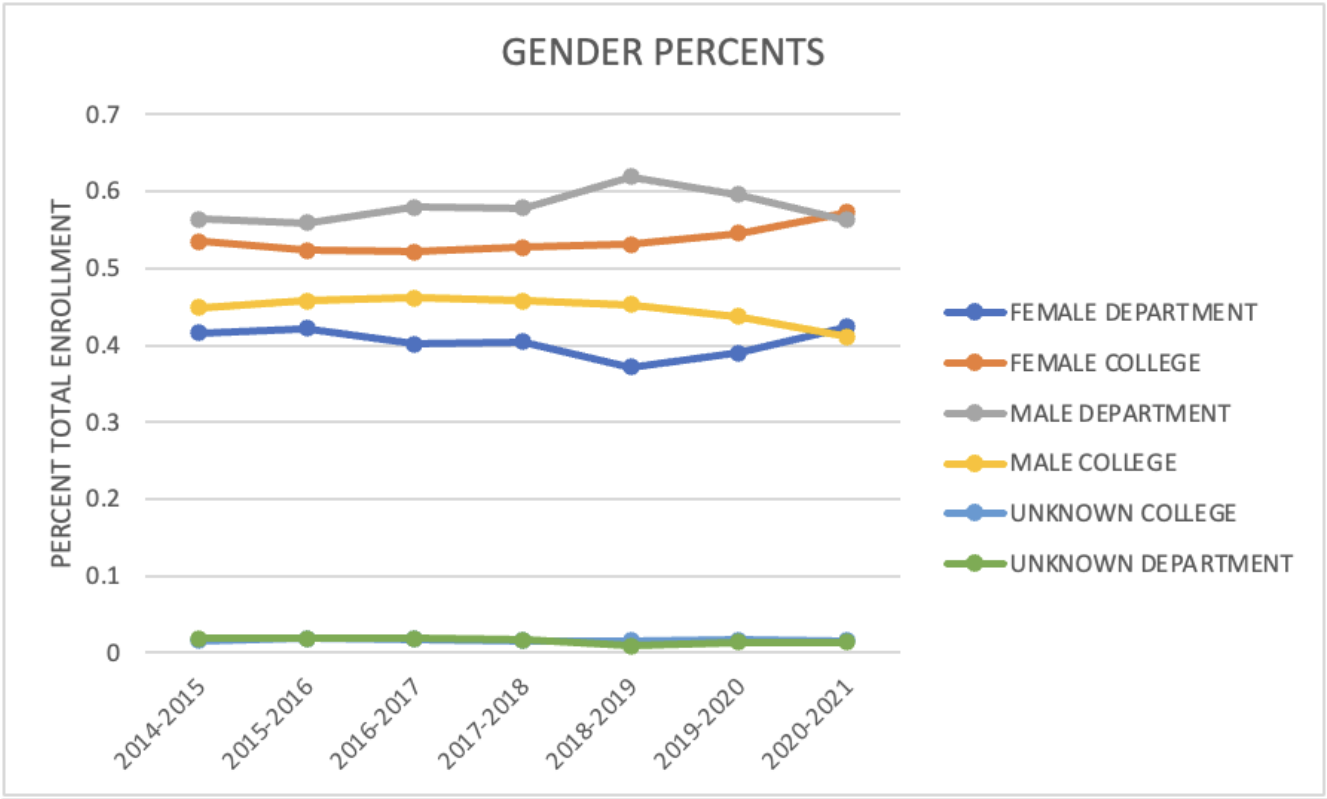


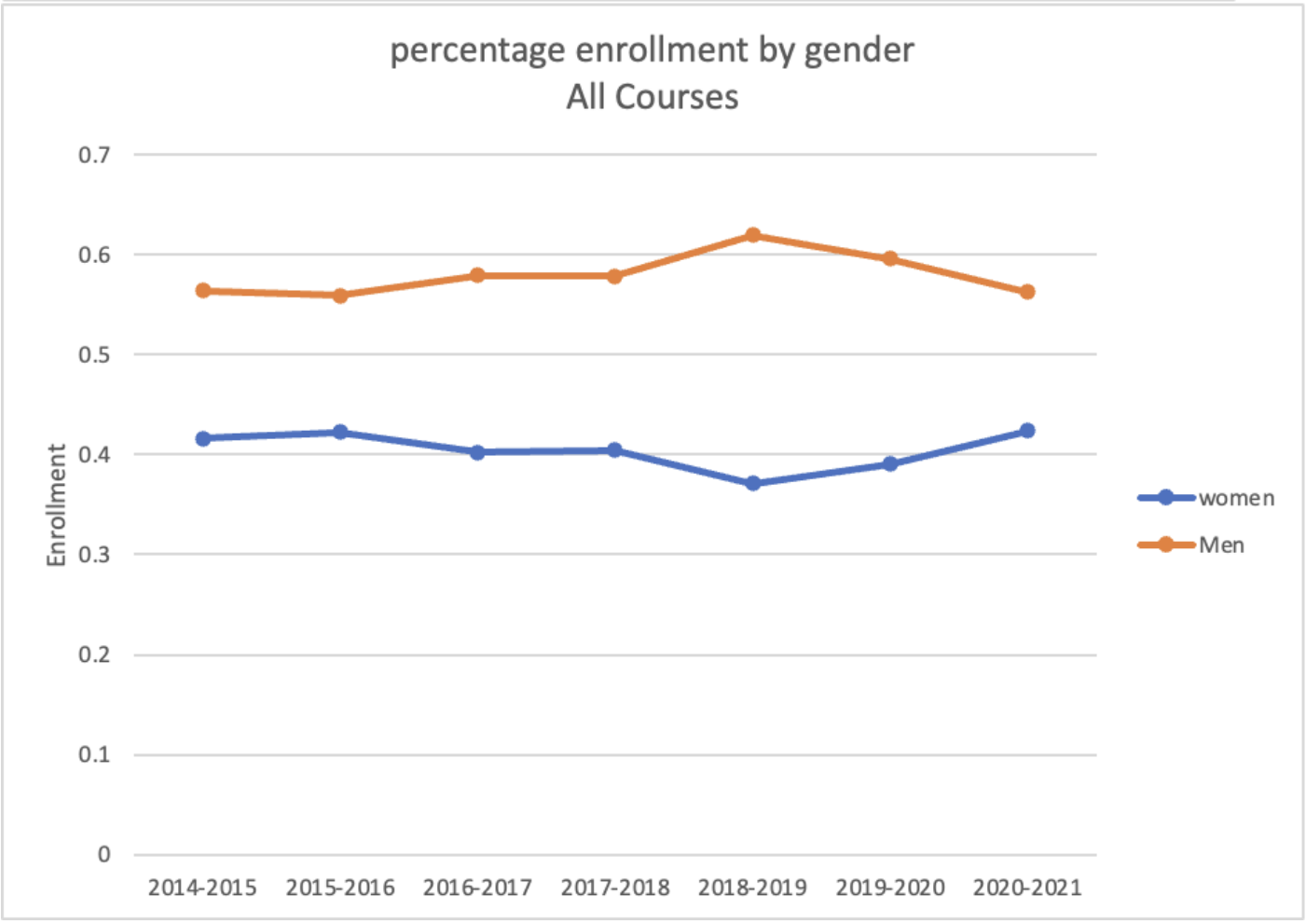
Most of the students who enroll in our courses are between the ages of 20-24. Overall, Cerritos College has a higher percentage of students who are 19 and under than our department does. This can be due to students spending one or two years completing math courses that are needed for success in our physics and engineering classes. In addition, our department is understaffed, which reduces the number of seats available in our classes.

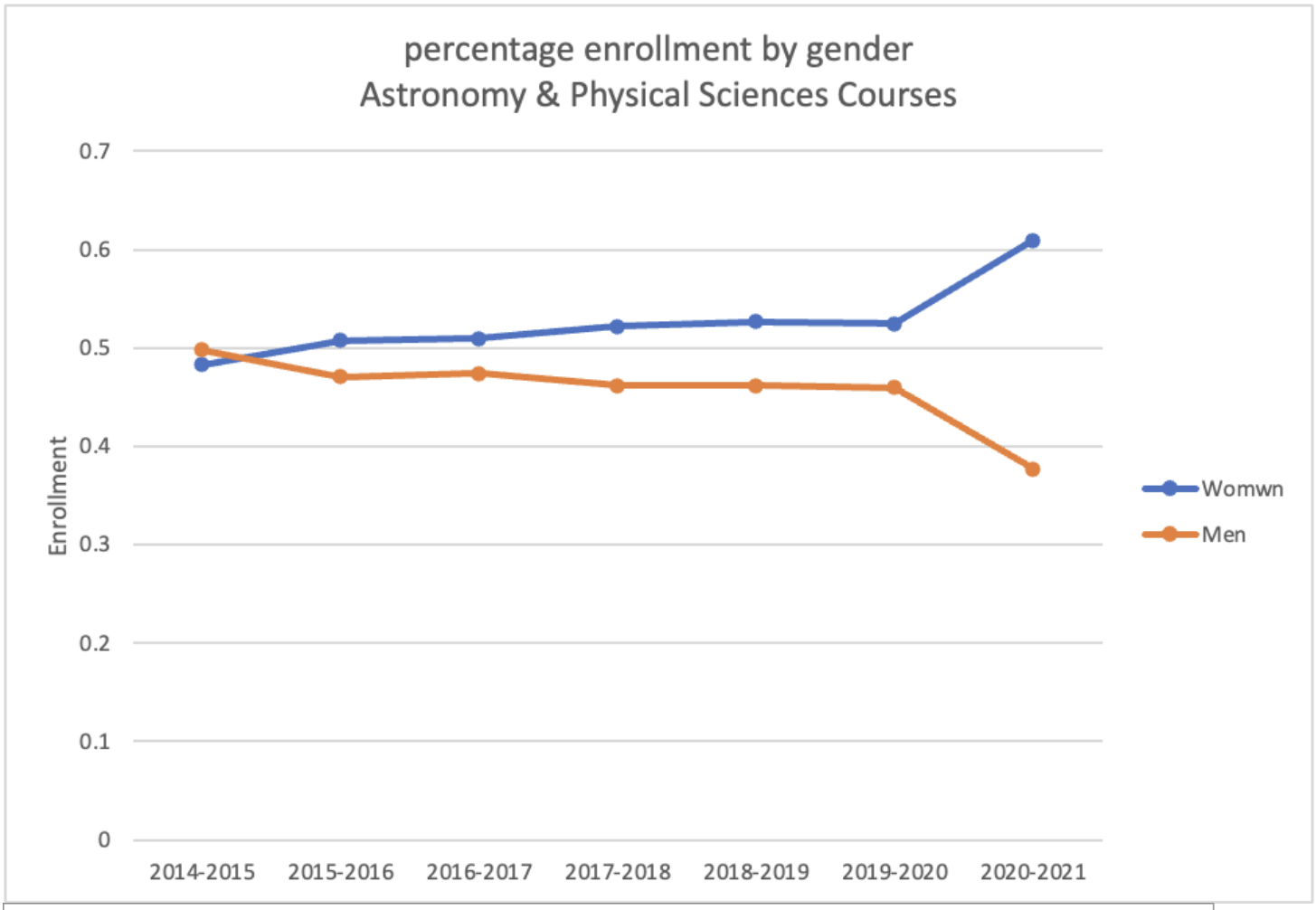
There has been an increased focus on Cerritos Complete from the college overall. However, our department sees there is a need for additional support for older cohorts. Our older students need an increase of support from Counseling, Academic Success, and other college services to the level that new students are receiving. For example, we recruit more tutors for our courses.

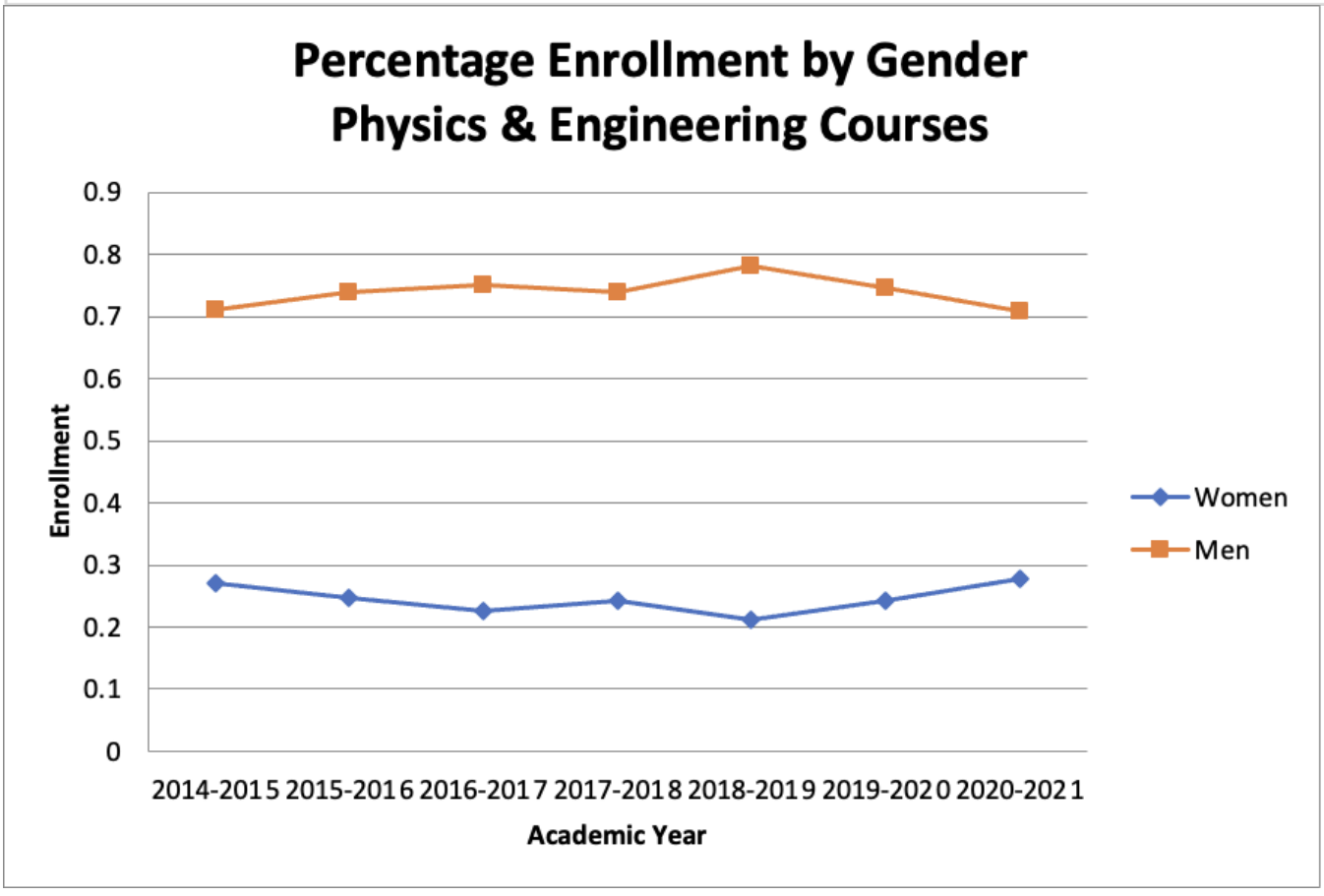
With the number of full-time faculty in our department and the teaching loads that we all carry, there is no time for our faculty to engage in increasing communication with student which is one of the goals of our department.

Demographics by GENDER:


GENDER PERCENTS
PERCENT TOTAL ENROLLMENT
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
FEMALE DEPARTMENT
FEMALE COLLEGE
MALE DEPARTMENT
MALE COLLEGE
UNKNOWN COLLEGE
UNKNOWN DEPARTMENT


percentage enrollment by gender
All Courses
Enrollment
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
women
Men


percentage enrollment by gender
Astronomy & Physical Sciences Courses
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Enrollment
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
Womwn
Men


Percentage Enrollment by Gender
Physics & Engineering Courses
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Enrollment
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
Academic Year
Women
Men

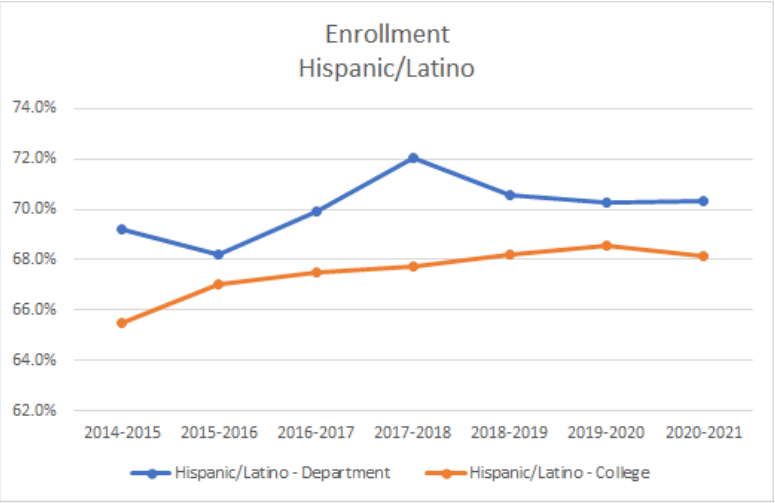
As the graph of percentage enrollment by gender indicates, Cerritos College has about 10% to 15% difference in enrollment between women and men, with more women than men taking classes here. For our department, the trend is reversed. We see about 15% to 20% more men enrolled in our classes than women.

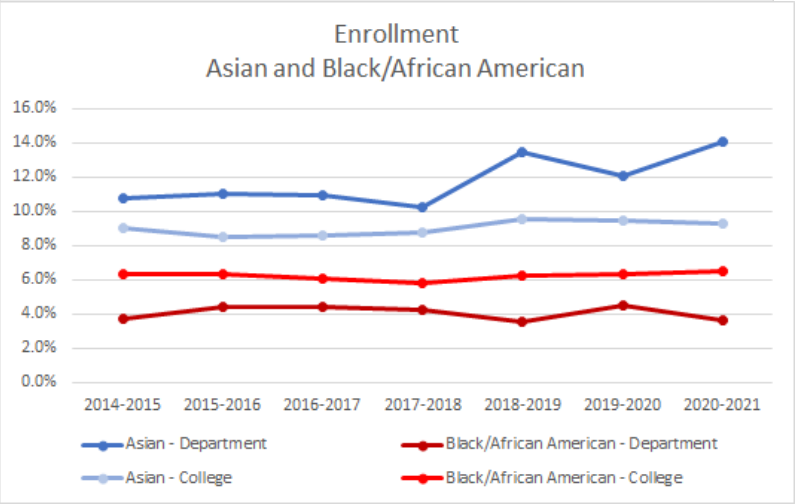
There is a persistent gap between the number of men and women taking the courses offered by our department, and we see this gap widen when we only consider classes in physics and engineering. In those classes we see that 70 to 75% of the students are men and 23 to 28% are women. Even as the number of students taking these classes have increased steadily, this discrepancy has existed. Compare this with a gap between 40 to 45% women and 53 to 58% men in our classes overall.

This is a global trend as it is recorded by most institutions around the world. We have attempted in our department to bring efforts to minimize this gap. We design our courses to be inclusive for all genders. In addition, our department has women faculty to bring role models for women in sciences.

One of the requests you will find later in this report is for creating a position to manage social media and other outreach for our department. We do not currently have the personnel to manage this with the number of classes our full-time faculty are teaching, and the required amount of time for lab and demonstration prep means we cannot add this duty to our stock room staff. Having this role filled by adding a person specifically to handle communication would allow us to increase our efforts to recruit more women and minorities into our program.

Demographics by RACE/ETHNICITY:



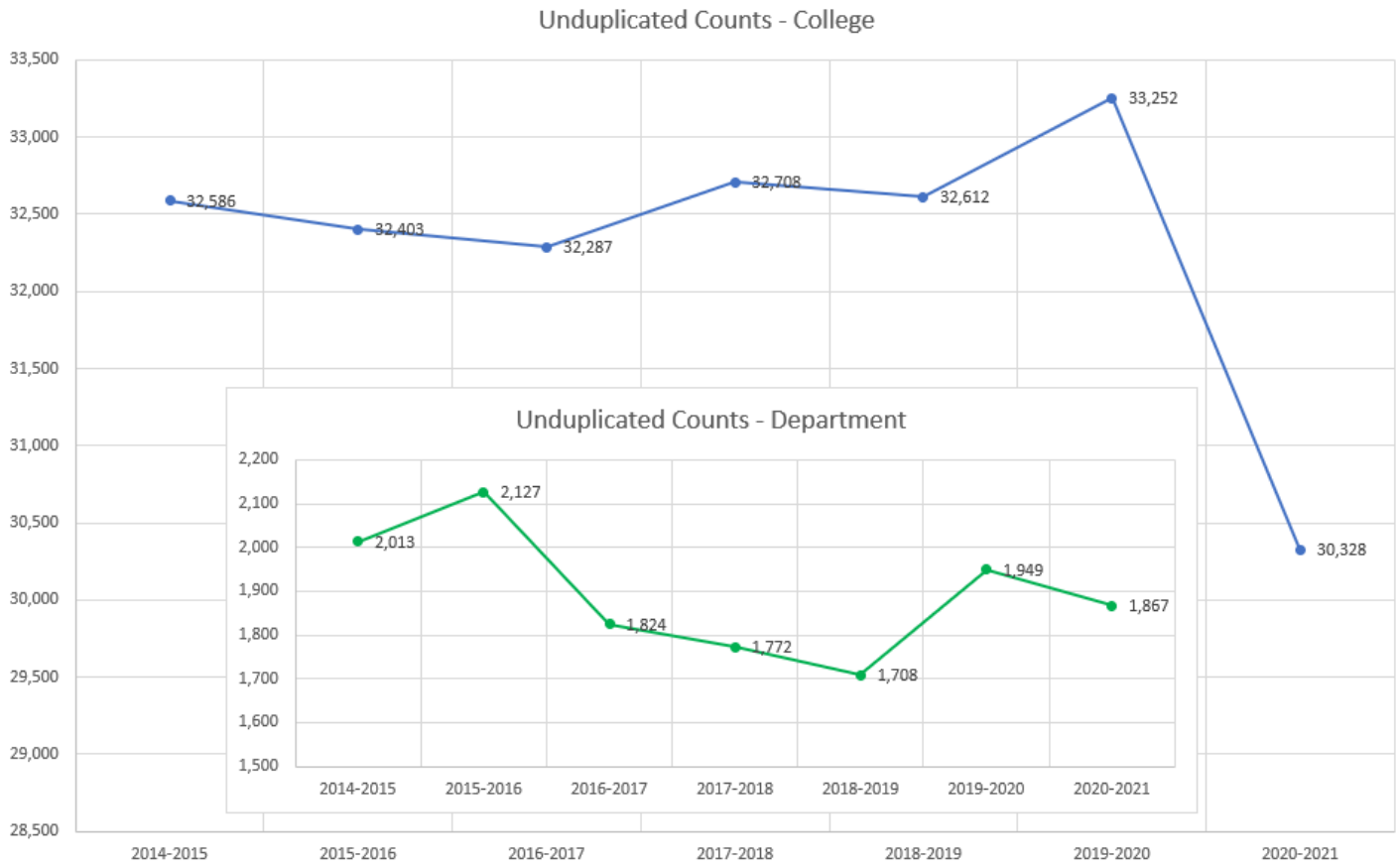


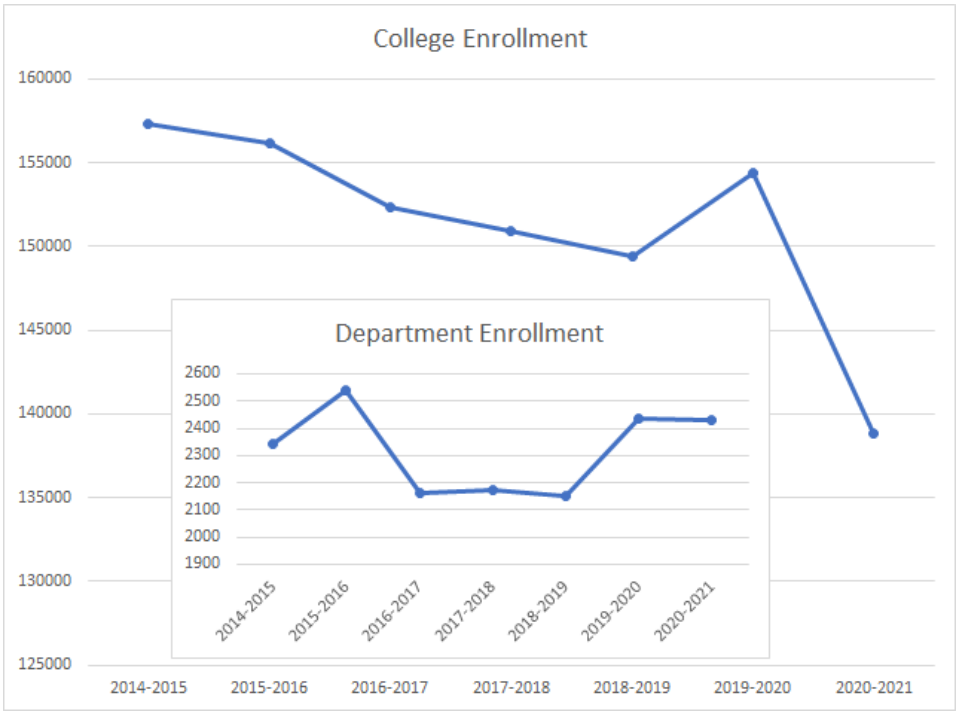
The enrollment percentages classified according to race/ethnicity in our department reflects the college's population percentages. Most of the students who are enrolled in our courses are Hispanic/Latino. These percentages were roughly stable over the period of the last six years.

Comparing percentages of our students across ethnicities, we find a higher percentage of Asian students are taking classes in our department than the percentage of Asian students overall. This trend is reversed for the population of Black/African-American students. For Asian students, our numbers are between 20% and 50% higher than the percentage of Asian students overall at Cerritos College, while for Black/African-American students, the percentage of students is between 28% and 45% lower than for the college overall. The trend for White students is similar to the one for Black/African-American students with the percentage of students in our classes being less than the percentages in the college overall. These trends are parallel to trends we see in other SEM departments like Chemistry. Percentages of students of other ethnicities are too small for determining a trend.

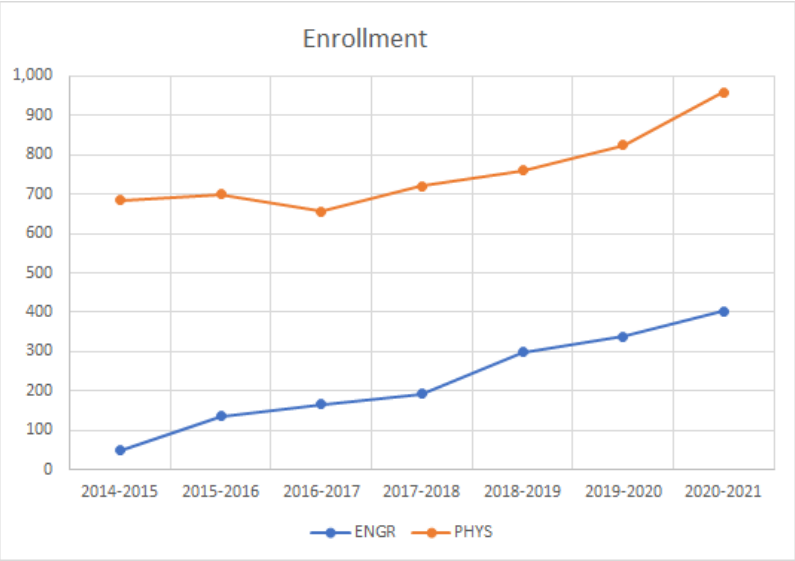
Headcount (unduplicated) and enrollment (duplicated) in the program. Consider the following questions when writing your response:

- Identify enrollment trends.
- Have there been an increase or decrease in enrollment in the last year?
- Are there differences in trends when you disaggregate the data (e.g., online versus face-to-face, demographics, special populations, etc.)?
- How will enrollment trends affect staffing decisions?





Enrollment in Engineering and Physics Courses



When reviewing enrollment trends at the college as a whole, the school has declining numbers during the last two academic years. Physics as a department showed an increase in the number of students that are enrolled in our courses. There is a high demand for our physics and engineering courses. The large dip in enrollment between 2016 and 2019 was due to loss of full-time instructors. When we hired new instructors, enrollment increased. Our enrollment is strongly tied to our instructor availability. We currently have 4 full-time and 11 adjunct instructors. All of the ENGR and PS classes are taught by adjunct instructors. Fifty percent of the ASTR and thirty-eight percent of the PHYS classes are taught by adjunct instructors. We have difficulty finding quality adjunct instructors, although we are always looking. We have requested growth positions through FHP every year. There is a need to hire more full time physics instructors as well as a full time engineering instructor to meet the high demand for our courses.

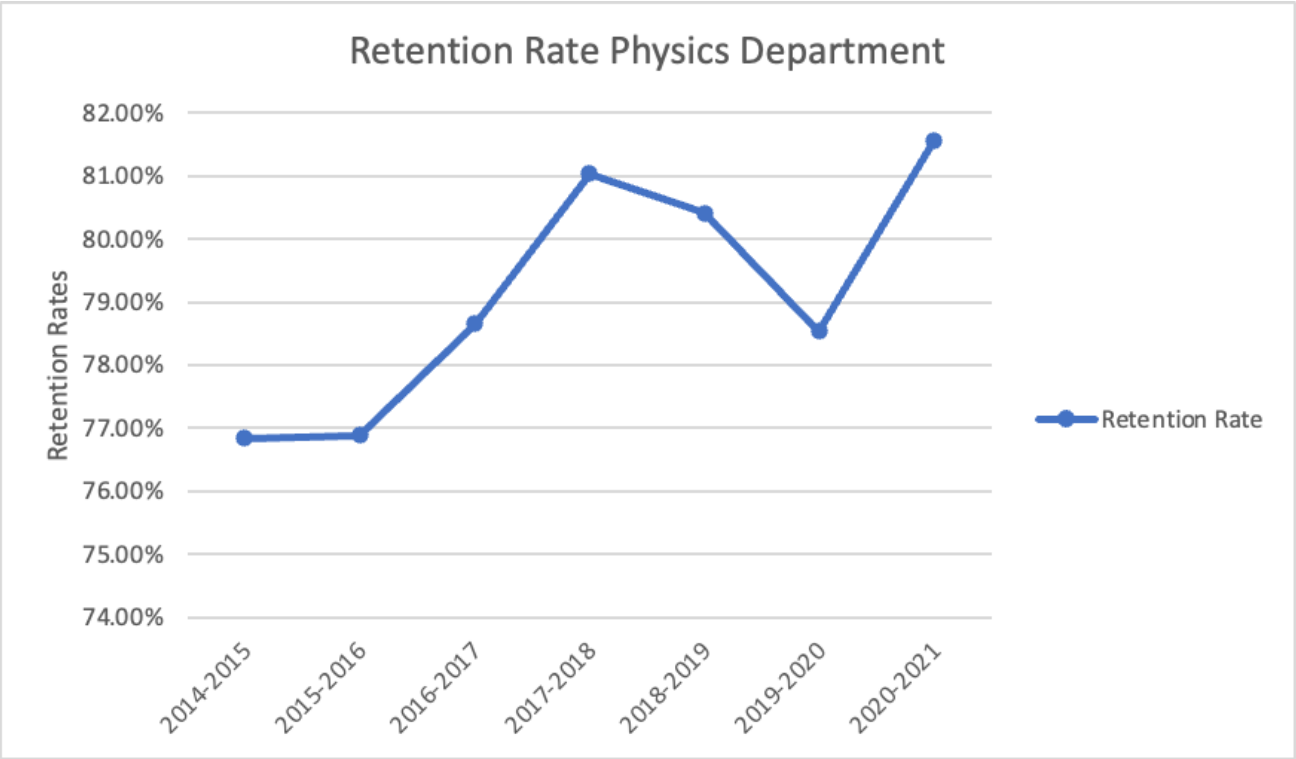
We have also worked to streamline the timing and availability of classes across multiple departments -- Math and Chemistry, in particular. The ultimate limitation is still the number of faculty available to teach the Physics 200 series and Engineering classes.

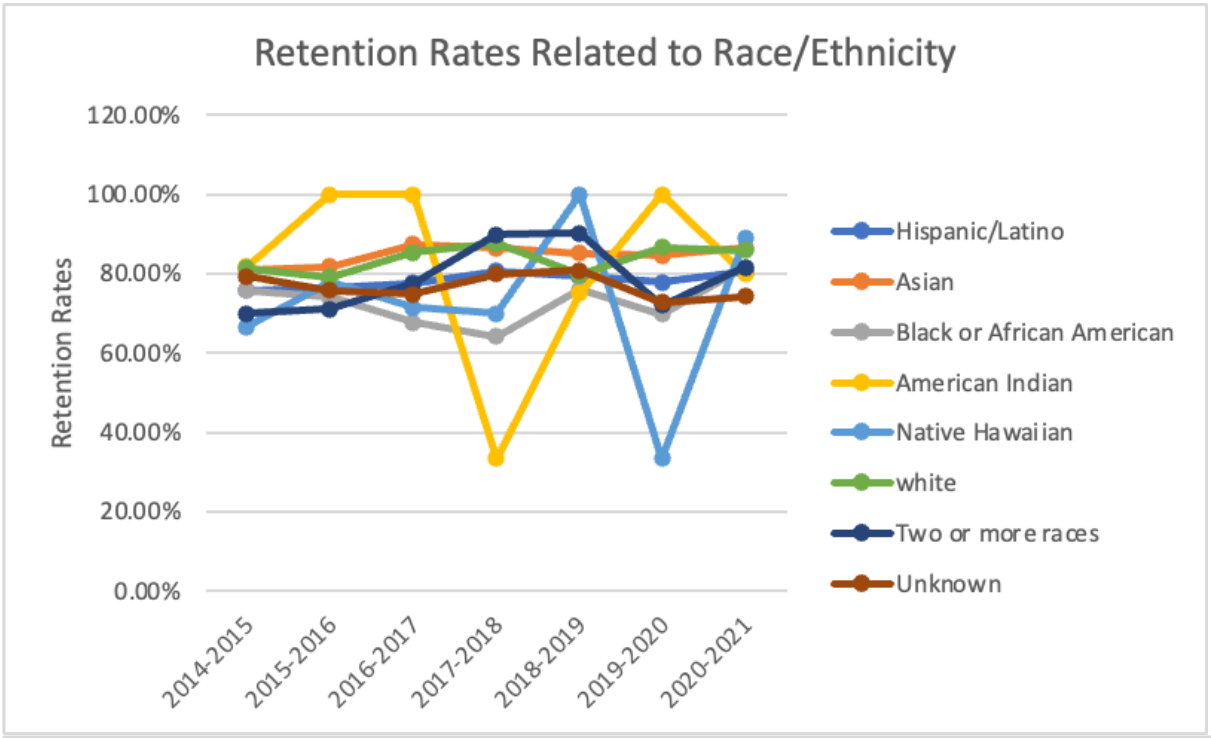
There is a decrease (4%) in unduplicated counts after the beginning of the COVID pandemic, however it was not as pronounced as the decrease the college saw (9%). Even during this time, our enrollment in physics and engineering classes was increasing.

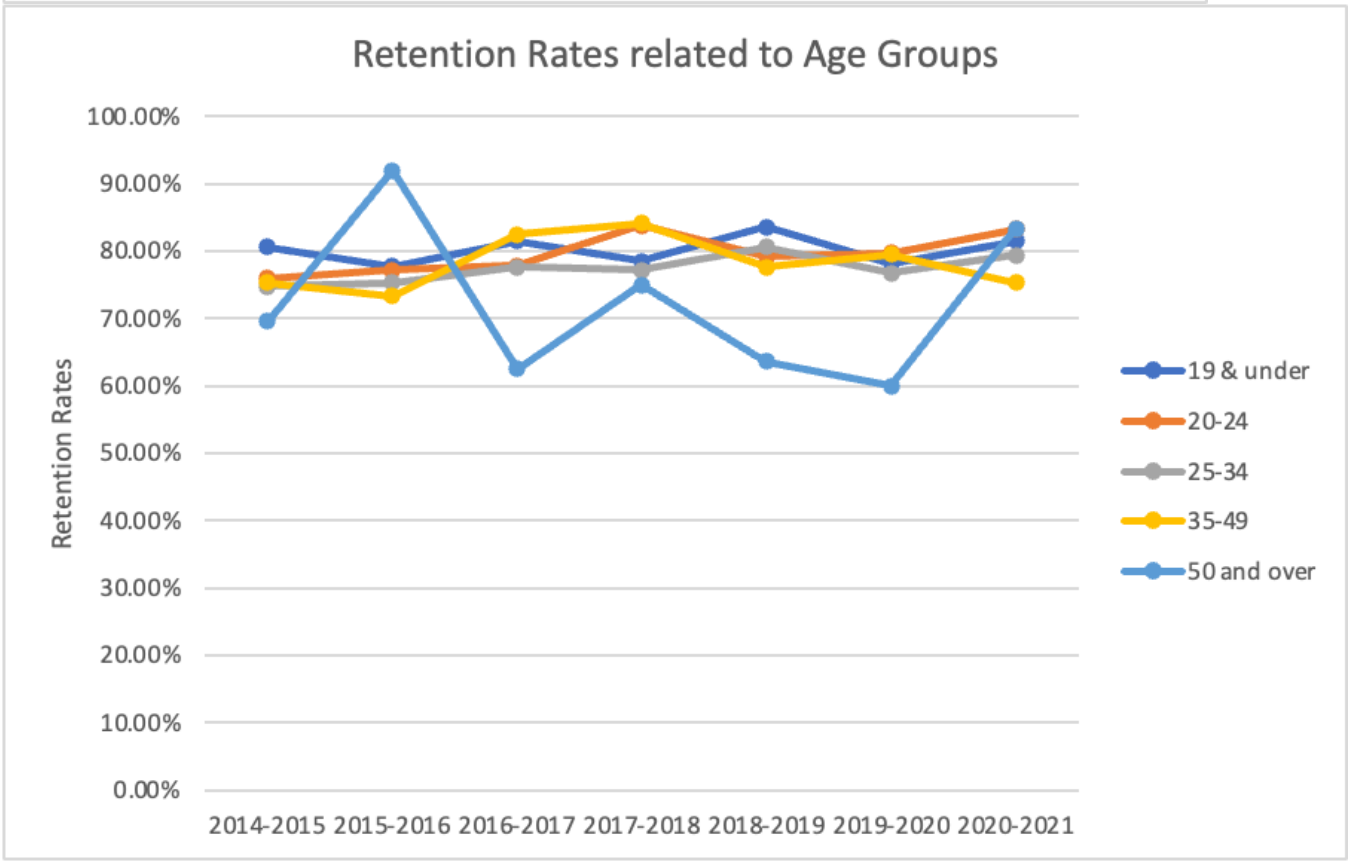
Discuss the program's success and retention rates, addressing any performance gaps if success rates are lower for disproportionately impacted students. Consider the following questions when writing your response:

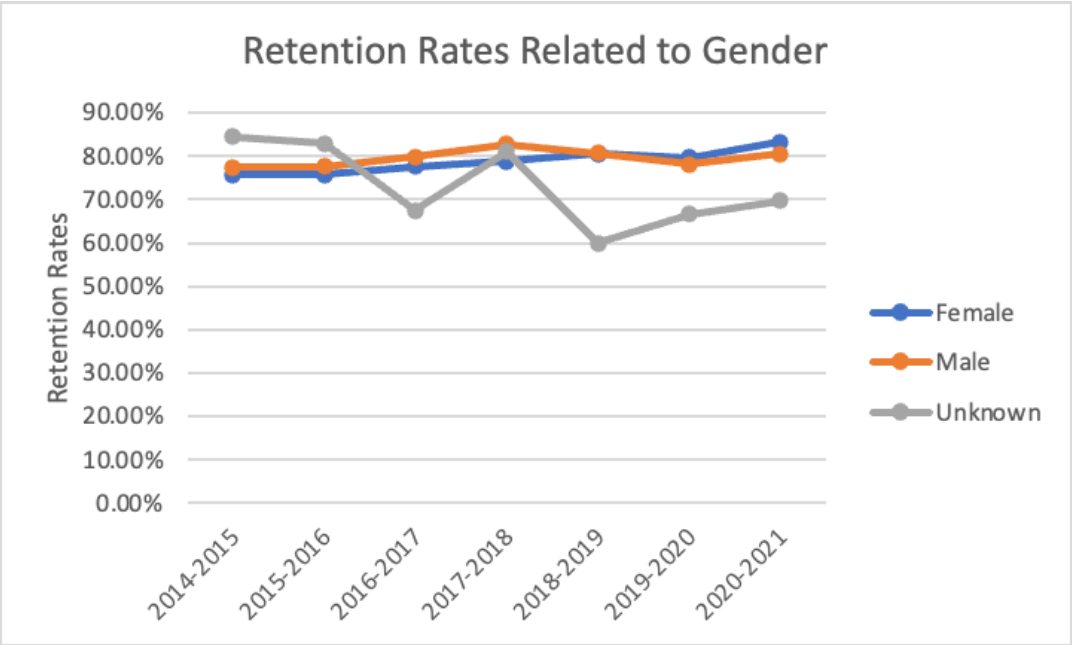
- How have the success and retention rates changed over time?
- Are there particular courses that have particularly low rates and may prove a barrier to program completion?

Retention Rates:



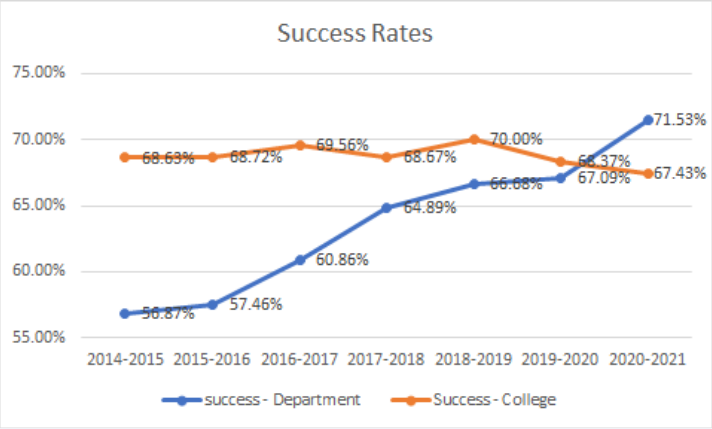

Retention Rates Related to Race/Ethnicity
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
Retention Rates
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
Hispanic/Latino
Asian
Black or African American
American Indian
Native Hawaiian
white
Two or more races
Unknown

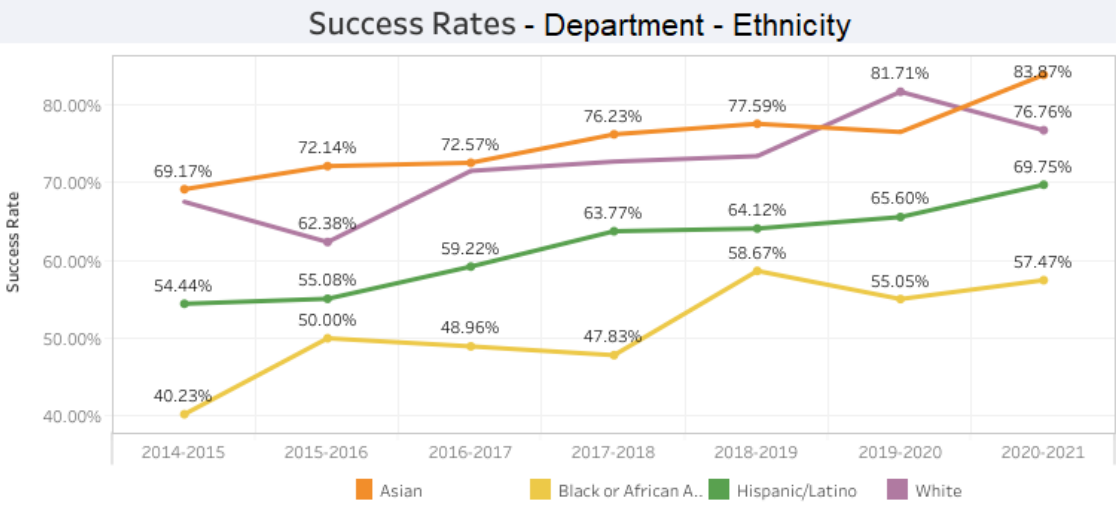

Retention Rates related to Age Groups
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Retention Rates
2014-2015
2015-2016
2016-2017
2017-2018
2018-2019
2019-2020
2020-2021
19 & under
20-24
25-34
35-49
50 and over

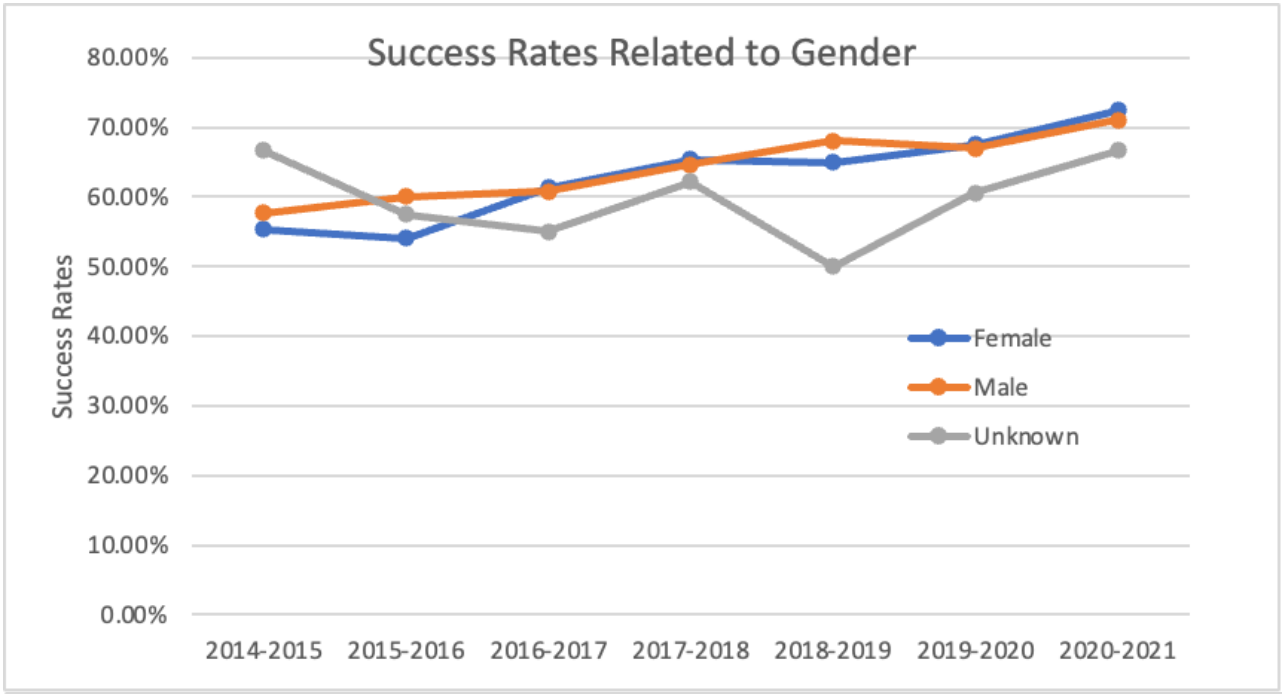


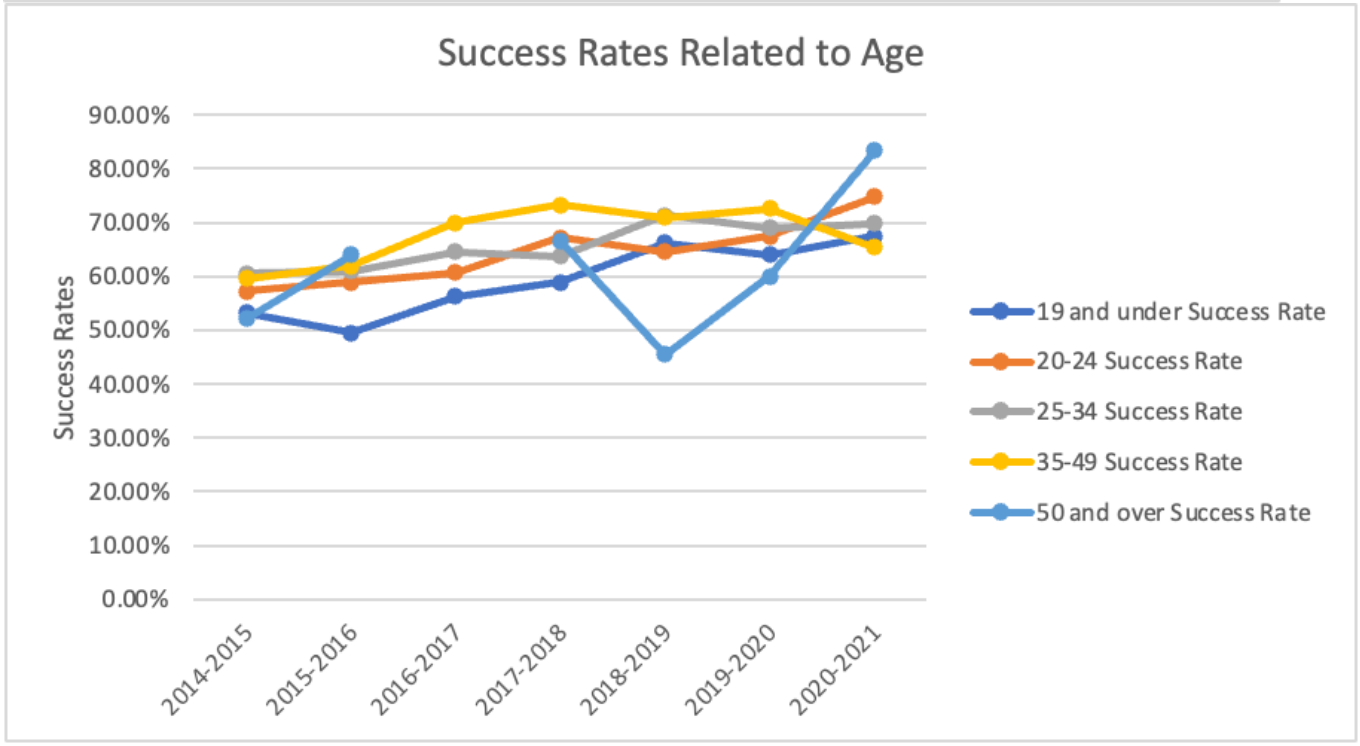
Overall, retention rates in the department have risen other than a small dip in 2019-2020. Retention across race/ethnicity, age groups, and gender are similar.

Success Rates:









Our success rates have been, on average, slowly increasing. In the last year, since we have been in the pandemic, it has surpassed the college's success rate. Much of this has been due to a jump in the success of the physics classes.

Our success rates by gender and age seem similar. There is a distinct difference, however, in our success rates by race/ethnicity. Our success rates in this area are similar to the college's, however there is a definite need to improve success for some ethnic/race groups. This needs to be addressed not just at a department level, but at the college level.

We do not see evidence of particular courses that have particularly low rates of success or retention that may prove a barrier to completion.

In looking at the disproportionately impacted populations within our classes, we find that they are few and always in groups that are very small (less than 6% of total enrollment for the course). They are more likely to be found in our low-level and general education classes and within the African American ethnicity. Comparing our lower-level classes in astronomy, engineering, and physics with similar low-level classes in biology, chemistry, and mathematics, we find the same trend across all of the classes. It does not occur in all classes in all years, but when it does it is most often within this group. When we added an English and history class to the list, the only DI group listed (again, not all years) was the same. This points to a systemic issue, rather than just a department one.

With regards to success and retention rates, what is the program doing or planning to do to close performance gaps and address student equity? Consider the following question when writing your response:

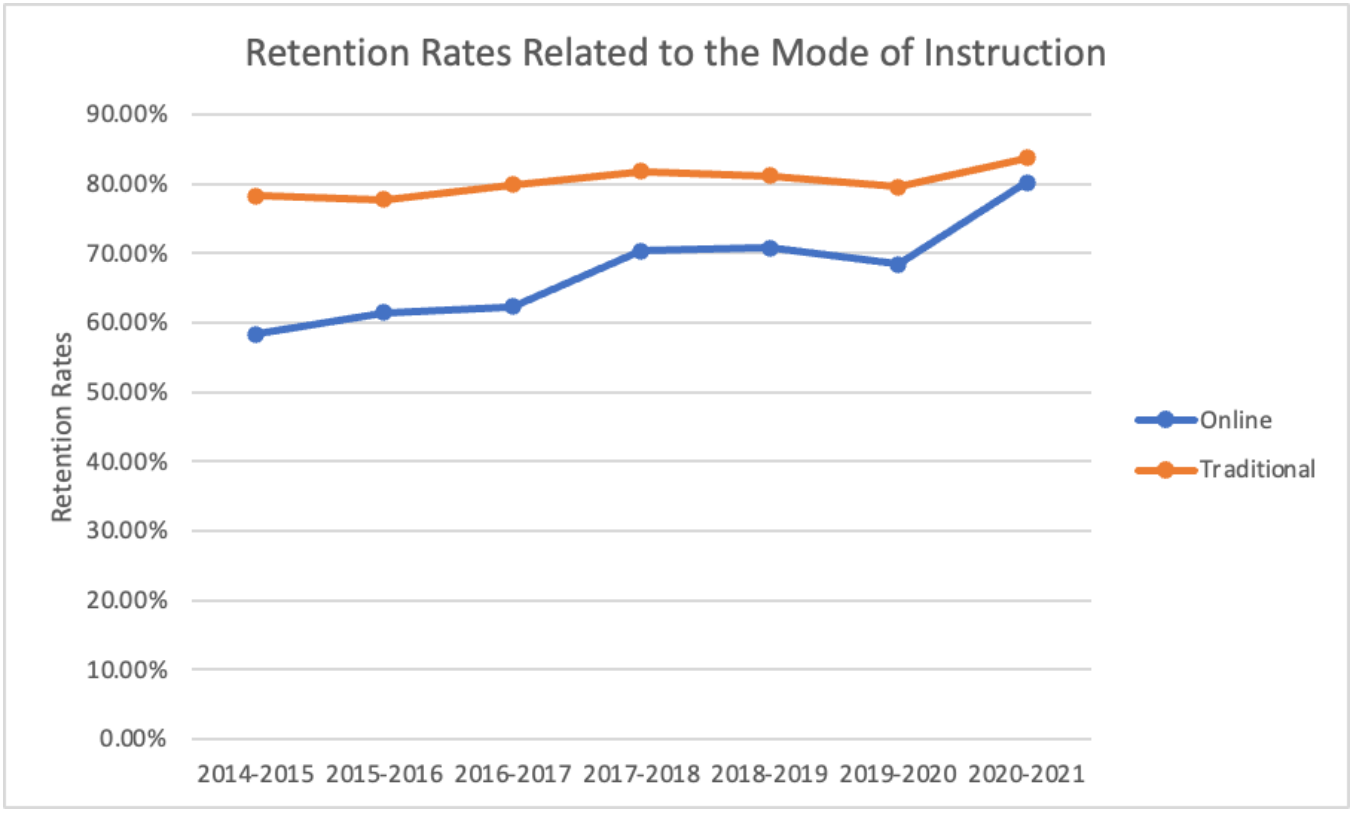
- Are there differences in success rates across delivery method (e.g., face-to-face compared to online)?

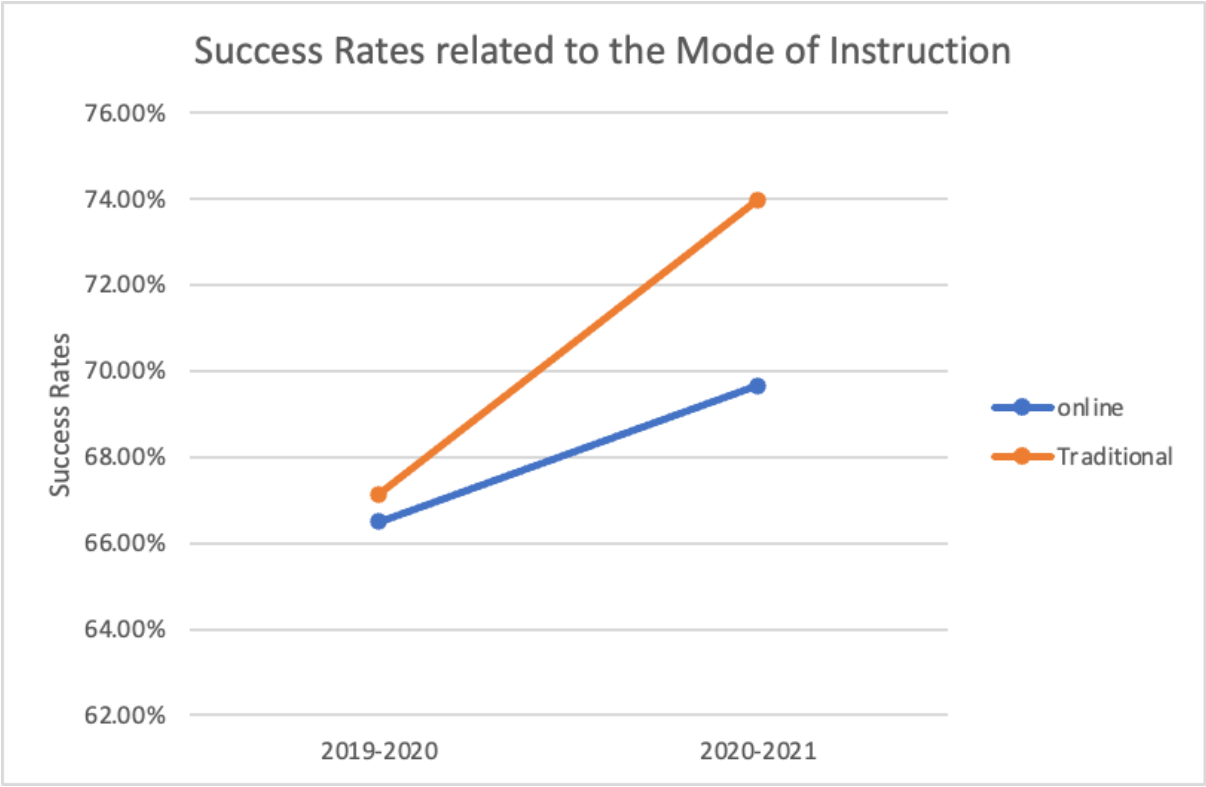
Closing Performance Gaps: Disproportionately Impacted Students

Researching the DI issue, we found research that addressed the issue relating specifically to physics and presented it at a division meeting in spring 2021. The study had 5 key findings.

- First, the students need a sense of belonging, of being part of a community. We have a club on campus, UMOJA, that we do promote to students for this.
- Second, the students need to perceive themselves (and be perceived by others) as future professionals in the field. We have had alumni and those from similar backgrounds as speakers several times in the last cycle and they are a prominent part of our NCAS program. Students really engage with these speakers and find themselves envisioning their own path to their future careers.
- Third, students need teaching that builds on strengths rather than focusing on deficits. One recommendation the study had at this point was to engage in formal and informal mentoring. We have wanted to do this for years, but have not had the personnel to make it a department-wide possibility. It is a part of both the NCAS and Micro-g NExT projects, where we are dealing with smaller numbers of students. In NCAS, we bring in mentors from local industry to interact with the students.
- Fourth, students need easy and destigmatized access to support for nonacademic needs. The college has been making more resources available to students with financial and other needs. We are striving at the department level to get those links out to students. We would recommend that the college put together a website where students could click on checkboxes for all of the possible needs they have and would then get a summary of the support links relevant to them.
- Fifth, college leaders need to design environments, policies, and structures that maximize success. Administrators should become familiar with and encourage students to utilize campus resources, including student affairs offices, dual-degree programs, funding programs, multicultural centers, tutoring, etc. This is a very broad area and, as faculty, we do the best we can to our students.

Closing Performance Gaps: Modes of Instruction





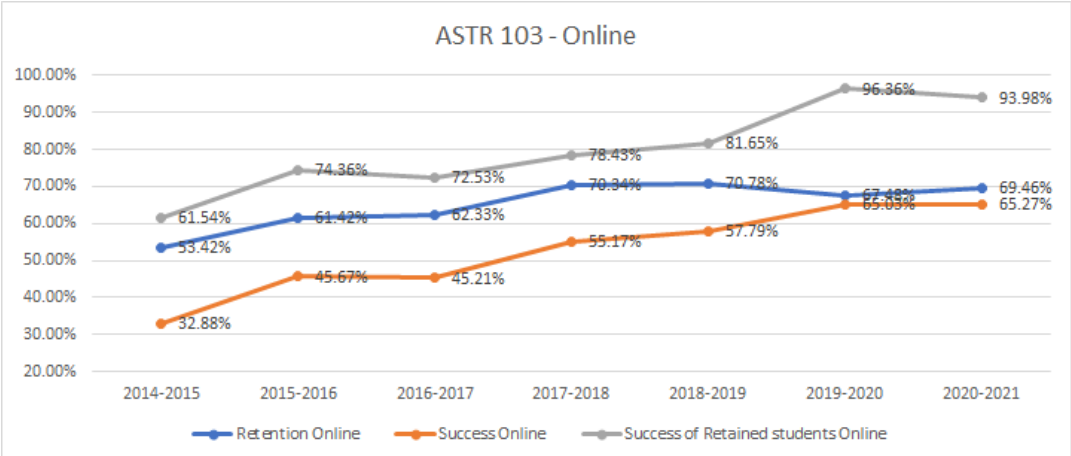
Our retention rates have been, on average, slowly increasing through the six years for both online and traditional classes. Our traditional classes have more retention rates than the corresponding online classes. This can be referred to the nature of the subjects we teach which need hands-on activities and lab work. The online instruction does not provide an effective environment for labs and activities.

This graph represents the success rates for the most recent academic years where our classes were mostly online. There were greater numbers of traditional classes in fall 2019, but fewer following. Our success rates are increasing for both traditional and online modes of instruction.

These graphs are somewhat misleading in that the college has classified REMOTE classes as traditional while online only represents purely asynchronous classes. Therefore, the traditional numbers here include classes that were distance education, but were taught synchronously. Based on this knowledge, it appears that synchronous teaching had better success than asynchronous teaching in 2020-2021. This is likely due to students having more interaction with both the faculty and their peers.

We have offered hybrid classes during the return to school as we move out of the pandemic. We did not offer in-person labs, as we could not guarantee social distancing in the lab without splitting the class in a way that was beyond the time availability of our few faculty. We did offer some in-person and hybrid lectures in both physics and astronomy. From our few data points and in speaking with the instructors, physics students learned more with in-person lectures. We have found that this learning tends to decrease with synchronous lectures and decrease further with asynchronous. Using Studio,when implemented in Canvas, to monitor student participation with recorded lectures and demonstrations, we see that many students in asynchronous classes do not completely watch the recordings. If they are in the classroom, they watch the lecture. That may be the simple answer to the differences.

Discuss conclusions drawn from the program data, assessments (SLOs), and/or other data. Indicate any specific responses or programmatic changes based on the data.
Our data shows a climbing retention and success rate. We review SLOs every semester to look for opportunities to make our program better. In that section, the ASTR 103 online class was referenced. Based on SLO data and observation, a new method of online instruction was initiated. We can now see how the changes affected the class.



The change in method was instituted in Fall 2019. The retention dropped slightly, although that could be due to method or pandemic, however the success went up. The gray line indicates the success rate of those students who did not drop the class. You can see that those who remained in the class jumped to much higher success rates. This truly shows how a change in method even within the same modality can affect the success rate of a class.

We did notice the difference in success based on ethnicity/race previously. We have researched this and even presented about it at a division meeting. The division discussion included

research on how to mitigate the situation in physics students, however a great deal of the research said that there needed to be school-wide support. Cerritos College has moved toward that, providing more student services than ever before. As faculty, we are doing our best to get the information out to the students to help them. In addition, we provide experiences and projects that they may not get elsewhere. Although this may or may not help in their class grades, it will certainly affect their overall educational success. The NASA programs are available in other places, however not all colleges nearby support or offer these programs to students. Although these experiences may or may not help in their class grades (as they are not classes although may increase their skills to improve class grades), they will certainly affect their overall educational success through greater skills, networking, experience, and internship and research opportunities.

Curricular Course Review : Version by **McLarty-Schroeder, Janet** on **01/31/2022 20:19**

Provide the curriculum course review timeline to ensure all courses are reviewed at least once every six years.
All courses were reviewed Sep 24, 2020. They are now all on the same schedule.

Explain any course additions to current course offerings.

At the time of our last program review, we had just completed revisions and additions to our engineering program and were about to start offering ENGR 110, 112, 215 and 235. Since then, we have added ENGR 210, 215L, 220, 240 and 245. Of these, we have yet to offer ENGR 210 and 220 due to issues related to restrictions with the pandemic. These have been addressed and we are moving forward with both. This represents the continued expansion of our engineering program.

Explain any course deletions and inactivations from current course offerings.

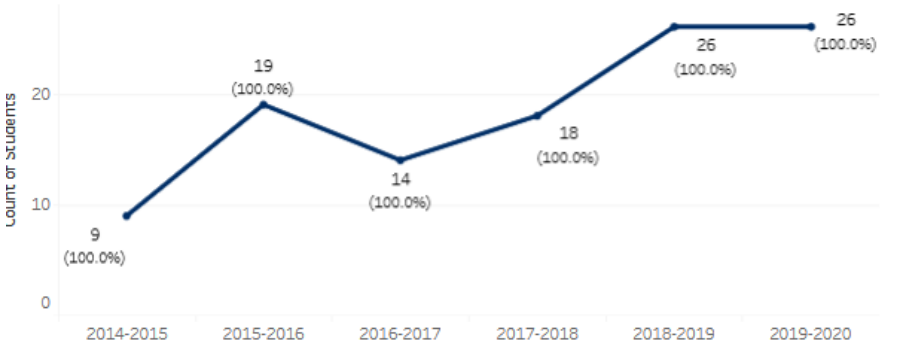
No courses have been deleted or inactivated during the last cycle.

Discuss how well the courses, degrees, and/or certificates meet students' transfer or career training needs. Consider the following questions:

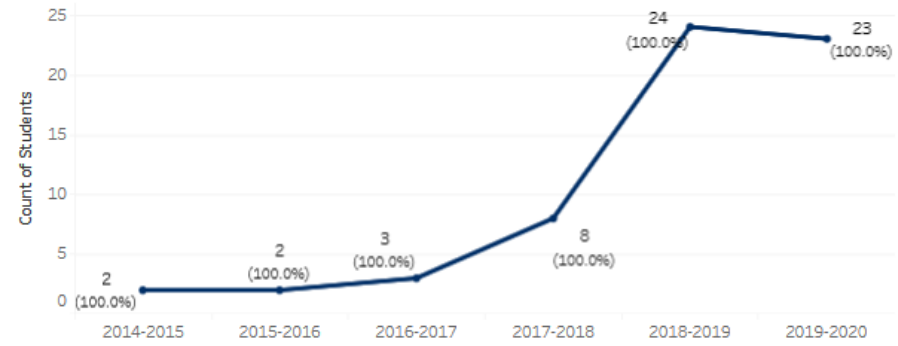
- Have all courses that are required for the program's degrees and certificates been offered during the last two years? If not, has the program established a course offering cycle?
- How has degree and/or certificate completion changed over time?
- Are there sufficient completers compared with the size of your program?

We offer four degrees within the department and a variety of classes that are part of degree programs for other departments. All courses are offered either every semester or every year.

The number of degrees awarded has been rising through time.



Physics Degrees



Engineering Degrees

Unfortunately, the number of degrees awarded does not come close to the number of students in the major. For engineering in Fall 2021, we have the following major counts:

Major	Student Count
Engineering:Elec Specialty-AB	21
Engineering:Elec Specialty-AC	13
Engineering:Elec Specialty-AS	5
Engineering-AB	151
Engineering-AC	168
Engineering-AS	54
Engineering-Tran	25
Engr:Aerospace&MechSpec-AB	11

Engr:Aerospace&MechSpec-AC	8
Engr:Aerospace&MechSpec-AS	6
Total Count	**462**

The CalState Dashboard indicates that 88% of transfers in 2020 to a CSU in engineering transfer without a degree.

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.

There are no licensure/certification exams required for our programs.

Program Reflection

Six-Year Program Reflection : Version by **McLarty-Schroeder, Janet** on **02/15/2022 17:50**

Provide an analysis of your program throughout the last six years, reflecting on student demographics and enrollment. Reflect on any changes you would like to see in your program in the next six years.

The physics, astronomy and engineering department has shown a great potential for growing and expanding. The enrollment of the department has not just grown in numbers but also in the type of student demographics we served. However, it is clear from the data that the lack of full time faculty has hindered us from providing the necessary support and resources to our students.

Currently, the total number of hours taught by full-time faculty is 45% above base load. This is nearly enough to justify two additional full-time positions for our department. There are still not enough courses offered for all physics and engineering students to move through without delaying their degree.

In the past program review period, two full-time faculty retired – Robert Buschauer in 2016 and James Henriques in 2018. This is reflected in our enrollment by a drop in the number of students taking our classes. Enrollment increased again when we hired Asma Said as a full-time physics professor in 2019.

We do not currently provide enough seats in physics each semester for our own majors and certainly not for the more than a dozen majors that require physics as part of their degree. If we have 500 engineering and physics majors that need four sequential physics classes, we would need to provide 500 seats in physics classes each fall and spring semester just for our students to finish within two years. In spring 2022, our physics capacity is 318 seats. Therefore, to accommodate our majors and chemistry, biology, computer science, architecture, physical therapy, and a variety of others is simply not possible. The reality is that students know this and either take classes at other schools or transfer without the physics (and the degree that requires it).

One critical change that must happen in the next six year is the addition of new full time faculty. The natural consequences of our current situation is the migration of our students to other institutions. We simply do not have the human resources to provide the classes.

Our faculty all go above and beyond to help students in multiple ways. Given our small number, we must select a few ways we can help and realize we are not able to do more. In addition, since our faculty also run our extracurricular activities (NASA programs, robotics and astronomy clubs) and still teach in overload, we simply do not have the time to take on more responsibilities. Spending time researching opportunities, increasing outreach, reviewing student transcripts to ascertain degree requirements, and even large-scale mentoring is not possible.

What is the six-year trend of degrees and certificates awarded? Is there anything you can do to help increase the number of students who acquire degrees and/or transfer?

The overall trend is low but rising in both physics and engineering. With the increase in curriculum in Engineering beginning in 2014 and then the increase in the number of degrees available, we have seen a steady increase in engineering degrees awarded, however they do not come close to the number of students in the major. (23 v 462)

It has become clear that most engineering students transfer without getting the degree. Reasons for that are unclear. There needs to be communication with these students and whatever barrier there is to them receiving the degree before transfer needs to be reduced or eliminated.

We have difficulty communicating with students within our majors. The college does not maintain the ability for such communication between departments and student majors.This hinders our ability to disseminate information. When the college provides contact information we can send emails to students, however this is sporadic. We can make a Canvas page for information and link it to our department web page and post information there.

In addition, engineering students should be made aware that most of them will have completed the coursework for more than one degree by the time they are ready to transfer. These other degrees should be pointed out to them and the process of receiving multiple degrees should be streamlined by the college. In fact, it would be optimal if the college could automatically award degrees as they are earned or at the time the student indicates that they are transferring to a four-year institution. This is not something that can be done at the department level. We do not have access to the information necessary, do not have the authority to make changes, and do not have the time to take on a project such as this.

Were there any unplanned events (positive or negative) that affected your program? If so, what were they and how did they affect the program?
At the onset of the pandemic in 2020, we were able to move our classes online relatively smoothly. The biggest challenge with this was maintaining quality lab classes. We saw our student success rate increase, however tracking the ability of students to show mastery of material through the PHYS 200 classes indicates that their comprehension decreased.

We started a collaboration with NASA and the California Space Grant Consortium. The Promoting STEM Preparation at California Community Colleges Using Low-Cost Programmable Micro-Computers (Arduino) and NASA Community College Aerospace Scholars involvement were both started during the last cycle. This brought more engagement and experience to the students of our college. With the help of the Foundation and ASCC, we have been able to offer funding to students who are not citizens, as well. Students who completed either of these programs tended to want to do more and went on to participate in other programs and internships (both in and out of NASA). A group of students who had participated in NCAS initiated our participation in the NASA Challenge Micro-g NExT. This has brought recognition to Cerritos College and to our students. Students from the last Micro-g NExT team have all transferred and are doing very well. A recent survey of the students who went through these programs have found them in a variety of professions and graduate schools with many internships behind them. They all say that these programs were beneficial (in some cases profoundly beneficial) to them and their career path. The benefits to the program include recognition and students choosing our school rather than others due to the opportunities available to our students.

The work required for this is substantial and done by our faculty entirely on a volunteer basis. The hours far exceed the yearly time required for staff development. Last year, more than 400 hours were tracked by the department chair alone to run these programs.

A few students return to help with the NCAS alumni panel (1 hour), however most students from the NASA programs transfer and do not return.

Please describe any recent achievements in your program by faculty and staff who have won awards or distinctions, new projects your program has implemented, committee work, professional development work, conference presentations, community engagement, or recently published work.
Profs. Janet McLarty-Schroeder and Carlos Mera have mentored 73 students through the Promoting STEM Preparation at California Community Colleges Using Low-Cost Programmable Micro-Computers (Arduino) program between 2016 and 2019. Professor McLarty-Schroeder presented her work with the California Space Grant Consortium at the national space grant conference in Washington DC in 2017. It was through their exceptional work on this program that they were invited to be part of a special pilot program with NASA Community College Aerospace Scholars (NCAS).

From 2016-2021, Cerritos College has had 121 students complete the NCAS program. Profs. McLarty-Schroeder and Mera continue to facilitate this opportunity and have worked to make Cerritos College one of six pioneering community colleges nationwide hosting a “NASA on Campus” experience. Students participating in this program have had the opportunity to visit a variety of NASA facilities, including the Johnson and Kennedy Space Centers. As part of this program, Profs. McLarty-Schroeder and Mera are recognized as Primary Investigators (PIs) with NASA under their Minority University Research and Education Project (MUREP) program. As PIs, they have attended many conferences and training sessions at NASA facilities.

Cerritos College is now supporting our third team of students in applying to the Micro-g NExT challenge, which is also affiliated with NASA. This is the second year our team has made it to phase 2 of the challenge. Professor McLarty-Schroeder is faculty advisor to the team, with Adjunct Professor Allen Bakalyar helping to advise students, as well. Professor McLarty-Schroeder was spotlighted in the Micro-g NExt March 2021 Newsletter and was asked to be part of their faculty panel both in 2021 and 2022.

In addition to his work with the NASA programs, Professor Carlos Mera was also named Most Outstanding Faculty 2017-2018 and is the advisor for the Robotics club.

Dr. Thad Szabo concluded a project with Cerritos College students in 2016 related to studying the distribution of galaxy clusters in our universe. This was affiliated with the Cosmology Group at USC. The research led to a refereed journal publication in 2018 in which four Cerritos College students were listed as co-authors.

The Astronomy Club here at Cerritos, under the advisorship of Thad Szabo, was able to secure ASCC funding which led to the installation of a permanent observatory on the MCIS building in March 2019. This facility has been used with our Observational Astronomy labs as well as other events, such as viewing the transit of Mercury in November 2019 and getting images of the Great Conjunction between Jupiter and Saturn in December 2020.

Additionally, Thad Szabo has worked with the CAMPARE and Cal-Bridge Programs at Cal Poly Pomona to recruit Cerritos College students for summer astronomy and physics research opportunities with a variety of universities and institutions during 10-week summer programs. Cerritos College has had several students participate and go on to present their research at national conferences.

Provide a status update on goals from the last program review cycle.

Goals from 2015	**Updates in Jan 2022**
G1: In order to keep faculty strong, we want to encourage faculty development.	Our goal was at least one conference per year per faculty member. Our work in our projects has allowed us to make this occur most years.
G2: To make sure that we are teaching our classes at the same level (or above) as those at the transfer institutions, we will compare classes in terms of content, resources, and hands-on activities.	This is something that must be looked at regularly. It is ongoing.
G3: In order to improve teaching, offerings, research and internship opportunities, knowledge of current practices, our goal is to increase faculty interactions with other faculty both at our college and at other institutions.	This has happened through conferences and projects. Interactions with other faculty participating in NASA programs occurs monthly. We worked with USC to try to obtain a grant to make a cubesat, but did not get the award. We maintain good relations with USC, however.
G4: We need to make students more aware of course offering, opportunities, related events, etc.	This has been hampered by the college not having a good communication system for departments to use to contact their majors. There was OrgSync for a short time, which we used with the help of IERP providing student lists of our majors. We do not have a method currently.
G5: We aspire to provide a faculty mentor for each student majoring in our field(s).	We started this, but have too few faculty and too little time. Most of our students are engineering and we do not have a full-time engineering faculty member.
G6: Our goal is to establish or find remote astronomy telescopic viewing opportunities for our students.	Thanks to help from the ASCC, we now have an observation platform on top of the MCIS building. With a bit more work, it will be able to be accessed remotely.
G7: Tutoring is necessary for the success of the students. We need to expand our offerings for student tutoring.	We do have some tutoring, but more is needed.
G8: Our goal is to look specifically at classes within our department to try to determine factors affecting low completion and success rates. (We will look at class size, modality, tutoring availability, student preparedness, cost of textbooks, etc.)	We have done this.
G9: We need to find funding to help support our programs.	This is ongoing.
G10: We are at the beginning of building an engineering program for the large number of student majors. There is a lot of work to be done to get to a robust program for the students.	This is ongoing.
G11: Our goal is to build engineering, physics and astronomy communities to allow students moving along the same path to network and share resources.	We have not been successful in building communities outside of those of shared experience in the classroom or projects.
G12: The lack of adjunct faculty available is inadequate to the needs of the department. We need to bring in more full time faculty so that we do not need to keep canceling classes, negatively affecting the transfer rate of students of many majors.	We have the same number of faculty and even more student interest.
G13: We need to increase our teaching space to accommodate our ENGR program (which has NO allocated space) and to allow for outdoor teaching areas and increased laboratories. (Increased space for all of our areas.)	We still have no allocated space.
G14: We need to have dedicated equipment for engineering classes.	We have received equipment for the circuits classes and some of the equipment for the materials class.
G15: Involvement in research is a great way of getting students engaged and promoting student success. Our goal is to encourage as many students as possible and are able to engage in research within their desired field. This could be through internships or bridge programs or research on campus or other opportunities. This helps propel students forward in the field and makes them more competitive for positions at transfer institutions.	We have encouraged students to pursue internships and have held internships at NASA information sessions. When we hear of available opportunities, we hope faculty will share them with their classes. We lack a better communication system.

If applicable, describe the resources the program received from the last review cycle and the impact it had on the program?

1. Equipment for the circuits class (lecture and lab) has allowed us to offer the class. We could not without it.
2. We have partial equipment for the Materials class and work to get the rest. With help from other departments to supplement what we have, we should be able to offer the class soon.

3. The college has supported our participation in projects that require some financial backing, such as the NASA projects. These have profoundly affected the students' engagement and have brought us new students and more opportunities. It has provided more interaction between faculty (with within and outside of our college) and staff development. It has also brought us new contacts in industry.
4. With support from the college for space and the ASCC with funding, we have a rooftop observatory. This has allowed for better observations and gives students a better view of sky objects. With a bit more work and setup, this observatory can be made remote.

Resource Requests

Faculty Resource Request(s) : Version by **McLarty-Schroeder, Janet** on **02/15/2022 17:50**

Program/Department/Division:

Physics, Astronomy and Engineering

Title of instructor position:

1. Engineering Faculty Full time
2. Physics Faculty Full time

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

1. Critical
2. Critical

Is this position:

- New (not in the current budget)
- Replacement (in the current budget, currently vacant or will be vacant in the next budget year)
- Full-Time Temporary
- Conversion (grant to general fund)

1. New
2. New

Cost estimate:

1. 70084.00
2. 70084.00

Occurrence:

- Recurring expense
- One-time augmentation

1. Recurring expense
2. Recurring expense

Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

1. General Fund
2. General Fund

Provide a summary and rationale for this position. Explain how the position will help the program better meet its goals.

1. The engineering department currently has about 500 engineering majors and no full-time faculty. The department needs a full-time person that can be in charge of expanding the class offerings, organizing outreach and curriculum. The new faculty will be in charge of opening communication channels to four-year institutions to create a transfer pipeline for engineering students.
2. Currently the physics department has two full time faculty members who teach physics full time. Both faculty have a 140 % teaching load. In addition, two of our Astronomy faculty help by teaching a couple of physics classes on top of their regular load. In addition, the department has hired several adjunct faculty. One of our critical 200 level classes only offers one section that is being taught by a returning retired faculty who is planning to leave permanently in two years. However, the department is still not able to offer enough classes to cover the demand that we have. An extra physics faculty member will allow us to increase the number of sections that we offer and strengthen the department. With the extra help, faculty will have the time to create more opportunities for our students.

If this position is not filled, what is the potential impact to student success?

1. Not filling this position will affect the number of class offerings for our students. This can result in students leaving Cerritos College for other schools with bigger programs. Also, the lack of classes will affect the preparation level of our students which could result in a lesser success rate once they transfer to a four-year institution.
2. Every semester we turn away students because we do not have enough class offerings. Especially in our upper-level classes. This situation is forcing students to stay longer at Cerritos and delaying their transfer plans or to leave our college to pursue their education elsewhere.

Classified Resource Request(s) : Version by **McLarty-Schroeder, Janet** on **02/15/2022 17:50**

Program/Department/Division:
Physics, Astronomy and Engineering

Position requested:

1. **Engineering Program Staff - Program Assistant II**
2. **Internship Bridge and Articulation Staff**
3. **Planetarium Director**

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

1. Critical
2. Important
3. It can wait (we would need the facilities first)

Is this position:

- New (not in the current budget)
- Replacement (in the current budget, currently vacant or will be vacant in the next budget year)
- Full-Time Temporary
- Conversion (grant to general fund)

1. **New - Full-Time Temporary**
2. **New**
3. **New**

Cost estimate:

1. **52029**
2. **50000**
3. **100000**

Occurrence:

- Recurring expense
- One-time augmentation

1. **One-time augmentation**
2. **Recurring expense**
3. **Recurring expense**

Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

1. **Other funding**
2. **General Fund**
3. **General Fund**

Provide a summary and rationale for this position. Explain how the position will help the program better meet its goals.

1. The Engineering program needs a person in charge to build a coherent program and pathway. This person will spend a year building connections and mapping the necessary class to optimize the educational pathway of our engineering students.
2. This person will be in charge of researching internship opportunities for engineering students. The duties will include to find and advertise internships, bridge programs, and articulation agreements. This position could be shared with other departments within the SEM division.
3. The person in this position will run, maintain and coordinate the use of the planetarium. This position will also run the outreach shows for schools and communities.

If this position is not filled, what is the potential impact to student success?

1. Without the proper guidance and pathway our engineering program will never be able to grow and be successful. This will continue to impact the transfer success of our engineering students. Dominguez Hills is a four-year university partner and the school does not have an engineering program. Cerritos College needs to be able to establish contacts outside our area to be successful.
2. Our students are in need of proper guidance and access to engineering resources. Being able to have connections to internships and four-year schools outside our area is critical. Or four-year partner school does not have a engineering program and we need to be able to make connections outside our area and tap to resources that are not available to our students right now.
3. Not having this position will interfere with the growth of the Astronomy program. Students will not have access to resources that will increase their interest in Astronomy as a major and profession.

Other Staffing Resource Request(s) (e.g., Manager, Confidential, etc.) : Version by **McLarty-Schroeder, Janet** on **01/31/2022 20:19**

None.

Program/Department/Division:
No Value
Position requested:
No Value
Priority:

1. Critical (mission critical or must have)

2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

No Value
Is this position:

- New (not in the current budget)
- Replacement (in the current budget, currently vacant or will be vacant in the next budget year)
- Full-Time Temporary
- Conversion (grant to general fund)

No Value
Cost estimate:
No Value
Occurrence:

- Recurring expense
- One-time augmentation

No Value
Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

No Value
Provide a summary and rationale for this position. Explain how the position will help the program better meet its goals.
No Value
If this position is not filled, what is the potential impact to student success?
No Value

Professional Development Resource Request(s) : Version by **McLarty-Schroeder, Janet** on **01/31/2022 20:19**

Explain and justify the program's training and professional development needs. Explain how the training/professional development will help the program better meet its goals.
Department faculty need to attend conferences to stay up to date on new research and network. Students can be taken to these conferences to help them learn that research is important for their upcoming career.
Professional Development Resource Request(s):
Funding for conference attendance
Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

Important
Cost estimate:
15000/annually
Occurrence:

- Recurring expense
- One-time augmentation

Recurring expense
Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

general fund

Facilities Resource Request(s) : Version by **McLarty-Schroeder, Janet** on **02/15/2022 17:50**

Identify and justify any facilities and equipment needs. Explain how it will help the program better meet its goals. If possible, indicate other disciplines who may share this space.
1. Engineering lab rooms (2) and storage space
The lab rooms will provide a proper learning space for our engineering students. The engineering labs require equipment that is permanently mounted to the lab stations in order to facilitate its use.
2. Planetarium
The planetarium facility will be used to enhance the teaching experience of our astronomy students.
This planetarium can also be used as an outreach facility and more community involvement.
3. Microscopes
These microscopes will be used in our engineering material science laboratory class. The equipment is needed to meet the curriculum requirements of the class.

4. Coulomb's Law Apparatus

The physics 202 lab classes do not have much in terms of experiments that would teach students about Electric Forces, specially Coulomb's Law, which is a fundamental topic in electromagnetic physics courses that engineers have to take.

What impact will this have on student success? What is the consequence of not getting this request fulfilled?

1. Engineering lab rooms (2) and storage space

The engineering program's ability to grow and be competitive with other colleges programs will greatly be hindered without these lab rooms. The department will not be able to offer several lab classes without the proper space and equipment for those classes.

2. Planetarium

The lack of a planetarium is not allowing our Astronomy department to expand and be able to expand the classes and degrees that we offer. Our community outreach efforts are greatly hindered by not having a planetarium.

3. Microscopes

Right now the department is using Microscopes from the biology department. However, those microscopes are not strong enough to provide proper instruction to our students. Not getting a set of microscopes will not allow the department to cover the class curriculum completely.

4. Coulomb's Law Apparatus

The effect of electric forces can be a very abstract concept to some students. Without this equipment our students are not able to get a complete picture of fundamental physics concepts like the Inverse Square Law.

Facilities Resource Request(s):

1. Engineering lab rooms (2) and storage space
2. Microscopes
3. Planetarium
4. Coulomb's Law Apparatus

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

1. Engineering lab rooms (2) and storage space (Important)
2. Planetarium (It can wait)
3. Microscopes (Critical)
4. Coulomb's Law Apparatus (It can wait)

Cost estimate:

1. Engineering lab rooms (20) and storage space (depends on facilities)
2. Planetarium (depends on facilities)
3. Microscopes (50000)
4. Coulomb's Law Apparatus (27648)

Occurrence:

- Recurring expense
- One-time augmentation

One-time augmentation

Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

General fund

Technology and Software Resource Request(s)

Identify and justify technology and software needs. Explain how it will help the program better meet its goals. If possible, indicate other disciplines who may share the technology and/or software.

No Value

What impact will this have on student success? What is the consequence of not getting this request fulfilled?

No Value

Technology and Software Resource Request(s):

No Value

Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

No Value

Cost estimate:

No Value

Occurrence:

- Recurring expense
- One-time augmentation

No Value
Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

No Value

Other Resource Request(s)

Identify and justify any other needs. Explain how it will help the program better meet its goals.
No Value
What impact will this have on student success? What is the consequence of not getting this request fulfilled?
No Value
Other Resource Request(s):
No Value
Priority:

1. Critical (mission critical or must have)
2. Important (creates value and efficiency for program)
3. It can wait (would be nice if the money is available)

No Value
Cost estimate:
No Value
Occurrence:

- Recurring expense
- One-time augmentation

No Value
Funding source:

- Instructional equipment
- Perkins
- Grants/contracts
- Vintage
- General fund (Program 100)
- Categorical – Equity
- Categorical – 3SP
- Categorical – Other
- Other funding

No Value

Prioritized Resource Request Recommendations : Version by **McLarty-Schroeder, Janet** on **02/15/2022 17:50**

Resource	Priority	Cost	Goal Alignment
Engineering faculty	1	70084 annually	3
Physics faculty	1	70084 annually	1
Microscopes	1	50000	3
Engineering Program Staff	1	52029	2, 3, 4
Engineering lab rooms	2	depends on facilities	3
Internship Bridge and Articulation Staff	2	50000 annually	2, 3,4
Conference Funding	2	15000 annually	1, 3, 4
Planetarium	3	depends on facilities	4
Planetarium Director	3	100000 annually	4
Coulomb's Law Apparatus	3	27648	1

Resource request:	Priority:	Cost estimate:	Program goal alignment:
undefined	undefined	undefined	undefined