Fullerton College Program Review and Planning
Self-Study for Instructional Programs
Fall 2021

Statement of collaboration

The program faculty members listed below collaborated in an open and forthright dialogue to prepare this Self Study. Statements included herein accurately reflect the conclusions and opinions by consensus of the program faculty involved in the comprehensive self-study.

Participants in the self-study

Printed Names		Program Signatures	
Mohd Ansari, Ph.D.	Annie Bianchino, Ph.D.	*Mohd Ansari*	*Annie Bianchino*
Theodore Chan	Guy Dadson	*Theodore Chan*	*Guy Dadson*
Chris Fernandez	Samuel Foster, Ph.D.	*Chris Fernandez*	*Samuel Foster*
Americo Fraboni, Ph.D.	Charlesworth Fraser	*Americo Fraboni,*	*Charlesworth Fraser*
James Gregson	Laura Lazarus, Ph.D.	*James Gregson*	*Laura Lazarus*
Stephanie Nobles	Iris Rauda, Ph.D.	*Stephanie Nobles*	*Iris Rauda*
Bridget Salzameda, Ph.D.	Mohammad Shahin	*Bridget Salzameda*	*Mohammad Shahin*
Tilahun Yimenu, Ph.D.		*Tilahun Yimenu*	

Authorization

After the document is complete, it must be signed by the Principal Author, the Department Coordinator, and the Dean prior to submission to the Program Review and Planning Committee.

__Stephanie Nobles_____	____ *Stephanie Nobles*_____	_12Nov2021__
Printed name of principal author	Signature	Date
__ Stephanie Nobles_____	_____ *Stephanie Nobles*_____	_12Nov2021__
Printed name of department coordinator	Signature	Date
Bridget Salzameda	*Bridget Salzameda*	December 14, 2021
Printed name of Dean	Signature	Date

1.0 Executive Summary

The Chemistry Department currently consists of twelve full-time faculty with the thirteenth serving as interim dean, two laboratory technicians (one at 100% and the other at 25%), and a pool of fifteen adjunct faculty. Since the previous Program Review (2017), the enrollment in the Chemistry Department has remained steady. Despite the unprecedented shift to remote learning due to the COVID-19 pandemic, there was an overall increase in both enrollments and headcounts of 4.3% and 4.1%, respectively. This is 16% higher than all other programs combined at the College. The number of program awards given per year increased by 50% since 2017. The number of transfer students increased steadily over the five-year period but dropped dramatically last year due to the pandemic. Throughout the five-year period, there remains an incredibly high demand for chemistry courses, supported by fill rates of nearly 100%. The maximum number of chemistry courses were offered every semester, including the summer term, with courses offered in the evenings and on Fridays and Saturdays. The five-year average completion and success rates for the students in these courses were 81 $\pm$ 3% and 69 $\pm$ 2%, respectively, and are within the ranges for the Institution Set Standards.

The COVID-19 pandemic had a dramatic effect on the Chemistry Department. Despite the severe disruption, the number of course offerings remained the same and seven of the nine chemistry courses exceeded the course success requirement. Full-time faculty spent many hours formulating rigorous laboratory curricula. Most of the faculty have earned their Online Teaching certificate, and some will be developing curriculum to offer online or hybrid chemistry courses in the future.

Course Student Learning Outcomes were assessed for all chemistry courses. The faculty are diligently working together to increase student success and bridge achievement gaps seen in student groups by incorporating equitable classroom strategies, offering professional development for adjunct faculty, and continuing to offer high impact practices such as Hornets Tutoring, Peer Undergraduate Mentoring Program (PUMP), Peer-Assisted Learning (PAL) tutoring, Building Opportunities Through Networking and Diversity (BOND) mentorships, community outreach opportunities, chemistry boot camps, and Science, Technology, Engineering, and Math Success Learning Community (STEM-SLC) cohorts. Each of these high impact practices support the retention, success, and transfer of students in the Chemistry program.

The faculty members of the Chemistry Department are heavily involved in both professional matters at the Division and College level along with State-wide activities to further the success of the students. They have assumed roles at multiple levels on the campus: Student Success Committee, Curriculum Committee, Academic Senate Senator, Institutional Research and Effectiveness Committee and the Executive Committee of the Academic Senate for California Community Colleges at the State level. Additionally, the faculty of the Chemistry Department are engaged in community activities (National Chemistry Week and Kindercaminata) and in several activities supported by grants and categorical funding (Hornets Tutoring, Science Boot-Camps, and PUMP). Each of these activities supports the community relations with the campus and the retention, success, and transfer of students in the program.

The faculty of the Chemistry Department have completed an evaluation of the statistical evidence collected by the Office of Instructional Research, the needs of the Department and Natural Science Division, and the activities the faculty are involved in to improve student success. With consideration to maintaining the significant growth that has been seen, the Chemistry Department is requesting (1) the creation of a Campus STEM Resource Center, (2) facilities and faculty for sustaining the growth of the program, (3) creation of chemistry specific professional development for adjunct faculty, (4) support for community outreach activities, (5) support for the laboratories and Chemical Stockroom, (6) support for PUMP, (7) support for the Science Boot Camps, and (8) support for Hornets Tutoring. These strategic action plans will improve the chemistry program and will promote excellence in learning.

Chemistry is a central science. It is an essential component in the education of STEM students, and forms the basis for many of the remaining sciences. Chemistry is critically important to all science related curricula in community colleges and higher-level institutions and is fundamental for all students who desire to major in the life or physical sciences, medicine, engineering and other disciplines that require technical knowledge. The study of chemistry stimulates technical and scientific experiences and fosters the development of well-informed scientific citizens in our community. The Chemistry program supports and promotes scientific literacy benefiting the community, state and nation. At the same time, chemistry classes require a large number of available resources which include availability to classroom and laboratory technology, laboratory maintenance, replacement of consumable items (e.g. chemicals), and disposal of hazardous wastes. The ability to offer chemistry courses is inherently expensive, however, chemistry is an essential discipline at Fullerton College and, therefore, needs continual support.

2.0 Mission

Please explain briefly how your program contributes to the College's mission, vision, core values, and goals. Highlight any new contributions since your most recent self-study. If your department has a mission statement, please share it. If not then please consider discussing one with your colleagues.

Mission

The Chemistry Department in the Division of Natural Sciences is an integral part of Fullerton College and shares in the College's mission to advance student learning and achievement and is dedicated towards promoting excellence in learning. The Chemistry Department acknowledges that students from our diverse communities have various academic and career goals and provides flexible pathways to achieve them by offering courses to meet general education requirements and to transfer to a four-year institution or professional school as chemistry, pre-health, or STEM (science, technology, engineering, and math) majors. To foster a supportive and inclusive environment, the program develops and promotes opportunities for students to become part of a successful learning community at Fullerton College and engage members of the scientific community, more broadly. Through monthly division seminars moderated by faculty, students are asked to share their experiences with the campus community, such as study strategies, advice on applying for internships, presenting results of a research internship, and more. Department faculty members, alongside student volunteers, share hands-on

chemistry activities for children regularly at outreach events such as KinderCaminata and at National Chemistry Week. Additionally, faculty serve as mentors or facilitate peer-to-peer mentorship in programs such as Hornets Tutoring, PUMP (Peer Undergraduate Mentoring Program), BOND (Building Opportunities Through Networking and Diversity), and the STEM-SLC (STEM Success Learning Community) program. Inside the classroom, faculty foster welcoming and inclusive learning environments that empower students through active learning strategies that support critical thinking. The Chemistry Department strives to create a community that welcomes diverse perspectives while supporting individual students. Students are encouraged to be involved in scientific engagement both inside and outside the classroom, while faculty facilitate meaningful interactions and support the growth and development of the students and the department.

Vision

The academic mission of the Chemistry Department is characterized by the pursuit of academic rigor and integrity, excellence in instruction, intellectual accomplishment, and community service. The program is aligned with the vision statement of the College. The Department has created a community that promotes inquiry and intellectual curiosity, personal growth and a life-long appreciation for the power of learning that can transform lives and inspire a positive change in the world.

Chemistry is an experiment-based discipline that promotes inquiry and intellectual curiosity. Students in the program regularly make discoveries within the laboratory environment that mirror the concepts and ideas being discussed within the classroom. The very nature of chemistry ensures that students will be given an opportunity to explore the material that is encountered in the classroom. The curiosity that leads to the discovery of new ideas within the classroom and laboratory environment carries over into the lives of students beyond the classroom. Many students within the program are involved in both weekend and summer research opportunities and also participate as volunteers in organized chemistry events. The experience and education afforded to students by the Chemistry Department provides for both academic and personal growth of students within the program and creates an appreciation for learning that undoubtedly continues through the lives of students in the program.

Core Values

The Chemistry Department is proud of its accomplishments and, like the institution, strives to improve the program and achieve the College's vision by embodying its core values.

The Chemistry Department promotes a sense of community that enhances the well-being of our campus and surrounding areas. To this end, department faculty develop and promote opportunities for students to see themselves as part of a successful learning community at Fullerton College and engaged members of the scientific community, more broadly. Chemistry faculty regularly participate in division seminars involving student success workshops and the promotion of scientific research and internship opportunities for students at local institutions.

Students are encouraged to present in these seminars, either individually or on panels, to share their knowledge and experience with the Fullerton College community. Additionally, department faculty members oversee peer and faculty-led mentorship programs, such as PUMP (Peer Undergraduate Mentoring Program) and BOND (Building Opportunities Through Networking and Diversity) and participate alongside students in community outreach events like KinderCaminata and the American Chemical Society's National Chemistry Week, aiding and encouraging students to build connections between students, faculty, and the local community.

The Chemistry Department respects and values the diversity of the entire community and promotes an environment of mutual respect and trust that embraces the individuality of all. The program consists of an ethnically and academically diverse group of thirteen full time faculty and a pool of part time faculty members (twelve in Spring 2021), teaching four courses for non-majors and five courses for majors. The broad background and engagement of the faculty within the Department ensures that all constituents (i.e. staff, faculty, administration) are included in discussions surrounding important decisions. Furthermore, the faculty of the Department supports the involvement of all its members in the decision-making process; whereas individual contribution is welcomed and supported, the strength of the Department is realized in collaborative efforts.

The Chemistry Department emphasizes student success and academic achievement within a supportive and equitable learning environment. The personnel within the Department are respectful of all persons participating in the program and efforts are made to provide an environment conducive to strong academic scholarship and success. Students are closely connected to faculty and take advantage of many educational opportunities, adding value to their course experience. We commit to equity for all we serve by providing additional means of academic support, through individualized peer and faculty-led mentorship programs, peer-tutoring, student success workshops, and preparatory boot camps. We partner with local universities such as California State University, Fullerton in special programs like PUMP and Project RAISE (Regional Alliance in STEM Education) to provide mentorship and research internship opportunities to students with the aim of increasing success and retention rates and encouraging more students to major in STEM fields, especially LatinX and other historically underserved students.

The Chemistry Department excels in supporting innovation in teaching and learning by using a variety of methodologies in the classroom and laboratory environment. The course retention and success are both impacted and improved by the use of class response systems ("clickers") and presentation tools (Doceri software and iPads) in the classroom, utilizing the concept of a "Flipped" classroom, computer studios and Vernier probes and software within the laboratory environment, and online homework for out-of-class instruction and assessment. As a response to the COVID-19 pandemic, the department quickly adapted and mobilized to share online resources and teaching strategies. Websites and applications such as Kahoot, Jamboard, Playposit, Flipgrid, and Google Docs have been used alongside utilities in Zoom (*e.g.,* breakout rooms, polls, annotation tools) to increase participation of students in hybrid online and

asynchronous classes. Laboratory experiments were replaced or supplemented with custom take-home laboratory kits, online alternatives like Beyond Labz, and videos produced by several faculty members in the department.

College Goals

The Chemistry Department has reflected on the goals and outcomes of the program and how they relate to course-level assessments, modifications in methodologies, and approaches to the curriculum and program. The program goals, objectives, and strategies to achieve the objectives are student-centered, and are driven by the desire to increase student success and reduce the achievement gap in the program:

Program Goals

The Chemistry Department will provide exceptional classroom and laboratory opportunities for students to achieve success in chemistry courses. Students will master content, develop critical thinking skills, communication skills, and technology skills using ethical standards to prepare them for professional careers and to be scientifically literate citizens. While being sensitive to the needs of all students, the program commits to increasing success and retention rates of underrepresented and under-prepared students. Additionally, the Department will strive to increase the number students from underrepresented groups participating in Chemistry.

Program Objectives

1. Students will demonstrate in-depth knowledge of the principles of chemistry to solve multi-faceted scientific problems using critical thinking and quantitative reasoning skills.

2. Students will apply the necessary laboratory skills to answer questions of chemical relevance that synthesize classroom learned principles of chemistry with the experiments they conduct in the laboratory.

3. Students will engage collaboratively and independently in classroom and laboratory settings with integrity and honesty.

Strategies to Achieve Objectives

1. Choose textbooks and select classroom and laboratory methodologies along with other instructional resources that are supported by evidence to improve student critical thinking and quantitative reasoning skills based on proven pedagogies.

2. Engage students with course material and technology relevant to their real-world experiences.

3. Provide an environment where students develop skills using safe laboratory practices and academic honesty.

4. Develop sustainable and green chemistry methods whenever possible.

Alignment of Program to Fullerton College Goals

The Chemistry Department program goals, objectives, and strategies to achieve the objectives support the College Goals through the promotion of student success, efforts to cultivate a culture of equity, and the strengthening of its connections with the local community. The exceptional opportunities for students both in and out of the classroom and laboratory promote student retention and success, important for the underrepresented and under-prepared students. The Department is well-aligned with College Goal 1 as the faculty in the program continually identify opportunities to increase student success, retention, and transfer through effective teaching strategies and by adhering to best practices as identified by the American Chemical Society. The efforts of the Chemistry Program are further highlighted by significantly increasing the number of chemistry sections supporting more STEM students, and by awarding significantly more degrees than the Chemistry Programs of peer institutions. Respecting the diversity of students in our courses, the faculty strive to cultivate a culture of equity and promote a feeling of belonging, as in College Goal 2, by employing interventions such as chemistry boot camps, peer-tutoring programs, and peer- and faculty-led mentorship programs. In alignment with College Goal 3, the program reaches out to the community in a variety of ways. For example, the Chemistry Department is actively involved in community outreach with faculty providing hands-on activities for children during KinderCaminata and during the American Chemical Society's celebration of National Chemistry Week. Students within the program are encouraged to become actively involved in these community programs, and are also directed toward research programs at local four-year institutions, *e.g.*, Project RAISE at California State University, Fullerton, MacREU (Materials Connection Research Experience for Undergraduates) at University of California, Riverside, the WAVE Fellows program at California Institute of Technology, and Chem-SURF (Summer Undergraduate Research Fellowship) at University of California, Irvine.

3.0 Students

Because there is a nearly infinite amount of student data that can be studied, please focus your analysis on the trends that stand out. The Office of Institutional Effectiveness (OIE) is providing data that will help you zero in on bottlenecks, gateways, and student equity issues. As per accreditation standards, OIE data will be broken down by race, ethnicity, gender, and other demographic categories. One of the purposes of this section is to identify inequities and make plans to remedy them.

3.1 Enrollment demographics

The Office of Institutional Effectiveness (OIE) provided data that cover a five-year period: Summer 2016 – Spring 2021, which includes the 2016-2017 academic year (AY) through the 2020-2021 academic year. The data are current through August 1, 2021.

1. Using the data provided by the OIE, briefly describe the enrollment trends in the program over the past five years.

Table 1 shows the number of enrollments (seat count) and the number of unique students (headcount) enrolling each academic year in the Chemistry Program. The total number of enrollments and headcount follow a similar trend during the five-year period, as they are directly correlated. The notable increases in both enrollment and headcount numbers from AY 16/17 to AY 17/18 can be attributed to the expansion of section offerings that occurred during 2017, as discussed in the previous Program Review. Moreover, the higher numbers remained stable into the AY 18/19, demonstrating the continued high demand for chemistry courses in the college. The data shows a modest decline in both enrollment and headcount numbers in AY 19/20 and AY 20/21, likely due to the unforeseen COVID-19 pandemic. The 5-year percent change in enrollments and headcount between AY 16/17 and AY 20/21 are 4.3% and 4.1%, which are 16.4% and 16.1% higher than that of all other programs combined at the College (-12.1% and -12.0%, respectively), suggesting the Chemistry Program maintained higher enrollment rates than the rest of the College. When comparing the percent change in enrollments and headcount between AY 19/20 and AY 20/21, the Chemistry Department experienced a decrease of 6.1% in enrollments and 6.4 % in headcount. This decline can be attributed to the effects of the pandemic, particularly due to the fact that students were less likely to enroll in courses that had online laboratory components.

Table 1: Key Performance Indicators Per Academic Year (AY) for the Chemistry Program.

	16/17	*17/18*	*18/19*	*19/20*	*20/21*
Enrollment	2126	2500	2506	2362	2217
Headcount	1737	2006	1998	1931	1808
**Completion*	84.1%	83.1%	82.3%	78.9%	76.4%
***Success*	72.6%	70.5%	69.4%	68.4%	66.4%

* Completion Institution-Set Standard: Above 79.2%; Warning 75.0-79.2%

**Success Institution-Set Standard: Above 64.4%; Warning 61.0-64.4%

The data in Table 2 shows the enrollment trends across all 9 chemistry courses during the 5-year period. When comparing the 5-year percent change in enrollments for each course, the courses with the greatest increase are CHEM 100 F (Chemistry for Daily Life), CHEM 201 F (Biochemistry for Allied Health Science), CHEM 211AF (Organic Chemistry I) and CHEM 211BF (Organic Chemistry II), with increased rates of 43%, 27%, 31%, and 37%, respectively. The course with greatest decrease in enrollments was CHEM 103 F (Chemistry in a Changing World), with a decrease of 22%. The number of sections of CHEM 103 F were reduced in order to liberate space for other courses in higher demand. There is less demand for this course as it is the only course in the program that does not have a laboratory component which might attract

less students looking to fulfill a science course for their general education requirement. Comparing the percent change in enrollments between AY 19/20 and AY 20/21 reveals that most courses experienced a slight decrease due to the effects of the pandemic.

Table 2: Enrollments Per Academic Year (AY) for All Courses in the Chemistry Program.

	16/17	*17/18*	*18/19*	*19/20*	*20/21*
CHEM 100 F	121	155	172	169	173
CHEM 101 F	300	338	365	353	291
CHEM 103 F	81	96	52	58	63
CHEM 107 F	654	769	691	689	654
CHEM 111 AF	494	552	563	515	480
CHEM 111 BF	262	270	296	284	275
CHEM 201 F	64	92	90	90	81
CHEM 211 AF	91	144	173	122	119
CHEM 211 BF	59	84	104	85	81
Grand Total	2126	2500	2506	2362	2217

2. Using the data provided by the OIE, describe the student population the department serves. Do you have a way of determining which students are majors, for example through a gateway course? Please explain.

The data provided in Table 3 shows a comparison of various student populations enrolled in chemistry courses (2,217) to students enrolled in courses for all other programs in the college (127, 766) for the academic year 20/21. The data shows 78% of chemistry enrollments are filled by students seeking either a degree or to transfer, similar to 77% for all other programs in the College. The data also shows 75% of students enrolled in chemistry courses are likely to come from low-income households, comparable to 74% for all other programs. Notable differences in student populations include: % certificate, where 1% of student enrolled in a chemistry course were seeking a certificate compared to 3% for all other programs; % special admit, where 0% of student enrolled in a chemistry course were special admittance compared to 3% for all other programs; % majors, where 8% of students enrolled in a Chemistry course were reported as chemistry majors compared to 21% for all other programs; 3+ program courses/year, where 1 % of students enrolled in a chemistry course enrolled in 3 or more chemistry courses in that year compared to 7% for all other programs; % 24+ unit attempts this year, where 51% of students enrolled in a chemistry course were enrolled in at least 24 units during that year compared to 22% for all other programs; and % college grad, where 12% of students enrolled in a chemistry course had obtained a college degree compared to 7% for all other programs.

Table 4 shows the breakdown of students in the Chemistry Program compared to students in all other programs by student race, ethnicity and ancestry, and gender identity. The Chemistry Program has a higher population of Asian and Filipino students (20.1%, 4.9%) compared to all other programs (11.1%, 2.7%), and a lower population of Black and LatinX (1.4%, 50.2%) compared to all other programs (2.9%, 57.8%), suggesting these two groups are

underrepresented. The Chemistry Program has a much higher population of female to male students (56.6% to 40.0%) when compared to all other programs (52.9% to 42.5%).

Table 3: Enrollments in Chemistry Compared to All Other Programs for AY 20/21.

Student Population	*Chemistry Program*	*All Other Programs*
Degree / Transfer	78%	77%
Certificate	1%	3%
Career Development	6%	6%
Special Admittance	0%	3%
Age: Under 20	29%	32%
Age: 20 – 24	49%	42%
Age: 25+	21%	26%
Majors	8%	21%
3+ Program Courses / Year	1%	7%
24+ Unit Attempts This Year	51%	22%
College Grad	12%	7%
DSS	6%	6%
Foster Youth	0%	1%
LGBT	9%	9%
Low-Income	75%	74%
Veteran	2%	2%

Table 4: Chemistry Enrollments by Race / Ethnicity and Gender for AY 20/21.

Student Population	*Chemistry Program*	*All Other Programs*
Amer. Indian / Alaska N.	0.2%	0.2%
Asian	20.1%	11.1%
Black / African Amer.	1.4%	2.9%
Filipino	4.9%	2.7%
LatinX	50.2%	57.8%
Native Hawaiian / Pacif.	0.2%	0.2%
Two or More	2.9%	3.4%
Unknown	5.5%	5.7%
White	14.4%	16.1%
Female	56.6%	52.9%
Male	40.0%	42.5%
Different Identity	3.4%	4.6%

It is important to note that it is difficult to know with certainty the number of students that are chemistry majors because only students that self-report their major is considered, which could make the data unreliable. There is no course offered by the Chemistry Program that would only be taken by chemistry majors, therefore, the numbers in the data collected may or may not be representative of the population of students that are majors in the program.

3. Which classes have the highest demand and why? Are they offered regularly -- at different times of the day and week, in different formats (in-person, on-line, hybrid)? Please explain.

The courses with the highest demand in the Chemistry Program are CHEM 107 F (Preparation for General Chemistry), CHEM 101 F (Chemistry for Allied Health Science), CHEM 111AF (General Chemistry I), CHEM 111BF (General Chemistry II) and CHEM 100 F (Chemistry for Daily Life). The five-year total enrollment is highest for CHEM 107 (3,454; Table 5), accounting for 35.0% of all enrollments in the program (9,882). This course has the highest demand because most students that require a year of general chemistry for their major do not meet the minimum prerequisites to enroll in the first semester of general chemistry (CHEM 111AF) and must take CHEM 107 to fulfill their prerequisite. Most STEM majors take one of year of general chemistry, which explains why CHEM 111AF and CHEM 111BF are also high demand courses. CHEM 101 F is a course required of numerous health science majors, while CHEM 100 F is taken by non-science majors looking to fulfill their general education requirements.

In the five-year period, all five courses were offered on a regular basis at different times of the day and days of the week, with CHEM 107 making up 35.0% of all sections. To accommodate the students, the Department has optimized the use of the laboratory space and has scheduled several Friday/Saturday courses and back-to-back classes from 7:00am to 10:30pm on Monday to Thursday as well as 7:00am to 5:00pm on Friday and Saturday. The percent of courses offered in the evening are highest for CHEM 111BF (31%) and CHEM 107 F (26%), demonstrating the high demand for these courses.

Until the onset of the pandemic and sudden switch to the remote environment, all chemistry courses were offered as in-person classes only due to their laboratory component. However, as the pandemic began and discussions about offering remote lectures and laboratories occurred, the Chemistry Department was the only one in the Natural Sciences Division to immediately and unanimously agree that holding classes remotely, without canceling sections, was a priority. The full-time faculty formulated rigorous laboratory curricula while maintaining the number of course offerings. All of the chemistry courses were offered strictly online during the pandemic until the Fall 2021 semester. During the Fall 2021 semester, some Chem 111AF and Chem 201F courses were offered as hybrid or fully in-person lecture and laboratory sections. In addition, curriculum was developed for Chem 111AF to continue to offer hybrid courses once the pandemic is over.

Table 5: Chemistry Courses with Most Enrollments over 5-Year Period (AY 16/17-AY 20/21)

Course	*Enrollments*	*Sections*	*% Online*	*% Evening*
CHEM 107 F	3454	145	0%	26%
CHEM 111 AF	2604	109	0%	21%
CHEM 101 F	1647	70	0%	16%
CHEM 111BF	1387	58	0%	31%
CHEM 100 F	790	32	0%	8%

4. Please describe how course offerings match students' preparation and goals.

The Chemistry Department is committed to meeting the needs of students. To meet the high demand for chemistry courses, sections are scheduled at the earliest possible time in the morning and run until late in the evening. In addition, one double section of CHEM 107 F and one section of CHEM 111BF are offered on Saturdays, allowing students the ability to take courses on the weekend. As described in the previous section, most STEM majors need to take CHEM 107 F in order to prepare for the first year of general chemistry, so every effort has been put forth to offer as many sections as space and time will allow. It should be noted that the number of sections offered for high demand classes are based on the availability of staff in the stockroom and facilities. To ensure that students are progressing through their chemistry courses in a timely manner, several courses are also offered during the summer term, with a 5-year average of 10 sections with an average of 211 enrollments (Table 6).

Table 6: 5-Year Average Number of Sections Enrollment by Semester (AY 16/17-AY 20/21).

Term	*Average Sections*	*Average Enrollments*
Summer	10	211
Fall	43	1035
Spring	47	1096

5. Does enrollment vary by semester? Please describe how course offerings are adjusted to meet student demand and help students reach their academic goals.

The enrollment over the five-year period for fall and spring semesters has remained steady with averages of 1,035 and 1,096, respectively. This steady enrollment is attributed to consistently offering the maximum number of chemistry sections every semester and during the summer term. As shown in Table 7, all 9 chemistry courses in the program were offered every fall and spring semesters during the five-year period.[1] In order to meet student demand, 4 out of the 5 courses with the most enrollments described above were offered every summer term during the 5-year period, including CHEM 101 F, CHEM 107 F, CHEM 111AF and CHEM 111BF.

Table 7: Course Offering by Term Over 5-Year Period.

Course	*Summer*	*Fall*	*Spring*
CHEM 100 F		5	5
CHEM 101 F	5	5	5
CHEM 103 F		5	5
CHEM 107 F	5	5	5
CHEM 111 AF	5	5	5
CHEM 111 BF	5	5	5
CHEM 201 F		5	5
CHEM 211 AF		5	5
CHEM 211 BF		5	5

[1] 5 = Course has been offered every term (Summer, Fall and Spring) in the last 5 years.

3.2 Student Achievement and Equity (and student demographic profile)?

1. Using the data provided by the OIE, briefly describe student achievement rates in your program over the past five years: completion, success, degrees/certificates, transfer, licensing, job placement, wage improvements (not all of these measures apply to every program).

The Chemistry Department achieved a course success rate that exceeded the Institutional-Set Standard (ISS) of 64.4% in all academic years, including those that were the most impacted by the pandemic (Table 8). However, the average course completion rate in AY 19/20 of 78.9% and AY 20/21 of 76.4% (Table 9) fell below the Institution-Set Standard of 79.2%. When comparing the yearly course completion and success rates for the Chemistry Program relative to all other programs in the College, the percentages for chemistry are slightly higher for AY 16/17 and AY 17/18, then steadily drop below the percentages for all other programs with the greatest variance in AY 20/21. These academic years' data are significantly lower than data reported in previous years. This decrease is attributed by the onset of the pandemic and the required move to remote learning which created an unprecedented disruption in education. The sudden transition to and continued remote learning significantly impacted course success and completion. During the spring semester of 2020 when classes were abruptly transitioned to a remote setting, many students petitioned for an "Excused Withdrawal" or EW, which explains the decrease in course completion rates. Moreover, students have had difficulty adapting to an online environment, particularly with chemistry courses, which are high unit courses that are time consuming and include a laboratory component.

Table 8. Course Completion Rates for Chemistry Compared to All Other Programs.

Academic Year	*16/17*	*17/18*	*18/19*	*19/20*	*20/21*
Chemistry	84.1%	83.1%	82.3%	78.9%	76.4%
All Other Prog.	83.3%	82.8%	84.3%	80.3%	81.2%

Table 9. Course Success Rates for Chemistry Compared to All Other Programs.

Academic Year	*16/17*	*17/18*	*18/19*	*19/20*	*20/21*
Chemistry	72.6%	70.5%	69.4%	68.4%	66.4%
All Other Prog.	68.1%	68.7%	70.3%	68.7%	69.2%

Considering the completion and success rates based on individual courses (Table 10), it is evident that courses exceeded the success and completion targets set by the ISS. These courses were Chem 100 F (Chemistry for Daily Life), CHEM 101 F (Chemistry for Allied Health Science), and CHEM 211BF (Organic Chemistry II). Courses that met the success standard, but did not meet the completion standard, were: CHEM 111AF (General Chemistry I), CHEM 111BF (General Chemistry II), CHEM 201 F (Biochemistry for Allied Health Science), and CHEM 211AF (Organic Chemistry I). Courses that did not meet either minimum requirement of 64.4% success

and 79.2% completion rates, were: CHEM 103 F (Chemistry in a Changing World) and CHEM 107 F (Preparation for General Chemistry).

Table 10. Success and Completion by Course (AY 19/20)

Chemistry Course	*Enrollments*	*Average Success*	*Average Completion*
100 F	169	84.0%	92.9%
101 F	353	71.4%	80.7%
103F	58	51.7%	75.9%
107 F	686	62.6%	76.1%
111AF	514	66.1%	78.0%
111BF	284	69.7%	77.1%
201F	90	68.9%	70.0%
211AF	122	75.4%	78.7%
211BF	85	83.5%	89.4%

While the data require careful review, it should be noted that the percentages are significantly lower than data reported for previous academic years. For comparison, in the 2017 Program Review, the Chemistry Department observed steady success rates ranging from 72.3% to 73.8% for the period of 2013-2017, as well as steady retention rates ranging from 82.8% to 84.2% for the same five-year period. In addition, examination of the data for the 2018-2019 academic year, reveals that the data for the 2019-2020 is an anomaly. For example, the average success rate for CHEM 107 F exceeded the set standard in the 2018-2019 academic year. As another example, the average course completion rates for CHEM 107 F, CHEM 111BF, CHEM 201 F and CHEM 211AF exceeded the set standard, during the same year. Therefore, it is important to stress that the 2019-2020 academic year is not an appropriate representation or indicator of the overall course success and completion trends that, under normal circumstances, would be observed. The 2019-2020 academic year was met with an unprecedented disruption to education, and the impact to the Chemistry Department is evident in the data. The sudden transition to remote learning, experienced during the spring 2020 semester, significantly impacted course success and completion rates, across the majority of chemistry courses.

The Chemistry Department is committed to promoting student equity and success and every effort is put forth to better serve students. For this reason, despite the severe disruption in spring 2020, seven of the nine chemistry courses exceeded the course success requirement including Chem 100 F, 101 F, 111AF, 111BF, 201F, 211AF, and 211BF. Of the seven courses, only three met the course completion standards as well (100 F, 101 F, and 211BF). The overall success rates observed in these courses can be attributed to several key components such as the use of Hornets tutoring program, PUMP, the STEM-SLC program, and chemistry boot camps.

During the 5-year period, a total of 190 unique students earned a total of 253 awards in the Chemistry Program, indicating some students earned multiple awards (Table 11). The number

of awards given per year increased significantly over the 5 -year period, as seen in data provided. Of the 253 total awards conferred, 142 were AA (associate in arts) degrees, 99 were AS (associate in sciences) degrees, and the remaining 12 were AST (associate in science for transfer) degrees. The data for the number of unique students by award type by year reveals something interesting. By comparing the total number of awards to the total number of unique students as a ratio, there has been a significant increase from year to year over the 5-year period, with ratios of 1.04 (AY 16/17), 1.18 (AY 17/18), 1.27 (AY 18/19), 1.52 (AY 19/20), and 1.48 (AY 20/21) respectively. This trend suggests more students are earning multiple degrees in the Chemistry Program.

A total of 366 students from the Chemistry Program have transferred to a 4-year Institution. Table 12 lists the number of students transferring per year from 2015-2021. The number of transfers has steadily increased over this period, excluding years 2020 (impacted by the pandemic) and 2021 (current year).

Table 11: Number of Program Awards by Student and Type Per Academic Year.

Program Awards	*16/17*	*17/18*	*18/19*	*19/20*	*20/21*	*Grand Total*
Unique Students	25	49	37	46	35	190
AA Awards	22	32	25	38	25	142
AS Awards	4	26	21	27	21	99
ADT Awards	0	0	1	5	6	12
Total Awards	26	58	47	70	52	253

Table 12: Transfers Per Year for Chemistry.

Year	*Transfers*	*% of Transfers*
2015	45	12.3%
2016	56	15.3%
2017	62	16.9%
2018	60	16.3%
2019	73	19.9%
2020	63	17.2%
2021	7	1.9%

Of the 366, 189 students earned a degree or award, and 177 students transferred before earning an award, suggesting about half of students will transfer before earning a chemistry degree (Table 13). According to the data, out of the 366 students, 176 transferred to a California State University (CSU), 130 transferred to a University of California (UC), and 60 transferred to other institutions.

Table 13: Transfers by Destination by Award Earners or Majors.

Destination	*Degree / Certificate*	*Major*
CSU	91	84
UC	90	40
Other	8	52
Total	189	177

Table 14 shows the breakdown of the 366 transfers by race / ethnicity, with LatinX (141), Asian (117) and White (83) students making up 93% of all transfers. While LatinX students make up 50.2% of enrollments (Table 4), only 37.4% of them are reported as majors. Therefore, the transfer rate of 39% for LatinX students in the Chemistry Program suggests they are transferring at expected rates. Because the data only accounts for chemistry students, it is difficult to know how LatinX students are transferring in general. The fact that students belonging to other races / ethnic groups (i.e., American Indian / Alaska Native, Black / African American, etc.) are not reported in these data is of concern, as these groups are known to be underrepresented in the sciences.

Table 14: Transfers by Race / Ethnicity for Chemistry.

Race / Ethnicity	*Transfers*	*% of Transfers*
Asian	117	32%
LatinX	141	39%
Two or More	12	3%
Unknown	13	4%
White	83	23%

2. Please pay special attention to equity issues -- where a group of students has an achievement rate that is below average. What factors can explain this?

The values for course completion and success by gender for the five-year period appear below average for both male and female students (Table 15). However, the male and female student populations are performing equally well, including students that identify with a different gender group.

The average course completion and success by ethnic group, DSS, foster youth, LGBT, and low-income, reveal there are notable achievement gaps among these student populations. The values listed under the gap category in Table 15 represent the number of students needed from that group to close the achievement gap.

When looking at the completion and success rates within each race/ethnicity group, it becomes clear that LatinX students have lower-than-average rates, with achievement gaps of 328 and 604 students for course completion and success, even though they make up 48.0% of all enrollments. American Indian/Alaska Native and Black/African American students have both

lower course completion and success values as well, when compared to Asian, Filipino, Native Hawaiian/Pacific Island., and White students. The groups with the lowest number of enrollments are American Indian/Alaska Native (24), Black/African American (184), and Native Hawaiian/Pacific Island. (40), making up only 2.1% of all enrollments.

Other student populations that are disproportionately impacted include DSS, foster youth, LGBT, and low-income groups. Students that are identified as DSS have lower-than-average success rates, with an achievement gap of 37 students. Students that are identified as foster youth have lower-than-average success rates as well, with an achievement gap of 12 students. Students that identify as LGBT have lower-than-average rates, with achievement gaps of 36 and 29 students for course completion and success, respectively. The highest achievement gaps for both course completion and success are seen among students from low-income populations, while this group makes up 79.6% of the entire population of students. Overall, it can be concluded that the groups that are the most disproportionately impacted are students that are economically disadvantaged.

Table 15: Course Completion and Success Rates for Student Populations.

Student Population	*Enrollments*	*Completion*	*Gap*	*Success*	*Gap*
Amer. Ind. / Alaska Nat.	24	62.5%		54.2%	
Asian	2467	84.6%		76.3%	
Black / African Amer.	184	79.9%		63.0%	
Filipino	582	84.4%		75.9%	
LatinX	5619	77.9%	-328	63.9%	-604
Nat. Haw. / Pac. Is.	40	82.5%		70.0%	
Two or More	428	80.1%		69.6%	
Unknown	383	83.6%		70.8%	
White	1984	84.0%		75.3%	
Female	6147	81.2%		69.7%	
Male	5254	80.9%		69.2%	
Different Identity	310	79.0%		69.0%	
DSS	679	77.4%		64.5%	-37
Not DSS	11032	81.2%		69.8%	
Foster Youth	44	70.5%		43.2%	-12
Not Foster Youth	11667	81.0%		69.5%	
LGBT	603	75.3%	-36	64.8%	-29
Not LGBT	11108	81.3%		69.7%	
Low Income	9319	79.8%	-511	67.7%	-799
Not Low Income	2392	85.4%		76.3%	

3. Does the department have regular discussions about equitable grading, attendance, late work, and extra credit policies, or about other strategies for helping students succeed? Could reforming classroom policies help more students succeed? Please explain.

The Chemistry Department is committed to implementing equitable grading practices in the classroom. To that extent, the faculty have met to discuss potential classroom policies that may be implemented in the future. However, further discussion is necessary to design specific policies and methods of how to introduce and implement such. Individual faculty are currently pursuing best practices and several efforts are being put forth towards fostering an equitable classroom environment to improve student success.

4. Please write a brief Equity Action Plan. What strategies can you implement to close this gap in student achievement within the next five years? What professional learning, curriculum development, or other forms of support does your department need?

According to the data presented in Table 15, above, student achievement gaps are reported for students that identify as either LatinX, DSS, foster youth, LGBT or low-income. While these quantitative data are useful to determine where the gaps exist, qualitative data would provide more insight into the specific needs of students. These student populations all tend to come from economically disadvantaged backgrounds. To implement effective strategies to close the achievement gaps among these students, it is important to understand the specific reasons why disproportionately impacted students do not succeed at the same rate. Therefore, the Chemistry Department is proposing for the Office of Institutional Effectiveness to collect qualitative data from students through an informal survey. For example, the survey could ask students about their work schedules, hours worked per week, status of financial aid, how far into the semester it takes to obtain financial aid funds, whether they require childcare, and other factors that may potentially impact their success in STEM courses.

The Chemistry Department strongly desires an institutionalization of support for adjunct faculty to participate in student-engagement training and other professional training as well as providing financial and other support necessary for adjunct faculty to meet with students outside of class.

The Chemistry Department offered a professional development workshop for its CHEM 107 F adjunct faculty in the summer 2019 semester, led by fulltime faculty. This workshop was designed to serve as a “boot camp” for part time instructors, where they were given teaching strategies. Approximately 50% of adjuncts were in attendance. The majority of classes taught by adjuncts in the department are introductory courses and often, they are the first chemistry course students take in a series. When more effective teaching strategies are employed to introductory courses, students will be better prepared in subsequent courses, which should improve success rates. The department is interested in working with Staff Development Services on campus to secure funding to run these professional workshops, focusing on adjuncts that teach the program foundation courses. The goal is to offer these short courses on

a regular basis, and to extend the workshop to other courses in the program with the goal of reaching as many part time instructors as possible.

An additional equity action plan is to hold focus groups with students of color to identify specific ways to increase students' sense of mattering and belonging. This will be more successful following a professional development in which faculty are trained in how to engage in meaningful conversations around race and cultural competencies. We suggest that this occurs across the Natural Sciences Division. The Chemistry Department feels that the establishment of a STEM center will help in this regard. The creation of the STEM center can also give Fullerton College a way to promote student-to-student interactions outside of the classroom and increase opportunities for adjunct and full-time faculty to meet with students. The STEM center could also serve as a central location for the continuation of the programs that the Chemistry Department has initiated to help with the equity gaps including PUMP, PAL tutoring and Hornets tutoring that empower students to be resources for other students.

Some faculty in the Chemistry Department have attended professional learning opportunities that center around high impact practices. These faculty will share their experiences with the Department as well as initiate discussions on possible capstone projects, early assessment and substantive feedback strategies, and meaningful group learning experiences.

3.3 Student Achievement and Pathways

1. Using the data provided by the OIE, briefly describe how students have moved through the program over the past five years: unit accumulation, prerequisites, corequisites, substitutions, gateway courses, and bottleneck courses. (Not all of these measures apply to every program.)

Over the last five years, CHEM 107 (Preparation for General Chemistry) has seen the largest number of enrolled students (Table 16). This result is not surprising since the majority of students entering our programs need additional preparation before attempting CHEM 111A (General Chemistry I). Concomitantly, CHEM 111A has had the second highest enrollment in the Chemistry Department during the same time period. Based on its high enrollment and because it is a prerequisite to CHEM 111A, CHEM 107 is the gateway course in our AA, AS and AS-T degree programs. It is also the course with one of the lowest success rates at 62.6% (Table 10).

Table 16. Five Most Enrolled Courses in Chemistry (2015 – 2020)

Course	*Enrollments (previous 5 years combined)*
CHEM 100 F	790
CHEM 101 F	1,647
CHEM 107 F	3,454
CHEM 111AF	2,604
CHEM 111BF	1,387

While CHEM 107 has had the largest number of enrolled students over the last five years, CHEM 111A has had the largest percentage of students repeating the course at 12.7% (Table 16). By comparison, CHEM 111B (10.7%) and CHEM 107 (10.6%) have also seen high percentages of repeat students. Based on the high enrollment and high percentage of repeat students, CHEM 111A and CHEM 107 could both be considered bottleneck courses. In addition, both CHEM 107 and CHEM 111A have the two of the three lowest course success rates at 65% and 67%, respectively (Table 18). The lowest course success rate is for CHEM 103 (58%), but this course does not serve as a preparatory course or a prerequisite in any of our programs. Therefore, a low success rate in CHEM 103 would not be a bottleneck course for students looking to earn an AA, AS or AS-T degree in chemistry.

Table 17. Chemistry Courses with the Highest Percentage of Repeat Students (2015 – 2020)

Course	*% Students Repeating*
CHEM 101 F	7.0%
CHEM 107 F	10.6%
CHEM 111AF	12.7%
CHEM 111BF	10.7%
CHEM 211AF	8.7%

Table 18. Chemistry Courses with the Lowest Success Rates (2015 – 2020)

Course	*% Student Success*
CHEM 103 F	58.0%
CHEM 107 F	64.6%
CHEM 111AF	67.4%
CHEM 111BF	69.7%
CHEM 211AF	73.3%

Based on the data in tables 17 and 18, it is quite clear that both CHEM 107 and CHEM 111A are impeding our students from moving on in the curriculum relative to other courses. This conclusion is also supported when observing how LatinX students are disproportionately impacted in these courses (Table 19). If the success gap for LatinX students (-224 students) is taken as a percentage of total LatinX enrollments in CHEM 107, it reveals that LatinX students are performing 12.2% worse relative to other ethnic groups as a whole. For CHEM 111A, this gap increases to 13.3%.

Table 19. Disproportionate Impact on LatinX Students for Highest Enrollment Chemistry Courses (2015 – 2020)

Course	*Enrollments*	*% Course Success*	*Raw Gap*	*% Gap*
CHEM 100 F	451	78.7%	-29	**-6.4%**
CHEM 101 F	924	70.2%	-71	**-7.7%**
CHEM 107 F	1,836	58.9%	-224	**-12.2%**
CHEM 111AF	1,147	63.9%	-153	**-13.3%**
CHEM 111BF	562	69.7%	-54	**-9.6%**

As shown in section 3.2.2 of this Program Review, a majority of enrollments in our chemistry courses are LatinX students. Furthermore, the success gaps for LatinX students are greatest in our CHEM 107 and CHEM 111A courses. Therefore, it is reasonable to assume that measures put in place to close the success gaps for LatinX students in CHEM 107 and CHEM 111A would yield the highest impact for improving success rates across all courses in the chemistry curriculum. In addition, improving outcomes for LatinX students would also improve the bottleneck issues in CHEM 107 and 111A.

Possible Strategies for Alleviating Course Bottlenecks

Alleviating bottleneck issues for CHEM 107 F and CHEM 111AF and improving success rates (especially for LatinX students) can be accomplished using a variety of measures.

One measure would be to have more full-time faculty teach CHEM 107 F or CHEM 111AF. In fall 2021, adjunct faculty currently teach 66.67% of our CHEM 107 courses and 30.00**%** of our CHEM 111A courses (Table 20), a trend that has continued even after the hiring of a new faculty member in fall 2020. A possible reason why the overall repeat percentage (and success gaps for LatinX in particular) is higher in CHEM 111A relative to CHEM 107 can be attributed to the higher percentage of adjunct faculty teaching CHEM 107. Especially in recent years, it has been very difficult to hire quality adjunct instructors for a variety of reasons, outlined in section 3.4. If students receive lower quality instruction because the instructor is inexperienced, for example, in CHEM 107 F, but still pass the course nonetheless, they are likely to struggle even more in CHEM 111A.

Another approach would be to have more adjunct faculty take part in professional development to improve their teaching skills. Since it is not always possible to have more full-time faculty teach CHEM 107 and 111A (due to an already understaffed department and limitations for hiring full time faculty), the amount of professional development offered to adjunct faculty teaching CHEM 107 and CHEM 111A can be adjusted. Virtually all of the professional development offered to adjunct faculty on campus takes a more generalized approach where topics such as equity-based pedagogies are discussed. Syllabus design and grading policies are also common topics. Additionally, campus-wide professional development is not specific to teaching chemistry. In an effort to get more adjunct faculty to take part in

professional development that includes specific pedagogies for topics in CHEM 107 and CHEM 111A, a 3-hour workshop has been developed within our department and was implemented in summer 2019, before the pandemic struck. About half of the adjunct faculty took part in the workshop and participant surveys were overwhelmingly positive. Based on this pilot workshop, it is apparent that more opportunities for this type of professional development could start to produce more lasting benefits to the quality of instruction in CHEM 107 and 111A and lead to improvements in course success rates as a result.

A third option would also be to change parts of the curriculum in our CHEM 107 F course to address the skills deficits often observed by our students. This third option would require re-writing portions of the CHEM 107 F lab curriculum. One reason for the lower success rates in CHEM 107 F and CHEM 111AF is the lack of basic study and note-taking skills for students taking these courses. Currently, the curriculum for these courses solely focuses on course content. The laboratory portion of these courses also focuses solely on course content. For CHEM 107 however, it is feasible that as many as two lab exercises could be replaced by activities used to develop notetaking and/or exam study skills. This could be an excellent third option for improving success rates in CHEM 107 F, but the greater impact may be seen in the success and repeat rates in CHEM 111AF because students who do pass CHEM 107 F will be better prepared for CHEM 111AF.

Table 20. Percent Sections Taught by Adjuncts for Chemistry Courses Spring 2020-Fall 2021

	Spring 2020		*Fall 2020*		*Spring 2021*		*Fall 2021*	
Chemistry Course	# of Sections	% Sections Taught by Adjuncts	# of Sections	% Sections Taught by Adjuncts	# of Sections	% Sections Taught by Adjuncts	# of Sections	% Sections Taught by Adjuncts
100 F	4	50.00%	3	33.33%	4	50.00%	3	25.00%
101 F	6	50.00%	6	50.00%	6	66.67%	6	50.00%
103F	1	100.0%	1	100.0%	1	100.0%	1	100.0%
107 F	14	64.29%	12	66.67%	13	61.54%	12	66.67%
111AF	9	33.33%	10	30.00%	10	10.00%	10	30.00%
111BF	6	16.67%	5	0.00%	6	0.00%	5	0.00%
201F	2	0.00%	2	0.00%	2	0.00%	2	0.00%
211AF	2	0.00%	3	0.00%	2	0.00%	2	0.00%
211BF	2	0.00%	2	0.00%	2	0.00%	2	0.00%
Totals	46	41.30%	44	36.36%	45	35.56%	43	37.21%

A fourth initiative that could be taken to improve outcomes specifically for LatinX students would be to develop a mentoring program for first-generation college students taking CHEM 107 and/or CHEM 111A. A division-wide mentoring program was piloted in 2019 called BOND

(Building Opportunities Through Net-Working and Diversity) to close the success gaps observed for many students who are first-generation college students. It entailed one-on-one meetings with full time faculty regarding scholarship and internship opportunities as well as supplemental academic counseling. Such a program could be re-launched, but if the program were to reach a large number of students, it would require funding and significant time commitments from faculty, especially the program coordinator. A Canvas course shell has been developed for the program with information regarding possible scholarships and internships for students to parse through, but once agaiHi n, its maintenance is not currently sustainable due to the large time commitment it requires from a faculty member.

2. For transfer degree programs: Are your current requirements in line with the Transfer Model Curriculum, or have you added extra steps, such as prerequisites? If you added extra steps, please explain.

The current requirements of our AS-T degree are in line with the Transfer Model Curriculum (TMC). No extra steps such as prerequisites have been added.

3. Please provide an update on the curriculum mapping you have done, perhaps in collaboration with Counseling. Are all programs (degrees and certificates) mapped? Based on course offerings for the last two to three years, could a student complete the map(s) you have created? If so, please demonstrate this with some facts from your schedules. If not, how will you address these discrepancies?

In collaboration with Counseling, the AA and AS-T degrees have been mapped for both 2-year and 3-year timelines. The Chemistry AS degree still needs to be mapped. Of particular note, a vast majority of students entering our programs require preparatory classes before attempting their core chemistry courses. For example, most students need to complete CHEM 107 F before attempting CHEM 111AF. Similarly, most students need to complete MATH 141 F (College Algebra) and 142 F (Trigonometry) before attempting MATH 151 F (Calculus I). All of our maps have incorporated this necessity so that students can plan accordingly.

Most of the maps have been able to incorporate preparatory math and chemistry coursework without exceeding the 60 units minimum for obtaining the degree. However, the AS-T degree requires a significantly more demanding course load relative to the AA and AS degrees. Consequently, an additional 3-year map was added with preparatory coursework, which causes the unit requirement to jump to 75 units (Table 21). If students follow this map, it would still be far less than the typical number of units students have completed when earning their AS-T degree in past, which typically approaches 95 units (Table 21). Even more importantly, it "eases" students into the science curriculum to help them acclimate to the rigors of their major by having them take only one STEM related course in their first semester. By having that first course be MATH 141 F, it solidifies their math in preparation for their first chemistry course the following semester. Based on both the chemistry and mathematics course offerings over the

last 2-3 years, students should be able to successfully complete all courses in the maps that were created.

Table 21. Three-year Map for the AS-T in Chemistry Program.

	Semester 1			
Course	Units	GE	Major	Elective
MATH 141 F / 143 F	4			x
IGETC 1C for CSU (or Area 6A for UC)	3	x		
IGETC Area 1A	4	x		
IGETC Area 3A	3	x		
Total Semester Units:	**14**			
	Semester 2			
Course	Units	GE	Major	Elective
MATH 142 F	4			x
CHEM 107 F	5			x
IGETC Area 1B	4	x		
Total Semester Units:	**13**			
	Semester 3			
Course	Units	GE	Major	Elective
MATH 151 F / 151 HF	4		x	
CHEM 111A F	5		x	
IGETC 3B	3	x		
Total Semester Units:	**12**			
	Semester 4			
Course	Units	GE	Major	Elective
MATH 152 F	4		x	
CHEM 111B F	5		x	
IGETC Area 4 (CSU Requirement 1)	3	x		
Total Semester Units:	**12**			
	Semester 5			
Course	Units	GE	Major	Elective
PHYS 221 F	4		x	
CHEM 211A F	5		x	
IGETC Area 5B	3	x		
Total Semester Units:	**12**			
	Semester 6			
Course	Units	GE	Major	Elective
PHYS 222 F	4		x	
CHEM 211B F	5		x	
IGETC Area 4 (CSU Requirement 2)	3	x		
Total Semester Units:	**12**			
Total Program Units:	**75**	**(Includes 13 preparatory STEM units.)**		

4. Do the data reveal differences among your AA, ADT, or certificate programs (in enrollment, completion, or success, for example)? Please explain.

As explained in section 3.2.1, the number of AA degrees awarded has increased overall in the last five years (Figure 1). However, a 29.2% drop in AA degrees awarded has been seen within the last year, invariably due to the pandemic as many students have found it difficult to learn in an emergency remote learning environment. The lower success rates associated with emergency remote learning delays the progress students make towards completing their degrees. In contrast to the AA program, the number of AS-T degrees awarded has increased since its inception in 2018 and has continued to increase by 20% in the last year despite the pandemic.

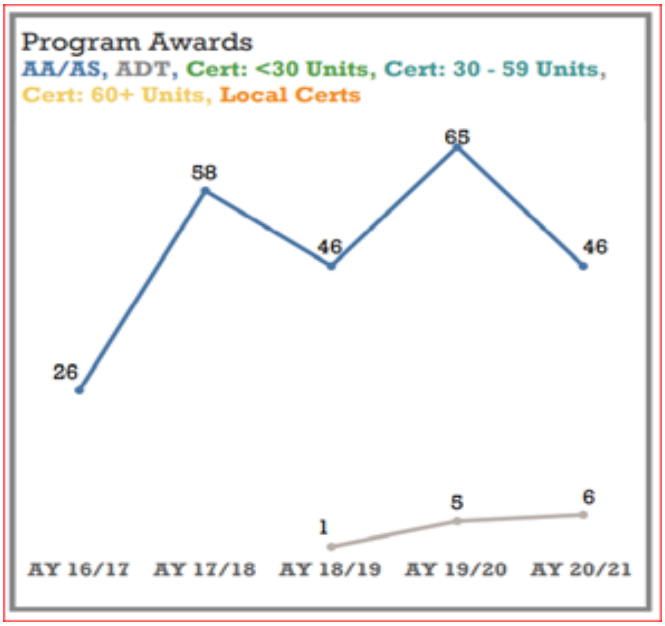


Figure 1. Number of degrees awarded for the AA/AS (blue) and ADT (gray) in chemistry in the last five years. Please note that the ADT is designated as AS=T in chemistry and was not available until 2018.

Early enrollment trends (since 2018) appear to show growing popularity among students regarding the AS-T degree vs. the AA and AS degrees (Figure 2). The head count for students choosing the AS-T pathway increased by 234% from 2019 to 2020, the last full pre-pandemic academic year, while the head count for all chemistry majors (AA, AS and AS-T combined) decreased by 28.5% during the same time period. Based on this data, it is expected that the number of AS-T degrees awarded will increase in the years to come.

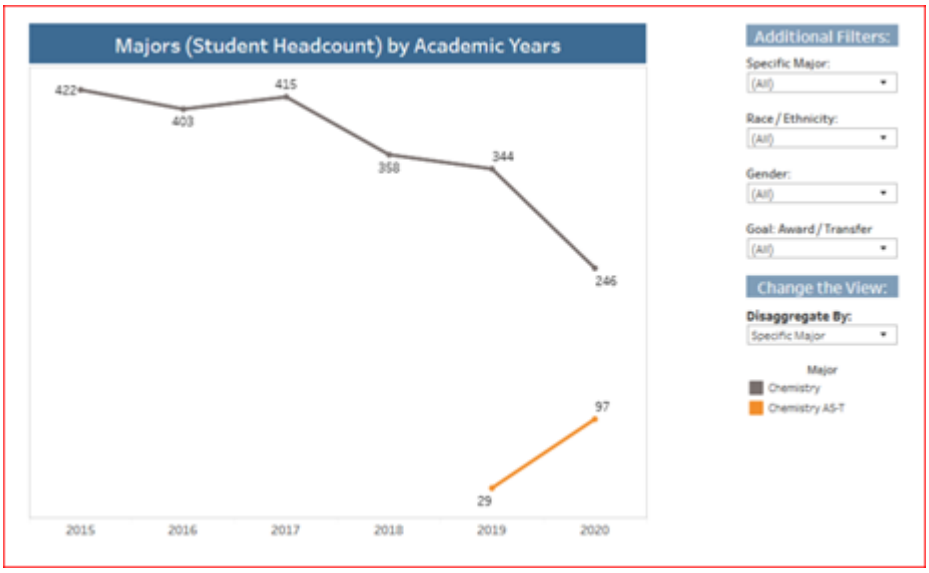


Figure 2. Student head count for all Chemistry Programs combined (gray line) and student head count for the AS-T in chemistry (orange line) over the last five years. Please note that the AS-T in chemistry was not available until 2018.

3.4 Faculty

1. Using the data provided by the OIE, briefly describe the faculty workload over the past five years: FTF (full time faculty), PTF (part time, or "adjunct" faculty), FTEF (full time equivalent faculty), WSCH per FTEF (weekly student contact hours). (Not all of these measures apply to every program.)

Over the last five years, the number of course sections taught in our department has changed from 90 to 99 sections (an increase of 10%, see Figure 3). During this same period, the number of full-time faculty in the department increased from 12 to 13 (an 8.3% increase, see Figure 4). Figure 4 also shows that the number of adjunct faculty teaching within our department changed from 18 down to 15 (a decrease of 20%). The data in Figure 4 is in agreement with Figure 5, which shows that over the last five years, the percentage of sections taught by full time faculty (changed from 58.4% to 64.3%) has increased relative to the number of sections taught by part time faculty (dropped from 41.6% to 35.7%).

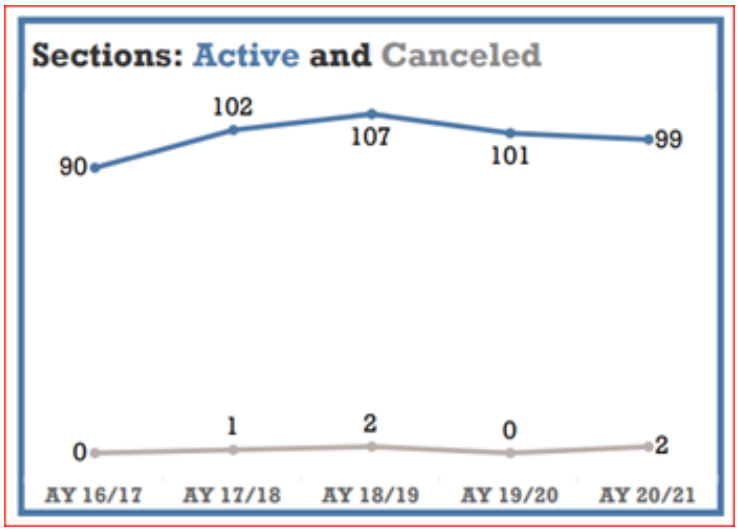


Figure 3. Number of chemistry course sections taught and canceled over the last five years.

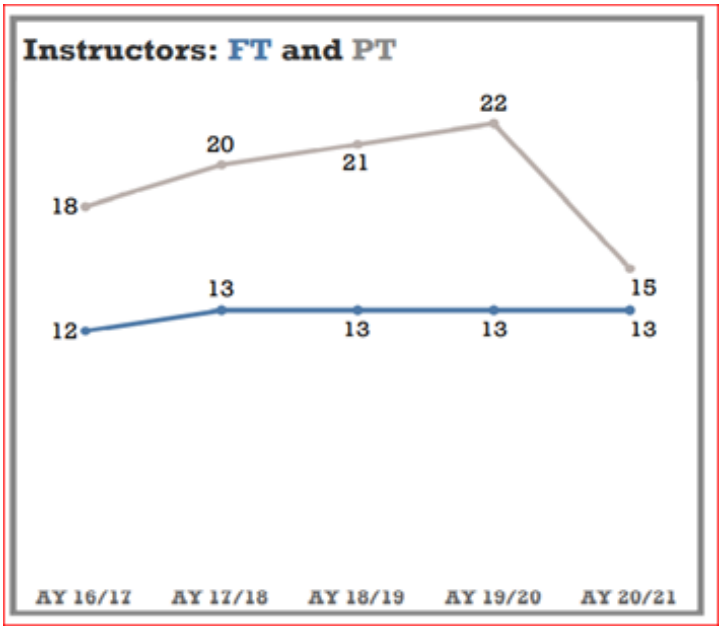


Figure 4. Number of full time and part time chemistry faculty over the last five years.

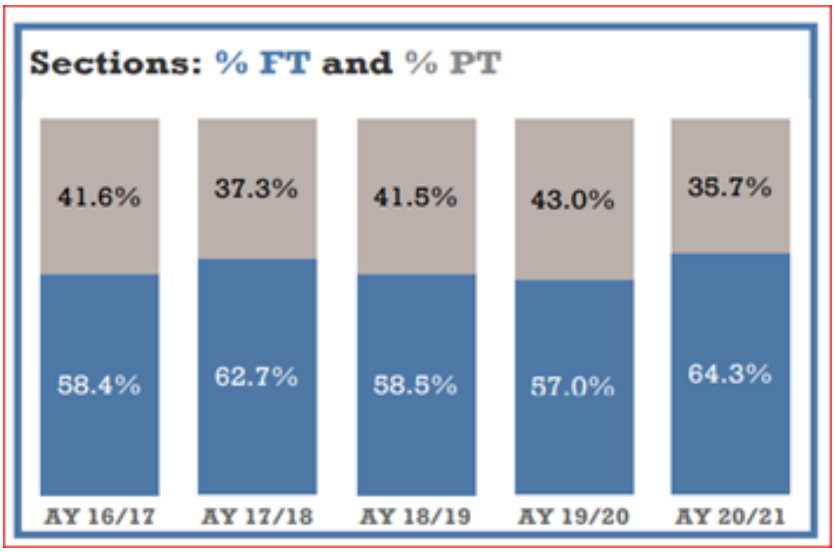


Figure 5. Percentage of chemistry sections taught by full time and part time faculty over the last five years.

A more detailed analysis of Figures 4 and 5 shows that the last year had a huge impact on the change in part time faculty within the department (invariably due to the pandemic). It would be expected that the decrease in part-time hires would be due to course sections being cut, but this is not what has happened. The number of course sections taught only dropped from 101 down to 99 in the last year (only a 2% decrease). This is also in addition to two sections that needed to be canceled. Therefore, the number of course sections offered by the department has remained flat over the last year, yet a 32% reduction in part time staffing occurred during the last year as well. What this reveals, is that the department is having difficulty finding part time faculty to teach classes. While many full-time faculty have picked up this slack by picking up extra classes, it is not likely sustainable over a long period of time especially when taking into consideration other time commitments on the part of full time faculty (see section 3.4.2 below).

It is important to note that a decrease in student enrollment has occurred across the community college over the last five years and our chemistry student enrollment has not been an exception to this trend. Both the fill rates (Figure 6) and average class size (Figure 7) over the last five years decreased by 8.5% and 5.1%, respectively. However, the decreases in enrollment have only had a minimal impact over the last five years on faculty workload given the flat weekly student contact hours (WSCH) and FTES/FTEF ratio (Figure 8), which declined by only 1.9% and 2.1%, respectively. Given the accelerated declines in enrollment during the pandemic, it is quite possible that enrollment could increase again upon returning to in-person classes and this would reverse the decreases in workload seen in the WSCH and FTES/FTEF data.

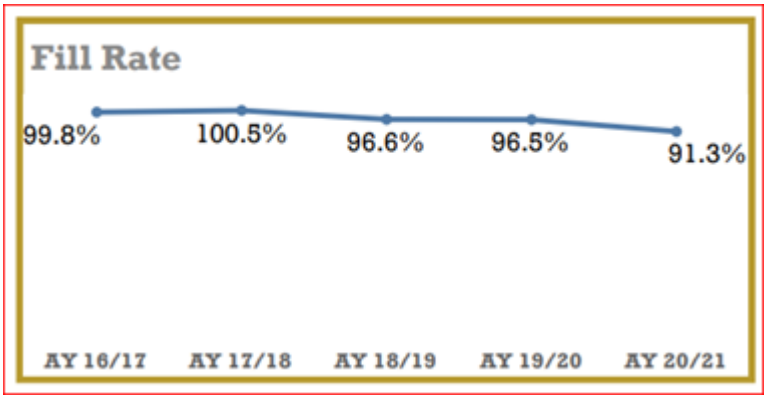


Figure 6. Fill rates for chemistry courses over the last five years.

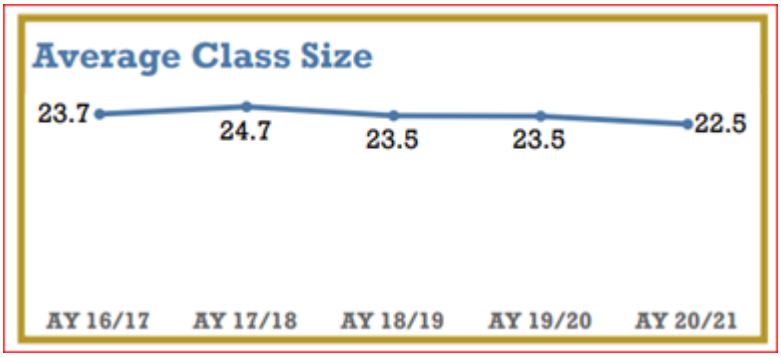


Figure 7. Average class size for chemistry courses over the last five years.

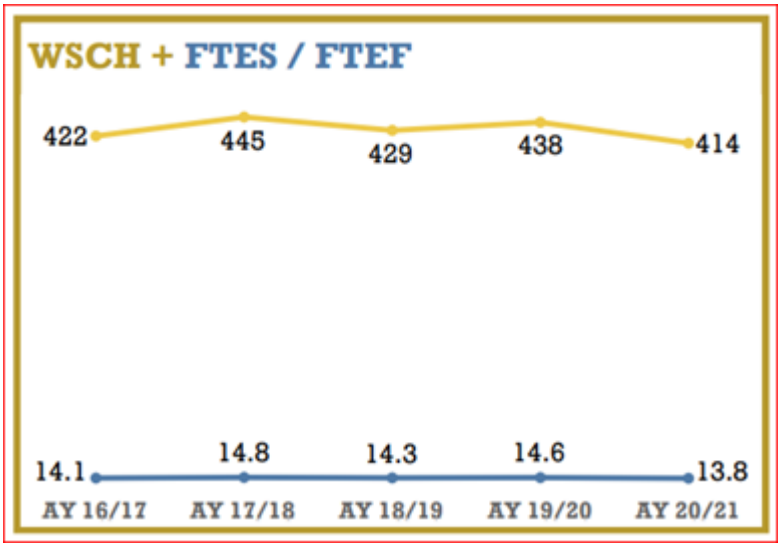


Figure 8. Weekly student contact hours (WSCH) and full time-equivalent-student to full time-equivalent-faculty ratio (FTES / FTEF) in the Chemistry Department over the last five years.

2. If your department plans to request hiring a full-time faculty member, this is the place to make the argument. Please discuss hiring needs in reference to data analyzed in sections 3.1 to 3.4.

Chemistry courses are required courses or restricted electives on eighteen different program outlines (fifteen degrees and three certificates). Offering enough chemistry courses is vital for our students to complete degrees in a timely manner. To reliably staff our program, we would need to have a minimum of 16 full time faculty along with a team of 12-14 adjunct faculty.

The Chemistry Department has faced several challenges since the last Program Review in 2017. The Department have had two faculty members resign, two faculty members that have begun the Reduced Workload program, one faculty member is on reassign time, and one faculty member that has taken an interim dean position, all while a high number of course offerings remain. These changes place a barrier for our students to complete their degrees and/or certificates in a timely manner. The Chemistry Department has had an increase in enrollment by 4.3% since Fall 2016 despite the pandemic (Figure 9). This is a large change compared to the overall change in enrollment for all other programs at the college (Figure 10). A high demand for courses has necessitated a higher percentage of adjunct faculty. Although adjunct faculty recruitment occurs at an on-going basis, we have not been able to successfully maintain a high-quality adjunct pool. The potential pool for adjunct faculty recruitment has been extremely limited.

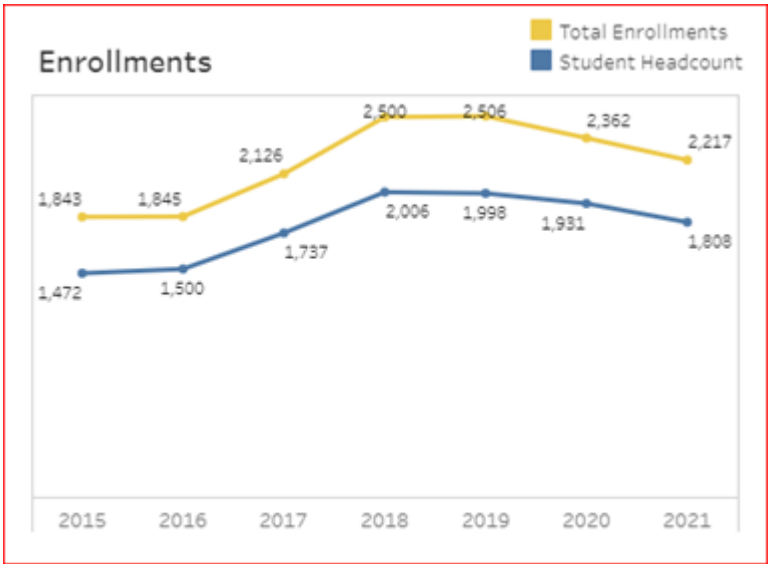


Figure 9. Total Enrollments and Student Headcounts (2015-2021)

5-Year Change Calculation

The following table calculates the % change in enrollments and headcount between AY 16/17 and AY 20/21.

Note the table shows the change for "This Program" as well as the change for all other programs combined at the College.

5-Year % Change in Enrollments	All Other Programs	-12.1%
	This Program	4.3%
% Change in Headcount	All Other Programs	-12.0%
	This Program	4.1%

Figure 10. 5-Year Enrollment Comparison of Headcount in the Chemistry Program compared to the other programs at Fullerton College.

The Chemistry Department has made every effort to offer and staff our high demand chemistry classes. The number of degrees awarded increased from 26 in the academic year 16/17 to 46 in the 20/21 (Figure 1). In addition, the number of sections offered have increased since academic year 16/17 (Figure 3). We have maximized our lab space and have included multiple Friday and Saturday course offerings. Class time is maximized by offering classes beginning at 7:00am and ending at 10:10pm. We currently have 12 adjuncts to fill positions but still require additional adjuncts to staff our course offerings (Figure 4). We are having difficulty finding and hiring adjuncts to fill our open positions. The pool of qualified adjunct faculty in the region is sufficiently small that trying to staff or even increase the number of course sections is not feasible. We have experienced a high turnover and last-minute resignations. Due to the lack of adjunct faculty, many have been given special permission to exceed the part time load each semester in order to staff open courses. Emergency hires have also been made, with instructors who have little or no teaching experience to avoid canceling classes that were filled, with students on waitlists. In some cases, course sections were closed because they could not be staffed (Figure 3). In response to this, full time faculty have also been taking on more overload, units above the 15-unit full load (Figure 11).

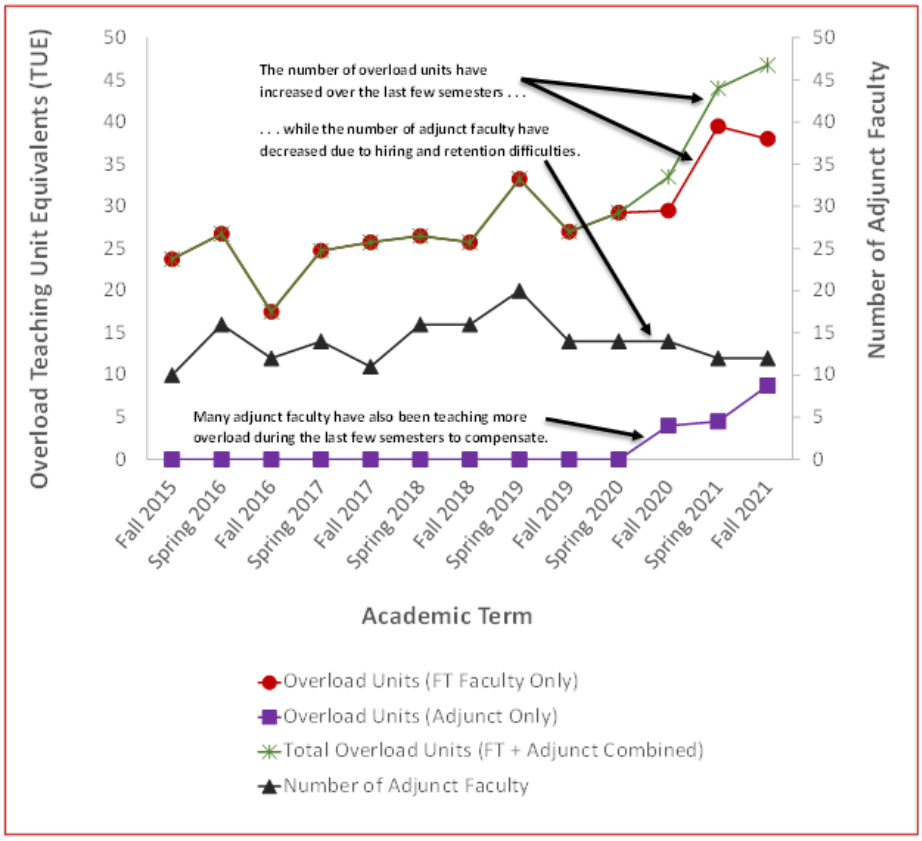


Figure 11. Overload Assessment of Full time and Part time Faculty (2015-2021)

The challenge in finding an adequate pool of qualified adjunct faculty coupled with our high percentage of adjunct faculty, make it difficult to manage quality and safety in the classroom and laboratory. Our students directly feel this burden and have made a number of serious safety and instruction-related complaints to both the Dean of Natural Sciences Division and the President of Fullerton College. Furthermore, the Chemistry Department struggles to both find and retain qualified adjunct instructors because we are competing with local industry-related jobs and higher adjunct salaries at nearby colleges. According to Figure 11, the Department lost seven adjunct faculty relative to last year. In Fall 2020, 18% of our adjunct faculty took industry-related positions, resulting in resignations just weeks before the semester began.

According to the data in Table 20, over 35% of the courses in the Chemistry Department have been taught by adjuncts in each semester between Spring 2020 and Fall 2021. The knowledge and experience of the full-time faculty within the Department cannot be replaced by adjunct faculty. Therefore, the increase in the number of sections taught by adjunct faculty presents an issue, particularly since our adjunct pool contains a significant number of inexperienced instructors. This issue mostly affects students in our Preparation for General Chemistry (CHEM 107 F) and Introduction to General, Organic, and Biological Chemistry (CHEM 101 F) courses. In Spring 2020 to Fall 2021 50% and above of the sections of CHEM 101 F and greater than 60% of the sections of CHEM 107 F were taught by adjunct faculty. More full-time faculty members are needed to provide both consistency of instruction and continuity for students to make

connections with faculty, as they begin the first course in a 5-course sequence, to obtain a chemistry degree or meet the requirements of other STEM programs

Two of our full-time faculty, who normally teach a large load of essential and difficult to staff courses (Chem 101/201) have recently begun phased-in retirement by enrolling in the Reduced Workload Program which permanently reduces their load. The rigorous courses these faculty members normally teach, including preparation for General, Organic, and Biological Chemistry, requires a knowledgeable and experienced instructor. These courses require a full-time faculty member with expertise in all of these fields. These chemistry courses are in high demand with many of the wait lists filling. All six CHEM 101 F courses in Fall 2021 had full waitlists with 10 students on each. The Chem 101 sections fill up every semester and our department turn away roughly 60 students every semester. We are currently experiencing a critical nursing shortage that's expected to continue through 2030. CHEM 101 F is the first in a two-course series for the allied health professions. This course is a pre-requisite for the nursing programs. The addition of new faculty will allow the Chemistry Department the flexibility to staff their courses as well as offer more sections, reducing the wait for students seeking chemistry classes and mitigating one of the barriers to completion.

In 2014, our department used an ACS Assessment Tool for Chemistry in Two-Year College Programs. The American Chemical Society (ACS), being the world leader in chemical education research, developed this resource to assist in the identification of strengths and opportunities for growth in two-year Chemistry Programs. In the *Faculty and Staff* section of the review, the Assessment Review Panel made the following comments regarding the department's current use of adjunct faculty:

"… it is recommended that a ***minimum*** of 75% of the courses be taught by full time faculty, to ensure consistency of instruction throughout the program. If course assessments show challenges providing consistent, high-quality instruction to all students, it may be necessary to hire additional full time faculty."

As of Spring 2021, our department only has a full time staffing percentage of 64.3% for our courses. A safe laboratory environment is heavily dependent on the presence of faculty with experience in the safety and emergency response procedures specific to our program. Essentially all (95%) of the sections taught in the Chemistry Department have a laboratory component. As the percentage of adjunct faculty increases, maintaining a safe laboratory environment becomes more difficult. The high rate of turnover that is commonly observed with adjunct faculty results in a dangerous loss of experience that is essential to a safe laboratory environment. This coupled with the loss of stockroom staff has drastically increased the need for well-trained full-time faculty.

The Chemistry Department has the largest difference in FTEF and number of full-time faculty in the Natural Sciences Division. The data in Table 22, provides an additional argument to support the hiring of additional faculty in the Chemistry Department. According to the fall 2020 data (Appendix E), the Chemistry Department has both the largest Total FTEF and difference

between the number of full-time faculty and Total FTEF in the Natural Sciences Division. However, chemistry lab experiments involve more hazards than other labs and with 95% of our courses including a laboratory component, and our dedication to lab safety, we are in need of more full-time faculty.

When the pandemic began and discussion about offering summer and fall laboratories remotely occurred, the Chemistry Department was the only department in the Natural Sciences Division to immediately and unanimously agree that moving our students forward academically and remotely was our priority. The full-time faculty of the Chemistry Department took on the burden to formulate rigorous laboratory curricula while maintaining the number of course offerings. The Chemistry Department has always aimed to produce as many FTES as possible, thereby supporting both the students and Fullerton College. Our full-time faculty members have regularly taken overload to meet the demands of our students, including this past summer during the pandemic. We hope that our Department's commitment to the Natural Sciences Division and Fullerton College is appreciated and acknowledged. The Chemistry Department is committed to curating a diverse faculty body and will continue to use new practices to do so in the upcoming hiring cycle upon being awarded with the ability to hire three new faculty members.

Table 22. Analysis of Full Time Equivalent Faculty in Natural Sciences Division

Department	*Number of FT Faculty*	*Total FTEF*	*Difference*
Anatomy and Physiology	4	5.3	-1.3
Biology	12	16.4	-4.4
Chemistry	**13**	**20.1**	**-7.1**
Earth Science	4	3.9	+0.1
Environmental Science	2	2.3	-0.3
Health Education	1	1.0	0
Horticulture	1	1.7	-0.7
Nutrition and Foods	4	5.1	-1.1
Physics	4	4.2	-0.2

3.5 Covid-19

Using the data provided by the OIE, briefly describe how the Covid-19 pandemic affected your department and how your department has adjusted. Did you make temporary changes? Or have you adopted new, long-lasting practices that enhance teaching?

The COVID-19 pandemic had a dramatic effect on the Chemistry Department. The 2019-2020 academic year was met with an unprecedented disruption to education, and the impact to the Chemistry Department is evident in the data. The sudden transition to remote learning, experienced during the Spring 2020 semester, significantly impacted course success and completion rates, across the majority of chemistry courses. Course success rates dropped to 68.4% in AY 19/20 and 66.4% in AY 20/21 while at the same time course completion rates

dropped to 78.9% in AY 19/20 and 76.4% in AY 20/21 (Table 1). The Chemistry Department, as a whole program, achieved a course success rate that exceeded the Institutional Set Standards (ISS) of 64.4%. However, the average course completion rate during the pandemic fell below the Institution Set Standard of 79.2%. In light of this, enrollments still maintained a 4.3% increase from AY 16/17 (Table 1). For comparison, in the 2017 Program Review, the Chemistry Department observed steady success rates ranging from 72.3% to 73. 8% for the period of 2013-2017, as well as steady retention rates ranging from 82.8% to 84.2% for the same five-year period. As the pandemic continued, there was a dramatic decrease in the number of students transferring: 63 in 2020 to only 7 in 2021 (Table 12). The number of program awards decreased dramatically from 70 in AY 19/20 to 52 in AY 20/21 (Table 11).

The Chemistry Department is committed to promoting student equity and success and every effort is put forth to better serve students. For this reason, despite the severe disruption in Spring 2020, seven out of nine courses exceeded the course success minimum standard. (CHEM 100 F, CHEM 101 F, CHEM 111AF, CHEM 111BF, CHEM 201F, CHEM 211AF, and CHEM 211BF). Of those seven courses, only three (CHEM 100 F, CHEM101 F, and CHEM 211BF) met the course completion standard as well. The overall success rates observed in these courses can be attributed to several key components that are described below.

1. The Chemistry Department has continued to greatly utilize and benefit from the Hornets Tutoring program during the transition to remote instructions. Having embedded tutors has undoubtedly improved student retention and success across chemistry courses.
2. The Peer Undergraduate Mentoring Program (PUMP) has maintained its offerings of academic mentorship, training and support to students during the pandemic. PUMP tutors served in many of the CHEM 111AF courses in 2019-2020.
3. In partnership with STEM-SLC, the Chemistry Department has continued to run chemistry boot camps prior to every semester, including summer, in 2019-2020.These boot camps have proven to be effective at preparing students, playing an important role in meeting the course success standards.

Many specific courses in the Chemistry Department saw dramatic changes in completion and success rates. However, we must take into consideration the student populations in these courses. For example, CHEM 201 F saw a significant drop in average completion from 85.36% in AY 18/19 to 70.0% in AY 19/20. The student population in CHEM 201 F, as well as other chemistry courses, includes many students that work in the healthcare industry. Many students were faced with long work hours, sudden changes in work schedules or working overtime in the midst of the public health crisis. An overall drop in course completion rates was also observed in CHEM 107 F, CHEM 111BF and CHEM 211AF. A close examination of data reveals the lowest course success and completion rates were observed in CHEM 103 F, with averages of 51.7% and 75.9%, respectively. The same general trends were also observed in the 2018-2019 academic year for this course, with the lowest reported course success and completion rates of 48.1% and 65.4%, respectively. CHEM103 F is intended for non-science majors seeking a general education science course with no laboratory component nor any prerequisites. Therefore, it is possible that this student population has fundamentally different or unrealistic expectations

and/or misconceptions of the course and may even demonstrate less interest in the sciences. Some considerations to address this could be to add a math prerequisite (quantitative reasoning) and/or include a more explicit list of course expectations in the course schedule. It is worth noting the course success and completion rates appear to have slightly increased from 2018-2019 to 2019-2020, which is in contrast to the trends for the other chemistry courses. A possible explanation might be that this unique population of students might actually benefit from the transition to remote instruction. In the future, it will be worth exploring a more virtual or even fully online modality of delivery.

The abrupt and sudden shift to remote instruction was disruptive not only to students, but for faculty as well. Most faculty in the Chemistry Department had no prior training to teach an online course, as was the case for educators across the nation. In spring 2020, several tutorials and workshops were held over the course of a few days, necessitating faculty to quickly learn how to conduct an in-person class on a computer. The Chemistry Program was heavily impacted by the transition to a virtual setting, particularly because eight out of nine chemistry courses have a laboratory component. Several faculty members have sought additional training and have earned an online training certificate. Course coordinators were forced to spend many hundreds of additional hours developing laboratory curriculum for their courses. Some faculty, foreseeing that the pandemic was going to be a long-term problem, seized the opportunity to secure funding and partner with third-party vendors such as Hands-On-Labs and e-Science to provide free lab-grade kits to students to work on experiments from home. The experiments were carefully reviewed, tested, and selected by faculty to ensure safety, rigor, and curricular overlap. While the home lab-kits cannot match the experience in an actual laboratory, students enrolled in CHEM 101 F, CHEM 107 F, CHEM 111AF, and CHEM 111BF greatly benefited from the hands-on practice, which is a core requirement for learning and success in most of the Chemistry courses. Some challenges associated with using take-home lab kits has led some of our course coordinators to produce their own lab videos and modules so that students can at least garner the skills of scientific observation, recording of data and interpretation of results. Although students do not get the hands-on skills, they would normally get by physically doing the experiments, the modules produced in this capacity will be used when in-person classes resume. The new lab modules are essentially electronic versions of the pre-pandemic lab curriculum and will serve as supplemental learning materials for students. This will be a long-lasting improvement to the lab curriculum for many of our classes.

Due to the hazardous and toxic nature of most chemicals used in Organic Chemistry, kits were not utilized in CHEM 201 F, CHEM 211AF and CHEM 211BF. CHEM 211AF and 211BF used Beyond Labz virtual laboratory simulations while CHEM 201 F used InSpark Laboratory simulations. In addition, interactive Labster Simulations and faculty-led recorded experiments were utilized to deliver a rigorous Chemistry Laboratory Curriculum.

The faculty wish to continue to take advantage of Labster or similar lab simulations technology to supplement and enhance the student learning experience. Furthermore, as many faculty practice blended learning and flipped-classroom pedagogy, a number of courses may continue to be offered as hybrid (lecture online and lab in-person) with the lecture recordings provided

and assigned in advance to dedicate more class time to engage students in discussion, problem-solving, and group work.

3.6 What has not been asked?

Please tell us about other ways your department has been successful, ways that the previous questions might have missed.

The Chemistry Department is working on a Chemistry Associate in Science for UC Transfer degree. Thus far, it has been approved by the curriculum committee. Next approvals are DCCC (District Curriculum Coordinating Committee), Board, and State. This will be the first UC Transfer degree in the District, a real win for those students with the intent of transferring to the UC system.

4.0 Outcomes

4.1 Program Student Learning Outcomes (PSLOs)

Since the last self-studies, the College adopted new Institutional Student Learning Outcomes (ISLOs) and new design principles for PSLOs. Please describe your department's PSLO revisions to date, and your PSLO plans.

Two faculty members of the Chemistry Department have met with a PSLO redesign committee member in a PSLO redesign workshop this semester. The faculty revised the PSLOs for the AS Chemistry degree program. They will then meet with the rest of the department to discuss their redesigned PSLOs. Once approved, the Chemistry faculty will have continued discussions on how the redesigned PLSOs will be assessed going into the future.

4.2 PSLO Assessment

The new PSLO design principles encourage departments to use PSLOs as a way of gauging student learning once they have completed a degree or certificate, not just when they have completed a single course. Please describe how PSLOs are assessed or will be assessed in your department.

Currently, PSLOs are assessed through course SLOs which are mapped to them. Therefore, all PSLOs have ongoing assessment throughout the student's progression in the program. Since faculty members have gone through the PSLO redesign process, further discussion with the entire Chemistry Department will have to be done to determine if the current mode of assessment will remain the same.

4.3 CSLO Assessment

Briefly describe the timeline your department uses to assess CSLOs on a regular basis and how you use the results to make improvements. This discussion should be based on SLO data, which is available on eLumen. (Your division's SLO reps can help with this.) Please include relevant CSLO charts or graphs in an Appendix. Since the last self-study, you should have assessed the CSLOs of every course that you

have taught, at least once. If that is not the case, please describe how you will accomplish this as soon as possible.

The Chemistry Department assess Course Student Learning Outcomes, CSLOs, once every three years. Each course has its own set of Student Learning Outcomes. Some will assess all three to four CSLOs in one semester while others will stagger and assess one or two of them every year. All CSLOs are assessed using either a two-point (meets/does not meet expectations) or a three-point (exceeds/meets/does not meet expectations) scale. Several courses were unable to assess CSLOs based on laboratory skills due to the pandemic and were marked N/A in Table 23. These will be assessed as soon as the students return to campus and resume normal laboratory classes. CHEM 103 F was the only course that did not assess CSLOs during the 2017-2021 period. Plans will be made for the coordinator of CHEM 103 F to ensure that the assessment of their SLOs occurs in Fall 2021 and resume the analysis every three years at a minimum.

The department uses the assessment of CSLOs in discussions about expectations of outcomes at the course level and the progression of skills we expect as the students move through our program. The data has led to changes in our laboratory program for general chemistry and an improvement in student competencies. Important changes include updating to more digital equipment and increasing the scope and depth of student laboratory notebook requirements.

Chemistry 107 F showed an overall success rate in CSLOs of 59.16% (Table 23). Although most courses saw a decrease in success in their CSLOs following the onset of the pandemic, CHEM 107 F has an overall low success rate throughout multiple semesters. Since Chem 107 F students feed into the 111AF and 111BF courses, their success is also greatly affected. This can be attributed to by a couple of factors.

First, the Chemistry Department investigated the effect the math course students took prior to CHEM 107 F and CHEM 111AF on their success. Success rate data (Table 24) show that students were 52% and 30% more successful in CHEM 107 F and CHEM 111AF, respectively, when having taken Math 141 F or Math 141HF prior to their chemistry courses when compared to those students that took Math 040 F, 041 F, or 043 F. By ensuring the students obtain the proper background knowledge, they are being set up to complete the series of chemistry courses more successfully for their program. The recommended math requisite of Math 141 F or 141HF prior to CHEM 107 F and CHEM 111AF has been added to the curriculum and will begin in Fall 2022.

In addition, to improve the success of our students, we require additional full-time faculty, especially for CHEM 107 F. In Spring 2020 to Fall 2021 greater than 60% of the sections of Chem 107 F were taught by adjunct faculty. More full-time faculty are needed to provide both consistency of instruction and continuity for students to make connections with faculty as they begin the first course in a 5-course sequence (Chemistry 107 F) to obtain a chemistry degree or meet the requirements of other STEM programs as discussed in section 3.

Table 23. CSLO Analysis of Chemistry Courses 2017-2021

Course	*Semester(s) Assessed*	*% Student Met Expectation SLOA-1*	*% Student Met Expectation SLOA-2*	*% Student Met Expectation SLOA-3*	*Average % Students Meets Expectation*
Chem 100	Spring 2019	91.43	80.95	94.29	88.89
Chem 101	Fall 2018		62.35		71.88
	Fall 2019			88.89	
	Fall 2020	71.74	64.13	N/A	
	Spring 2021	70.83	73.33	N/A	
Chem 103	No Data				
Chem 107	Spring 2018	55.13	88.46	50.00	59.16
	Fall 2019	56.56	83.61	42.62	
	Spring 2021	72.93	63.91	26.32	
Chem 111A	Spring 2021	58.73	58.05	90.32/93.55 (*3&4)	75.10
Chem 111B	Spring 2021	38.37	63.22	N/A	50.87
Chem 201	Fall 2020	61.54			68.89
	Spring 2021	68.75	75.00	N/A	
Chem 211A	Fall 2018	73.33	66.67	92.86	76.21
Chem 211B	Fall 2018	79.31	75.86	100.00	85.06

*CHEM 111A has 4 CSLOs for the course.

Table 24. Success Rates for CHEM107 F and CHEM 111AF with Prior Math Course (AY 19/20)

	Success Rates for CHEM 107 F	*Success Rates for CHEM 111AF*
Math 040F/041F/043F	48%	50%
Math 120F/120HF	73%	68%
Math 141F/141HF	73%	65%
Higher-Level Math	82%	77%

To increase the success of the students in the Chemistry Program, the faculty are dedicated to incorporating Hornets Tutors into their classrooms. The Chemistry Department has the highest number of sections with Hornets Tutors in the Natural Sciences Division (Table 25) with CHEM 107 F and CHEM 111AF, having the highest overall number of sections with Tutors (Table 26).

Table 25. Number of Sections with Hornets Tutoring in Natural Sciences Division (Summer 2019-Spring 2021)

Subject	*Number of Sections*
Chemistry	81
Biology	44
Nutrition	23
Earth Sciences	18
Physics	14
Anatomy	13

Table 26. Number of Sections Staffed with Hornets Tutoring in the Chemistry Department (Summer 2019-Spring 2021)

Subject	*Number of Sections*
CHEM 111AF	18
CHEM 107 F	17
CHEM 111BF	17
CHEM 101 F	11
CHEM 211BF	7
CHEM 201F	6
CHEM 211AF	5

4.4 SLO Equity Analysis

1. Looking at CSLO attainment data, do you find significant differences by race, ethnicity, gender, and other categories? Please include some illustrations of this data in the Appendix. Describe here what the data shows. What strategies will you use to close the attainment gaps among groups of students? What kinds of professional learning would help?

The CSLO data was disaggregated by ethnicity (Table 27). In looking at the CSLO data shows that there are significant differences by race. In the 5-year period, the percent of students that met or exceeded expectations was greater than 80% for American Indian/Alaska Native, Asian, and White Non-Hispanic students while lower (70-80%) for Filipino, LatinX, and Pacific Islander students. African American students has the lowest percent of students that met or exceeded expectations at 66.97%. It is important to note that, of the 5,268 students assessed, smaller numbers of African American (2%), American Indian/Alaska Native (0.5%), Filipino (6%), and Pacific Islander (0.3%) students were assessed during this period compared to Asian (22%), LatinX (48%), and White Non-Hispanic (21%) students. Given the much greater number of Hispanic students included in this assessment, the lower percent of LatinX students that met or exceeded expectations compared to Asian and White Non-Hispanic students is significant. Additionally, although LatinX students make up nearly 50% of all students assessed, they make up only 30% of the students that were seen to exceed expectations. This is disproportionately smaller compared to Asian and White Non-Hispanic students which each make up

approximately 30% of students seen to exceed expectations even though the total number of Asian and White Non-Hispanic students assessed was only 22% and 21% of the total, respectively. To contrast this, African American students made up 2% of the total number of students assessed and also 2% of the total number of students identified as meeting expectations.

Regarding CSLOs, some chemistry courses, like CHEM 100 F, use a two-point scale (meets/does not meet) while others like CHEM 103 F use a three-point scale. It is possible to imagine that the difference between receiving “exceeds” vs. “meets” expectations could be a somewhat subjective judgement call that could be influenced by implicit bias. For this reason, the recommendation from the Institutional Integrity Committee, to report SLOs on a meets/does not meet scale, seems that it could potentially result in a more equitable assessment of CSLOs across all courses. Another strategy could involve the use of rubrics. Rubrics are used by some instructors that are or could be shared with all instructors of that course, making the assessment process less ambiguous and less susceptible to bias. A clearly defined rubric that states the criteria for meeting a particular benchmark empowers students as well by providing them with the knowledge of what they specifically need to do to achieve it. Additionally, using different types of assessments could lead to more equitable outcomes by allowing students to demonstrate knowledge and skills in a variety of ways. Some examples of assignments used in the assessment of CSLOs in our program are research papers, laboratory notebooks, poster presentations and standardized exams.

The same strategies that would be used to alleviate course bottlenecks in Section 3.3, could also be used to address the gap between groups of students in meeting course expectations. One strategy is to address skills gaps that are disproportionately observed in historically marginalized groups of students. Students that have these skills gaps could possibly be helped through curriculum changes that include class exercises on how to take notes, time management, and supplemental academic advising specific to the sciences. In addition, more full-time faculty to teach courses allows for more consistency of instruction that will help alleviate CSLO attainment between sections in the same course. Training adjunct faculty in best teaching practices in chemistry to improve skills is critical as many of the adjunct faculty are inexperienced. By giving them the professional development training, the students will benefit in a stronger, more consistent education.

The Chemistry Department will continue to offer high impact practices such as Hornets Tutoring, PUMP, PAL tutoring, BOND mentorships, and STEM-SLC cohorts to bridge the CSLO attainment gaps between groups of students. However, additional professional development opportunities centered on incorporating culturally responsive practices within chemistry courses that already have packed curriculum would be beneficial. In addition, equity gaps can be bridged by incorporating workshops in which Chemistry faculty can work together in building high impact assignments as well as discuss equitable grading practices and other strategies that can be applied to all chemistry courses in a sequence.

Table 27. Percent Student Success by Ethnicity in all Department CSLOs from Spring 2016-Spring 2021

Ethnicity	*Students Exceed Expectations*		*Students Meet Expectations*		*Students Do Not Meet Expectations*	
African American	3	2.75%	70	64.22%	36	33.03%
American Indian/Alaska Native	1	4.17%	19	79.17%	4	16.67%
Asian	39	3.36%	914	78.73%	208	17.92%
Filipino	12	3.85%	237	75.96%	63	20.19%
LatinX	40	1.60%	1754	70.05%	710	28.35%
Pacific Islander	0	0	12	70.59%	5	29.41%
Unknown	0	0	42	77.78%	12	22.22%
Unspecified	0	0	3	50.00%	3	50.00%
White Non-Hispanic	40	3.70%	829	76.69%	212	19.61%

2. Compare the equity analysis in this section to the equity analysis in Section 3.2. Are there some groups who have lower completion and success rates AND lower SLO attainment rates than other groups? Can new departmental strategies close both gaps? Please explain. [For example, many departments found that their SLO attainment gaps are quite a bit smaller than their success gaps (or the gaps don't exist). This might mean that many students who get a D or lower in a course are actually learning the material (i.e. attaining the SLOs) but they are winding up with a failing grade for other reasons: absences, tardies, missed assignments, missed exams, poor performance on high-stakes assignments.]

The equity analysis in Section 3.2.2, shows that African American students have a 79.9% course completion rate. However, in looking at the CSLO data in Table 24, it shows that only 66.97% of African American students are successfully attaining the CSLOs. The LatinX students have a much lower success rate of 63.9% and only 70.05% are meeting expectations. There is a definite gap present with the LatinX students. One way in which the Chemistry Department is trying to bridge this gap is by having Hornets tutors embedded into many of the chemistry courses. 42% and 37% of LatinX and African American students, respectively, are in courses with Hornets Tutoring.

The Chemistry Department will continue to offer high impact practices such as Hornets Tutoring, PUMP, PAL tutoring, BOND mentorships, and STEM-SLC cohorts to bridge the CSLO attainment gaps between groups of students. In addition, the Chemistry Department will have ongoing discussions on high impact practices that can be incorporated into the courses as discussed in the previous question.

Table 28. Percent of Students Reached by Hornets Tutoring Program

Ethnicity	*Percent of Students in Courses with Hornets Tutoring*
American Indian/Alaskan Native	50%
Asian	51%
African American	37%
Filipino	51%
LatinX	42%
NHPI	33%
Two or More	47%
Unknown	48%
White	45%
Total	45%

5.0 Other Areas of Program Effectiveness

5.1 Your Department and General Education

1. Using the data provided by the OIE, please look at students who take your courses for GE credit.
2. What role does your department play in helping students complete the GE pathway?
3. Do you offer GE courses at a variety of time slots and at a frequency that allows students to fulfill GE requirements?
4. Please take into account daytime, evening, weekend, and online classes to provide a brief sketch of your GE course availability.

Because the vast majority of our courses meet CSU and IGETC requirements as well as major requirements for Science and Allied Health students, looking at the numbers in aggregate provides little insight into how we serve the general education needs of students college wide. CHEM 100 F and CHEM 103 F do not meet any science or allied health major requirements that we are aware of so we can assume that those students enrolled to meet their GE requirements.

We have typically offered a number of sections of CHEM 100 F every semester at various times throughout the week, including evenings. However, since the lab space used for this course is also used by courses that serve allied health and science majors, and since those courses have had a significant backlog over the years, we have shifted our resources to prioritize courses that serve allied health and science majors. This limits our scheduling flexibility when offering CHEM 100 F. Ultimately, our course offerings are constrained by our facilities.

CHEM 103 F does not have a laboratory component but the limited amount of classroom space available caused us to reduce the number of sections we offer in favor of higher demand, more backlogged courses that serve allied health and science majors. While still offered every semester, CHEM 103 F may also lend itself to possible online offerings. Although we had

offered it online prior to the pandemic, those offerings were discontinued because of two main challenges: 1) The faculty member, skilled in online instruction that offered the course previously retired and 2) It tended to attract students who were unaware of and/or unprepared for the rigor of a science course taught online. As a result of the experiences gained in the pandemic, there are more faculty who are skilled in online instruction and willing to use this method and delivery, and students are more experienced with the rigors of online instruction and can make a more informed decision as to whether this method of delivery would work for them. Consequently, it may be feasible to continue offering sections of CHEM 103 F online going forward.

CHEM 101 F, CHEM 107 F, CHEM 111AF and CHEM 111BF also meet GE requirements. Students sometimes chose to take CHEM 101 F and CHEM 107 F and less frequently CHEM 111AF to meet GE requirements. While anecdotally we find those numbers to be small, especially considering that the above courses are primarily populated with allied health and science majors., without specifically disaggregated data, we would be unable to determine how many GE students are served. The above courses are offered day and evening and in CHEM 107 F and CHEM 111AF are also offered on the weekends to meet the diverse schedules of students.

5.2 Outside Influences on Your Department

1. Describe any laws, regulations, trends, policies, procedures, or other influences that have an impact on your program. Please include any other data that may be relevant to student achievement, learning, and trends within your Basic Skills, CTE, or Transfer Education programs.
2. Make sure you are including all degree and certificate programs, including the College's GE program.
3. Please also consider not only your courses, but also prerequisite and corequisite courses that might be offered by a different department.
4. If AB 705 applies to the program then how are you meeting its mandates?

While AB 705 does not apply to our Chemistry Program as far as the mandate itself, it has the potential to have a significant impact on our Chemistry Program as well as all other programs that require chemistry as part of their requirements. As chemistry courses have at a minimum intermediate algebra (e.g., MATH 40F or equivalent) there is concern that use of default placement procedures or guided self-placement may cause a significant decrease in the number of students prepared to succeed in chemistry courses. There are two main areas of concern that could make it more challenging for students to succeed in chemistry courses: under placement of students in math courses and over placement.

Based on preliminary data, thus far (Figure 12), the implementation of AB 705 has not had a noticeable difference in the success and retention rates in our CHEM 107 F courses. The Math Department began phasing in AB 705 in fall 2017 via the decrease in Math 40 F sections offered. Therefore, Figure 12 does not show a drop in the number of Math 40 F sections offered until spring 2018. If implementation of AB 705 resulted in lower success and retention rates in

CHEM 107 F, there would've been a marked decrease as the number of Math 40 F sections offered decreased from spring 2018 to fall 2019. However, the success and retention rates remained virtually unchanged during that time. It was only upon the start of the pandemic in spring 2020 that the success and retention rates for CHEM 107 F began to noticeably decline. However, this is more attributed by the dramatic shift to remote learning and not the result of lower number of Math 40 F sections.

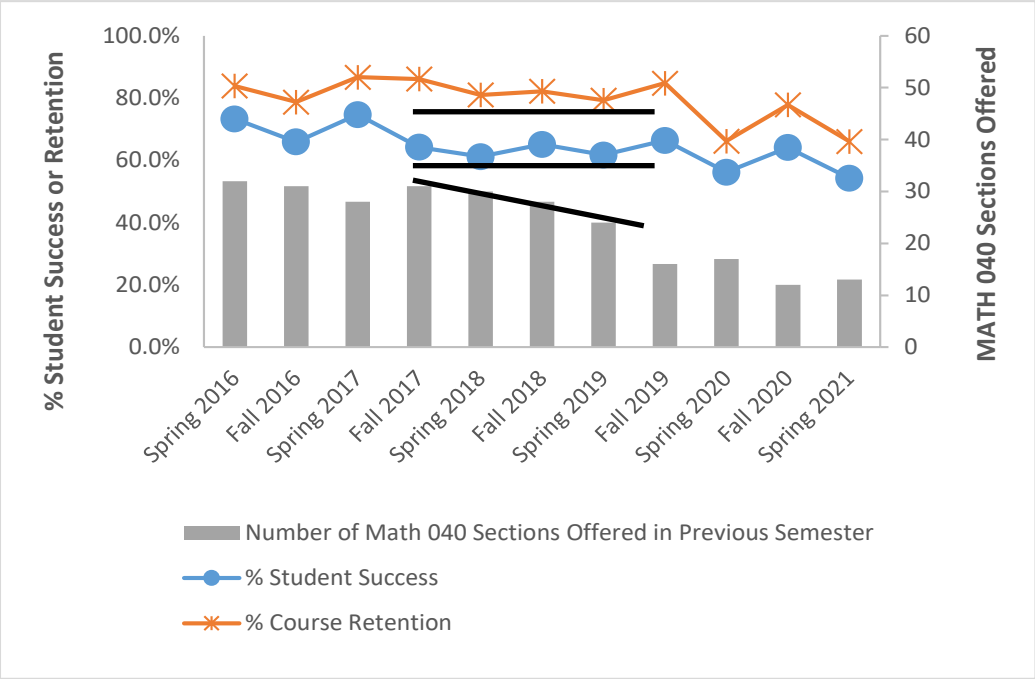


Figure 12. Percent student success and retention in CHEM 107 F and the number of Math 40 F sections offered in the previous semester over the last five years.

For students pursuing a career in STEM, the first college level math course appropriate to their degree or transfer would be college algebra/pre-calculus (e.g., MATH 141 F/MATH 142 F). Students, especially those from disadvantaged backgrounds along with returning students whose most recent math course has been more than three semesters prior to enrollment, may find college algebra not only challenging, but intimidating. Further, those who have not completed intermediate algebra prior to enrolling at the college that opt for college algebra, would not have met the pre-requisites for chemistry courses until they have successfully completed college algebra, which for many students does not occur on the first attempt.

Students intimidated by the prospect of taking college algebra may under place themselves choosing to take the statistics pathway to fulfill their math requirement, essentially eliminating a STEM field as a viable option. Of particular concern is whether students of color and disadvantaged students already underrepresented in STEM fields would be less apt to purse such fields. Currently, due to the major confounding variable that is the COVID-19 pandemic, it may not be possible to determine what impacts AB 705 may be having on chemistry

enrollments, however it will be important for the college to study the trends and consider interventions designed to boost confidence and achievement in algebra-based pathways so that students may have more options within STEM and be better prepared to succeed.

5.3 Your Program's Active and Applied Learning and High-Impact Practices

1. The College wants to create an inventory of faculty efforts to make learning active and applied. Please briefly describe opportunities your students have to apply and deepen knowledge and skills through projects, internships, co-ops, clinical placements, group projects outside of class, service learning, study abroad, and other experiential learning activities that you intentionally embed in coursework, or elsewhere in your program.

The Chemistry Department has several opportunities for students to apply and deepen knowledge and skills through projects inside the classroom, attendance of chemistry boot camps, peer mentoring with embedded Hornets tutors, PUMP, service learning in community outreach events, undergraduate research experiences with project RAISE, as well as faculty engagement and mentoring in the BOND program.

Projects inside the Classroom

Some faculty have incorporated project-based learning into their curriculum. For example, some faculty have course projects such as poster presentations where they require students to synthesize concepts from several sections of the semester to foster critical thinking skills as well as communication and writing skills.

Hornets Tutoring

The faculty of the department are actively involved in the Hornets Tutoring program with the highest number of sections staffed with tutors in the Natural Sciences Division (Table 25). Embedded tutors have been assigned to difficult courses to provide regularly scheduled, out-of-class, peer-facilitated sessions. These tutors provide weekly review sessions and tutoring for the students. The extra "time on task" work affords students extra practice with problem solving. This program continued to serve students after moving to remote instruction. During the Fall 2021 semester, 22 sections of Chemistry courses had tutors. The Chemistry Department has greatly benefited from this program and having embedded tutors has undoubtedly improved student retention and success across chemistry courses. Please see data provided in the 2017 Program Review.

Peer Undergraduate Mentoring Program (PUMP)

PUMP, a mentoring program started in 2012, aims to improve student retention and successful completion in Science, Technology, Engineering and Mathematics (STEM) courses. PUMP program pairs first year Fullerton College STEM students with academically outstanding STEM students from California State University, Fullerton. Offering individualized peer mentoring has been beneficial to the STEM students at Fullerton College (refer to data found in the 2017 Program Review).

The PUMP program easily and quickly transitioned to a remote setting with the onset of the pandemic and remote learning. Flexibility was essential during this time and end of the semester weekly topics shifted from career based to providing support with students adjusting to their STEM classes to a virtual environment. The program transitioned to an Online platform, Canvas. Live Zoom sessions, texting and email were utilized to reach students during a difficult transition. The program was essential in providing information about the college's resources during the pandemic, as well as having mentors provide consistency when everything else seemed to be quickly changing.

Student and mentor feedback from the end of the Spring 2020 semester was positive so PUMP has continued to run to serve our students through summer 2021. The Chemistry Department is proud of our CSU mentors now reaching from CSUF to CSU Dominguez Hills. They provide clear support for our Fullerton College students.

Boot Camps

In partnership with STEM-SLC, the Chemistry Department offers Boot Camps for the most rigorous chemistry courses including CHEM 107 F, CHEM 111AF, CHEM 111BF, CHEM 211AF and CHEM 201 F. Boot Camps are workshops, led by full time faculty, that are held just before the beginning of the fall and spring semesters (or shortly after). Students review topics that faculty have determined to be roadblocks for success in the courses. One of the main benefits for students that attend Boot Camps is getting a head-start in the courses. The CHEM 107 F, 111AF, and 111BF courses require that students understand and can apply concepts learned in the prerequisite course to the newly presented material. Many students who received B or C grades need extra support in this area, and the Boot Camps are designed to review concepts that these students struggle with. Students who attend boot camps feel more empowered to take on the next course in the series and get the review that helps to prepare them for success. These Boot Camps have proven to be effective at preparing students, playing an important role in meeting the course success standards. Data can be found in Program Review 2017.

STEM Success Learning Community (STEM-SLC)

The STEM-SLC is a program that assists first-year students as they navigate the rigorous curriculum associated with STEM major/career pathways. Students are arranged into cohorts, providing them with a supportive environment which fosters a sense of community with their peers. Students receive regular academic counseling to ensure they are progressing successfully towards their set transfer date. In addition, cohorts are enrolled in sections that are taught by full time faculty, providing students with greater accessibility to faculty members. This is particularly important in the different chemistry sequences, where subsequent course enrollment and performance is vital to continued success.

BOND (Building Opportunities Through Networking and Diversity)

The BOND program pairs students with a particular career goal or interest with a faculty member with a similar background or education. This allows the student to get specialized mentorship from a faculty member. The faculty will meet with the student periodically

throughout the semester ensuring that the student is meeting certain goals in both education and career or transfer readiness.

PAL Tutoring
Peer Assisted Learning tutoring pairs students with the knowledge of course material with a student seeking tutoring help. This program is temporarily shut down due to the pandemic but is scheduled to restart Spring 2022.

Community Outreach Events
Several Chemistry faculty are involved in community outreach events such as KinderCaminata, and National Chemistry Week. Students have an opportunity to volunteer in these outreach events where they perform hands-on experiments or demonstrations for young students to inspire them to pursue an education in the STEM fields.

Project RAISE
Project RAISE is an Undergraduate Research Experience that is exclusively designed for community college students pursuing their first bachelor's degree and who plan on majoring in a STEM (science, technology, engineering, or mathematics) field. Faculty mentors at Cal. St. Fullerton provide training and mentorship to succeed in the program.

2. Are there institutional barriers hindering your department's ability to offer or enhance these learning experiences for students? Please explain.

Funding of these programs is a constant barrier. Institutionalizing them or having a STEM center that can be the focal point for all of these programs would be beneficial. In addition, may faculty have been forced to take on overload to make up for the fact that there are not enough qualified adjunct faculty to teach courses. Therefore, any extra time required to run these opportunities for which faculty are not compensated for, is now dedicated to taking on overload units to make up for the lack of adjunct faculty. Obtaining additional faculty for the Chemistry Department will benefit by sharing the workload and giving time needed to continue working on and implementing these programs.

6.0 Planning

6.1 Progress on Previous Strategic Action Plans

1. Please briefly describe the goals (Strategic Action Plans, SAPs) from your last self-study. How much progress have you made on them? If you have reached a goal, explain how it allows ongoing improvement, especially if you received additional funding.

Strategic Action Plan #1 Support to improve student success through biweekly professional development seminars for chemistry adjunct faculty.
The goal of this strategic action plan was to improve student success in these courses. Due to the lack of funding, the biweekly professional development seminars were not implemented.

However, a three-hour summer workshop was organized in Summer 2019 and funded by professional development money. This “pilot” workshop was conducted in two time slots (9-12 pm and 1-4 pm) on a Tuesday in June to garner as much attendance as possible. A total of 8 adjunct faculty attended (roughly half of all adjunct faculty in the Chemistry Department at the time). This was a significant accomplishment since many of our adjuncts were already teaching summer courses at other campuses at the time. Post-workshop surveys yielded generally positive reviews and a consensus that more professional development opportunities would be welcome by our adjunct faculty.

As part of the teaching workshop, adjunct faculty were provided with a 54-page manuscript for various content-centered pedagogies common to the CHEM 107 and CHEM 111A curriculum. The document also included suggestions for syllabus design and building classroom community. This portion of the workshop fostered lengthy discussions on course structure to improve student success.

While this was only a one-time workshop, it can (and will) serve as a platform for further professional development opportunities. Upon further reflection of this workshop, it became quite evident that more time was needed to address the pedagogical focus for various topics in the course. While a one-time workshop is not nearly enough to train faculty to become better instructors and sustainably improve student outcomes, this workshop could easily be broken up into a series of workshops (maybe a couple per semester) to cover more ground. This is especially necessary because there is often a lot of turn-over of adjunct faculty in our department. In fact, at least two of the adjunct faculty who attended the summer, 2019 workshop are no longer teaching with us because they now have tenure-track positions elsewhere. This anecdotal evidence may suggest that workshops such as these did help these adjunct faculty improve their teaching to the extent that they were able to land full time jobs.

Goals from the previous self-study/program review

Strategic Action Plan #2 Support for the Chemistry Department to participate in community outreach activities to promote both our program and Fullerton College.
Monies were requested to purchase items such as solid-phase extraction cartridges for separating mixtures of food dyes and also fluorescent rocks with UV-lamps for providing participants with great visuals and experience with sample analysis. This SAP was never funded through the last Program Review. However, the biology and Chemistry Departments co-organized a STEM open house at Fullerton College in spring 2018 and many requested supplies were paid for using Project Raise funds. Some supplies garnered for this event have continued to be utilized for our KinderCaminata and National Chemistry Week annual events. Other supplies continue to be utilized for classroom demonstrations as well. These events have temporarily been cancelled due to the pandemic, however, we will have some equipment required to continue them when all restrictions are lifted.

Strategic Action Plan #3 Continue and expand offering Supplemental Instruction (SI), now called Hornets Tutoring, for chemistry courses.

This SAP was not directly funded from the last Program Review, however, Hornets Tutoring has continued to be implemented in chemistry courses due to funding by Equity or college general funds. Data for the 2016-2017 academic term show students that attended 5 or more tutoring sessions per semester had a 90.0% completion rate compared to those that did not participate (81.6%) and students in equivalent courses with no tutoring offered (83.8%). Students that attended 5 or more tutoring sessions per semester had a 77.3% success rate compared to those that did not participate (69.4%) and students in equivalent courses with no tutoring offered (71.1%). No data has been obtained since AY 16/17. Please see Program Review 2017 for data.

Strategic Action Plan #4 Creation of a Chemistry Department webpage
The Chemistry Department has developed a website that is linked to the website for the Division of Natural Sciences https://natsci.fullcoll.edu/chemistry/. This website provides links to the following: (a) courses, (b) course prerequisites, (c) programs, and (d) staff and faculty. The course and program links provide direct access to the online college catalog, allowing student to read more about the various courses and programs offered by the department. The program link advertises the three approved Chemistry Programs (AA, AS, and AS-T) and announces the newly developed UC transfer degree (anticipated offering starting fall 2022).

The department website also provides useful information and links for the chemistry proficiency examination. The chemistry proficiency examination may be taken to satisfy the chemistry prerequisite for CHEM 111AF General Chemistry I. Many students will contact either the Division Dean or Department Coordinator to obtain information about the proficiency examination. The department website provides answers to many of the questions that students ask regarding this exam and, additionally, provides links to helpful resources in preparation for the exam: CHEM 107 F lecture notes, sample questions from Fullerton College and other community colleges, and test appointment information. Additionally, the department website provides links to the prerequisite challenge form and Admissions and Records.

Lastly, the department website contains a list of the department staff and both full- and part time faculty member. The list of full-time faculty member include links for those with college websites; thus, providing students with another avenue by which information about the courses and programs can be obtained.

Strategic Action Plan #5 Support for the Chemistry Department laboratories and Chemical Stockroom.
Some of the items that were requested were funded. Equipment and supplies such as the PicoSpin-80 NMR Spectrometer, class A burets, digital power supplies, a ChemDraw Software 3-year site license, a liquid nitrogen dewar, and a cloud chamber, CloudTracker2 were purchased. The PicoSpin80 NMR was delivered just a few months before the college when in lockdown due to the pandemic. There was no assessment from student hands-on experiments. However, with its improved resolution and ease of student performance, the PicoSpin 80's benefit to students is predictable. The site license for ChemDraw, which was granted for the improvement of the CHEM 211AF, CHEM 211BF, CHEM 101 F, and CHEM 201 F courses has helped students produce professional quality molecular structure drawings of organic molecules in their laboratory

reports and other assigned projects. In addition, it greatly helped faculty explain important organic chemistry concepts in the remote environment. Thus, the department requests the continuation of funding for the ChemDraw site license.

The additional laboratory equipment obtained allows the Department to better serve the students in the laboratory courses. Enrollments remained high, with the exception of the pandemic, as students were not able to take lab. Therefore, the number of course sections offered and the number of students served increased by 15% from the last program review during the years in which laboratory sections were held on campus. This required additional funding for chemicals and waste disposal, additional equipment to increase the number of student lockers, additional hourly help including help to realign laboratory rooms and equipment to increase capacity. In the long term, it increases the number of degrees and participation in community outreach events.

Strategic Action Plan #6 Support to improve student success through a Peer Undergraduate Mentoring Program (PUMP)
This was funded through Fullerton College. PUMP, a mentoring program started in 2012, aims to improve student retention and successful completion in Science, Technology, Engineering and Mathematics (STEM) courses. PUMP program pairs first year Fullerton College STEM students with academically outstanding STEM students from California State University, Fullerton. Offering individualized peer mentoring has been beneficial to the STEM students at Fullerton College (refer to data found in the 2017 Program Review).

The PUMP program easily and quickly transitioned to a remote setting with the onset of the pandemic and remote learning. Flexibility was essential during this time and end of the semester weekly topics shifted from career based to providing support with students adjusting to their STEM classes to a virtual environment. The program transitioned to an Online platform, Canvas. Live Zoom sessions, texting and email were utilized to reach students during a difficult transition. The program was essential in providing information about the college's resources during the pandemic, as well as having mentors provide consistency when everything else seemed to be quickly changing.

Student and mentor feedback from the end of the Spring 2020 semester was positive so PUMP has continued to run to serve our students through summer 2021. The Chemistry Department is proud of our CSU mentors now reaching from CSUF to CSU Dominguez Hills. They provide clear support for our Fullerton College students.

Strategic Action Plan #7 Expanded facilities along with more full-time faculty and stockroom staff to support sustained expansion of Chemistry sections.
This SAP was to obtain expanded facilities along with more full-time faculty and stockroom staff to support sustained expansion of Chemistry sections and reduce the time to completion for students. The funding for the installation of a portable laboratory in Staff parking lot B-2 east was not obtained.

In the time since the last program review, the Chemistry Department lost a laboratory technician and hired one additional full time faculty member. Although one full time faculty member was hired in Fall 2020, Section 3.4 outlines the reasons for an additional 4 full-time faculty and one stockroom technician are required. The increase in full-time faculty has resulted not only in increased number of sections offered and more access to high-demand chemistry classes for students but has also seen more faculty involvement in community outreach, committee service and innovative teaching approaches.

Support for the Chemistry Department laboratories is essential, as the increase in sections has a concomitant increase in supplies, equipment and waste disposal. The additional Chemical Stockroom personnel is crucial to our weekend course offerings. Without that support, all Saturday labs will be cancelled.

Overall, increasing both faculty and stockroom personnel will have a direct impact by increasing the number of students served which will result in increasing enrollment, an increasing number of sections offered, and an increase in degrees, and transfers.

Strategic Action Plan #8 Continue and expand offering boot camps for students enrolled in Chemistry courses
Chemistry boot camps are funded by Program Review and Project RAISE. Students how participate in boot camps have an increased retention and success rates in the Chemistry program. Students who participated in the program achieved higher levels of success compared to comparable students who did not attend (Please see data in Program Review 2017). The courses and number of students served in boot camps were expanded to include students in the STEM cohorts. Courses now offering boot camps include CHEM 107 F, CHEM 111AF, CHEM 111BF, CHEM 201 F and CHEM 211AF. The boot camps also Increased persistence of students in Chemistry Program. As students achieve more success, they are more likely to persist in the program.

Strategic Action Plan #9 Support to improve student success and retention through providing classroom instructional resources.
SAP 9 was to gain support to improve student success and retention through providing classroom instructional resources that allow students access to materials. A set of Clicker response systems was purchased. These were utilized to increase student engagement for the purpose of increasing student retention and success in the course. Although the onset of the pandemic prevented the use of the Clickers, they will be critical for the return to the classroom. Therefore, we would like to purchase additional sets of Clickers. The current set allows only one instructor to use it at any one time. While several courses are being administered at identical times, additional sets of Clickers will allow other classes to benefit from their use.

The Spartan software provides molecular modeling and other features for the general, organic, physical, and inorganic chemistry curriculum. The software provides a unique method for learning complex chemistry concepts that may help bridge equity gaps in the classroom.

Strategic Action Plan #10 Create a campus STEM Resource Center
A Campus STEM Resource Center has not been created. The funding of the STEM Center will achieve some important outcomes that include an increase in the number of STEM degrees and certificates, an increase in the number of STEM majors transferring, the increase in the number of students attending mentoring, tutoring, and other programs, and an increase in the placement of students in research and internship programs. A STEM Center provides a "one-stop shop" with easy access to STEM and CTE counselors, tutors, faculty mentors, group advising and many more resources. It will serve to promote more collaboration between STEM faculty and counselors regarding best practices for a student's schedule based on course difficulty, work schedule, and other factors. It will provide a location for STEM tutors such as Hornets Tutors or science PAL tutors. It will provide a welcoming and inclusive environment for students, tutors, faculty, and counselors to interaction, thus providing a more integrative, comprehensive, and inclusive campus climate that could help to reduce achievement gaps among student groups.

2. If additional funds were NOT allocated to you in the last review cycle, how did the LACK of funds have an impact on your program?

No funds were allocated for increasing the number of laboratory rooms. As a result, despite very strong demand, we are limited in the number of students we can accommodate and, in our ability, to significantly reduce the time for students to get degrees or transfer.

Strategic Action Plan #1
The lack of funds for SAP #1 did result in a delay in the implementation of adjunct faculty professional development opportunities, but once it became known that some professional development funding was available, a workshop was developed. However, this was a one-time workshop. Any further workshops will need an additional funding source.

Strategic Action Plan #2
This SAP was never funded through the last Program Review. However, the biology and Chemistry Departments co-organized a STEM open house at Fullerton College in spring 2018 and many requested supplies were paid for using Project Raise funds. Some supplies garnered for this event have continued to be utilized for our KinderCaminata and National Chemistry Week annual events. Other supplies continue to be utilized for classroom demonstrations as well.

Strategic Action Plan #3
The third SAP from our previous self-study was to continue and expand offering Supplemental Instruction (now called Hornets Tutoring) for Chemistry courses. This SAP was not directly funded from the last Program Review, however, Hornets Tutoring has continued to be implemented in chemistry courses due to other funding resources. This program is a high

impact practice that has shown greater success, retention, and persistence rates. The Chemistry Department suggests the institutionalization of this program.

Strategic Action Plan #9

SAP 9 was to gain support to improve student success and retention through providing classroom instructional resources that allow students access to materials. Access to technology is more important now that ever. A constant equity issue is for all students to have access to software and hardware that can be utilized in the learning process. For many students, access to a device is one part of the issue while access to WIFI to run those devices is another. By having devices for students to use on campus in the classroom, they have both access to a device and to WIFI. This digital access includes the use of software, such as Spartan. The Spartan software provides molecular modeling and other features for the general, organic, physical, and inorganic chemistry curriculum. The software provides a unique method for learning complex chemistry concepts that may help bridge learning gaps in the classroom. Digital access also includes the use of tablets in the classroom. In order to have all of that, a device charging is also needed.

Strategic Action Plan #10

This Campus STEM Resource Center was not funded. The funding of the STEM Center will achieve some important outcomes that include an increase in the number of STEM degrees and certificates, an increase in the number of STEM majors transferring, the increase in the number of students attending mentoring, tutoring, and other programs, and an increase in the placement of students in research and internship programs. A STEM Center provides a "one-stop shop" with easy access to STEM and CTE counselors, tutors, faculty mentors, group advising and many more resources. It will serve to promote more collaboration between STEM faculty and counselors regarding best practices for a student's schedule based on course difficulty, work schedule, and other factors. It will provide a location for STEM tutors such as Hornets Tutors or science PAL tutors. It will provide a welcoming and inclusive environment for students, tutors, faculty, and counselors to interaction, thus providing a more integrative, comprehensive, and inclusive campus climate that could help to reduce achievement gaps among student groups.

6.2 New Strategic Action Plans

Please write brief, concrete plans that you will accomplish over the next four years. Your plans might include requests for additional funds. The Program Review Committee will read these and either endorse the request or ask for more information. Please keep in mind that the Committee's endorsement does not guarantee additional funding. The President's Advisory Council and Faulty Allocation Committee play major roles in allocating funds and prioritizing new faculty hires.

Please number each of your plans. This will help keep to track of them. Also, make sure that each funding request includes the following elements:

1. It is supported by the data and analysis in previous sections of this self-study.
2. It fulfills a part of the College mission, vision, goals, or objectives.
3. It explains how the request helps the College attain student equity.
4. There is a measurable way to tell if the extra funding will be effective.

5. It considers whether you can reach this goal (or parts of it) without additional funding.
6. Please give a dollar amount, or best estimate. If you can identify a funding source, then please name it. If you can put the request into one of the following categories, please do so: Personnel, Facilities, Equipment, Supplies, Computer Hardware, Computer Software, Training, Other.

STRATEGIC ACTION PLAN # 1	
Describe Strategic Action Plan	Create a Campus STEM Resource Center. The proposed Campus STEM Resource Center will require a full-time classified staff member to run the Center, and suitable facilities to house it. There are several possible locations for the Center, which include the land adjacent to the native plant garden and the former Math Lab in the 600 building. The director of the Center would have the following duties: – Identify STEM majors and develop database for tracking – Develop contact folder and meet with STEM majors once a semester – Identify potential majors and recruit them – Assist STEM majors with educational plan, resume, and statement of purpose – Coordinate with Institutional Research and Basic Skills offices to identify trends and opportunities – Match STEM majors with faculty mentors for increasing connectivity to college – Identify scholarship, internship, and employment opportunities in STEM fields – Develop “environmental scan” (job market) in LA/OC – Identify, promote, and assist undergraduate research opportunities – Assist STEM majors with applications for scholarships and internships – Update STEM calendar of events – Develop/Maintain/Update STEM website – Manage STEM tutors hiring/scheduling – Assist with tutoring and supplemental instruction – Develop and assist with STEM-experience activities – Act as liaison between STEM programs – Act as liaison with CSU/UC STEM departments – Coordinate STEM seminar series

	– Develop funding opportunities for STEM – Communicate/market STEM programs to campus and community
List College goal/objective the plan meets:	College Goals: Goal #1: Promote success for every student. Goal #2: Cultivate a culture of equity. Goal #3: Strengthen connections with our community. Goal #4: Commit to accountability and continuous quality improvement. Objectives: 1.1: Create a clear pathway for every student. 1.2: Enhance workforce training opportunities. 1.4: Increase completion of courses, certificate and degree programs, and transfer-readiness. 1.5: Encourage completion of degrees for students enrolled in Career Technical programs. 2.1: Remove institutional barriers to student equity and success. 2.3: Increase outreach to and recruitment of underserved populations. 2.4: Foster a sense of belonging where all are welcome and student basic needs are addressed. 3.1: Create and expand partnerships with local K-12 and higher education institutes. 3.2: Create and expand relationships with local businesses and civic organizations. 3.3: Be a cultural hub for the local community. 4.3: Provide professional and career development opportunities for students, faculty, and staff.
Explain how the request helps the College attain student equity	A STEM Center provides a "one-stop shop" with easy access to STEM and CTE counselors, tutors, faculty mentors, group advising and many more resources. Promote more collaboration between STEM faculty and counselors regarding best practices for a student's schedule based on course difficulty, work schedule, and other factors. Provide a location for STEM tutors (Hornet Tutors or science PAL Tutors) Provide a welcoming and inclusive environment for students, tutors, faculty and counselors to interact, thus providing a more

	integrative, comprehensive and inclusive campus climate that could help to reduce race-based achievement gaps.
What Measurable Outcome *is anticipated for this SAP?*	– Increased number of STEM degrees/certificates – Increased number of STEM majors transferring – Increased recruitment of underrepresented groups to STEM majors – Increased success rate of STEM students – Increased persistence and retention of STEM students – Increased number of students attending tutoring and SI sessions – Creation of a STEM Alumni Network – Increased placement of students in research and internship programs – Increased opportunities for students to participate in community service – Increase the amount of grant money to support student/faculty research opportunities – Greater connectivity and partnerships with area STEM industries – More interdisciplinary coordination among STEM departments
What specific aspects of this SAP can be accomplished without additional financial resources?	This plan is highly dependent on funding and facilities.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel	$87,000/yr ongoing	General Fund
Facilities	$150,000	Measure J Bond or Carryover
Equipment	$10,000	Instructional Equipment Funds
Supplies		
Computer Hardware	$3000	Instructional Equipment Funds
Computer Software		
Training		
Other		
Total Requested Amount	$250,000	

STRATEGIC ACTION PLAN # 2	
Describe Strategic Action Plan	Expanded facilities along with more full-time faculty and stockroom staff to support sustained expansion of Chemistry sections and reduce the time to completion for students To address the increasing demand for chemistry courses, the Department has increased the number of sections offered significantly through creative use of facilities including realigning the laboratory space and offering classes from early in the morning to late in the evening and six days per week. The continued increase in demand for chemistry courses can only be met through an increase in the number of available lecture and laboratory rooms. The lecture and laboratory courses are currently offered in multiple rooms in the 400 Building (412, 414AB, 416A, 416B, 417, 420, 421, 423, 425, 432, 433, 434, 435, 436, 439, 441). In addition to retaining access to these rooms, the Chemistry Department requests the use of an established lecture room (or "portable") and funding for the installation of a portable laboratory in Staff Parking Lot B-2 East. Access to a single lecture room and single laboratory would allow the Chemistry Department to efficiently use existing lecture and laboratory space and serve many more students. An increase in the number of laboratory rooms coupled with an increase of lab sections offered will require additional staffing for the chemistry stockroom, including the addition of a Lab Tech and additional hourly help. The Chemistry Department also requests additional fulltime faculty. As discussed in Section 3, the pool of qualified adjunct faculty in the region is sufficiently small that trying to maintain our current number of course sections with 12 adjunct faculty and only 12 full time faculty is not feasible. In each of the last four semesters, despite being fully staffed early in the process, we have had to resort to emergency staffing measures to avoid cancelling full sections that had full waitlists included last-minute hiring of adjuncts with little or no teaching experience and obtaining special permission to have one or more adjunct faculty exceed the part time load each semester. This is not sustainable. To reliably staff our program with the current number of sections offered, we

	would need to have a minimum of 16 full time faculty along with a team of 12-14 adjunct faculty. The Chemistry Department request that we begin the process of increasing the number of fulltime faculty during the next 4 years of the Program Review cycle. Lab Tech = $36,000 3 Fulltime Faculty 3 x $79,859 = $239,577	
List College goal/objective the plan meets	College Goals: Goal #1: Promote success for every student. Goal #2: Cultivate a culture of equity. Goal #4: Commit to accountability and continuous quality improvement. Objectives: 1.4: Increase completion of courses, certificate and degree programs, and transfer-readiness. 2.1: Remove institutional barriers to student equity and success. 2.2: Increase equity in hiring and training. 4.2: Ensure financial, physical, and technological resources are available to maintain necessary services and programs.	
Explain how the request helps the College attain student equity	The Chemistry Department is committed to equity, diversity, and inclusivity. Increasing the number of full-time faculty and stockroom personnel help the College attain student equity by maintaining the high number of offered chemistry courses, and creating continuity of instruction between sections of a course. This will increase the completion of courses, the success rates and retention of students, and lead to more degrees, certificates and transfers.	
What Measurable Outcome *is anticipated for this SAP?*	The Chemistry Department will be able to sustain or grow the number of sections offered and reduce the number of student on our waitlist by at least 50%.	
What specific aspects of this SAP can be accomplished without additional financial resources?	Additional Resources would be required to accomplish all aspects of this SAP	
If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.		
Type of Resource	Requested Dollar Amount	Potential Funding Source
Personnel	$251,409	District

Facilities	500,000	Existing Bond Funds
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	$751,409	

STRATEGIC ACTION PLAN # 3	
Describe Strategic Action Plan	Support to improve student success through bimonthly professional development seminars for chemistry adjunct faculty teaching pre-general chemistry (CHEM 107) and general chemistry (111A) courses. Starting the week prior to the start of each semester, all adjunct faculty members who are teaching a CHEM 107 F or CHEM 111AF course will be invited to participate in a (paid) teaching workshop for three hours on a bimonthly basis (two meetings per semester). Topics to be considered will include: • Building systems for learning based on areas where students struggle. • Equity in teaching as it pertains to accessing course materials. • Building classroom community. • Helping students with time-management. • Incorporating cultural responsiveness in teaching (i.e., Creating Canvas discussion assignments addressing the contributions people of color, LatinX, etc. have made in specific fields of science/chemistry). • Syllabus design. • Lab safety. • Developing course materials. • Chemistry demonstrations for student engagement. • Writing appropriate-level exams. • Sharing information about programs or events related to student success, retention and persistence. A total of 6 meeting hours for each participating member will be required for an entire semester (12 hours per academic year). To encourage part time faculty to participate, we

	anticipate an hourly rate of $55 per hour will be required. The current number of part time faculty teaching either CHEM 107 F or CHEM 111AF is ~13. If (10) of those faculty participate plus 1 full time faculty coordinates the meetings, then the yearly expenditure for this SAP would be: – One full time faculty coordinator: 32 hours (@ $55 / hour) = $1,760 – 10 part time faculty participating: 120 hours (@ $55 / hour) = $6,600 – Hospitality (snacks and beverages): – 4 meetings x $100 = $400 – Binders: 10 x $6 = $60 ***One benefit to this SAP is that if we are unable to hire additional full time faculty soon, then we can at least improve the level of instruction for these courses by improving the teaching capabilities of new and returning adjunct faculty currently teaching for the Department. Given the high level of turnover among adjunct faculty in these courses, it may be necessary to conduct these workshops on a continuing basis. Another benefit is that such a program may help the Department attract and retain more high-quality adjunct faculty.
List College goal/objective the plan meets:	College Goals: Goal #1: Fullerton College will promote success for every student. Goal #2: Fullerton College will cultivate a culture of equity. Goal #4: Commit to accountability and continuous quality improvement. Objectives: 1.1: Create a clear path for every student. 1.3: Improve student critical thinking skills. 1.4: Increase completion of courses, certificate and degree programs, and transfer-readiness. 2.1: Remove institutional barriers to student equity and success. 2.4: Foster a sense of belonging where all are welcome and student basic needs are addressed. 4.3: Provide professional and career development opportunities for students, faculty, and staff.

Explain how the request helps the College attain student equity.	Our students deserve high-quality instruction regardless of instructor. Helping adjunct faculty improve their ability to build systems for learning will address the learning gaps that disproportionately impacted students have coming into our CHEM 107 and CHEM 111A courses. This is at the heart of equity as it specifically pertains to teaching course content. Alternatively, helping adjunct faculty incorporate cultural responsiveness into their teaching should help our LatinX students in particular feel a better sense of belonging. In addition, helping adjunct faculty incorporate time-management advisement into their teaching should help first-generation college students find sustainability in their pursuit of a science degree (and eventual transfer). To be clear, this "time management advisement" goes beyond simply telling students to take less classes or work less hours. This should improve persistence rates across the board, but especially for disproportionality impacted students who are at greater risk of college shock.
What Measurable Outcome *is anticipated for this SAP?*	– Increased number of students in Chemistry Program transferring – Increased retention rate of students in Chemistry Program – Increased success rate of students in Chemistry Program – Increased legacy success rate of students in our Chemistry Programs (i.e. success rates in Chem 111BF and beyond should improve as a result of better instruction in Chem 107 F and 111AF. – Increased persistence of students in Chemistry Program All of these metrics could specifically be applied to our LatinX students who have been the most disproportionately impacted group of students based on data discussed in sections 3.2 and 3.3.
What specific aspects of this SAP can be accomplished without additional financial resources?	A single workshop conducted in June, 2019 was supported using professional development funds. With this said, it is not clear that professional development funding would be available for multiple workshops offered at semi-regular intervals over a four-year period. It would be a logical assumption that external funding would be required to follow through on this strategic action plan since this program is not currently supported with any other financial resources.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.		
Type of Resource	**Requested Dollar Amount**	**Potential Funding Source**
Personnel		
Facilities		
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training	$8,820	General Funds or Professional Development Funds
Other		
Total Requested Amount	$8,820 per year	($35,280 over four years)

Strategic Action Plan # 4	
Describe Strategic Action Plan	Support for the Chemistry Department to participate in community outreach activities to promote both our program and Fullerton College. The Chemistry Department is committed to engaging in outreach activities, specifically, we aim to reach K-12 students by providing them with fun and interactive activities to get them enthusiastic about chemistry, which hopefully serves as a strong foundation for their future success as chemistry undergraduates here at FC. It is important to expose individuals at an early age to scientific concepts so that when these students get to college they are already excited about pursuing STEM-related disciplines. Our faculty and staff currently participate in numerous outreach events, both on- and off-campus such as our yearly STEM Open House, National Chemistry Week, KinderCaminata, and Family & High-School Senior Night, among others. In addition, we rely on enrolled FC student volunteers to provide them with opportunities to serve as mentors and leaders to younger K-12 students. Moreover, our Chemistry 100 F apple-course provides non-major students with an opportunity to visit local K-12 schools and perform demonstrations in the classroom. <u>Equipment ($928)</u>:

	Solid phase extraction cartridges for food dye separation hands-on activities – C18-E stationary phase, 2 g sorbent mass: 2 boxes (@ $200/box) = $400 – Phenyl stationary phase, 1 g sorbent mass: 1 box (@ $200/box) = $200 – Vacuum adapter caps for 1 g cartridges: 2 packs (@ $50 / pack) = $100 – Vacuum adapter caps for 2 g cartridges: 2 packs (@ $50 / pack) = $100 – UV-protective glasses: 16 pairs ($8 / pair) = $128 <u>Supplies ($1850)</u>: – T-shirts for events: 60 t-shirts (@ $10 / t-shirt) = $600 over 4 years. – Fluorescent bracelet/necklace beads: $250 over 4 years. – Miscellaneous items TBD for various events: $1000 over 4 years <u>Computer Hardware / Software ($2900)</u>: – Laptop for hands-on graphing activities: 2 (@ $1350 ea.) = $2700 – graphing package: 2 (@ $100 ea.) = $200
List College goal/objective the plan meets:	<u>College Goals</u>: Goal #1: Fullerton College will promote success for every student. Goal #2: Fullerton College will cultivate a culture of equity. Goal #3: Fullerton College will strengthen connections within the community. <u>Objectives</u>: 1.3: Improve student critical thinking skills. 2.3: Increase outreach to and recruitment of students from underserved populations. 3.1: Create and expand partnerships with local K-12 and higher education institutions. 3.2: Create and expand partnerships with local businesses and civic organizations. 3.3: Be a cultural hub for the local community.

Explain how the request helps the College attain student equity.	By engaging in community outreach, the Chemistry Department is creating partnerships and strengthening connections with local K-12, higher education institutions, local civic organizations and local businesses. We are exposing individuals at an early age to scientific concepts so that when these students get to college, they are already excited about pursuing STEM-related disciplines. By engaging in the community, we are promoting science and Fullerton College to a wide variety of underserved communities. By promoting Fullerton College, we are creating a cultural hub for the local community. Fullerton College student volunteers serve as mentors and leaders to the younger K-12 students. These Fullerton College students serve as role models to the younger K-12 students, showing them that they too can become college students in the STEM fields.
What Measurable Outcome *is anticipated for this SAP?*	– Increased number of traditionally underrepresented students interested in majoring in chemistry – Increased participation of local K-12 schools in outreach events – Promoting our program and Fullerton College to our local community – Provide FC students with opportunities to reach out to their local community
What specific aspects of this SAP can be accomplished without additional financial resources?	Most of our outreach participation relies on faculty, staff and student volunteers. However, for the Chemistry Department to continue to participate in the aforementioned events, we need funding to acquire the equipment and supplies for our demonstrations.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	**Requested Dollar Amount**	**Potential Funding Source**
Personnel		
Facilities		
Equipment	$928	
Supplies	$1,850	
Computer Hardware	$2,700	
Computer Software	$200	
Training		
Other		
Total Requested Amount	$5,678	

STRATEGIC ACTION PLAN # 5	
Describe Strategic Action Plan	Support for the Chemistry Department Laboratories and Chemical Stockroom The Chemical Stockroom is an essential component of the Chemistry Department. The Chemical Stockroom is responsible for the procurement and preparation of chemicals for use in the chemistry laboratories, and the maintenance and purchase of equipment that are commonly used in chemistry experiments and demonstrations. Additionally, every community event in which the Chemistry Department is engaged (e.g., National Chemistry Week, Kindercaminata and Open House celebrations) requires support from the Chemical Stockroom. To ensure that the Chemical Stockroom can provide the Chemistry Department with the support required for the courses that are offered and for participation in community events, the following resources are requested <u>Course Specific Equipment:</u> – Bomb Calorimeter (1 @ $5248) – Buchi Rotary Evaporater (1 @ $7,200) – Abbe 5 Refractometer (1 @ $2,000) – Mel-Temp Capillary Melting Point Apparatus (10 @ $1,175 each) – PicoSpin 80 Capillary Cartridge (1 @ $800) – SpectroVis Plus Spectrometer (30 @ $399) – Vernier LabQuest3 (30 @ $339 each) – ChemDraw Software, 3-year Site License (1 @ $5,000) <u>General Equipment / Stockroom:</u> – FlashScrubber Glassware Washer (1 @ $13,200) – Ice Maker Hoshizaki F-500 BJA (2 @ $4,405 each) – Refrigerator (2 @ $400 each) – Carts (4 @ $200 each) – Analytical Balances (4 @ $4,000 each) – Spec200 Spectrometers (12 @ $1700 each) – Corning Heavy Duty Stirrer 11”x11” (1 @ $883) – Corning Hot Plate (10 @ $461 each) <u>Demonstration Equipment:</u> – FLIR Systems Scout III 240 Thermal Night Vision Monocular (1 @ $1,500) – Vacuum Pump (1 @ $1000)

List College goal/objective the plan meets	College Goals: Goal #1: Promote success for every student. Goal #4: Commit to accountability and continuous quality improvement. Objectives: 1.3: Improve student critical thinking skills. 1.4: Increase completion of courses, certificate and degree programs and transfer-readiness. 4.2: Ensure financial, physical, and technological resources are available to maintain necessary services and programs.
Explain how the request helps the College attain student equity	The Chemical Stockroom is an essential component of the Chemistry Department. The Chemical Stockroom is responsible for the procurement and preparation of chemicals for use in the chemistry laboratories, and the maintenance and purchase of equipment that are commonly used in chemistry experiments and demonstrations. These are important aspects to the chemistry courses. Having the ability to perform laboratory experiments and view demonstrations improves critical thinking skills and helps attain student equity by giving the students different modes of learning opportunities. Additionally, every community event in which the Chemistry Department is engaged (e.g., National Chemistry Week, Kindercaminata and Open House celebrations) requires support from the Chemical Stockroom. This helps Fullerton College build communities with K-12 and higher education schools around.
What Measurable Outcome *is anticipated for this SAP?*	– Purchased items (from list above, "Description of SAP") – Increased number of students in Chemistry Program transferring – Increased retention rate of students in Chemistry Program – Increased success rate of students in Chemistry Program – Increased persistence of students in Chemistry Program – Increased number of Chemistry Associate in Arts and Associate in Science degrees – Increased participation in community events
What specific aspects of this SAP can be accomplished without additional financial resources?	All items must either be purchased with Program Review or Instructional Equipment funding.
If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.	

Type of Resource	**Requested Dollar Amount**	**Potential Funding Source**
Personnel		
Facilities		
Equipment	$118,941	General Fund/Instructional Equipment
Supplies		
Computer Hardware		
Computer Software	$5,000	General Fund
Training		
Other		
Total Requested Amount	$123,941	

STRATEGIC ACTION PLAN # 6	
Describe Strategic Action Plan	Support to improve student success through a Peer Undergraduate Mentoring Program (PUMP) The intent of the Peer Undergraduate Mentoring Program (PUMP) is to improve the study strategies of first- year college students through a student/peer-mentoring program. Through PUMP, selected students of Fullerton College (FC) are given tools to: – Improve retention rates in STEM courses – Improve completion rates in STEM courses – Improve degrees in STEM majors – Improve transfer rates into four-year universities in STEM majors. Improve student success in STEM post-graduate school and/or STEM careers. The essential elements of the PUMP program include: – Selection of FC STEM students – Selection of California State University, Fullerton (CSUF) STEM mentors – Mentor training workshop – Mentor/Student introduction luncheon – Advisor/Mentor/Student Meetings – Initial and Final Assessment Surveys Individuals in the PUMP program will have well-defined roles:

	– FC Faculty Advisor: will provide a training workshop for mentors; is responsible for the initial preparation to start-up the program; will meet weekly with FC students; will meet weekly with mentors; and is responsible for preparation, administration, and program assessment – CSUF Faculty Advisor: will select and invite outstanding CSUF undergraduate STEM students to participate; will meet weekly with mentors; and will collaborate with FC Faculty Advisor regarding meeting preparation and program progress – CSUF Mentors: will meet every two weeks with FC students; will interact weekly with FC and CSUF Faculty Advisors; and preparation – FC Students: will meet every two weeks with mentor. As an estimate of the resource request, one semester of PUMP will require the following effort/time: – FC Faculty Advisor: 32 hours plus 10 additional hours for assessment, 42 hours total ($55/hour) – CSUF Faculty Advisor: 32 hours ($55/hour) CSUF Mentor: 75 hours (for each of the approximately 10 mentors, $15/hour)
List College goal/objective the plan meets	College Goals: Goal #1: Promote success for every student. Goal #2: Cultivate a culture of equity. Objectives: 1.3: Improve student critical thinking skills. 1.4: Increase the completion of courses, certificate and degree programs, and transfer-readiness. 2.4: Foster a sense of belonging where all are welcome and student basic needs are addressed.
Explain how the request helps the College attain student equity	– Improve retention rates in STEM courses – Improve completion rates in STEM courses – Improve degrees in STEM majors – Improve transfer rates into four-year universities in STEM majors.
What Measurable Outcome *is anticipated for this SAP?*	Pre- and post-surveys of student's perspective on program and collection of class assessment and data provided by the college will help measure outcomes for this SAP. Specifically,

	the following outcomes are anticipated: 1. Increased number of STEM students transferring to 4-year universities 2. Increased retention rate of students in STEM courses 3. Increased success rate of students in STEM courses 4. Increased student performance in STEM courses
What specific aspects of this SAP can be accomplished without additional financial resources?	The PUMP program is incredibly dependent on external funding. With exception to funding for the CSUF Mentors, the PUMP program is not currently supported with institutionalized financial resources.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	**Requested Dollar Amount**	**Potential Funding Source**
Personnel	$15,870	General Fund/Project RAISE
Facilities		
Equipment		
Supplies	$2500	General Fund
Computer Hardware		
Computer Software		
Training		
Other	$2000	
Total Requested Amount	$19,820 per year	$79,280 for 4 years

STRATEGIC ACTION PLAN # 7	
Describe Strategic Action Plan	Continue and Expand offering Boot Camps for students enrolled in most chemistry courses. Prior to the start of the semester, students are invited to attend a free intensive review session for CHEM 107 F, 111AF, 111BF, 201 F, and 211AF courses. Topics covered in these sessions include entry level skills and laboratory techniques essential to success in the course. Each boot camp lasts several days, between 6-12 total hours. Faculty are paid to provide instruction and individualized help with computations

	and lab skills. The total number of hours requested per semester is between 45-55 hours of instruction, with 10-15 hours of preparation/set up. Faculty are paid as professional experts at a rate of $55/hour.
List College goal/objective the plan meets	College Goals: Goal #1: Fullerton College will promote success for every student. Goal #2: Fullerton College will cultivate a culture of equity. Objectives: 1.3: Improve student critical thinking skills. 1.4. Increase the completion of courses, certificates, and degree programs, and transfer-readiness. 2.1: Remove institutional barriers to student equity and success. 2.4: Foster a sense of belonging where all are welcome and student basic needs are addressed.
Explain how the request helps the College attain student equity	These boot camps not only provide additional training for students, they give them a place where they can start to form connections with faculty and other students in their learning community. Giving the students tools to learn chemistry as well as place to belong will address the learning gaps that disproportionately impacted students have coming into our chemistry courses as well as give them a better sense of belonging. In addition, some faculty like to incorporate time-management skills into their boot camps. This will help to increase persistence and success rates for disproportionally impacted students in the Chemistry Program.
What Measurable Outcome *is anticipated for this SAP?*	Pre- and post-surveys of student's perspective on the program Increased retention rate of students in the Chemistry Program Increased success rate of students in the Chemistry Program Increased persistence though the course sequence Increased number of students transferring
What specific aspects of this SAP can be accomplished without additional financial resources?	The boot camps are now funded by prior Program Review funding and by external grants such as project RAISE.

If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.

Type of Resource	**Requested Dollar Amount**	**Potential Funding Source**
Personnel	$7000/year $9500/year	Project RAISE Program Review

Facilities		
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	$16,500/year = $66,000 for 4 years	

STRATEGIC ACTION PLAN # 8	
Describe Strategic Action Plan	Continue and Expand offering Hornets Tutoring for chemistry courses. Data from the previous Program Review (2017) showed Hornets Tutoring had a positive impact on students that participated (Section 5.3.6). Traditionally, all chemistry Hornets Tutoring courses have been funded by Equity funds but funding is uncertain. To ensure that we are able to continue offering Hornets Tutoring sessions to improve student retention and success, a more stable source of funding is sought. - Support for 8 student SI leaders per semester ($12/hour, 12 hours/week, 14 weeks/semester)
List College goal/objective the plan meets	College Goals: Goal #1: Fullerton College will promote success for every student. Goal #2: Fullerton College will cultivate a culture of equity. Objectives: 1.3: Improve student critical thinking skills. 1.4. Increase the completion of courses, certificates, and degree programs, and transfer-readiness. 2.1: Remove institutional barriers to student equity and success. 2.4: Foster a sense of belonging where all are welcome and student basic needs are addressed.
Explain how the request helps the College attain student equity	Hornets Tutoring, incorporated into many of the difficult chemistry courses will increase course success and retention, and the persistence rate of students. This will lead to an increase in course completions, degrees and transfer in

	Chemistry. In addition, it will increase the number of students participating in STEM activities.	
What Measurable Outcome *is anticipated for this SAP?*	Pre- and post-surveys of student's perspective on the program Increased retention rate of students in the Chemistry Program Increased success rate of students in the Chemistry Program Increased persistence though the course sequence Increased number of students transferring	
What specific aspects of this SAP can be accomplished without additional financial resources?	Equity funds have traditionally been used to support chemistry SI courses and if continued, no additional support would be required.	
If additional financial resources would be required to accomplish this SAP, please complete the section below. Keep in mind that requests for resources must follow logically from the information provided in this self-study.		
Type of Resource	**Requested Dollar Amount**	**Potential Funding Source**
Personnel	$32,300/year	General Fund
Facilities		
Equipment		
Supplies		
Computer Hardware		
Computer Software		
Training		
Other		
Total Requested Amount	$32,300/year	

6.3 Optional: Long-Term Plans

Your department might have more plans than just immediate requests for funding. If so, please describe them here.

1. Designing cohorts for students based on clusters of career goals. The Chemistry Department currently accepts students with intended career goals in STEM fields in "STEM Cohorts". Students in a STEM Cohort are provided with guaranteed seats in specific chemistry course sections and receive concurrent support, including tutoring and counseling. The Chemistry Department seeks to create similar cohort models for students with other career goals, such as nursing.

2. Greater collaboration with K-12, California State Universities (CSUs) and the University of California campuses (UCs) in the region. The Chemistry Department seeks to expand research collaborations with local CSUs and UCs, providing more research opportunities for our students and a streamlined pathway for transfer to a UC or CSU campus. The Chemistry Department also seeks to engage with K-12 teachers in the community, providing

professional development and resources to help strengthen the Chemistry Programs at those schools, and providing a pathway to possible future careers in STEM.

3. The Chemistry Department will continue to engage in and, where possible, seek the institutionalization of programs and activities to improve student retention and success. There are a number of student-centered programs the faculty are involved in that require long-term funding. Many of the chemistry faculty are engaged in programs to improve student performance in the classroom and upon transfer, e.g. Science Boot Camps, Hornets Tutoring, Outreach, and PUMP. These programs are highly dependent on financial support from Fullerton College and/or grants. The survival of these programs is tenuous as new and temporary funding sources are constantly sought. These programs are essential to improving the retention and success rates for students in the program and, therefore, the Chemistry Department will continue to seek long-term funding through their institutionalization. Additionally, the Chemistry Department would like to see the return of a 400 Building Open House and, possibly, "Science Night" to improve connections to the community and increase both awareness and interest in the sciences (and chemistry).

4. The Chemistry Department will continue to seek the institutionalization of professional development opportunities for adjunct faculty in their specific discipline. A "pilot" workshop dedicated to CHEM 107 F and CHEM 111AF adjunct faculty was conducted. It was found to have a significant accomplishment in both the attendance by adjunct faculty and the amount of information gained. The topics ranged from syllabus design, student-centered learning, building classroom community, and more, with the intention of increasing student success in these courses. While this was only a one-time workshop, it can (and will) serve as a platform for further professional development opportunities. Upon further reflection of this workshop, it became quite evident that more time was needed to address the pedagogical focus for various topics in the course. While a one-time workshop is not nearly enough to train faculty to become better instructors and sustainably improve student outcomes, this workshop could easily be broken up into a series of workshops (maybe a couple per semester) to cover more ground. This is especially necessary because there is often a lot of turn-over of adjunct faculty in our department.

5. With the development of a Campus STEM Resource Center, it would be appropriate for the Chemistry Department to consider the creation of a capstone (research) project that may be completed by students upon graduation of an associate degree in chemistry and before transfer to a local university. In partnership with the local university, students from the program could participate in a summer research project, providing a transition from the community college to the university, while in the same providing an opportunity to satisfy undergraduate research requirements.

6. With increased emphasis on pathways, the Chemistry Department seeks to strengthen its relationship with surrounding industries. A stronger relationship may create pathways to

internships for our students and the potential to create a chemistry certificate program to help meet the labor needs of these industries.

7. The Chemistry Department seeks to create projects that involve students in the design of laboratory experiments. Students will be involved in designing innovative and environmentally friendly experiments that would be incorporated into our laboratory curriculum. These projects will serve as an introduction to laboratory research and will serve to improve the retention and success of the students involved in the design of the project and the general population of students through the improved laboratory curriculum.

7.0 Executive Summary

Please provide the reader with a brief overview of the highlights, themes, and key elements of this self-study. Please don't include new information you did not discuss earlier. Although you will likely write this section last, please remember to put this summary at the front of your report.

8.0 Publication Review

The College wants to maintain integrity in all representations of its mission, programs, and services. Please help this effort by reviewing your publications: professional social media profiles, websites, brochures, pamphlets, etc. Please tell us the date they were last reviewed and if you found them to be accurate in all representations of the College and program missions and services. Information on the college's graphic standards is available here.

1. For each of your program's publications, please provide the URL where the publication can be viewed. If the publication cannot be accessed via the Internet, please contact Lisa McPheron, Director of Campus Communications at lmcpheron@fullcoll.edu.
2. If you find an inaccurate publication, please explain how you will make corrections.
3. If your department maintains a social media presence then please describe it here. What do you use it for? How do you monitor it? Who is in charge of it? In what ways is it benefiting the College and your program? Does it follow the District's social media guidelines?
4. If your program regularly communicates with the wider community, please describe how. What feedback do you get from the community?

Publication
David Watermeier and Bridget Salzameda
Journal of Chemical Education **2019** *96* (5), 961-964
https://pubs.acs.org/doi/10.1021/acs.jchemed.8b00831

Chemistry Department Website
The Chemistry Department has developed a website that is linked to the website for the Division of Natural Sciences https://natsci.fullcoll.edu/chemistry/. This website provides links to the following: (a) courses, (b) course prerequisites, (c) programs, and (d) staff and faculty. The course and program links provide direct access to the online college catalog, allowing student

to read more about the various courses and programs offered by the department. The program link advertises the three approved Chemistry Programs (AA, AS, and ADT) and announces the newly developed UC transfer degree (anticipated offering starting fall 2022).

The department website also provides useful information and links for the chemistry proficiency examination. The chemistry proficiency examination may be taken to satisfy the chemistry prerequisite for CHEM 111AF General Chemistry I. Many students will contact either the Division Dean or Department Coordinator to obtain information about the proficiency examination. The department website provides answers to many of the questions that students ask regarding this exam and, additionally, provides links to helpful resources in preparation for the exam: CHEM 107 F lecture notes, sample questions from Fullerton College and other community colleges, and test appointment information. Additionally, the department website provides links to the prerequisite challenge form and Admissions and Records.

Lastly, the department website contains a list of the department staff and both full- and part time faculty member. The list of full-time faculty member include links for those with college websites; thus, providing students with another avenue by which information about the courses and programs can be obtained.

Appendix A: Key Performance Indicator (KPI) data

The Office of Institutional Effectiveness will provide data for departments to analyze. To answer some of the questions on this form, departments will need disaggregated data that focuses on specific groups. The data will be presented to identify equity gaps among groups, so that departments can plan ways to close those gaps. Departments should also be informed how their student populations compare to the overall college population, and the population of the college's service area.

Fullerton College
Instructional Program Review
Fall 2021

APPENDIX A

Chemistry

The following packet of information contains data for the comprehensive Instructional Program Review process for the Chemistry program.

Data cover a five-year period: Summer 2016 - Spring 2021, which includes the 2016-2017 academic year through the 2020-2021 academic year. Data are current through August 1, 2021.

NOTE: An academic year includes the Summer, Fall, and Spring terms, so the AY 16/17 includes the Summer 2016, Fall 2016, and Spring 2017 terms.

If you have questions about the data packet, please contact the Office of Institutional Effectiveness.

Program Selector:

Chemistry

Appendix B1: SLO data

This data is still off-limits to the OIE because it is housed in eLumen. The Faculty Senate only allows faculty members to have access to SLO data on eLumen. The Senate's SLO Assessment Committee will work with its division reps to help departments disaggregate SLO data, just as KPI data is disaggregated in Appendix A.

Fullerton College

SLO Performance - By Division, Course, CSLO

Program: Chemistry Dept. Date: 09-13-2021

Terms: Spring 2021, Fall 2020, Summer 2020, Spring 2020, Fall 2019, Summer 2019, Spring 2019, Fall 2018, Summer 2018, Spring 2018

CHEM101 F: Chemistry for Allied Hlth Sci

Identify names and general properties of inorganic and organic compounds.

	Greatly exceeds expectations.		Exceeds expectations		Meets expectations		Does not meet expectations but developing		Does not meet expectations		N/A		Total	
Spring 2021	0	0.00%	0	0.00%	34	70.83%	0	0.00%	8	16.67%	6	12.50%	48	100.00%
Fall 2020	0	0.00%	0	0.00%	66	71.74%	0	0.00%	17	18.48%	9	9.78%	92	100.00%
Summer 2020	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2020	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Summer 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2018	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Summer 2018	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2018	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Totals	0	0.00%	0	0.00%	100	71.43%	0	0.00%	25	17.86%	15	10.71%	140	100.00%

Apply quantitative analysis to solve unit conversion, mole concept, stoichiometry, and solution concentration problems.

	Greatly exceeds expectations.		Exceeds expectations		Meets expectations		Does not meet expectations but developing		Does not meet expectations		N/A		Total	
Spring 2021	0	0.00%	0	0.00%	55	73.33%	0	0.00%	16	21.33%	4	5.33%	75	100.00%
Fall 2020	0	0.00%	0	0.00%	59	64.13%	0	0.00%	25	27.17%	8	8.70%	92	100.00%
Summer 2020	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2020	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Summer 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2018	0	0.00%	0	0.00%	106	62.35%	0	0.00%	48	28.24%	16	9.41%	170	100.00%
Summer 2018	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2018	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%

September 13, 2021 10:51 PM Page 1 of 23

Appendix B2: SLO data: Ethnicity

Fullerton College

CHEM CSLOs all courses demographic breakdown ethnicity F21

by Demographic Category with Demographic Element

The purpose of this report is to present the number and percent of assessment scores at each mastery level for each program or institution learning outcome for a given term(s) or assessment cycle(s) for a given department, program, or course group. You can also choose to show this information by course.

Department: Chemistry Dept.

SLOs: CHEM all courses CSLO Data Group

Courses: All Courses

Date: 09-24-2021

Terms: Spring 2021, Fall 2020, Spring 2020, Fall 2019, Spring 2019, Fall 2018, Spring 2018, Fall 2017, Spring 2017, Fall 2016, Spring 2016

Demographics Categories and Elements:
Ethnicity: African American, American Indian/Alaskan Native, Asian, Filipino, Hispanic, Pacific Islander, Unknown, Unspecified, White Non-Hispanic

Demographic Category: Ethnicity

African American

CSLO: Identify names and general properties of inorganic and organic compounds.

	Greatly exceeds expectations.		Exceeds expectations		Meets expectations		Does not meet expectations but developing		Does not meet expectations	
Spring 2016	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2016	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2017	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2017	0	0.00%	0	0.00%	2	50.00%	0	0.00%	2	50.00%
Spring 2018	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2018	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2020	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2020	0	0.00%	0	0.00%	0	0.00%	0	0.00%	2	100.00%
Spring 2021	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Overall	0	0.00%	0	0.00%	2	33.33%	0	0.00%	4	66.67%

CSLO: Apply quantitative analysis to solve unit conversion, mole concept, stoichiometry, and solution concentration problems.

	Greatly exceeds expectations.		Exceeds expectations		Meets expectations		Does not meet expectations but developing		Does not meet expectations	
Spring 2016 *	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2016	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2017	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2017	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2018	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2018	0	0.00%	0	0.00%	6	100.00%	0	0.00%	0	0.00%
Spring 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2019	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Spring 2020	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Fall 2020	0	0.00%	0	0.00%	2	100.00%	0	0.00%	0	0.00%
Spring 2021 *	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Overall	0	0.00%	0	0.00%	8	100.00%	0	0.00%	0	0.00%

*Too few to report

Appendix C: Success Rate Data for Chemistry 107 F and 111AF (provided by Megan Harris, Senior Research and Planning Analyst, Fullerton College)

Success Rates for CHEM 107 F:

48% for MATH 040 F/041 F/043 F
73% for MATH 120 F/120HF
73% for MATH 141 F/141HF (52% increase over MATH 040 F/041 F/043 F)
82% for higher-level mathematics

Success Rates for CHEM 111AF:

50% for MATH 040 F/041 F/043 F
68% for MATH 120 F/120HF
65% for MATH 141 F/141HF (30% increase over MATH 040 F/041 F/043 F)
77% for higher-level mathematics

Note:

The values were calculated from data (on the following pages) provided by Megan Harris, Senior Research and Planning Analyst, Fullerton College.

JOURNAL OF CHEMICAL EDUCATION
Cite This: J. Chem. Educ. XXXX, XXX, XXX−XXX
Activity
pubs.acs.org/jchemeduc

Escaping Boredom in First Semester General Chemistry

David Watermeier and Bridget Salzameda*

Department of Chemistry, Natural Science Division, Fullerton College, 321 E. Chapman Avenue, Fullerton, California 92832, United States

Supporting Information

ABSTRACT: An interactive activity for first semester general chemistry students was created to review topics in preparation for the final exam. An escape room, a problem-solving adventure activity, is the framework for this newly designed learning activity. The benefits of this activity to students include review of chemistry concepts, interaction with other students in a familiar social environment, problem-solving practice, and development of team-building skills. A complete explanation of the activity is described in detail. After students participated in this activity, a survey was administered to the students to gain relevant feedback. The general chemistry concepts covered by this activity include density, unit conversions, significant figures, laboratory equipment use, glassware identification, electronic configuration, periodic table use, nomenclature, hybridization, balancing equations, combustion analysis, and thermodynamics.

KEYWORDS: *High School/Introductory Chemistry, First-Year Undergraduate/General, Public Understanding/Outreach, Thermodynamics, Student-Centered Learning, Collaborative/Cooperative Learning, Hands-On Learning/Manipulatives, Humor/Puzzles/Games, Problem Solving/Decision Making, Reactions, Precipitation/Solubility, Physical Properties, Phases/Phase Transitions/Diagrams, Periodicity/Periodic Table, Nomenclature/Units/Symbols, Laboratory Equipment/Apparatus, Heat Capacity*

INTRODUCTION

In modern chemistry courses, instructors design approaches to engage students with diverse learning styles. Researchers have shown that games can be effective in reinforcing chemistry concepts and can serve as useful pedagogical tools in the classroom.[1−6] Here we introduce a chemistry-themed escape room designed to excite, entertain, and encourage students while reviewing key concepts from first semester general chemistry. The problem solving involved in this game fosters active participation and team building while allowing students to gain confidence in general chemistry topics, such as unit conversions, nomenclature, and thermochemistry.

Escape Room Games

Escape rooms have become popular in major cities across the United States and target people who engage in video and live-action games.[7] Applications for mobile devices and online versions of escape rooms have been created to appeal to this population.[8,9] In addition, the escape room concept has been translated for classroom use.[10−14] In a typical escape room game, groups are first briefed with a storyline related to a series of puzzles they must solve.[7] After the narrative is presented, the doors to a theme-decorated room are closed, "trapping" the students in the room. The group of students must then work together to solve several puzzles to escape the room within an allotted time. By using clues and problem-solving skills, players determine the solutions to one set of problems, and are then led to another set of riddles. The escape room described in this paper, containing a chemistry-related storyline and chemistry-related puzzles, was designed in collaboration with a professional game designer from Escape Room Era.

Purpose of a Chemistry Escape Room

This escape room was developed to engage students while reviewing major topics encountered by them in first semester general chemistry. A class of 24 students, working in groups of four, can complete this activity in one laboratory period. By working in groups to "escape the room", students must explain chemistry concepts to one another, in ways similar to high impact methods such as peer tutoring or a study-group setting.[15−18] In addition, this environment helps students gauge their own level of understanding and elucidate skill sets they may have not understood throughout the semester.

HAZARDS AND SAFETY PRECAUTIONS

Common laboratory glassware is used during this activity. All students who participate in the escape room must wear all personal protective equipment relevant to a chemistry laboratory.

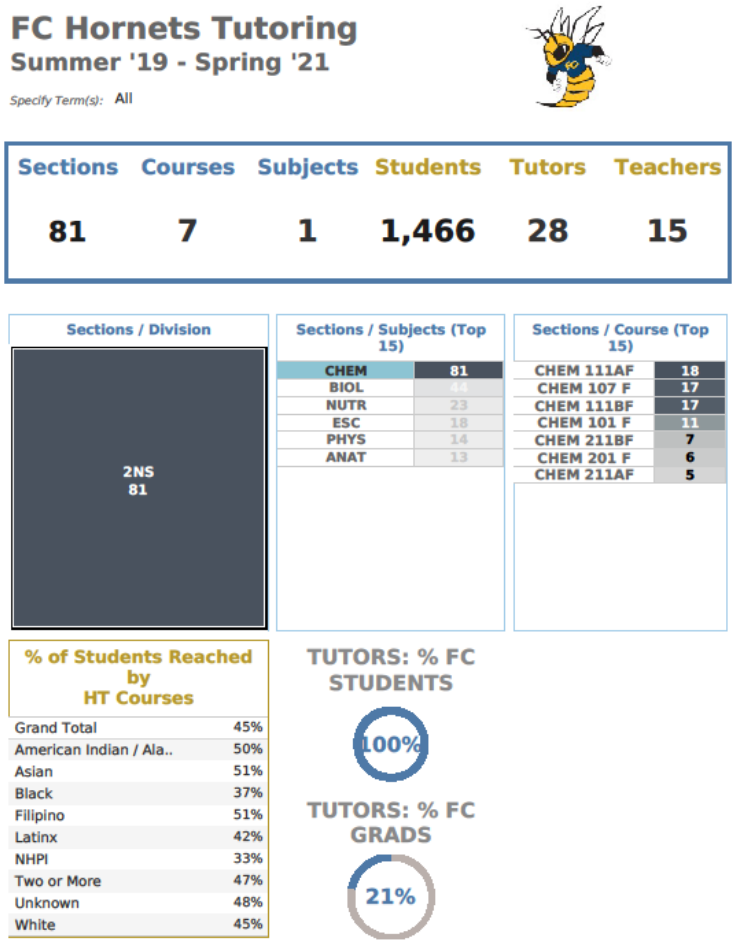
Received: October 12, 2018
Revised: February 16, 2019

DOI: 10.1021/acs.jchemed.8b00831
J. Chem. Educ. XXXX, XXX, XXX−XXX

Appendix E:

	FTEF Load	FTEF Overload	FTEF Adjunct	Total FTEF	Adjunct %	# Adjuncts
Fall 2020	**11.17**	**2.23**	**6.65**	**20.05**	**57.85**	**14**
	Total Sections		**Total Sections Taught by Adjuncts**		**% Sections Taught by Adjuncts**	
Fall 2020	**44**		**16**		**36.4**	
	Average Census Class – Size		**Certificates Issued 2020 – 2021**		**Degrees Awarded 2020 – 2021**	
Fall 2020	17		0		52	

Appendix F: Hornets Tutoring Data



HORNETS COURSE SUCCESS