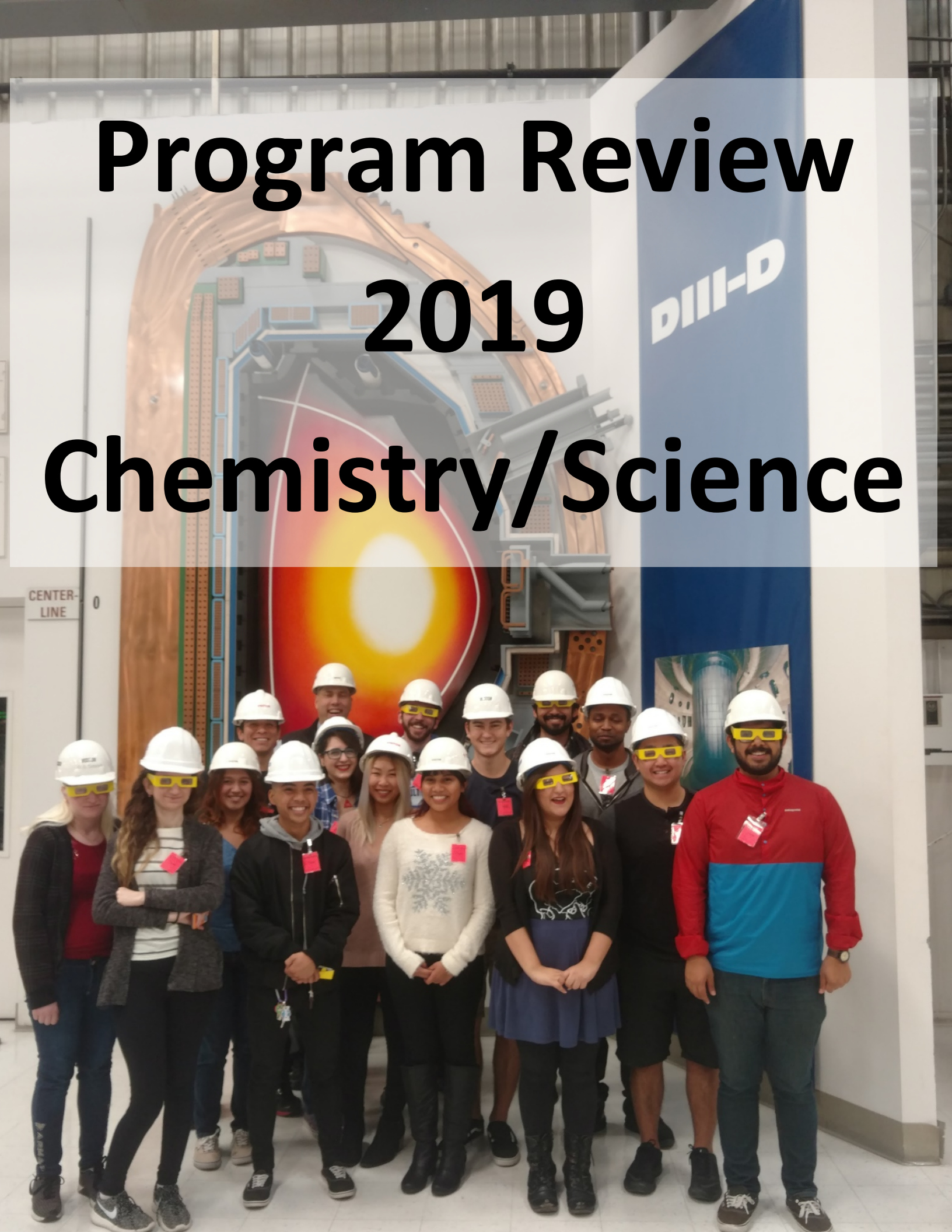
Program Review 2019 Chemistry/Science



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"This program review report for 2012 - 2018 is respectfully submitted by the members of the Grossmont College Chemistry Department.

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DEPARTMENT/PROGRAM

ACADEMIC PROGRAM REVIEW

1 1 OVERVIEW
DEPARTMENT HISTORY & PREVIOUS PROGRAM REVIEW RECOMMENDATIONS

1.1 Department History

In 1964, when Grossmont College opened, we offered courses that covered most of the first two years of a science major curriculum in addition to courses to prepare allied health and other related programs. The initial course offerings included Fundamentals of Chemistry (Chem 115 and 116), General Chemistry (Chem 141 and 142), Quantitative Analysis and first-semester Organic Chemistry (Chem 231). A few years later, Science 110 Introduction to Scientific Thought was added as well as Chemistry 110 (a non-majors course without a lab) and Chemistry 120 (Preparation for Chem 141). In the early 1990's we obtained a National Science Foundation (NSF) grant to develop the chemistry tutorial classes which were added to the curriculum. Because the tutorial courses (T-classes) did not articulate outside our department nor were they included in the degree listings, these courses were optional. However, since each chemistry courses was now tied to a tutorial course, these T-classes became quite popular and provided a robust adjunct to regular lecture and laboratory instruction. The T-classes also had a positive effect on our WSCH.

The above list represents the courses offered at Grossmont until the 1990's. In the late 1990's we developed a new chemistry course called Forensic Chemistry (Chemistry 113) and in 2002 we started offering the second semester of Organic Chemistry (Chemistry 232, formerly called Chem 223). In 2009 we also developed a new chemistry course for allied health majors (Chemistry 102) in response to the state-wide recommendation that colleges begin offering a one-semester course encompassing general, organic and biological chemistry (GOB course).

In 2007, the first new building on campus since the founding of the college was opened. The Science Laboratory building (Bldg. 30) greatly expanded our facilities and modernized our laboratories, our stockroom capability and tutorial classroom. Our new chemistry laboratories have become perhaps our greatest physical asset. Prior to the new building opening, our department had use of three chemistry laboratories, each lab outfitted with only two fume hoods and outdated facilities. The new building provided us with four state-of-the-art chemistry labs and we were fortunate to have a major voice in the design and use of these labs. One of our primary goals was to install enough fume hoods to provide a safe workspace for every student thereby eliminating the previously inefficient practice of standing in line to gain access to a fume hood. All of our fume hoods are standardized and equipped with the necessary utilities- electrical/data ports, natural gas, compressed air, house vacuum, running water and pocket sinks- which provides a self-contained, safe working environment for each student. The hoods in our organic chemistry lab also have additional gas delivery for conducting reactions in inert atmospheres. Thoughtful placement of lab benches and overhead projectors preserves the necessary sight-lines between the instructor and students at all times. This design aspect was crucial to our needs; besides having the capability to monitor students engaged in laboratory work, we

created a learning space to be used for both lecture and lab sessions. This ability provides a seamless transition between lecture and lab activities and reflects the structure of our chemistry program which combines the lecture and lab into one course, with both components taught by the same instructor.

The new building expanded our stockroom space and streamlined the functioning layout of our facilities. Locating the stockroom in the center of the building enables access to all chemistry labs which are situated on the periphery of the second floor. (There is also a connecting mini prep facility which services the Earth Sciences lab adjacent to the chemistry area.) A single fume hood was installed in the stockroom for prep work and temporary hazardous materials storage. Generous storage cabinetry and workbenches were designed to maintain critical sight lines throughout the entire stockroom, most of which can be monitored by the centrally located technicians' office. The layout of our chemistry area restricts student access to the stockroom while providing an efficient arrangement for servicing the lab classes while in session.

The other major improvement to our facilities, and boon to our program, was inclusion of our Chemistry Science Learning Center (CSLC), the largest contiguous space on the second floor of our building adjacent to our lab areas. The CSLC is a large mezzanine that extends the width of the building and opens to the learning center on the first floor. This space was designed to expand our chemistry tutorial program and the layout resembles a large classroom. The room is outfitted with 40 computer stations, an instructor station that controls dual overhead projectors, an oversized map printer used by Earth Sciences and a regular pay-printer for students. Three walls are covered with whiteboards, and bookshelves and deep map shelves. The computers are cloned with our chemistry software packages, molecular modeling programs, chemistry drawing programs, GIS software (for Earth Sciences) and the regular complement of Windows software (Word, Excel, PowerPoint, etc.). The chemistry faculty offices are located down the hall from the CSLC so that students have ready access to full-time instructors' office hours.

Since our last program review, the department has grown markedly, and we have made a couple of substantive curriculum changes. The department currently stands at 6 full-time members and 23 adjunct instructors. However, one of our full-time faculty members, Cary Willard, has been serving as interim dean of the Math and Science Division for more than two years, and has not been teaching in the department. Also, we lost one full-time instructor, John Oakes, to retirement in 2018. We have, however, been approved to hire a replacement full-time instructor to begin in Fall 2019.

For a number of years we have offered both the first and second semesters of Organic Chemistry. Like all of our classes the lab and the lecture are connected, and taught by the same instructor. While this presents a scheduling challenge, the department has recognized the benefits of such an arrangement since the department's inception. Students enjoy a far better educational experience by having continuity between lecture and lab. This arrangement works well for our introductory and majors-level courses since students are required to take both lab and lecture. However, curricular changes at our transfer institutions have removed the Organic Chemistry lab requirement for some majors. Moreover, many of these majors require that Organic Chemistry be taken prior to transfer. This meant that many of our students were required to take the lab from us, but not their transfer school. To better meet the needs of these students, and to provide a niche in the region, the department began the change to the curriculum to separate the lab and lecture in Organic Chemistry. We now offer Chemistry 241 and 241L (lab) and Chemistry 242 and 242L (lab). This allows those students who need only the lecture to take the lecture, while simultaneously offering lab for those students who require the lab as well.

Reflected in our increase in the number of adjunct instructors, our section counts have also increased. So much so, that we are finding it difficult to offer all sections in a five day week. In the last 10 years we have seen 76% growth in our 10 year low of Fall term section counts. 2012 we offered 24 sections of chemistry, and in 2018 we offered 43 sections. To accommodate the growth we are offering a section of Chem 115, two sections of Chem 120, a section of Chem 141, and a section of Chem 142 on Saturdays. To support this effort we have also hired an additional stockroom technician to service the Saturday classes, and the additional sections throughout the normal week. This growth is notable when one compares the fact that a 4 unit chemistry class with 24 students generates 4.8 FTES, where a 3 unit lecture-only class with 50 students generates 5 FTES. Many of our classes have 9 WSCH, however. These classes generate 7.2 FTES for 24 enrolled students.

1.2 Previous Program Review Recommendations

1. Continue collecting and analyzing data on the effectiveness of the CSLC.

Collecting effectiveness data for a resource where students are not required to avail themselves is tricky. The sample is skewed to those students who are proactive in their learning, and may not necessarily represent the efficacy of the resource. This being said, numerous students use the tutoring room regularly. Our tutors serve primarily students from Grossmont College, and a handful from Cuyamaca. We serve an average of 370 students per semester in our informal, and wholly underestimating, accounting.

2. Participate in campus conversations regarding tutoring in order to determine tutoring resources needed to operate the CSLC.

The Chemistry Department has been involved in the campus-wide tutor discussion. Questions of centralized tutoring, and that which occurs within each department have been discussed. The department finds local-to-the-department resources to be the most effective for students. Students interact with tutors in the midst of their classmates, and tutors have ready access to faculty when questions arise. In addition, the shared hardship experienced by chemistry students is one that builds a sense of community within the department. Students spend many hours in lecture and lab with each other. This often spills into the tutoring center where they work together toward a common goal. It is a beneficial experience.

3. Seek out opportunities to enhance your cultural awareness such as attending flex week activities related to diversity, participating in student success discussions and initiatives, and inviting leaders from Umoja, EOPS and other similar programs to attend department college hour sessions.

Department members regularly attend workshops.

4. Identify and participate in formal collaboration projects such as: The Student Pathways Project, One Theme/One Campus or other integrative learning initiatives that focus on student engagement and success.

One campus themes, and integrative learning initiatives are well and good, but the chemistry curriculum is very full. We have little to no “wriggle room” in our content. Couple this with the linear nature of the physical sciences, and it makes for a difficult time for integrative pursuits. Also, the existing coursework is very challenging. Adding extra assignments, or assignments that don’t directly speak to specific content can take time away from material that needs to be covered to maintain proper articulation with our transfer

institutions. For example, we offer a “Forensic Chemistry” course. Forensic chemistry, in the formal sense, is not a lower division course, and is most often something covered at the graduate level. To adequately teach forensic chemistry, students require a foundation in the basics of chemistry. This is a challenge with this class, and it results in students being exposed to the occasional forensic example while studying chemistry basics. It is not a “true” forensic chemistry course. This is common for many integrative efforts. Beginning students require the foundation to participate in the integration. Given the packed semester, there isn’t time.

5. Communicate with Biology and other departments in order to maximize the enrollment of Chem 232.

Changes to requirements for transfer have affected much of our 231/232 enrollment. This, in addition to the way that our transfer institutions treat organic chemistry transfer. In an effort to serve students better, we have split the lecture and lab for 231/232. These new courses are 241 and 241L (lab), and 242 and 242L (lab). This is an effort to meet the needs of those students who are only required to take the lecture portion of organic chemistry. Unlike most chemistry classes, there are a number of majors that don’t require organic chemistry lab. This will allow them to complete a required lecture without having to complete an un-required lab. This is a circumstance specific to organic chemistry, however.

6. Reopen discussions with the Nursing Department regarding content for Chem 102.

Chemistry 102, is not a course that most chemistry instructors would willingly design. It is very wide, and not very deep. However, it meets the needs of nursing programs, and their associated unit caps. This is something that is not under the control of the Chemistry Department, nor the Nursing Department. It is a consequence of professional program curriculum decisions. We’re happy to meet the need.

7. Develop a metric to identify supply needs and gather data.

Our supply needs have changed dramatically in recent history due to changes in the interpretation of class fee guidelines and our rapid growth. We are no longer able to charge students for broken equipment and glassware. Campus resources have been dedicated to help the department maintain its equipment and ensure that there are sufficient supplies. However, obtaining these augmented funds has not been formalized. We need a formal process where we can count on equipment being available to students. We continue to track all broken glassware, and communicate the needs to campus budgetary processes. This has been the same way that we have communicated additional needs due to our expansion. We have also made systemic changes to the way that students are issued equipment in an effort to be better stewards of our resources. To accommodate our growth, we have begun to implement “community drawers” with laboratory equipment. Instead of being issued a set of glassware, students use class sets of equipment. This helps us maintain “burn rates”, better estimate our equipment needs, and more efficiently use our resources.

8. Using the Course History Information Report, continue to submit curriculum modification proposals for those courses that have not been reviewed by the Curriculum Committee in more than four years or curriculum deletion forms for those courses that have not been offered in the last three years.

The department reviews courses when required.

9. Use student-learning outcome data for continued course and program improvement.

As implemented, SLOs are created and modified in a fashion that reduces their utility for studying teaching and learning. A department can simply change an SLO, or change its evaluation if a particular outcome does

not suit them. One can appreciate the effort for initiating departmental discussions, but coming from a department where these sorts of discussions have been part of the culture for several decades, SLO implementation has been burdensome, and of limited utility.

The Chemistry Department has always reviewed its measurement outcomes and processes in a systematic fashion. This process has regularly occurred for as long as this author has been a member of the department (20+ years). Before SLOs were fashionable, the Chemistry Department has critically evaluated outcomes for all of its sections using nationally normed exams written by the American Chemical Society. One of the reasons that we are able to do this effectively is that all sections for a given course use common final exams and lab activities. In addition, a number of years ago, the department was comprehensively evaluated by the American Chemical Society in an effort to learn how we can better serve students.

2 CURRICULUM DEVELOPMENT AND ACADEMIC STANDARDS

To answer these questions, refer to your department's catalog descriptions from the most recent college catalog (see “Courses of Instruction” section. This is the blue section).

If your program has an Associate Degree or Certificate program, refer to the relevant pages from the catalog (see “Associate Degree” section. This is the yellow section).

2.1 Describe how your course offerings have changed since the last program review. Have you added or deleted courses since the last review? If so, why? Include new or deleted programs, degrees and certificates.

The undergraduate chemistry curriculum is not one filled with multiple options of courses available to students. The typical chemistry major takes the same suite of courses regardless of their institution. The same is true for other majors that require chemistry. As such, our course offerings change little.

Most classes since the last program review are unchanged outside of the typical course outline refresh. While we have added four new classes, these are not “new” classes in the formal sense. Chemistry 231 was our first semester Organic Chemistry course with a lab, and Chemistry 232 was our second semester Organic Chemistry course with a lab. Because of some changes to transfer requirements, we learned that many of our students did not require organic chemistry lab. As such, we created four new courses. Chemistry 241 and 241L (first semester organic chemistry lecture and lab) and Chemistry 242 and 242L (second semester organic chemistry lecture and lab). This is the only course in our curriculum that has a separate lab and lecture section. While combining them is our preference, we have opted to split them in this case to better serve our student population, and to provide a niche option for the community. In the first two years of the typical chemistry curriculum, organic chemistry is the only course where lab can be an option for some majors. This is why we decided to split these courses, and why we are not considering splitting any of our other courses.

2.2 Describe your department’s practice for determining that all course outlines reflect currency in the field, relevance to student needs, and current teaching practices.

All of our department decisions are made through consultation in department meetings. The most recent change of consequence was the splitting of lab and lecture for our organic chemistry courses. The overall decision to make the split was decided by the department, but the details of the curriculum were left to those in the department with organic chemistry experience, and much of the administrative portions of the task fell

to the department chair. For the other courses, we routinely make small tweaks here and there, and update our outlines as textbooks change.

Since we like to keep as much uniformity as possible between sections, one full-time department member serves as the course coordinator for each course where multiple sections are offered. The course coordinator makes sure that all instructors for that course are on the same page. The coordinator develops the schedule for the course, and distributes it to each instructor for inclusion in their syllabus. They also ensure that the final exam is in order, and that all instructors know its contents. The department determines the letter grade cut-off percentages as well.

"Current teaching practices" is an interesting phrase. Is there anything new under the Sun? This can be interpreted as lecture/lab issues, online, or hybrid delivery organization. Sure, we have new technological tools available, but the human brain hasn't fundamentally changed, and I suspect that learning hasn't either. This author has been an early adopter of many tools along his career (first learning management system on campus, first to stream lectures and whiteboard content, first chat server, etc). In that time I have learned a fundamental lesson. There is no magic in learning. It takes time, coaching, and lots of hard work by the student. There are no magic shortcuts. You can't replace months of sloth and gluttony with a sudden appreciation for kale or some other mythical "super food". There are systemic things that we can do for students to help them navigate their path through the maze of higher education, but when it comes to studying, and engaging the material, there is no substitute. This being said, the department has begun offering online sections of Science 110 and hybrid sections of Chemistry 120, 141 and 142. For the most part, these offerings fill well. As far as assessing their success, it is a bit more problematic. In all cases the courses were discussed by the department prior to offering. Are they better for students? That is a difficult question. Are students more successful? Less successful? That is a difficult question to answer because one would need to compare the same instructor's students to the non-hybrid relative to the hybrid sections. Same for online. We don't have a long enough track record. We could compare them to the aggregate, but that doesn't necessarily answer the question if the delivery method makes a difference. Maybe an alternate delivery method allows a student access to a class where they otherwise would not be able to do so. This, too, is a complicated question where only anecdotal data may exist.

As mentioned previously, our curriculum is rather static. Beginning chemistry is something that hasn't changed much in 100 years. No DNA discovery, no ever-changing programming languages and computer hardware changes, nothing that initiates a substantive examination of the content of our curriculum. Like many things, we argue about the periphery. Many of the principles taught in beginning chemistry were worked out from approximately 1865 to 1923. The Journal of Chemical Education began in 1924, so chemists have been embroiled in establishing curricular orthodoxy from an early date. There was a shift in chemical education about 50 or 60 years ago to a more physical approach in general chemistry, but since then, most of the hand-wringing and ink has been spent on how chemical principles are conveyed rather than adding new material.

For us in the community colleges, our transfer institutions dictate much of what we cover in our courses. This makes complete sense given the linear nature of the physical sciences. We need to make sure that our students have the knowledge and skills for the next course in the sequence. This limits our ability to make big changes in curriculum. We could make sequencing and other changes, but these changes can negatively impact students. For example, let's say that we find it better to move material typically taught in second semester general chemistry to first semester, and other material from first to second semester. Students still receive the material, but what happens when they are only required to take a single semester of general

chemistry? Now, because of the changes we are in jeopardy of losing articulation for our first semester course. These students would now be at a disadvantage, and be required to take both semesters to get the required material, rather than the single semester of a "traditional" course.

Aside from allied health programs at Grossmont, the bulk of our offerings service those students preparing to transfer to a four-year school and earn a science degree. We routinely respond to requirements in other disciplines for specific courses. For example, many nursing programs have begun requiring a single General Organic Biochem (GOB) course instead of the traditional two-semester sequence (Chemistry 115 and 116). We responded by offering Chemistry 102. The Administration of Justice Department requested a course equivalent to Chemistry 115 that was tailored to their Forensic Evidence Technician program, so we developed Chemistry 113. These courses were added in previous review cycles. These courses do not incorporate "new" material, but package existing curriculum differently. While science is a dynamic discipline, its fundamentals haven't changed for about 100 years.

We have, however, begun offering hybrid courses. 100% online courses are not optimal for lab science courses. Couple the lab question, with the traditional dismal success rates of online courses, and you have a boondoggle. Chemistry is difficult. Taking it online removes the student from a robust support structure of hands-on instruction, and peer assistance. Hybrid courses seem to be a reasonable middle ground for some students. We have had success with hybrid courses where students meet on Saturdays for laboratory instruction and further enrichment. These courses seem to fill a niche for some students, so they are offered every semester.

As for introducing current issues into our classes, we do not have a formal mechanism. All members of the department regularly introduce current events and other vignettes as appropriate, but there is no formal process for their inclusion across all courses.

2.3 How does your department use student engagement strategies in the classroom? How are your faculty including current issues in course content? Consider environmental, societal, ethical, political, technological, and/or other issues when answering this question.

I find that those outside of the sciences don't always understand the realities of science instruction. Science faculty spend anywhere from 5.5 to 8.5 hours of instruction with their students each week. Students are working with each other, independently, with their instructor, and listening in lecture during this time. This creates a strong sense of community in chemistry classes. A common enemy does much to bring people together. Because of this structure, engagement is common, and rather involved. They are interacting with their instructor and their peers. A number of years ago this author was trying to schedule a meeting, and when my office hour was proposed as a suitable time slot, I responded with, "I can't, that is my office hour". Other instructors in the room from other departments, said, "Yeah, right. Like anybody comes to office hours". This is not the case with chemistry. My office is centrally located, and I can say without fail that at any given time, if an instructor's door is open, there is a student in the office. Yes, this is anecdotal at best, but I can say that students are regularly in our offices. It's the way things work.

Providing context to a discussion of phenomena that cannot be seen is a principal part of a proper chemical education. This context can come from a variety of disciplines, but one thing is certain. We don't have time to deviate from our established curriculum. Teaching "chemistry in context" is not easily accomplished, and many would argue counterproductive. Before a student can tackle complex environmental systems, they need

to understand the physical underpinnings of the environment. Straying into political discussions does not further a student's understanding of ionization energy. Sure, current events often get incorporated into the discussion, but they do not provide the scaffolding for the discussion.

2.4 What orientation do you give to new faculty (both full- and part-time), and how do you maintain dialogue within your department about curriculum and assessment? What strategies do you have in-place that ensure consistency in grading in multiple sections and across semesters (e.g., mastery level assessment, writing rubrics, and departmental determination of core areas which must be taught)? Consider department practices, academic standards, and curricular expectations (i.e. SLOs and teaching to course outlines)?

Since its inception the Chemistry Department at Grossmont has maintained as much consistency between sections as possible. All courses use a common final between sections, common schedule, and common grade cut-off percentages. The content of many of our final exams is provided by the American Chemical Society, as we regularly administer appropriate, nationally normed exams. This provides us a yardstick with which we compare our students to those educated across the country. For those courses where an appropriate ACS exam is not available, we collectively write and agree upon a common final exam.

The lab program is also structured collectively. We write our own lab manuals so as to provide the most responsive curriculum. Labs are added to the manual after testing by individual faculty. Any faculty member can suggest an addition, and lead the testing. Lab report expectations are also discussed in department meetings. Since we structure lab reports like scientific papers, their organization is understood by most chemistry faculty with little instruction. The key is to convey the expectations for a proper report. These expectations are discussed at department meetings. For large section count courses such as Chemistry 115 and 120, we pool our TA hours so that all instructors in those sections have their labs graded with common keys. This is done in an effort to maintain consistency in these courses.

Six years ago the department submitted itself for review by the American Chemical Society. Among a number of department strengths, they noted the following that pertain to collective course planning and assessment.

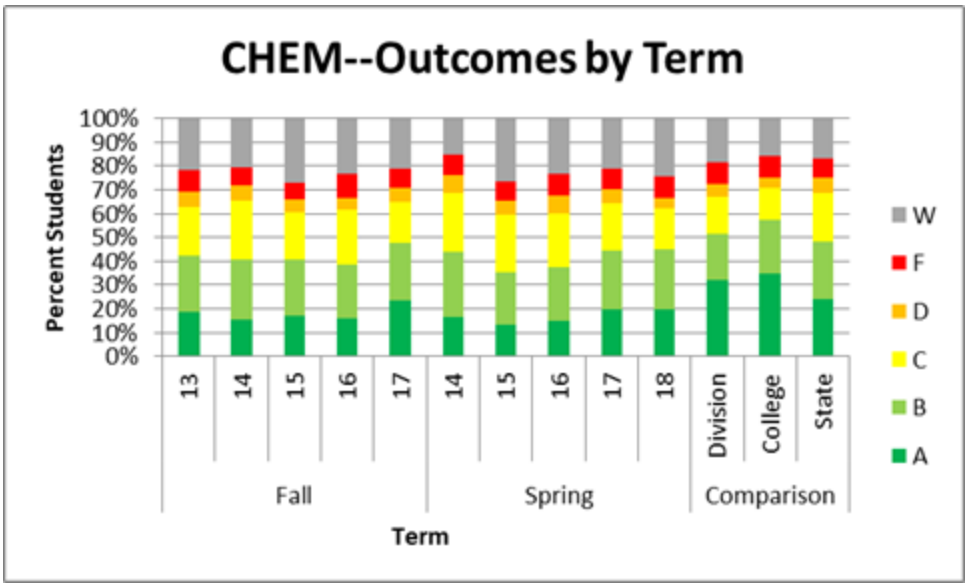
1. Faculty are encouraged to seek out and implement new pedagogical techniques, providing continuous improvement to the quality of chemistry education. Having faculty involved in the determination of prerequisites ensures they are appropriate to the courses.
2. Faculty have input into course development and communicate with student advisors regarding transfer issues.
3. Faculty are part of comprehensive and effective student mentoring and advising services.
4. Tools for assessing student learning, quality of education, and student learning objectives support continuous improvement of the program.
5. Collaboration with other campus departments and four-year institutions promotes sharing of effective practices and supports student transfer.

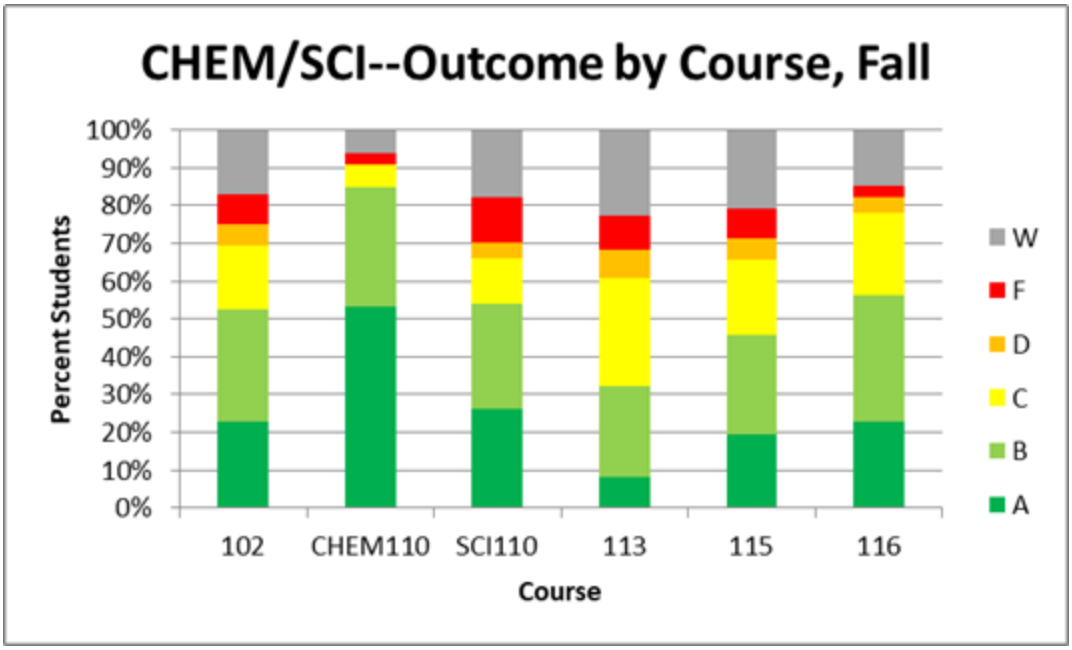
We regularly collaborate with our transfer institutions as well when making adjustments. For example, this past year in looking at chemistry grade data and corresponding pass rates at SDSU for their 100 to 200 students, we found that a grade of 70% in Chemistry 100 at SDSU indicated a much better likelihood of passing

Chemistry 200 at SDSU. Our passing grade was 66% in Chemistry 120 (our 100 equivalent), so we have increased the pass cut-off percentage to 70% for this class.

2.5 Referring to the Grade Distribution Summary graphs (see Appendix 1), comment on how your department patterns relate to the college, division and statewide patterns. For course-by-course graphs, provide an explanation for any courses with different grade/success patterns than others. This may relate to major's courses vs GE, first-year vs second-year or basic skills vs transfer. Please describe how the department handles any unusual grading patterns. If you have any information that allows calibration of your grading data to external standards (performance of your students on standardized tests or licensing exams, transfer and/or employment success) please provide those to us and explain the connection. [The Program Review Data Liaison can help you with this section and will be providing you with all required data.]

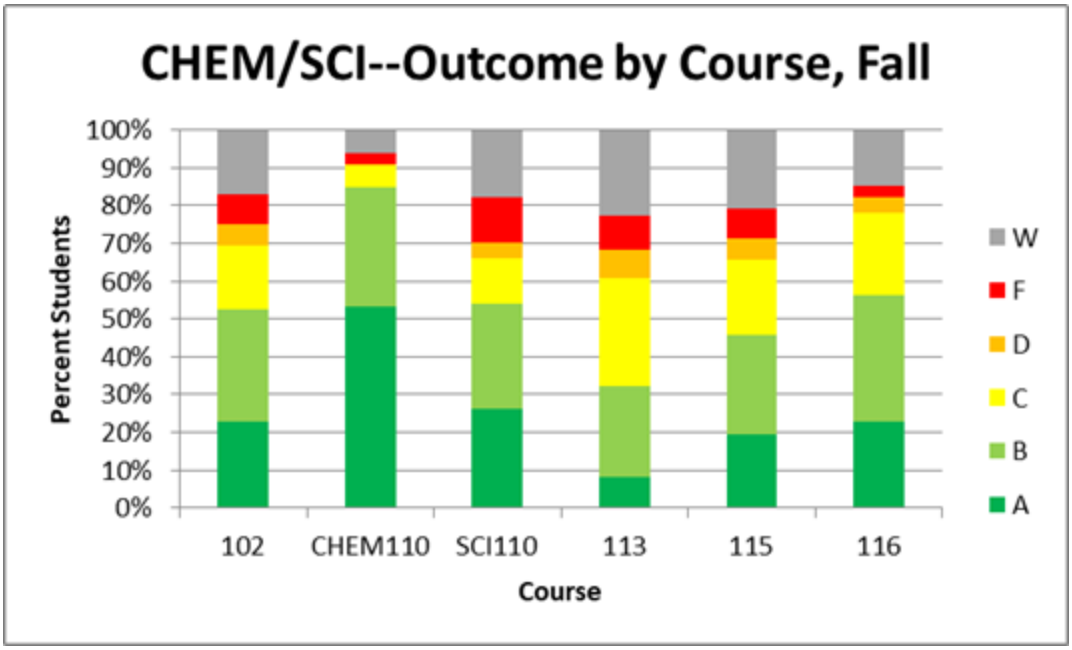
Grade distributions are always interesting. By definition one would figure that most people are average. However, like the hamlet of Lake Wobegone, it seems that all of our students are above average. OK, not all, but more than half. This seems odd. For the Chemistry Department, it seems that about 40% of our students are above average. One might figure that we should have a slightly higher success rate given that most of our students have had to successfully complete at least one prerequisite before taking most of our classes. All of our classes except for Science 110 and Chemistry 110 either have a math prerequisite and/or a chemistry prerequisite. Unfortunately for our success rates, chemistry is difficult for just about everybody. In looking at the "CHEM-Outcomes by Term", our grade distributions are somewhat consistent. With the exception of the 17/18 terms, the fluctuations are less than 5% in aggregate, with consistent grade distributions.



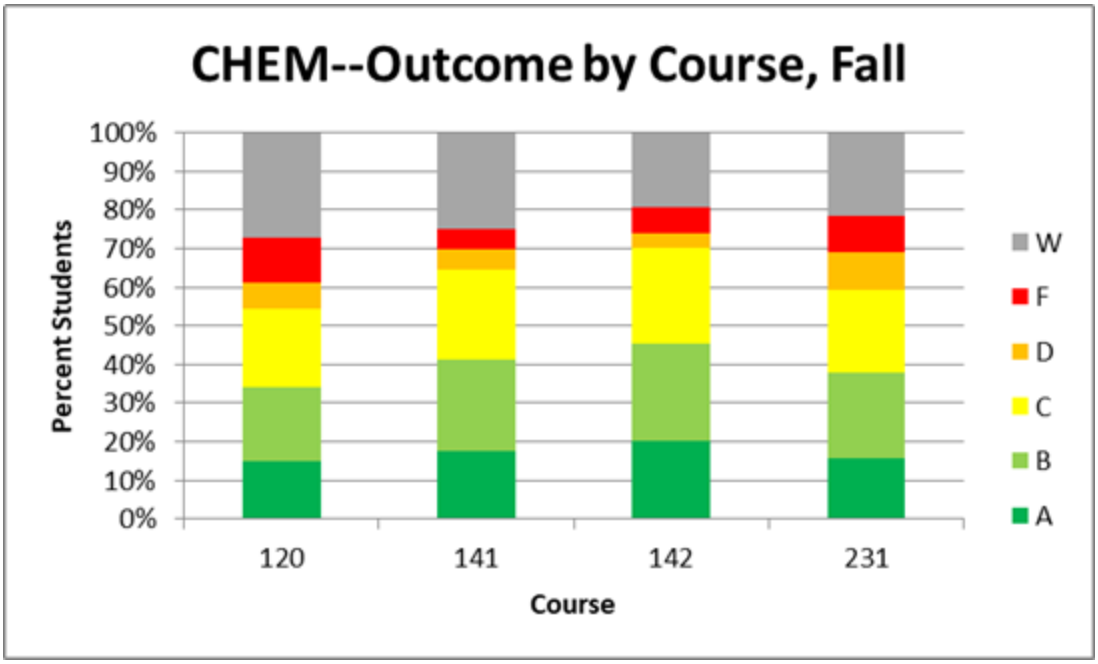


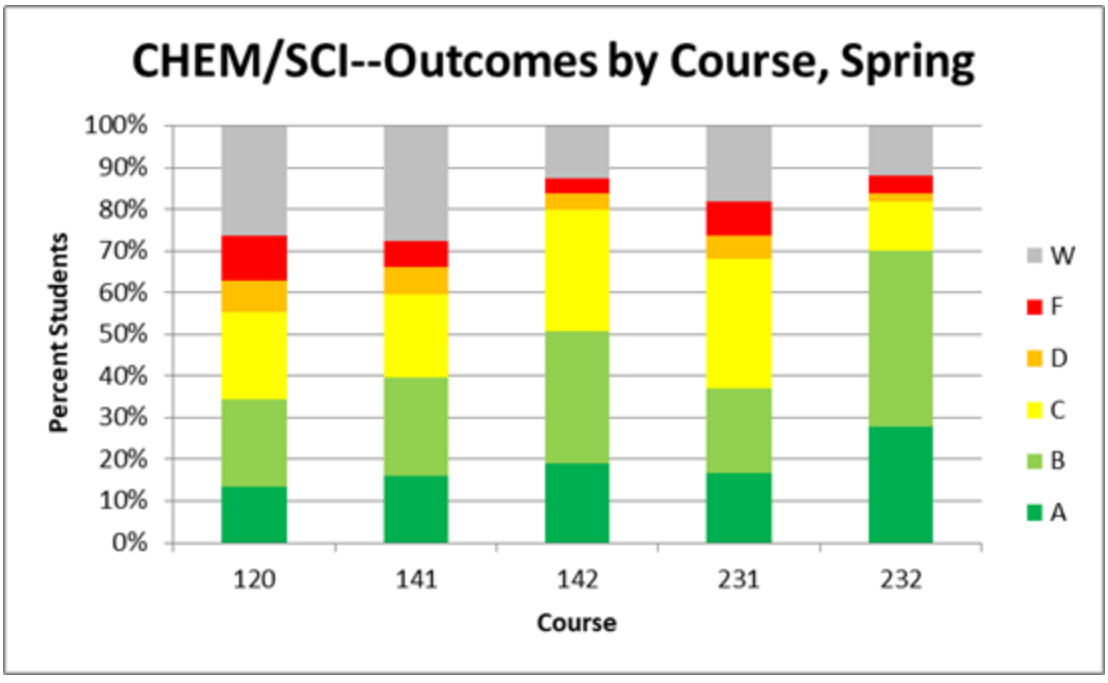
The non-majors chemistry courses show a success pattern that one would expect given their student populations. For example, those courses that are frequented by health science students (102, 115, and 116), especially nursing, tend to have a higher proportion of “A”s and “B”s due to the weight that those departments place on successful completion of these courses. Nursing students will often drop a chemistry course if they are on course to receive a “C”, and take it again for a better grade. However, there are two anomalies to this trend: Chemistry 110 and Chemistry 113. Both Chemistry 110 and Chemistry 113 are taught by a single instructor in any given term. We usually teach one section of Chemistry 110 and one or two sections of Chemistry 113. Chemistry 113 is a course primarily taken by students in the Forensic Evidence Technician program in the Administration of Justice Department. This course articulates as Chemistry 115 to our transfer institutions, and with the exception of a number of lab exercises, and a bit of lecture content, is identical to Chemistry 115. Chemistry 113 students aren’t under the same GPA considerations that Chemistry 115 students are. Also, this is often a class that they dread, and take toward the end of their program. Far removed from their algebra class. As a side note, studies show that the best predictor of success in a chemistry course is recency of an algebra course. Currently, the Chemistry 113 instructor is providing additional resources to 113 students to improve success and retention. She has implemented a number of note-taking strategies, guest speakers, additional practice, and additional workshops outside of normal class times to assist students.

The Chemistry 110 grade distribution is instructor related. College-level courses should not have more than 50% “A”s awarded. However, the enrollment for this course is low compared to many other chemistry courses. As such, the absolute numbers can sway the percentages significantly. Still, the course should present a college-level challenge. We are in the process of working with this instructor.



The course outcomes for our majors courses, Chemistry 120, 141, 142, and 231 are consistent between terms, and across courses. Chemistry 142 enjoys the highest success rate while Chemistry 120 the lowest, as one might predict. Chemistry 142 students are seasoned college students. They are focused, experienced in mathematics, and preparing to transfer. While Chemistry 120 is an introductory course with a more heterogeneous preparation and educational trajectory. As mentioned previously, we have changed our passing cut percentage in an effort to ensure better prepared students moving into Chemistry 141. In addition, we have also begun discussion on course content in Chemistry 120 to reduce the breadth, and more deeply cover those topics fundamental to success in Chemistry 141. Over the review period, Chemistry 231 has similar success rates as that of Chemistry 141. I suspect that the success rates are also a bit more variable as a percentage due to the smaller number of students who take Chemistry 231.



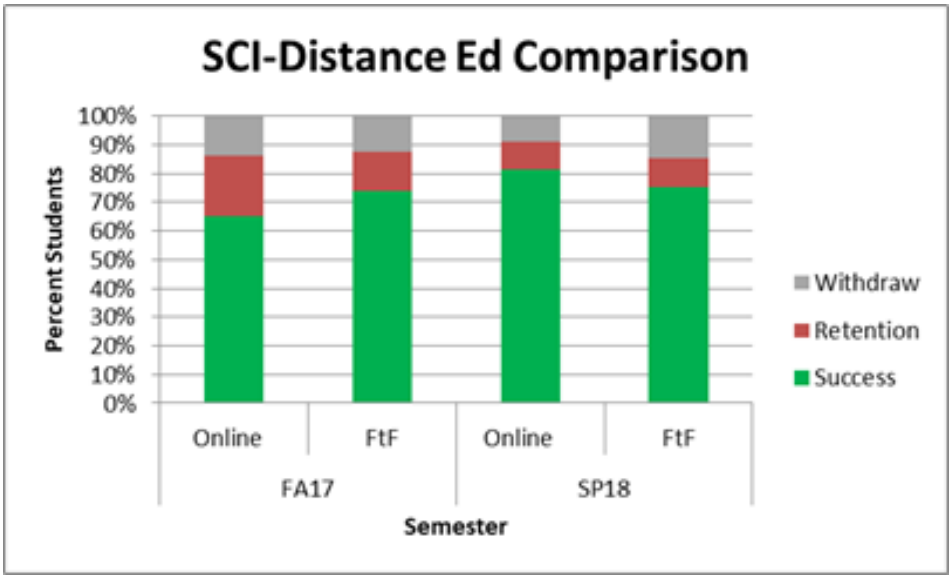


As mentioned previously, we administer American Chemical Society final exams for our Chemistry 142 and Chemistry 231 courses. These are nationally normed exams with detailed item analysis that allow us to compare our students to those across the nation. Most of the students that we compare to are those at four year schools. We submit student scores to assist the ACS with their norming studies. By submitting our scores, the ACS shares how our students compare to other students over the norming period. Over this period our students fared better than their compatriots at other institutions.

National Totals	
Mean	39.50
Standard Deviation	10.8
Median	39
Standard Error	3.97

Grossmont Totals	
Mean	43.3
Standard Deviation	9.14
Median	42
Standard Error	3.94

2.6 If applicable, provide a comparison of the retention and success rates of distance education (online) sections (including hybrid) and face-to-face sections. What are your department policies on course delivery method? Is there anything in the data that would prompt your department to make changes? (Required data will be provided by the Program Review Data Liaison – insert graph here).



The Chemistry Department offers a single fully online course, Science 110. The data provided doesn't seem to show any trends. Face-to-face success has gone down marginally, while online sections have gone up. However, the relatively small numbers of students involved can probably account for the the swings in percentages, and it is not clear whether there are any trends to be identified. We do have some hybrid sections, but they are recent additions, and no data is available for this cycle.

2.7 If applicable, include the list of courses that have been formally articulated with high schools. Describe any articulation and/or curricular collaboration efforts with K-12 schools. (Contact the Dean of CTE if you have questions).

We have begun discussions with Helix High School with offering Chemistry 120 on their campus. At this time, the department is in support of such an arrangement. There is an instructor at Helix who can teach this course, and they are extremely interested in offering this course next year. They are looking to such a course to provide opportunities for college preparation that are better than they are receiving from AP curricula.

A passage from our recent articulation report follows,

> "All courses in this discipline are transferable to both CSU and UC Systems. Furthermore, courses in this discipline have been evaluated by the CSU and UC systems to meet requirements for general education. As a result, approved Chemistry courses assist students in meeting CSU General Education Breadth requirements in the area of Scientific Inquiry and Quantitative Reasoning. Similarly, there are approved Chemistry courses in the Physical and Biological Sciences area of IGETC. All courses that have received transferability and general education designations are notated as such at the end of each course description in the Grossmont College Catalog. The courses with course to course articulation by department with specific CSUs and UCs can be found on ASSIST.org."

Our students successfully transfer every year. Primarily to SDSU and UCSD, but we regularly send students to UC Berkeley, UC Riverside, UC Davis, CS San Marcos, UC Irvine, Point Loma Nazarene University, and others.

2.8 Please describe how the program ensures that articulations are current. Identify any areas concern or additional needs that your department has about articulation with four-year institutions.

For the most part, owing to our relatively static curriculum, our articulation agreements often hum along with little drama or intrigue. When there is a bit of interest, it is usually initiated by SDSU, who is often our "thorn" on the articulation front. Much of the articulation issues have historically surrounded second semester Organic Chemistry (232 and now 242/242L). Second semester organic chemistry has traditionally been an upper division course, however, this is not universal with all institutions. Much of this has been worked out, and students transfer every year. There was also a time when there was misinformation regarding this articulation promulgated by unidentifiable sources, which complicated student communication. All seems to be well at this time.

We do have an issue with our transfer degree, however, it is out of our hands. With the current unit count in other required disciplines (math, etc), it is impossible for our students to meet the chemistry requirements in the ADT and stay under the maximum number of units. This will probably require some sort of statutory intervention to resolve.

3 – STUDENT LEARNING OUTCOMES (SLOs)

Figure 1

SLO CYCLE

Five-Step Assessment Process for Continuous Improvement of Student Learning at Berea College

3.1 Describe any changes (e.g., addition/deletion of SLOs, postponement of assessments) your department has made to your SLO assessment cycle. Include a brief description of why these changes were necessary. NOTE: Changes should include reassessment of SLOs requiring further attention.

We have not made any changes to our assessment cycle.

3.2 Give examples of how your department/unit has used SLO assessment results to improve a course, course sequence, and/or program over this program review cycle. In your narrative, please pay particular attention to assessment of courses that directly lead to a certificate/ degree/transfer (e.g., English 120, Psychology 120) and/or constitute a high enrollment course. For help with this prompt, please see the chart on the following page:

We have not made changes to our curriculum as a direct result of our SLO analysis. For many years (more than 20) we regularly evaluate our program through department-wide communication and communication with our transfer institutions. Recently we split our organic chemistry lab and lecture in response to local requirements for our transfer students. We have changed our “C” cut score after discussing results at SDSU where a higher cut score for the equivalent course yielded better success in the subsequent course. We also routinely rotate lab activities into, and out of the curriculum based upon instructor input.

3.3 What resources (time, professional development, curriculum approval process, etc.) did you need to carry out these improvements? Please explain.

The resources were primarily time. The biggest challenges surrounded the negotiation of the various curriculum processes.

3.4 What evidence did you collect to demonstrate that the planned improvements were successful? If you have yet to assess the improvements, what evidence do you plan to collect?

It is too early to assess any effects. It will take a few semesters with the "C" cut score to assess the effect on Chem 141 success rates. As for the changes in organic chemistry, this will also take time. Our data gathering is complicated by the fact that Cuyamaca College has begun offering the equivalent course every semester. This has greatly impacted our enrollments since the district capacity for this class has increased significantly.

3.5 How will you use this evidence to ensure ongoing course/course sequence/program improvements are sustained?

We will respond to the results and make any appropriate changes.

4 - FACILITIES AND SCHEDULING

4.1 List the type of facility spaces your department/program utilizes for instruction. This can include on-campus, off-campus, and virtual.

Our classes use two spaces: laboratory and lecture. Each of these spaces have whiteboards, and data projectors. It is important that both data projectors and whiteboards can be used simultaneously. It makes little sense for us to have projector screens that cover whiteboards.

We do need to have greater access to large, tiered lecture rooms. There is not enough availability of these rooms on campus to accommodate our multi-section courses. Multi-section courses (double and triple section) are those courses where an instructor teaches 2 or 3 sections of a class where the lectures are a combination of all the sections, and each section meets separately with the same instructor for their lab activity each week. This is a very efficient way of offering classes since the department can offer more sections while simultaneously lowering the load. For example, a single section of Chemistry 115 is equivalent to 0.35 LED (0.2 for lecture, and 0.15 lab). Offering two sections in this manner would "cost" 0.70 LED. However, if these two sections were offered as a double section, the instructor load would be 0.50 LED. During the difficult budget times of recent years, the department, in an effort to meet student needs with a limited budget compressed many offerings to the double and triple section model. As such, having access to larger classrooms is important for us.

In a further effort to meet the increase in our course offerings, we have begun offering courses on Saturday and Friday evening. This opens room in our lab rooms to offer more classes. This also has the benefit of attracting students only available on weekends for long stretches of time for lab.

4.2 Are the spaces listed in 4.1 adequate to meet the program's educational objectives?

Yes___ No_X__

- If you checked 'yes', please explain how your department/program utilizes facility space so your department can meet its educational objectives. Please provide an explanation of specific facility requirements of your program, and how those requirements are being met.

Mentioned above, our lab facilities are meeting our needs, especially since we have added Saturday courses. Laboratory space is what ultimately limits the size of our classes, so we have finite space that presents more than just a scheduling challenge. Currently, we are able to serve our students.

- If you checked 'no', please explain how your department/program is not meeting its facility space needs to adequately meet its educational objectives. Please provide an explanation of specific facility requirements of your program, and how those requirements are not being met.

At the same time, we are in need of large, tiered lecture space. There aren't enough rooms on campus to schedule as many as we need.

4.3 What proactive steps have you taken with regards to facility and scheduling to improve the ability of your department to meet the educational objectives of your program and ensure that students can complete their program in a timely manner?

Chemistry and science courses are scheduled throughout the morning, afternoon, evening. Some of our courses such as organic chemistry and forensic chemistry have one or two sections offered each semester. To ensure that day and evening students are able to complete our courses we rotate the times and days that these courses are offered. As mentioned earlier we have expanded our teaching hours into Friday evening and Saturday in order to accommodate students. The tradition in the department for many years was to keep the majors classes staffed with full-timers. Due to our growth, we have had to modify this approach. Expanding the school week, and hiring more adjuncts has allowed us to add sections, and that helps students keep on schedule. It does, however, present challenges with maintaining rigor and uniformity, however. In order to support this expansion, the department has hired a third lab technician to cover Saturday lab sections and the additional course offerings.

4.4 Identify and explain additional needed technological and equipment resources that could further enhance student learning in these spaces.

At this point our biggest needs surround laboratory instrumentation. We need to replace our aged gas chromatograph and infrared spectrometer. Also, the organic program would like an NMR. These are large capital expenses that require service contracts to maintain the functionality of these instruments. We need 4 additional Vernier laboratory interface data loggers, and their associated probes: temperature, pH, spectrometers, and voltage. In addition to the complement of probes for the new boxes, we also need to replace 4 spectrometers for existing data loggers.

4.5 Are students trying to access your program impacted by the facility spaces listed in 4.1?

Yes___ No__X_

- If you checked 'yes', please explain how students are being negatively impacted by unmet facility needs experienced in your department/program. Please provide some specific examples.

- If you checked 'no', please explain how your department/program is actively managing its facility space needs to meet its educational objectives and provide student access to your program. Please provide some specific examples.

As mentioned previously, we have expanded our work week to accommodate any limitations in our facilities.

4.6 If applicable, please include any additional information you feel is important regarding facilities and scheduling that was not included above including non-classroom spaces such as offices, storage, preparation areas, open workspaces for students/tutoring, etc.

To accommodate our increase in number of sections, we have hired a 3rd stockroom technician. We are in need of office space for this technician. Right now, the 3rd technician is housed in our conference room. This is

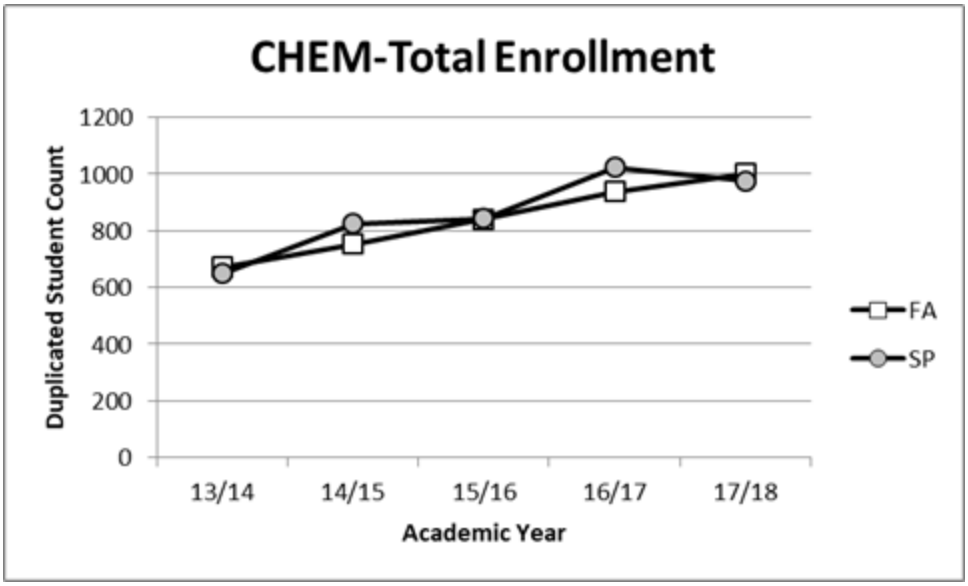
far from optimal in that it is a corporate space. We need to create space for the new technician within our lab area.

We have a number of persistent maintenance issues that compromise our lab facilities. Many doors in the department are not square such that they bind. This complicates opening, and interferes with properly securing doors in that there is not enough force in the closer to overcome the friction in the door jamb. Also, a number of gas valves in the hoods throughout our labs are stripped, and need replacing. It would be nice to find a longer term solution for these valves as they are in a near continuous state of disrepair. Our sinks are also a regular problem because they do not drain adequately to keep up with the load.

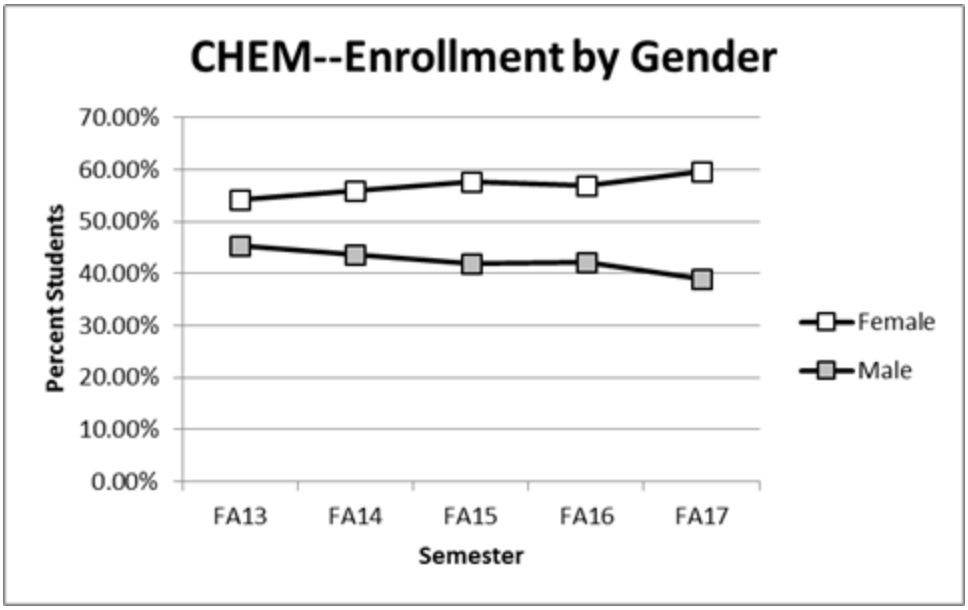
5 – STUDENT EQUITY AND SUCCESS

NOTE: See Appendix 2 for enrollment data; Appendix 3 for student success data.

5.1 What are the identifiable patterns with regards to overall trends in enrollments in your department? Explain what is causing these trends (e.g. campus conditions, department practices). Once you have identified and explained your enrollment patterns, then address what your department has done/is doing to address identified issues. Examples of any changes you made to manage enrollment are encouraged.

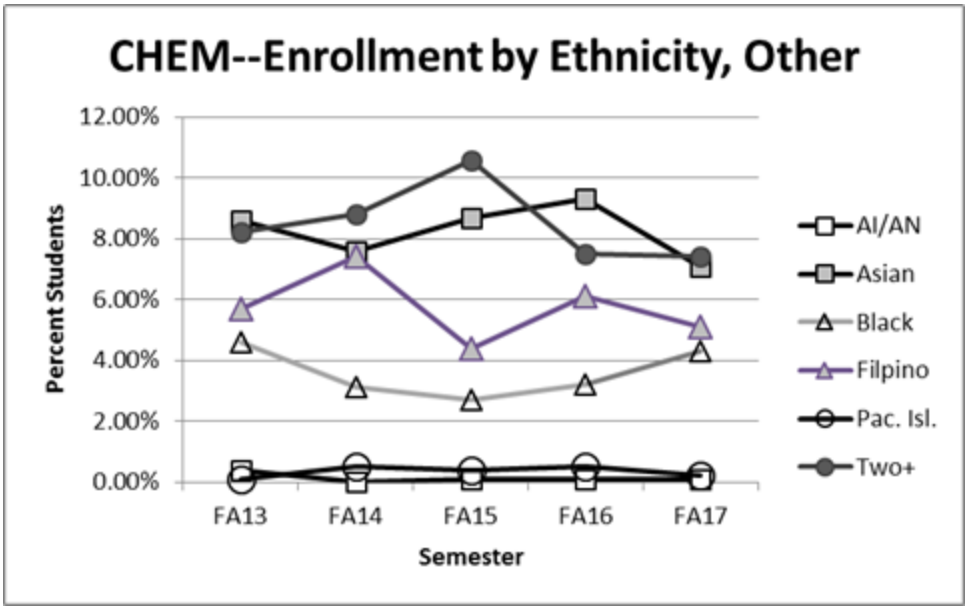


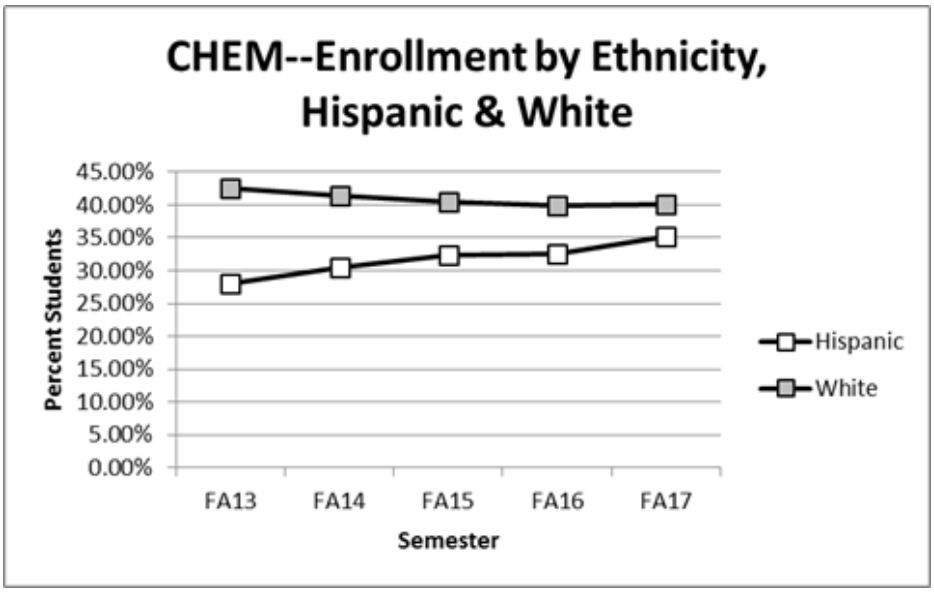
Our enrollment has steadily increased since our last review. Some of this increase can be attributed to our offering classes on Saturday, but I think there is a systemic increase in the number of students pursuing science degrees. Why? We don't know. Many of these students grew up during the last recession, or are immigrants from even more modest means. Maybe pursuing science and engineering is a hedge against a future economic downturn. Technical degrees typically fare better during economic uncertainty.

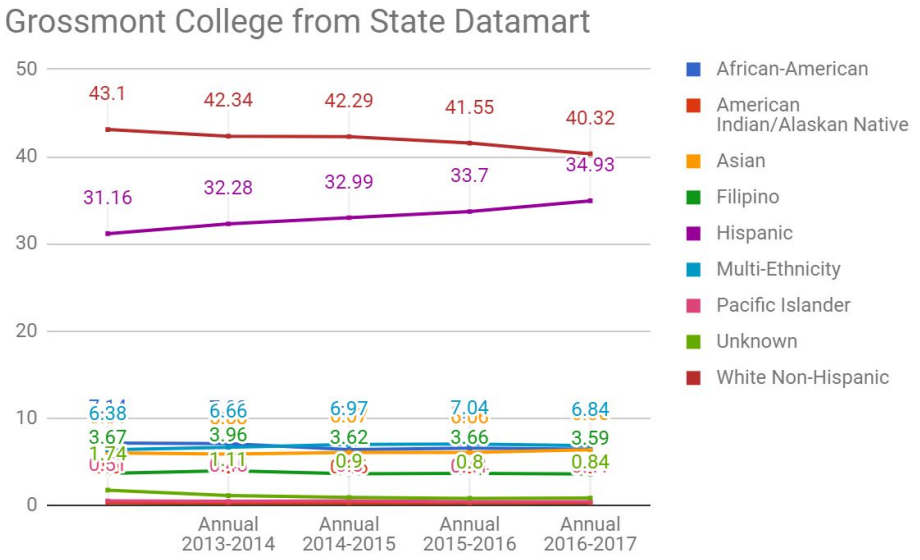


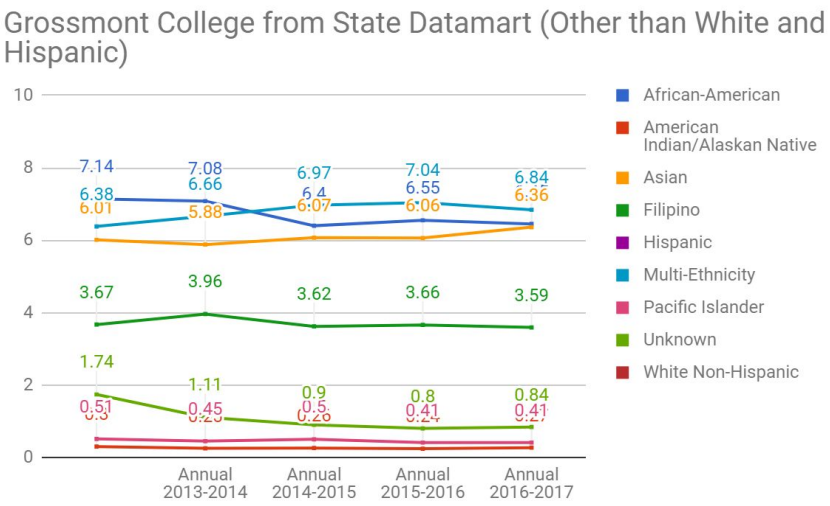
Our gender enrollment seems to reflect national norms in higher education. Males are trending down, while women are more highly represented. Traditionally, chemistry is overall about 50/50 in gender representation. There is a greater representation of males in the more physical disciplines, and engineering, and a higher percentage of females in biochemistry, and less physical disciplines.

Comparing our hispanic student population we see a growth over the report period, with a corresponding drop in white student enrollment. College data, shown below, shows a similar trend.

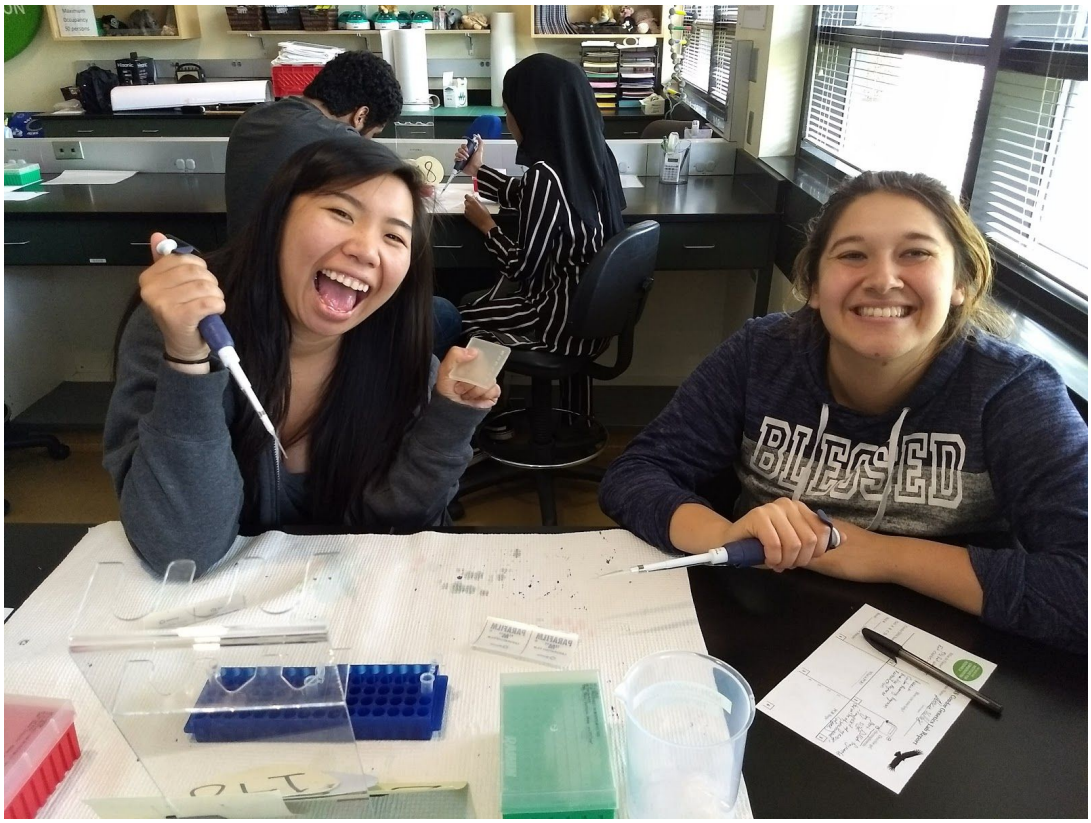



CHEM--Enrollment by Ethnicity, Hispanic & White
Percent Students
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
FA13
FA14
FA15
FA16
FA17
Semester
Hispanic
White

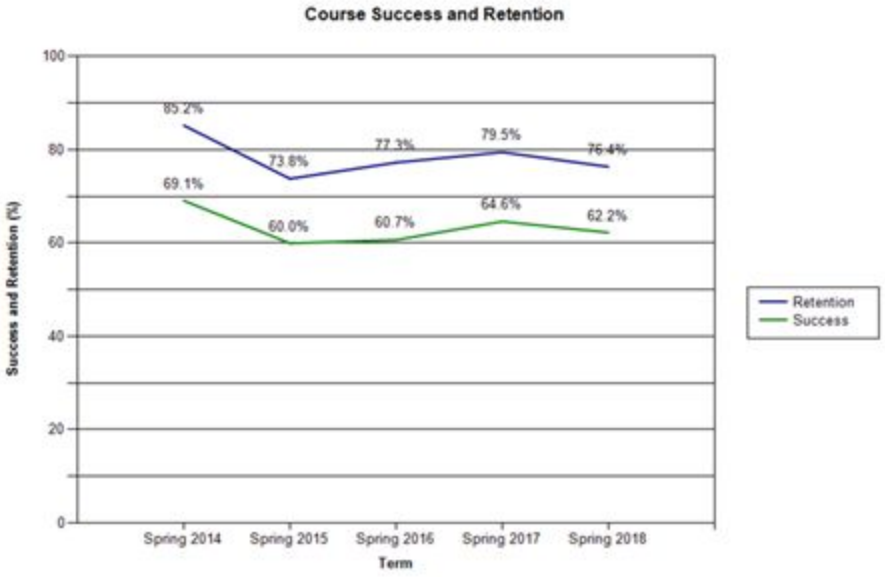

Grossmont College from State Datamart
50
40
30
20
10
0
43.1
42.34
42.29
41.55
40.32
31.16
32.28
32.99
33.7
34.93
6.38
6.66
6.97
7.04
6.84
3.67
3.96
3.62
3.66
3.59
1.74
1.11
0.9
0.8
0.84
Annual 2013-2014
Annual 2014-2015
Annual 2015-2016
Annual 2016-2017
African-American
American Indian/Alaskan Native
Asian
Filipino
Hispanic
Multi-Ethnicity
Pacific Islander
Unknown
White Non-Hispanic

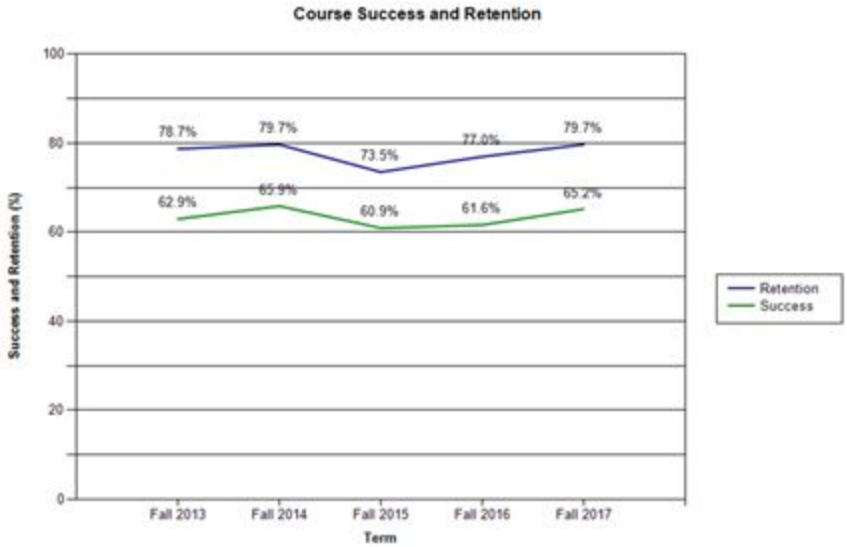


Our Asian population is marginally higher compared to the college percentage (~8% vs ~6%), and our Black fraction is correspondingly smaller than the college (~4% vs. ~6%). Given the relatively small population of chemistry students, I suspect that the variation in the Black population is a due to the small numbers. Two or three students can make significant swings in the percentage. I am not convinced that there is some sort of systemic cause.



5.2 Discuss trends in student success and retention overall in your department and explain these trends (e.g. campus conditions, department practices). Also examine the success and retention data disaggregated by gender, age and ethnicity. For any groups that have success rates in your department at lower or higher than college-wide describe what factors you think cause those patterns. Provide examples of any changes you made to improve student success/retention, especially for groups that have equity gaps. [Data and a summary of notable patterns will be provided by the Program Review Data Liaison]





Success and retention in the Chemistry Department is lower than both the current college numbers, and the college's goals. Currently the college 5 year average is 69% success and 84% retention. The college five year

goals are 75% success and 85% retention. Comparing the Chemistry Department's offerings to that of the college is not an equitable comparison. Currently the college awards an "A" grade to nearly 35% of students. A more equitable comparison would be to other chemistry programs. A more useful metric would be to compare the success rate of our students in subsequent courses at transfer institutions. A cursory search of publically available data shows that our department has better success and retention than most, and worse than many. At SDSU in 2017-2018 0.81% of the total number of degrees awarded were chemistry, biochemistry, or chemical physics degrees. According to a 2010 study of collegiate GPAs, "Attrition in STEM Fields at a Liberal Arts College: The Importance of Grades and Pre-Collegiate Preferences" Chemistry was at the bottom of the list for GPA (2.78) for the schools studied. (https://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1141&context=workingpapers). This all to say that we are a different animal from the broader college population. Chemistry is difficult, and we implement many strategies to help students learn the material. We have made tutors available during most of the hours and days that we offer classes (including Saturday). We regularly review our delivery methods, and content through regular department meetings. While the college goals of 75% success and 85% retention are admirable, replicating such percentages in a chemistry program is extremely challenging..

5.3 Describe specific examples of departmental or individual efforts, including instructional innovations and/or special projects, aimed at encouraging students to become actively engaged in the learning process in their classes.

Engagement can come in a variety of forms. The nature of a proper chemical education requires students to engage in laboratory activities, which compel student engagement. Students engage with the material, their peers, laboratory equipment, and their instructor. One of the adjustments that first-time chemistry students are required to make is that they are not passive participants in the learning process. They are required to use all of the faculties to pass the course. This includes the ability to converse with peers and other adults, write, analyze, and complete tasks that require manual dexterity. This is true of nearly all of our classes. Below is a list of responses from my faculty colleagues.

- "Two projects with rubrics to show understanding of chemistry's importance in the real world and to allow for different learning styles than exams or labs (short story and presentation)
  Scaffolding with simulations, cartoons and animations"

- "In 141 and 142 I have my students present data interpretation of equilibrium lab and often poster-board presentations. When I teach 120, I have them do this for both reaction labs as well. They present and explain with board work."

- "In the capstone project in 2nd semester Organic Chemistry. Students present total synthesis of a target molecule including retro synthetic analysis.

- "1- Design/Preparation of Scientific Posters (CHEM 141) Students choose a scientific subject of interest, (we usually narrow the scope to chemistry) which encourages the students to create their own learning path. Students engage in the research, selection of relevant content, organization, design, and presentation. They not only become "experts" on the subject they select, but they also become teachers and science communicators. I have attached one of the posters samples."

- “I have transformed this assignment to follow the Transparent Assignment Design practice. https://atl.wsu.edu/assignment-design/transparent-assignment-design/”

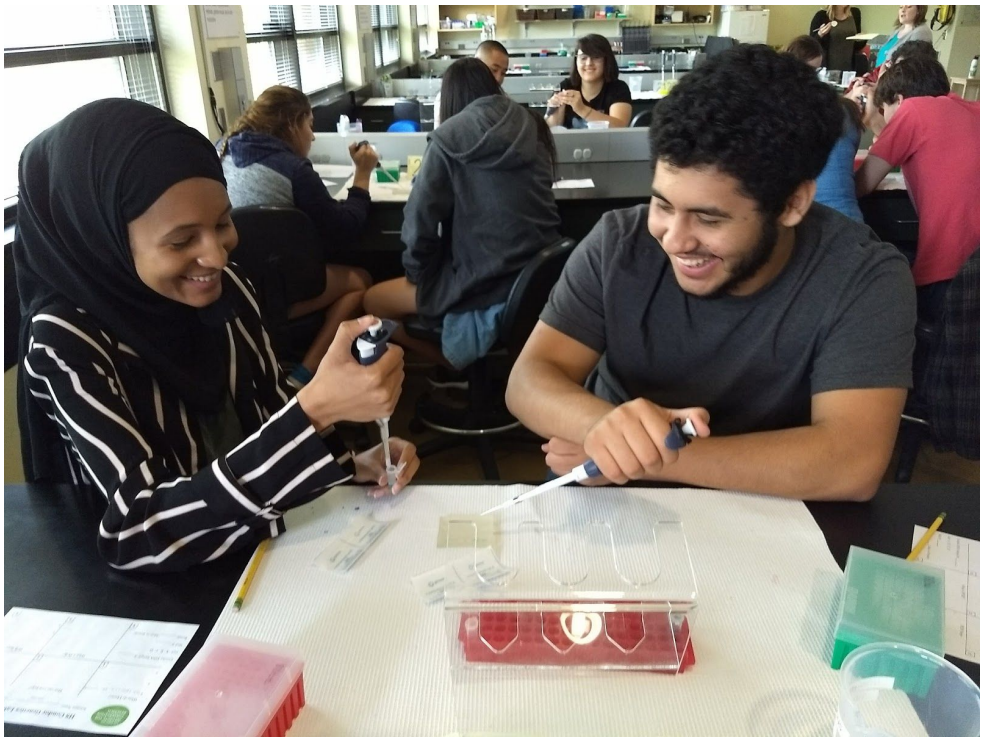
- “2- Research Survey on " Perception of Conflict Between Science and Religion". Course SCI 110. For this assignment, students are presented with the Pew Research Center Survey https://www.pewresearch.org/science/2015/10/22/perception-of-conflict-between-science-and-religion/ and are encouraged to design, administer, analyzed and present their own survey to the class. We use some of the questions from the Pew Center Survey and students add some questions of their own. This encourages the students to develop their own inquiry and gives them ownership into the project. Students learn as well how to chart, and objectively present collected data. Student commitment and engagement has been surprisingly significant. Some students create quite innovative ways to administer the survey such as social media, street interviews, survey monkey.”

- “For the past several semesters I have been reserving the lab weekly for 1 hr to 1 1/2 hrs outside of class time, this semester directly before class, for an optional “Workshop”. It functions similarly to “office hours”, but because it is called a “Workshop”, I am getting regular weekly attendance of over half my class. At the workshop, students bring their questions from HW, practice Exams, labs, or just general questions, and I fill every white board in the classroom with answers to their questions, while explaining things in detail. Then, when class starts, we do a 5-10 minute summary with the whole class of everything that is written on the white boards before we take the Quiz or Exam that is generally scheduled each week. It has proven to be a very effective review, but in other semesters when it is scheduled after class or at another time, it has been equally well attended with a larger focus on working on the HW problems that were just assigned in lecture. The key is calling it a “Workshop”, and answering questions publicly on the white board so that students coming in and out during the session can see what has been asked. It also allows greater participation, because students attend who otherwise wouldn’t come to “office hours” because they don’t have a specific question of their own.”

- “Another thing I have found especially helpful is assigning “AVA” assignments twice a week that are worth a small percentage of their grade. AVA stands for “articles, videos, and assessments”, but I have found videos to be the most useful, so most of the assignments are now videos. How it works is this: I post videos in Canvas that are attached to an assignment. I have them broken down into two categories, one is Forensic videos where every Sunday night, they write 7 sentences summarizing the video. The second is Chemistry videos, where every Wednesday night before lecture Thursday, they watch videos pertaining to that upcoming lecture, and then submit a sentence telling me how long they spent watching the videos. The assignments are very simple, but they could be altered to be as complex as the instructor wanted, or even formatted as online-quizzes. For my purposes, the goal for the Forensic videos is simply to engage them in watching them to learn about how much Chemistry is involved in Forensics, without too heavy of a focus or major amounts of time committed to that, so the 7 sentence summary works fine. For the pre-lecture Chemistry videos, the goal is simply to force them to preview the material before lecture, in the same way that you would ask students to read a section of the book before coming to class--but the video thing is much more effective. Also, simply having them write the time they spent doesn’t force the top students to watch hours of videos that they don’t need to watch, or engage in busy-work assignments that they don’t need, while still giving all students access to an abundance of lecture material from a variety of internet sources, both before and after lecture.”

- "Finally, I attended a Forensic Advisory meeting last week and met experts in Forensic fields all over San Diego. In particular, Toniann, a Criminalist from San Diego Police Department who specializes in Firearms, volunteered to do a guest lecture, demonstration, and help me set up a serial number restoration lab! I am working with Lisa in the stockroom to clear some lab time for this, and to make sure we have all necessary equipment. The students and I are all very excited about this opportunity!"
- "Element presentations in chemistry 141/142. The 141 lab report peer review. There are all of the lab manual revisions that have been done with an eye toward active learning."
- "I started giving my students reflective surveys after exam 1 and 2 for the past couple of semesters and have shared them with other instructors."

5.4 Explain how the program incorporates opportunities for student engagement outside of class time and/or in collaboration with other departments (e.g. interdisciplinary course offerings, learning communities, internships, research projects, service learning, or participation in community events, tournaments, competitions, and fairs) to enhance student learning.



The principal means by which chemistry students interact with their community, and find community is through the Science Club. The Science Club works with local elementary schools to provide activities for "Science Night" and in-class science lessons. Students plan the project, practice, and organize the effort. The Science Club also visits businesses and other venues of scientific interest in an effort to let science students interact with practicing scientists in their place of business. The Science Club also allows students from a variety of disciplines to gain exposure to potential vocations, or even learn about a scientific discipline that they didn't know about. For example, while visiting the California Science Center in Los Angeles we watched a film about the efforts of NASA to get to Mars. During the film one of my students quietly exclaimed, "I didn't

know that NASA had doctors". This was truly enlightening in that this author never thought that a student wouldn't know that there were NASA physicians. An epiphany!

5.5 If state or federal licensing/registration examinations govern the program, please provide data and comment on student success trends.

There are no licensing exams.

5.6 If your program offers a degree or certificate in the college catalog, explain the trends regarding number of students who earn these degrees and/or certificates, including any changes that you have made to increase awards. Insert the "Degrees and Certificates" data table in this section.

Award	13/14	14/15	15/16	16/17	17/18	Total
Biological Sciences AS	3	5	5	5	5	23
Chemistry COA	2	2	0	5	5	14
Chemistry AS	0	2	1	6	8	17
Exercise Science–Athletic Training AS	0	0	0	0	0	0
Exercise Science & Wellness AS	7	10	3	7	15	42
Exercise Science & Wellness COA	6	11	3	6	11	37
Geography AS	3	1	0	1	2	7
Geography AA-T	1	1	6	5	8	21
Geology-AS	1	0	1	1	0	3
Geology AS-T	1	1	1	2	1	6
Mathematics AS	25	36	22	26	28	137
Mathematics AS-T	22	35	29	36	55	177
Oceanography AS	0	1	0	0	0	1
Physics AS	0	9	5	5	8	27
Physics AS-T	3	10	15	10	24	62
University Studies--Science & Math	5	4	2	0	0	11
University Studies--Math, Nat. & Comp. Sci	111	119	122	100	145	597
General Studies--ESW	3	1	2	2	6	14
General Studies--Science & Quant. Reas.	58	55	36	45	62	256
MNSESW Total (Degrees & Certificates)	251	303	253	262	383	1452
College Total (Degrees & Certificates)	2870	3134	3170	3576	4101	16851

Over the review period we have experienced a growth in Chemistry degrees, but I suspect that this is commensurate with our overall growth. A more useful measure of degree attainment would be as a percentage of course enrollment, or some other metric that accounts for growth. As mentioned previously, we are unable to meet the requirements for the AS-T degree unit limitations due to courses outside of our discipline. We are not unique. There are only a handful of Chemistry programs statewide who offer transfer degrees.

5.7 If you have any information on what students who major in your department go on to achieve

We have no formal data set regarding student outcomes after they leave Grossmont. Anecdotally we have students who are completing undergraduate, graduate, and professional degrees. A number of years ago we studied the success of our students at SDSU compared to their colleagues, where they uniformly fared better. Anecdotally we are seeing an increase in number of transfers to UCSD.

6 - STUDENT SUPPORT AND CAMPUS RESOURCES

6.1 Are the college's student support services (Tutoring, Counseling, Health Center, Library, Financial Aid) adequate to meet your student's needs? Please elaborate on your answer.

In-house tutoring is very important for us. Students tutoring students can be less intimidating compared to student-instructor interactions. Having tutors nearby is also helpful in that if they ever run into any difficulty, or need some clarification, they can find faculty to help immediately. Our tutoring space is also a good community-building location. Students can work collaboratively, and with tutors to complete their coursework. Tutor availability is the same for any student workers in that we have to work around their class schedule. This can be problematic, but the biggest stumbling block is the on-boarding process. Processing the district paperwork is painfully slow. Students need to build the tutor relationships and habits early in the semester. Negotiating the hiring process often takes a few weeks at the beginning of the semester. This is too long.

6.2 What services do students in your department/program use most often or that make the most difference? Can you provide any examples where services have clearly improved student retention and success?

It is difficult to assess any efforts for retention and success. Even tutoring center success data is skewed in that users self-select. If a student is proactive enough to seek assistance from a tutor, then they are already taking the necessary steps to promote success. Our data is anecdotal at best, but we can say that students appreciate the help from the tutors, and use them regularly.

6.3 Are college support services adequately supporting your faculty and staff? Consider the following support services: IT, Instructional Operations, Business Services, Printing, Bookstore, Maintenance, CAPS, and any other support services important to your faculty and staff.

For the most part services are adequate. We do have maintenance issues that need to be resolved, however. Doors that stick, sinks that are slow to drain, and hood gas valves that are stripped.

7 – ON-CAMPUS/OFF-CAMPUS INVOLVEMENT

Last Name	First Name	Activity/Committee	Year	Value to Student Success
Lehman	Jeff	Academic Senate VP	2011-2017	Campus governance
Lehman	Jeff	Sabbatical	2017-2018	Produced instructional materials for students

Lehman	Jeff	College Recognition Committee	2011-2017	Campus governance
Lehman	Jeff	EPC Co-Chair	2014-Present	Keeping students, and employees safe
Lehman	Jeff	President Hiring Committee		Campus governance
Lehman	Jeff	Science Club Advisor	2012-Present	Building community in the sciences. Elementary school science workshops. Middle school science demos, community science demos at the library and Grossmont Center. Trips to science museums. Trips to SDAA viewing.
Lehman	Jeff	Accreditation Standard IIID Co-Chair	2013-2015	Campus governance
Lehman	Jeff	Budget Allocation Taskforce	2013-2015	Campus governance
Lehman	Jeff	Future Cities Judge	2018	Community outreach
Lehman	Jeff	Robotics Judge	2016-2017	Community outreach
Lehman	Jeff	Emergency Management class for district executives	2018	Keeping students, and employees safe
Lehman	Jeff	IHE Emergency Managers Committee for SD County OES	2012-Present	Keeping students, and employees safe
Olmstead	Thomas	Sabbatical	2018-2019	Created new course Environmental Chemistry of Wine; wrote textbook; lecture slides
Olmstead	Thomas	D'Vine Path Program for autistic young adults providing vocational and life skills development in viticulture, agriculture and the arts-Fallbrook CA	2108-2019	Instructor and Support Staff

Olmstead	Thomas	Wine Grape Growers Association-Fallbrook CA	2018-2019	member
Olmstead	Thomas	Wrote textbook for new Wine Chemistry course	2018-2019	primary resource for Chem110 student
Czworkowski	John	15th Annual Got Plans Career/College Fair at Cuyamaca College (w/ Wendy Ochoa)	2018 Oct 20	Gave pre-college students guidance around studying science & chemistry, & potential careers
Larter	Martin	Supervise peer tutors for Science learning Center 6 hrs per week	2012- present	Help mentor tutors on how to teach studnts to be self learners by showing them resources they can use for their chemistry problem solving, and techniques to use in order to teach the logical patterns of chemistry
Larter	Martin	Student Success Fair	Feb 27 2019	Promoting the various programs in chemistry and creating enthusasim by doing simple chemistry demonstrations
Larter	Martin	Academic Senate Department Representative	2015-2016 and 2018-2019	
Vance	Diana	Co-Chair Chemistry and Science Department	2015-2017	
Vance	Diana	Chair Chemistry and Science Department	2017-present	
Vance	Diana	Member CCC	2015-present	
Vance	Diana	Academic Senate Department Representative	2015-present	
Vance	Diana	Member IEC	Fall 2018-Present	
Vance	Diana	Update 102, 115, 116, 120, 141, and 142 chemistry lab manuals	2010-present	The laboratory experience is a key component of most of our chemistry courses. Updating the lab manuals to include transparent design, scaffolded questions, more clear directions, and examples helps our students. I do this at the end of each semester.

Vance	Diana	Institutional Review Committee	2010-until dissolved	This committee ranked department requests for activities. Many of these projects directly impacted students.
Vance	Diana	Institutional Review Committee Co-Chair	Spring 2012	Is this too old?
Vance	Diana	Academic Rank Committee	2011-present	This committee considers academic rank advancement for full and part time instructors as well as emeritus status.
Vance	Diana	Grossmont College 50th Anniversary: ran Lip Balm Lab	April 2012	Community outreac
Vance	Diana	Screening Committee	Fall 2015, Spring 2016	
Vance	Diana	Regional Chemistry Meeting at Miramar College	Spring 2016	
Vance	Diana	Annual College Planning Forum Attendee	2015, 2016, 2017, 2018, 2019	
Vance	Diana	High School Outreach Events	6/6/18, 5/4/18	Gave short presentations to high school students about the Grossmont College MNSESW departments
Vance	Diana	Chemistry and Science Department Brochure	Spring 2018	Worked with Creative Servies and department to create a department brochure to be used in outreach activities and given to students.
Vance	Diana	GCCCD Job Fair	April 2017?	
Vance	Diana	Build and maintain content on Department website	Fall 2015-present	
Vance	Diana	High school student outreach with John Cz in quad	Spring 2018?	
Vance	Diana	Counsel Breakfast outreach	Fall 2019	Probably not for this cycle....
Vance	Diana	NIOLOA attendee	9/21/19	Next cycle?

George	Judy	Distinguished faculty committee member	Sp15(?)-present	The committee votes on the nominees for distinguished part time and full time faculty
George	Judy	Commencement Speaker Committee	Sp15,16,17,19	The committee chooses the commencement speaker from qualified candidates
George	Judy	!0th grade Honors Chemistry, The Cambridge School	Sp 18	Community Outreach
George	Judy	Editing of 120,141,142 lab manuals with DV	2010-present	Lab experience is fundamental component to understanding chemistry
George	Judy	Grossmont College 50th Anniversary: ran Lip Balm Lab	Sp 2012	Community outreach
George	Judy	Hire Committee chair Chem Tech full time position	Sp2018 Fa2017	Adequate support staff facilitates well run labs
Ochoa	Maria Wendy	Academic Senate	Sp2019	Campus governance
Ochoa	Maria Wendy	High school student outreach	Fall 2018	
Ochoa	Maria Wendy	Course Marketing	Summer 2017	Poster to promote SCI110 Online Course. Increasing enrollment over summer and options for students accessibility.
Ochoa	Maria Wendy	WIST Conference (Women in Science and Technology	Sp 2017/ Upcoming Fall 2019	Biennial Conference to promote involvement of Women in Science. The conference offers professional development tools to students and professional in STEM
Ochoa	Maria Wendy	Board Member AWIS SD (Association for Women in Science)	Fall 2018-Present	
Ochoa	Maria Wendy	57th ASGC ICC Awards Ceremony	Sp 2019	Award presentation. Recognicion of student's effort and dedication.
Ochoa	Maria Wendy	Research Project with NU and Scripps Institute of Oceanography: What	SP2018-present	

		kind of microbes attach to floating plastic in coastal waters?		
Ochoa	Maria Wendy	Rise Above Plastics San Diego / Surfrider Foundation	Fall 2017-2018	Volunteering work to launch/promote program OCEAN FRIENDLY RESTAURANT. Awareness value to students
Carlson	Theresa	Course Redesign Grant	academic year of 2017-2018	Worked on redesigning a general chemistry course with the help of technology to help bring the D, F, W rate down
Carlson	Theresa	OER conferences	2016-present	I go to OER conferences to learn about what is available in open resources for the chemistry field
Carlson	Theresa	STEM Fair -- Tbilisi, Georgia	2015-2017	Promoting chemistry and biochemistry degrees to high school students in a low income country
Carlson	Theresa	Updated lab manual for SDSU General chemistry course	2014- present	
Carlson	Theresa	Technovation Challenge Judge -- Tbilisi, Georgia	May 2017	Every year, Technovation invites teams of girls from all over the world to learn and apply the skills needed to solve real-world problems through technology.
Carlson	Theresa	SDSU Affordable Learning Solutions	Spring 2016-present	
Dunn	Sarah	Board Member for SCSMM (Southern California Society for Microscopy and Microanalysis)	Fall 2017-Fall 2019	Helped arranged meetings twice a year for undergraduate and graduate students to showcase their research; mentoring
Dunn	Sarah	Canvas @ONE online certification course	Fall 2018	Professional Development - Improved working knowledge of Canvas and tools
Paulsen	Heike	Lunch Science Club focusing on kitchen chemistry experiments	Fall/Spring 2018-2019	Promoting science to all high school students
Paulsen	Heike	Vertical Alignment Team between	Fall/Spring 2018-2019	Professional Development - Improved working knowledge of NGSS

		Middle School and High School NGSS curriculum		
Butland	Karen	Accreditation Steering Committee, Standard IIB and review of others	2018-present	transfer value to students long term
Butland	Karen	Hosted booth during WOA Week of Accreditation	Spring 2019	Raise awareness with students regarding the process of accreditation.
Butland	Karen	Reviewed textbook "Foundations of College Chemistry"	Spring 2019	Improved materials for student learning.
Butland	Karen	Peer Mentor Program	May 2019	Attendance at event shows support to students and raises awareness of this program.
Butland	Karen	Forensic Workshops at Detective Summer Camp	Summer 2017, 2018, 2019	Community Outreach
Butland	Karen	Collaboration with Administration of Justice Department and Forensic Technology Advisory Meeting	2016-present	Forensic chemistry class hosting 2 guest speakers from local crime labs. Also development of new lab on serial number restoration.
Butland	Karen	Extensive Canvas Training Workshops	Summer 2017-present	Excellent online organization and addition of materials to supplement course.
Butland	Karen	Development of course materials for Forensic Chem	2018-present	Improved materials for student learning including handouts and lab report pages.
Butland	Karen	Completed AOJ-206 Criminal Investigation (student)	Fall 2017	Improved materials for Forensic Chemistry course
Butland	Karen	Attended Chemistry In Context WebEx Meeting	Fall 2017	Direct impact on curriculum for students in my Environmental Chemistry course.
Butland	Karen	Collaboration with San Diego Gas and Electric	Spring 2017	Environmental Chemistry course extra credit Tour of SDGE with focus on their electric car program.

Butland	Karen	"Can Boring Chemistry Be Made Fun" Elementary School Workshops at La Jolla Elementary/Gillispie	2015	Community Outreach
Stanfield	Jessica	Classified Staffing Prioritization Committee	January 2019 - present	Help decide which departments get to hire classified staff, some of which will directly work with students or support the college overall
Stanfield	Jessica	Grossmont College Student Equity Plan Writing Team	Fall 2015	Increase student equity & programs to support student equity
Stanfield	Jessica	Grossmont College Academic Senate - Division Senator	2014 - 2017 & 2018 - Present	Shared governance for the college
Stanfield	Jessica	Grossmont College Academic Senate - Department Representative	Fall 2017 - Spring 2018	Shared governance for the college
Stanfield	Jessica	Part-time Faculty Committee	2014 - 2017 & 2018 - Present	
Stanfield	Jessica	Science Competition Judge	Fall 2013	Community outreach onsite @Grossmont
Stanfield	Jessica	BeWise Overnight Chaperone	Spring 2016	Community outreach
Stanfield	Jessica	Chem 141 Homework & Final revamp	Spring 2018	Learned about best-practices in online homework to redevelop our shared homework set for our chem 141 students
Stanfield	Jessica	Online Teaching Certification through @One	Spring 2018	Certified to teach online to develop online chemistry and science courses for the department
Stanfield	Jessica	Volunteer - Salk Institute Educational Outreach	2011 - Present	Community outreach
Stanfield	Jessica	Chemistry Gear-Up Workshop	2015, 2016, 2017	Pre-semester workshop with Martin Larter to make sure chem 120 "graduates" were ready for chem 141

7.1 Referring to the above table, what activities contributed most to student success?

I don't think that any relationship to student success can be made with any single activity. How would one assess such things without controlling variables? Anecdotally, all activity can contribute to student success in that it furthers the mission of the college. Some activities have a direct impact such as those that address classroom activities, while plenty will have an indirect effect due to a positive impact on campus climate, or support services. This being said, I can comment on those activities which generated the most discussion, and thought in the department.

The compressed calendar discussion, not represented in any formal activities, generated numerous discussions as to those "deal breaker" activities in the laboratory. If we were suddenly forced to reduce our time in the laboratory (Yes, the time is the same, but compression reduces student time-on-task.), how could we maintain the quality of our program. Anytime the non-negotiables are discussed, it is always spirited.

Transparent assignments has also been of interest. Especially given the types of activities that we assign students, and conveying to our students that frustration, and confusion are integral parts of a proper science education. We expect students to experience frustration.

7.2 Please provide an overall reflection on your department's activity displayed in your table.

With Cary Willard serving as dean, and the retirement of John Oakes, we are down nearly 30% in full-time faculty. Given this, my first observation is that we have an active cadre of adjunct instructors. They are participating in campus governance, department business, and their communities. This is encouraging. Also encouraging is that all full-time, and a significant percentage of part-time, faculty in the department are participating in some sort of student outreach or success initiative,

7.3 Are your overall faculty professional development needs sufficient to ensure students are successful in your program?

Yes____ No __X__

If no, please describe what faculty professional development needs are not being met.

The best professional development is discipline-specific professional development. Many of the campus offerings surround some promotion of a campus initiative. This is fine, useful, and necessary, but it does not substitute, nor supplant spending time with colleagues in your own discipline outside of your institution. Funding to attend the American Chemical Society meeting on a regular basis (every year, every other year, etc) would go a long way to promoting faculty engagement and student success.

8 – FISCAL & HUMAN RESOURCES

Fiscal Resources

Chemistry/Science (Combined Total)					
	FA13	***FA14***	***FA15***	***FA16***	***FA17***
Earned Enroll	859	965	1,091	1,218	1,312
Max Enroll	869	943	1,117	1,277	1,485
% Fill	**98.8**	**102.3**	**97.7**	**95.4**	**88.4**
Earned WSCH	5027.8	5740.8	6414.0	7146.3	7925.8
Total FTEF	9.5	10.7	11.7	13.8	16.4
Earned WSCH/FTEF	**531.1**	**538.2**	**547.4**	**517.2**	**482.8**
	SP14	***SP15***	***SP16***	***SP17***	***SP18***
Earned Enroll	849	1,032	1,081	1,197	1,211
Max Enroll	840	1,098	1,173	1,423	1,392
% Fill	**101.1**	**94.0**	**92.2**	**84.1**	**87.0**
Earned WSCH	5037.0	6156.0	6353.8	7398.6	7577.1
Total FTEF	9.1	11.8	12.4	15.7	15.9
Earned WSCH/FTEF	**556.6**	**520.9**	**513.8**	**472.3**	**477.5**
	SU13	***SU14***	***SU15***	***SU16***	***SU17***
Earned Enroll	97	209	298	293	268
Max Enroll	80	166	216	274	332
% Fill	**121.25**	**125.90**	**137.96**	**106.93**	**80.72**
Earned WSCH	504.86	401.52	629.44	707.65	1,441.56
Total FTEF	1.05	1.60	2.45	3.15	4.35
Earned WSCH/FTEF	**480.82**	**250.95**	**256.91**	**224.65**	**331.39**

Chemistry					
	FA13	***FA14***	***FA15***	***FA16***	***FA17***
Earned Enroll	660	748	830	985	1,047
Max Enroll	664	738	862	1,032	1,140
% Fill	**99.4**	**101.4**	**96.3**	**95.4**	**91.8**
Earned WSCH	4430.8	5074.2	5631.0	6447.3	7130.8
Total FTEF	8.5	9.7	10.5	12.6	14.8
Earned WSCH/FTEF	**523.3**	**524.9**	**535.4**	**511.0**	**481.3**
	SP14	***SP15***	***SP16***	***SP17***	***SP18***
Earned Enroll	647	812	838	1,040	966
Max Enroll	616	872	896	1,154	1,112
% Fill	**105.03**	**93.12**	**93.53**	**90.12**	**86.87**
Earned WSCH	4,431.00	5,496.00	5,629.60	6,927.60	6,842.10
Total FTEF	8.05	10.62	10.97	14.27	14.67
Earned WSCH/FTEF	**550.43**	**517.66**	**513.34**	**485.58**	**466.51**
	SU13	***SU14***	***SU15***	***SU16***	***SU17***
Earned Enroll	97	179	270	269	219
Max Enroll	80	116	166	224	272
% Fill	**121.3**	**154.3**	**162.7**	**120.1**	**80.5**
Earned WSCH	504.9	310.8	544.8	641.8	1294.6
Total FTEF	1.1	1.4	2.3	3.0	4.0
Earned WSCH/FTEF	**480.8**	**222.0**	**242.1**	**217.6**	**327.7**

Science					
	FA13	***FA14***	***FA15***	***FA16***	***FA17***
Earned Enroll	199	217	261	233	265
Max Enroll	205	205	255	245	345
% Fill	**97.07**	**105.85**	**102.35**	**95.10**	**76.81**
Earned WSCH	597.00	666.60	783.00	699.00	795.00
Total FTEF	1.00	1.00	1.20	1.20	1.60
Earned WSCH/FTEF	**597.00**	**666.60**	**652.50**	**582.50**	**496.88**

	SP14	***SP15***	***SP16***	***SP17***	***SP18***
Earned Enroll	202	220	243	157	245
Max Enroll	224	226	277	269	280
% Fill	**90.2**	**97.3**	**87.7**	**58.4**	**87.5**
Earned WSCH	606.0	660.0	724.2	471.0	735.0
Total FTEF	1.0	1.2	1.4	1.4	1.2
Earned WSCH/FTEF	**606.0**	**550.0**	**517.3**	**336.4**	**612.5**

	SU13	***SU14***	***SU15***	***SU16***	***SU17***
Earned Enroll	0	30	28	24	49
Max Enroll	0	50	50	50	60
% Fill	**N/A**	**60.0**	**56.0**	**48.0**	**81.7**
Earned WSCH	0	90.7	84.6	65.8	147.0
Total FTEF	0	0.2	0.2	0.2	0.4
Earned WSCH/FTEF	**N/A**	**453.4**	**423.2**	**329.1**	**367.5**

8.1 Describe any patterns in enrollment; maximum enrolment and % fill in the program since the last program review. What are typical section maximum sizes (capacity) for your courses and what dictates those caps? Have you changed the number of sections offered and/or section sizes in response to changes in demand? If so, what effect has it had?

The data presented above show the unprecedented growth that the Chemistry Department has experienced over the review period. Over the course of this review the department has grown more than 50% for the combined earned enrollment, and nearly 60% for the Chemistry earned enrollment. Our summer program has grown more than 125% over the review period. While that growth is significant, it is subject to wider swings due to the smaller numbers of students.

While we have offered more classes, our class sizes are limited to our lab space. The American Chemical Society recommends a 24:1 student to instructor ratio in the laboratory. Most of our labs are near this (26:1) with a single lab that is 32:1. However, we increase our efficiency by teaching multiple sections. A multiple section has an instructor meet all students for lecture. These lecture students then enroll in one of multiple lab sections. For example, a double section can have 52 students in lecture, and two lab sections with 26 students in each. This means that, under the old lab/lecture load calculation, an instructor will receive 0.20 LED for the lecture section and 2(0.15) for each lecture section for an overall load of 0.50. If these sections were taught as single sections, then an instructor would meet two lectures and two labs per week, and the overall load would be 0.70 LED (2(0.15) + 2(0.20) = 0.70). Most of our multi-section courses are taught as double or triple sections. The WSCH calculation, however, does not distinguish between lecture and lab. Therefore, the Chemistry department provides WSCH to the college coffers without a commensurate increase in compensation to the instructor. Chemistry instructors must teach more hours to make load compared to other disciplines due to lab/lecture LED inequity.

8.2 Describe and explain any patterns in Earned WSCH, FTEF and Earned WSCH/FTEF since the last program review. Please explain changes in FTEF due to changes in faculty staffing levels. For courses/sections with low Earned WSCH/FTEF explain their importance in the program and measures the department/program has taken/plans to take to improve efficiency and/or balance low and high efficiency offerings and/or maximize course % fill.

Our WSCH climbed accordingly, however our WSCH/FTEF has fallen off in the last two years. To accommodate our growth we have had to offer more sections, and hire faculty to teach them. More sections led to a reduction in the fill % which is to be expected due to more class options. This has a negative effect on WSCH/FTEF. Neglecting summer, there was only one term in chemistry that saw a sub 90% fill percentage. Science 110 seems to be a bit more variable. Some of this could be due to the smaller numbers. However, the spring term experiences a notably smaller percent fill than the corresponding fall terms. This is a typical trend across the campus, but we do not know why for Science 110.

8.3 For money that you get from the college and/or from Perkins funds as part of your budget, is this amount adequate? What is this money used for to operate your department? If it is not adequate, please explain how additional funds would be used to improve student learning and success.

Recent changes have removed our ability to charge students for broken laboratory equipment. It is becoming a challenge to replace broken glassware, and we will need a process to formalize the replacement. Currently we account for all broken laboratory equipment and submit this accounting to campus leaders. Having a formalized process will bring consistency to budgeting, which makes it easier to plan for future needs. We don’t necessarily need more money, we just need a process to meet this changing need.

8.4 If your program has received any financial support or subsidy outside of the college budget process (grants, awards, donations), explain where these funds are from, how they are used, and any other relevant information such as whether they are on-going or one-time.

This year we have received a one-time donation to the department, that we are planning to use to replace an item that was broken in our move to the new building a number of years ago: a mercury barometer.

Human Resources

Chemistry/Science (Combined Total)					
	FA13	***FA14***	***FA15***	***FA16***	***FA17***
FT Faculty Count	7	7	7	7	7
PT Faculty Count	6	9	9	13	24^
Full-Time FTEF	6.967	5.550	5.867	7.517	5.600
X-Pay FTEF	0.350	0.550	0.750	0.200	0.200
Part-Time FTEF	2.150	4.567	5.100	6.100	10.617
Total FTEF	9.467	10.667	11.717	13.817	16.417
FT Percent	**77.3%**	**57.2%**	**56.5%**	**55.9%**	**35.3%**
Permanent RT	0.3826	0.3826	0.4752	0.4752	0.4752
Temporary RT	0.15	0.15	0.15	0.10	
Other					1*
^Sabbatical Replacement positions are counted as 2 adjunct faculty					
*Interrim Adminstrative Assignment					

Chemistry					
	FA13	***FA14***	***FA15***	***FA16***	***FA17***
FT Faculty Count	7	7	7	7	7
PT Faculty Count	4	8	9	12	21
Full-Time FTEF	6.567	5.150	5.267	6.917	5.200
X-Pay FTEF	0.350	0.550	0.750	0.200	0.200
Part-Time FTEF	1.550	3.967	4.500	5.500	9.417
Total FTEF	8.467	9.667	10.517	12.617	14.817
FT Percent	**81.7%**	**59.0%**	**57.2%**	**56.4%**	**36.4%**

Science					
	FA13	***FA14***	***FA15***	***FA16***	***FA17***
FT Faculty Count	1	1	1	1	1
PT Faculty Count	2	2	2	2	3
Full-Time FTEF	0.40	0.40	0.60	0.60	0.40
X-Pay FTEF	0	0	0	0	0
Part-Time FTEF	0.60	0.60	0.60	0.60	1.20
Total FTEF	1.00	1.00	1.20	1.20	1.60
FT Percent	**40.0%**	**40.0%**	**50.0%**	**50.0%**	**25.0%**

8.5 Describe the roles and responsibilities of full-time versus part-time faculty in your department. If any trends or changes are apparent in the past six years, please explain the reasons for them.

The primary difference in roles and responsibilities between full-time and part-time instructors revolves around the expectation to participate in campus governance. Part-time instructors are welcome at all department meetings, and their participation in all aspects of department governance is encouraged, but there are no expectations of these instructors outside of their contractual obligations. This being said, our regular dependence on part-time instructors to teach some of our majors-level courses has increased with our increasing number of sections and our reduced count in full-time instructors. This has been the biggest change in the last six year.

8.6 Are the current levels of staffing of faculty adequate? Discuss part-time vs. full-time ratios and issues surrounding the availability of part-time instructors as well as duties and responsibilities of full-time faculty members that influence their loads (such as reassigned time and use of overload).

Our current staffing predicament with a retirement, and a department member fulfilling dean duties is clearly evident in our % of full-time FTEF. We experienced a 54% drop in % FT FTEF from 2013 to 2017 overall, and more than 55% drop for our chemistry courses. Meanwhile, our overall part-time instructor count as increased by 300% over the same period. Due to lab/lecture inequity, lab science faculty routinely are required to work overload. Extra-pay overload further overstates our %FT FTEF. At a minimum we need to replace our missing instructors. Even at this staffing level, we will still be around 50% FT FTEF. Given this situation we could use an additional faculty member above our replacements.

8.7 If staffing levels are not adequate, give a justification of your request for increased Full Time faculty based on how this position would contribute to basic department function and/or the success, retention and engagement of students in the program.

Students are best served by engaged, present faculty. Faculty who are consistently a part of the department, and consistently part of department and college governance are full-time faculty. Full-time faculty are an integral part of any successful program. No amount of magic, campus-wide initiative du jour, or SLO

assessment can replace full-time faculty. As of Fall 2017 we are just over 35% FT FTEF. This is not a sustainable position if consistency and quality are department goals.

8.8 In the table below, list non-faculty positions that are responsible to your program (by title rather than by individual name). This list should include classified staff as well as work study and student workers.

The only consistent non-classroom employees are our laboratory technicians. The number of work study, graders, and tutors varies with available funds. The list below is for the current academic year and is representative of most semesters. For example, all instructors contribute any large-class TA hours to a pool that benefits the entire department. This pool changes in size from semester to semester depending on our large enrollment sections. Our tutoring allocations was one from a number of years ago, and has not been augmented in any fashion. With the increase in minimum wage, we are not able to staff as many hours.

Position	Funding	FTE/Hours					
		YR 1	YR 2	YR 3	YR 4	YR 5	YR 6
Senior stockroom technician	General fund	1	1	1	1	1	1
Stockroom technician	General fund	1	1	1	1	1	1
Stockroom technician	General fund	0	0	0	0	1	1
Student worker	Department funds					0.25	0.25
Student worker	Department funds					0.25	0.25
Work study	Federal Work Study	0.25	0.25	0.25	0.25	0.25	0.25
Work study	Federal Work Study	0.25	0.25	0.25	0.25	0.25	0.25
Tutor	Tutoring allocation from college			0.3	0.3	0.3	0.3
Tutor	Tutoring allocation from college			0.3	0.3	0.3	0.3
Tutor	Tutoring allocation from college			0.3	0.3	0.3	0.3
Tutor	Tutoring allocation from college			0.3	0.3	0.3	0.3
Grader	Pooled TA hours	0.2	0.2	0.2	0.2	0.2	0.2

Grader	Pooled TA hours	0.2	0.2	0.2	0.2	0.2	0.2
Grader	Pooled TA hours	0.2	0.2	0.2	0.2	0.2	0.2
Grader	Pooled TA hours	0.2	0.2	0.2	0.2	0.2	0.2
Grader	Pooled TA hours	0.2	0.2	0.2	0.2	0.2	0.2
Grader	Pooled TA hours	0.2	0.2	0.2	0.2	0.2	0.2
Grader	Pooled TA hours	0.2	0.2	0.2	0.2	0.2	0.2
Grader	Pooled TA hours	0.2	0.2	0.2	0.2	0.2	0.2

8.9Briefly describe the duties for each position. Include a discussion of any changes in terms of non-faculty staffing and describe the impact on basic department function and/or the success of students in the program. Are current staffing levels adequate in non-faculty positions? If not, give a justification of your request for increased resources.

An efficiently run laboratory stockroom is paramount to an effective chemistry program. Our stockroom technicians play a vital role in student success at Grossmont College. A few examples of what our technicians manage includes all equipment and reagent inventory, prepare solutions and other equipment for laboratory use, repair equipment, manage all department purchases, maintain all breakage records, manage hiring of all tutors, work-study, and graders, service labs while in operation, and the cleaning of labs. With the recent hiring of our third technician, our technician compliment is sufficient. However, we could use more tutors to service the Chemistry Learning Center.

Work study students assist with the servicing of labs while classes are in session, and with cleaning and organizing. Student workers also provide this service.

For our large section count classes (Chem 120 and 115) we pool our TA resources to provide graders for all instructors. This helps ensure consistency in lab grading between sections, and provides a more uniform student experience between sections.

Finally, tutors provide a vital service to fellow students. They are able to staff the learning center throughout much of the days that we offer classes, including Saturdays. Our missing piece to the tutor equation is paid faculty oversight. Our tutoring program could be improved by providing faculty reassigned time to recruit, manage, and train tutors. Having this resource located within the department is important. Tutors can ask faculty questions, and we can be more responsive to student needs.

9– SUMMARY AND RECOMMENDATIONS

9.1 Summarize program strengths in terms of: Outreach Engagement Retention

The Chemistry Department has an active faculty who involved in their community and on campus. The Science Club is active in local elementary schools, middle schools, and after school programs leading science activities. Faculty are leading summer camp science activities, participating in high school outreach fairs, working with Women of Science, and volunteering at the Salk Institute. Faculty have also taught classes at Las Colinas, and developed department brochures. We are also in the midst of a program to offer Chemistry 120 at Helix High School.

Student engagement is very much a part of science education. Time in the laboratory allows for increased student-student, and student-faculty interaction. Aside from the opportunities in class, the department is engaging students with the Science Club, in the tutoring center, peer mentoring, and with pre-semester "Gear Ups" to help jump start students.

Retention is a challenge in chemistry. Aside from the difficulty of the discipline, many students are headed to professional programs such as medicine, and will drop a class if they are not receiving at least a "B". Still, faculty continually work to increase retention. Aside from continuous course tinkering such as additional resources being made available, to continuous improvement of laboratory experiences, faculty also work to assist student ability to meet class obligations. Chemistry's common syllabi allow students to make up laboratory work throughout the department, and not with their instructor of record, but any chemistry section.

9.2 Summarize program weaknesses in terms of: Outreach Engagement Retention

The Chemistry Department's biggest challenge is with retention. This has historically been an issue, and is not unique to Grossmont College. Any efforts outside of normal day-to-day teaching are also greatly compromised by our missing full-time faculty. We are down two full-time instructors due to retirement and dean positions. Meanwhile our program has grown such that our adjunct instructor growth has increased by 300%. We are stretched thin.

9.3 Describe any concerns that may affect the program before the next review cycle such as retirements, decreases/increases in full or part time instructors, addition of new programs, external changes, funding issues etc.

A big issue for us will be retirements in the next cycle. We are facing 2 or 3 faculty retirements, and the retirements of 67% of our stockroom technicians in this time period, and while it seems that we may have

plateaued a bit with our recent growth, we are still much larger than we were in the last cycle. It will be even more important to the quality of our program to maintain full time staffing levels.

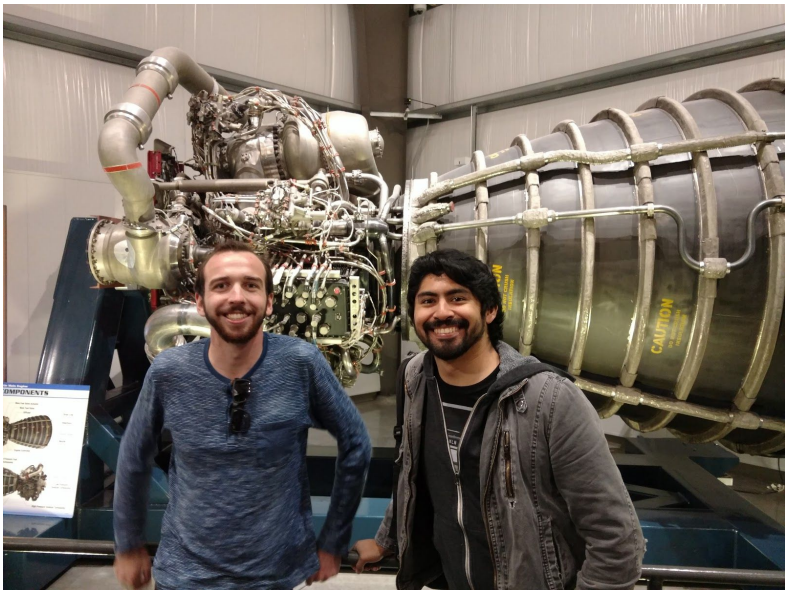
Finding well-qualified adjunct instructors is a continuing struggle. This search is further complicated when the region experiences periods of full-time hiring, and when there is disparity in part-time pay with our neighboring districts.

We will continue to require regular funding to replace our broken glassware now that we are not able to charge the students who break it. This process will need to be formalized in such a fashion that we can count on regular replacement. We will also need to make large capital purchases to replace laboratory instrumentation. This instrumentation will also need to be supported with service agreements.

Finally, Tom Olmstead has begun the first step in a winemaking certificate program by developing its inaugural course. Currently this course will be offered as a Chemistry 110 class, but it will probably be rolled into a more comprehensive program. This will all require additional time in course development, and negotiating the curriculum process. This is difficult when we are short staffed.

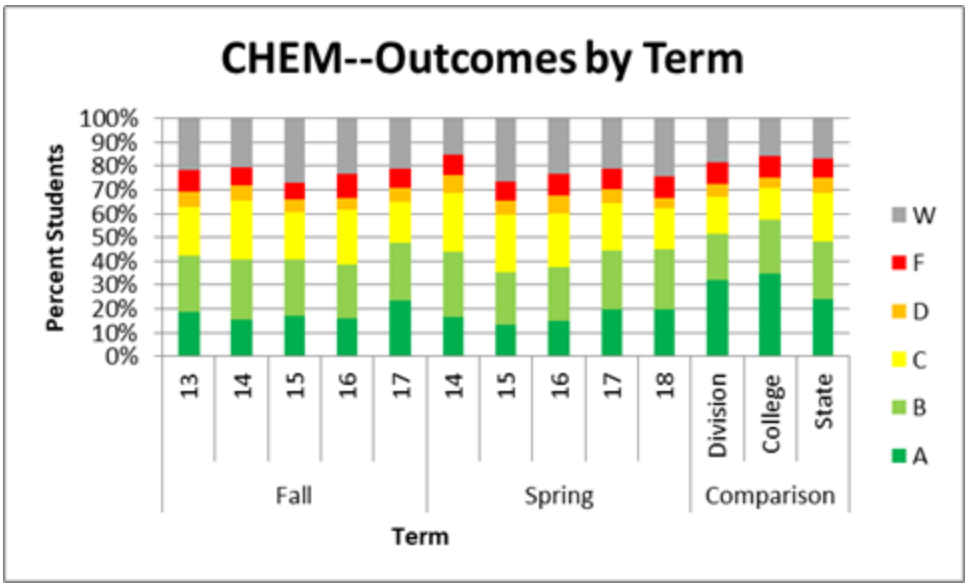
9.4 Make a rank ordered list of program recommendations for the next six-year cycle based on the College's new Strategic Plan which includes outreach, engagement, and retention.

1. Hire at least one *additional* full-time faculty member. This would increase the department from seven to eight full-time faculty.
2. Replace retiring faculty and stockroom technicians in a timely fashion.
3. Replace aging chemical instrumentation: Gas chromatograph, infrared spectrometer, UV/Vis spectrometers, Vernier data acquisition devices, conductivity apparatus, and melting point apparatus.
4. Purchase appropriate NMR spectrometer.
5. Continue to work toward a dual enrollment Chemistry 120 course at Helix High School.
6. Continue to implement appropriate scaffolding and transparent design across our curriculum.
7. Continue service contracts on equipment and computer software.



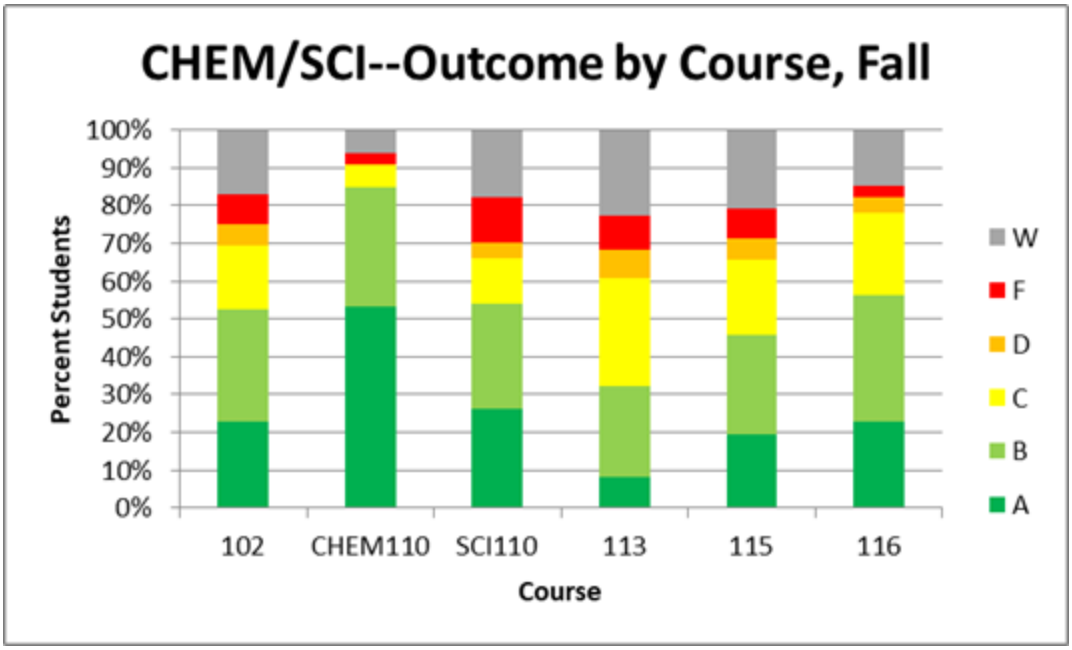
APPENDICES

10 Grade Distribution Summary

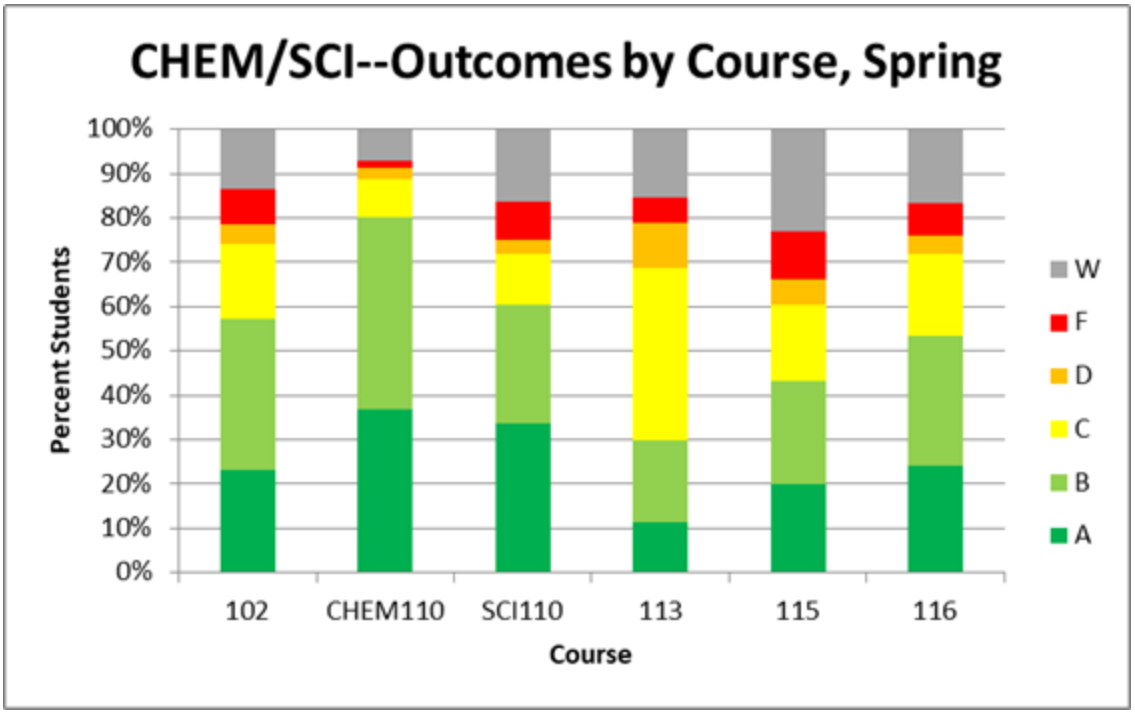


Chemistry has relatively stable patterns of student outcomes but lower student success than statewide chemistry courses. The difference seems to be a higher proportion of withdrawals and fewer A grades awarded.

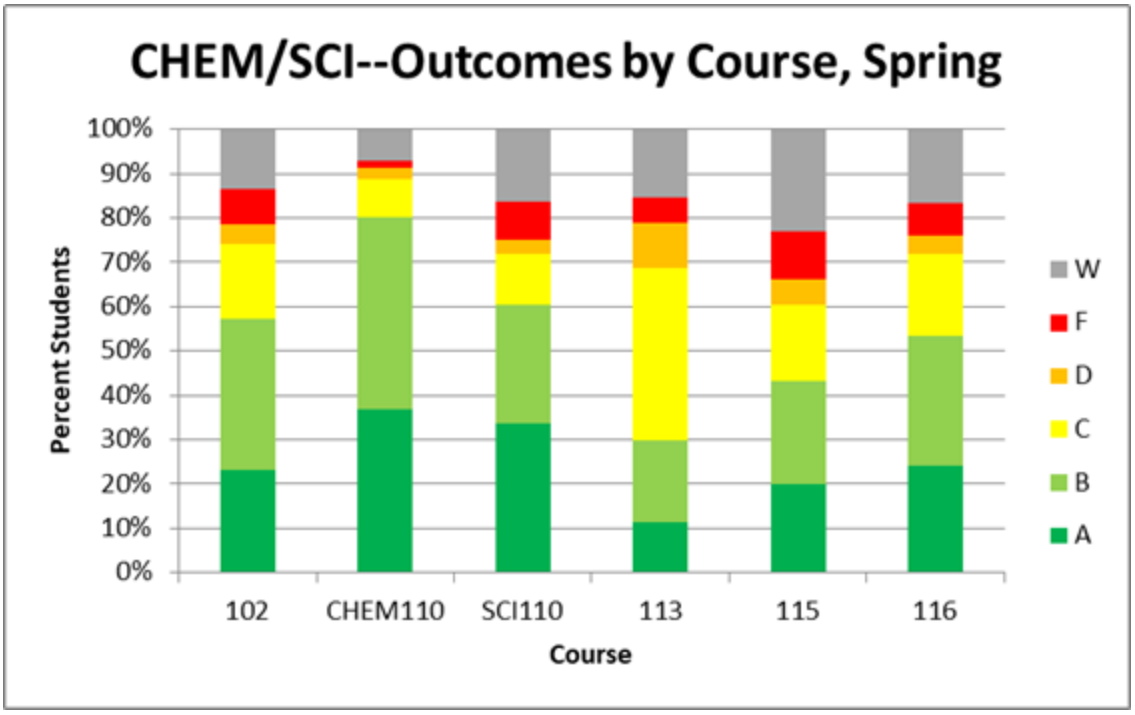
10.1 Outcomes for GE courses

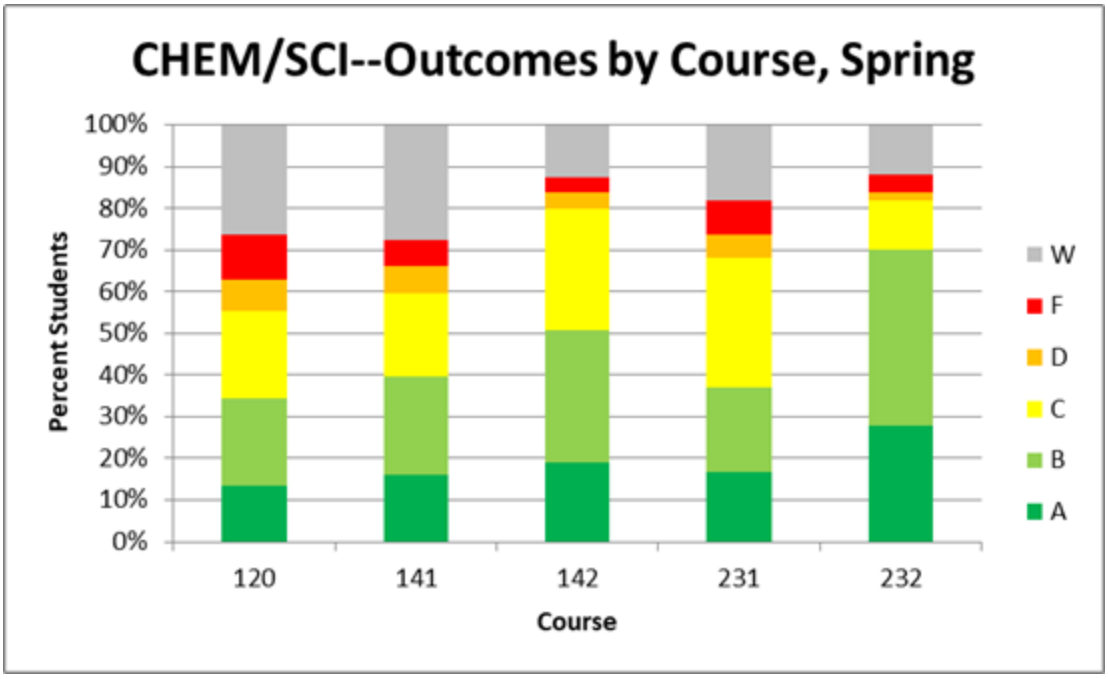


What is different about Chem 110 than these other courses for it to have such a different outcome pattern? What is Chem 113? Why is it comparatively more challenging?



10.2 Outcomes by Course, Major's Track Courses

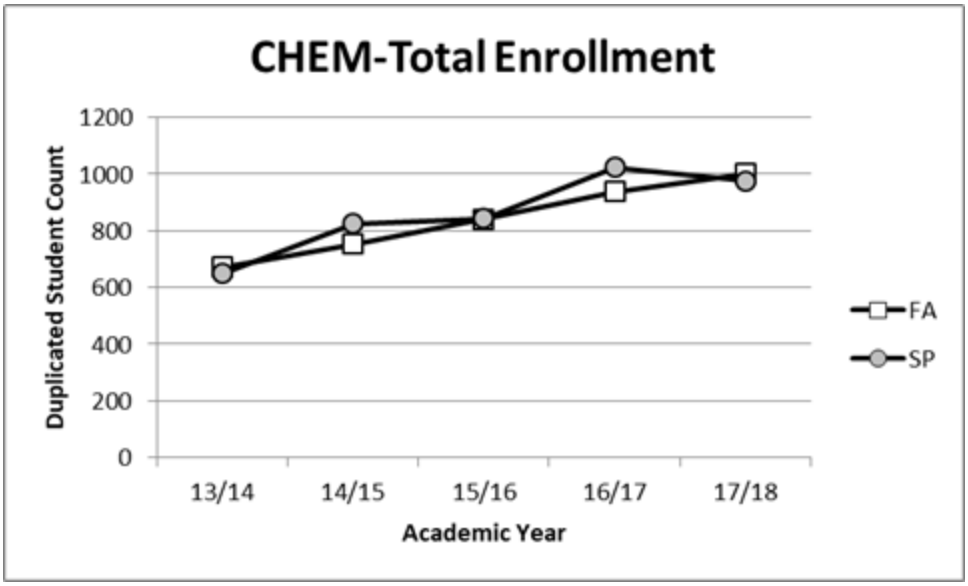




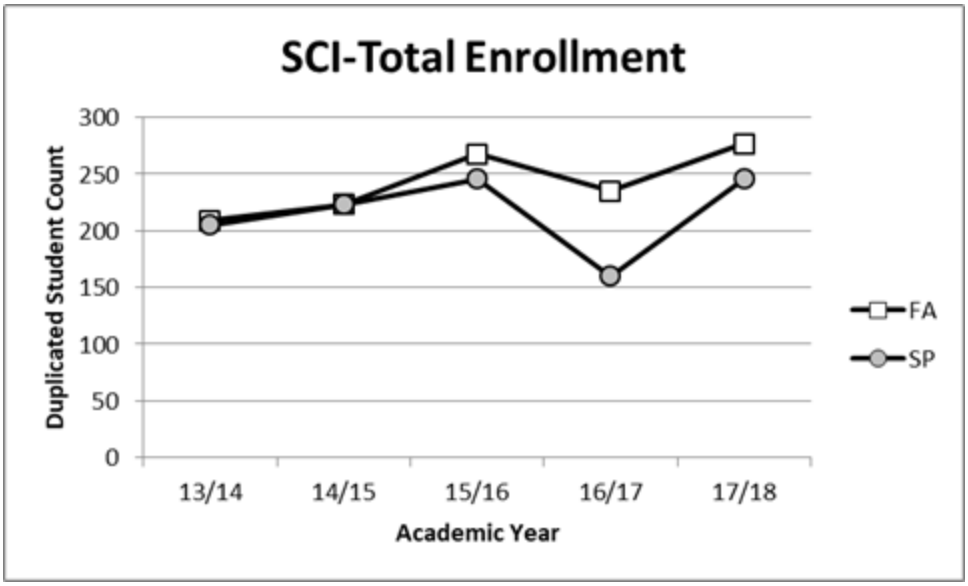
Chem 141 seems to do a good job of preparing students for success in 142 and the same for 231 and 232. However the transition between 120 and 141 seems more challenging. Have you evaluated entry/exit skills and/or learning outcomes for these courses to set the level of expectations of students systematically?

12 Enrollment Data

12.1 Chemistry

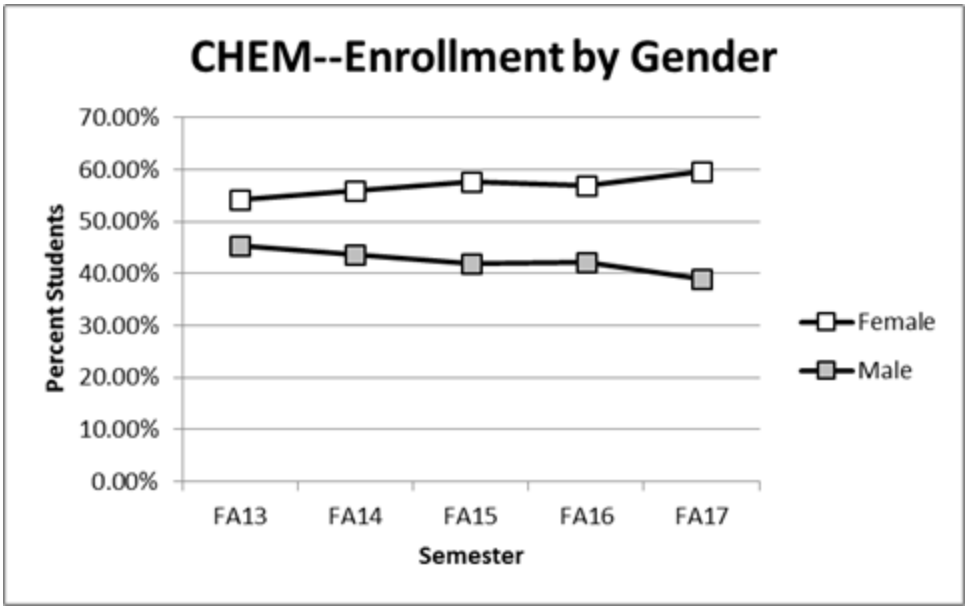


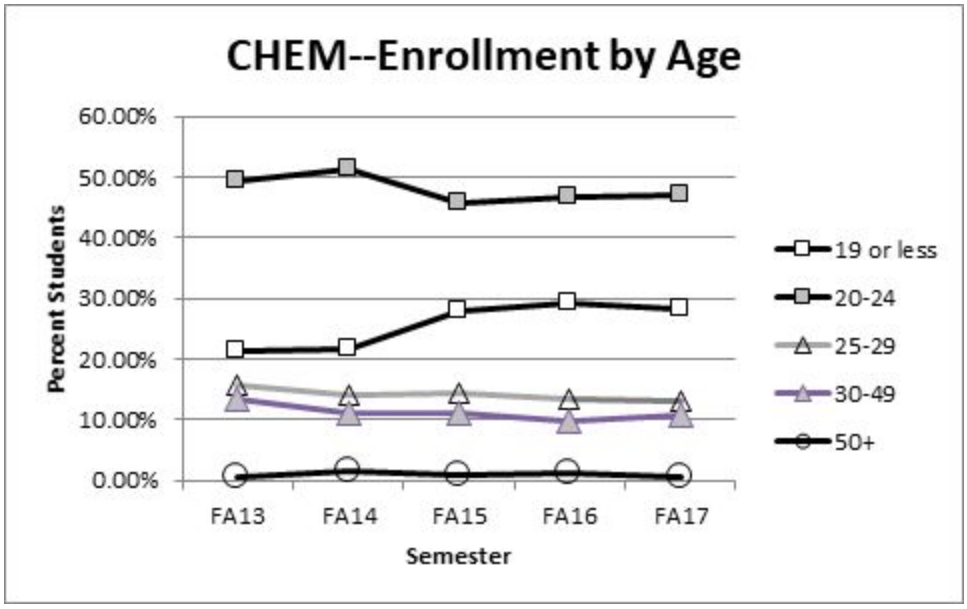
12.2 Science

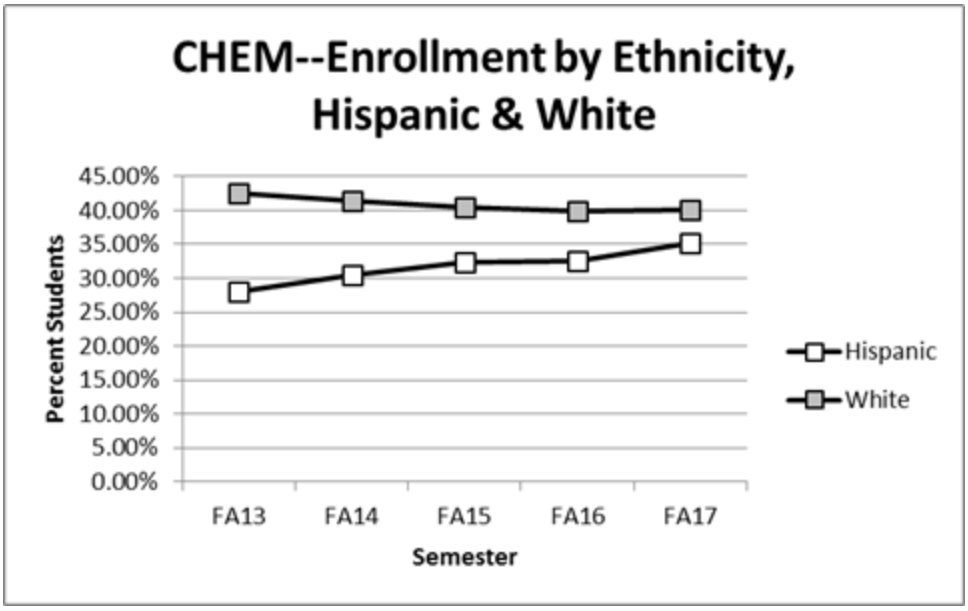


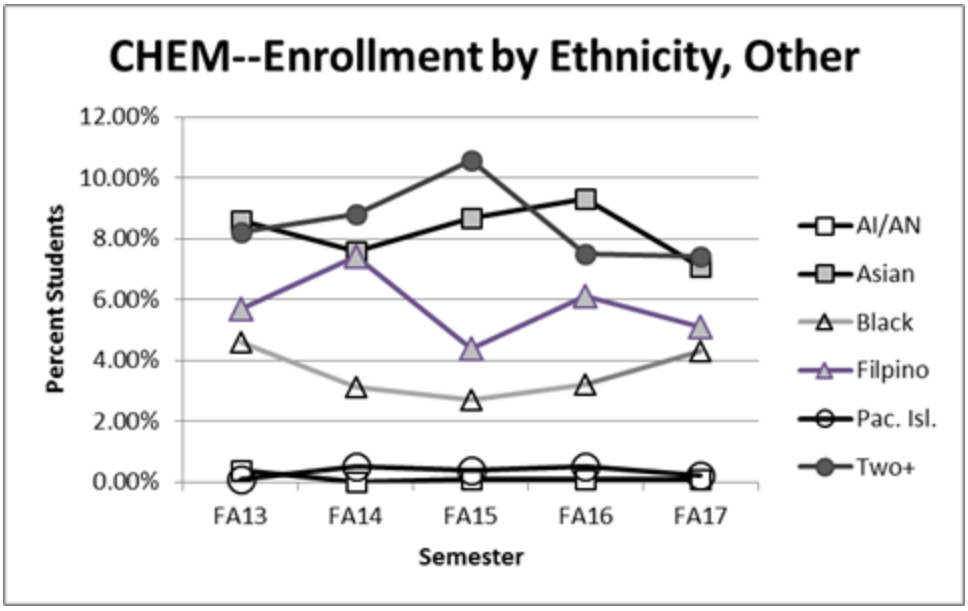
12.3 Disaggregated Enrollment Data

12.3.1 Chemistry

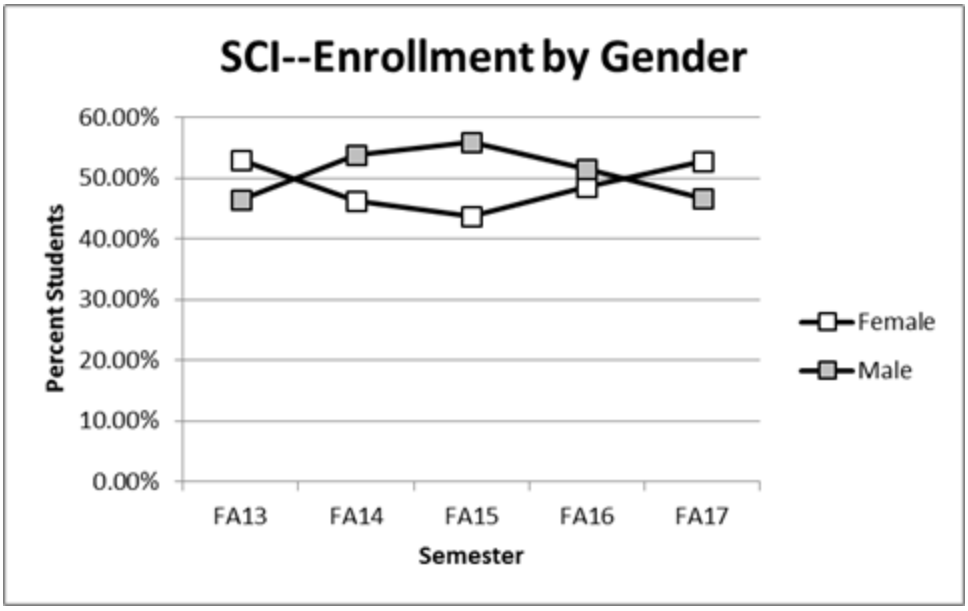


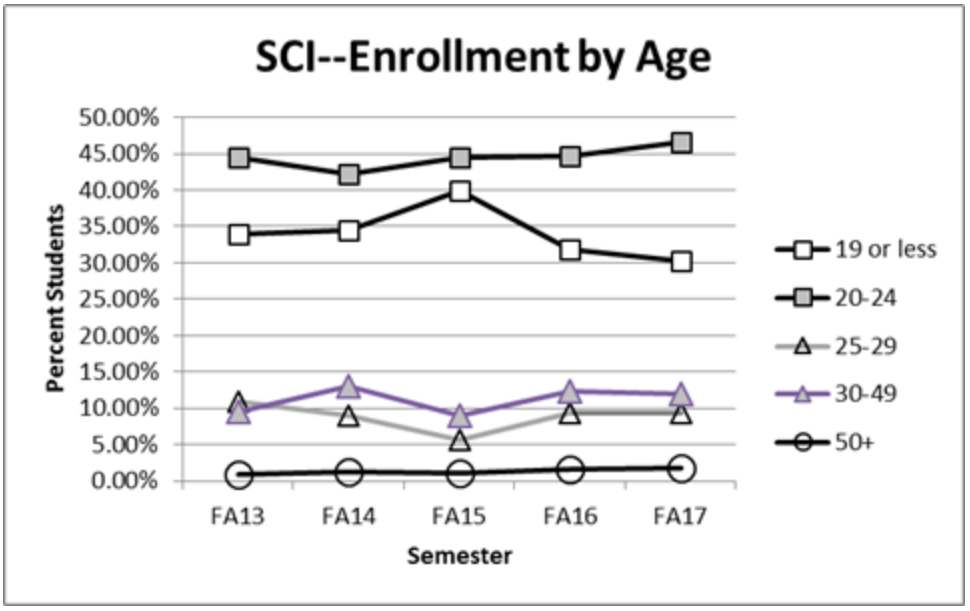

CHEM--Enrollment by Age
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Percent Students
FA13
FA14
FA15
FA16
FA17
Semester
19 or less
20-24
25-29
30-49
50+

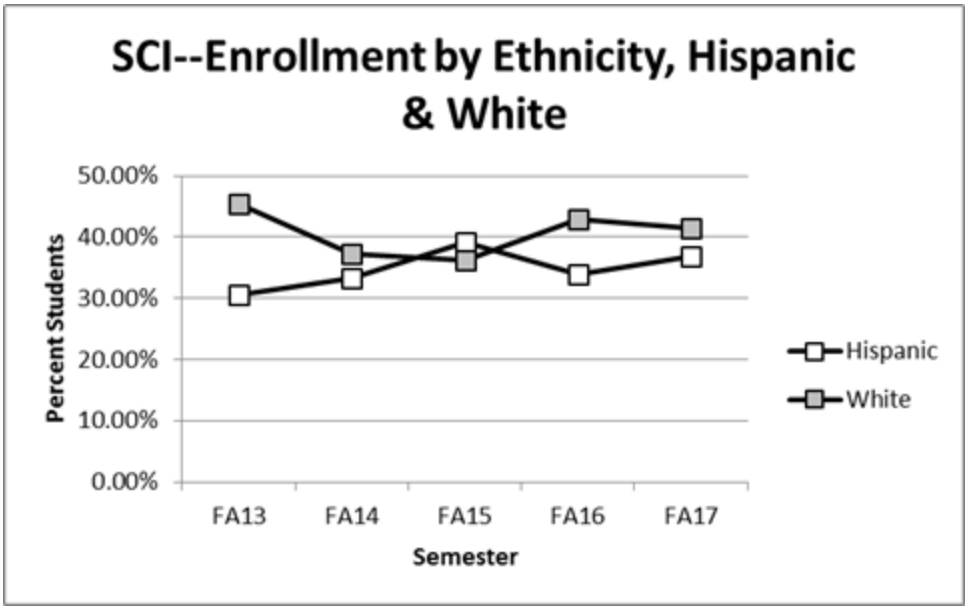

CHEM--Enrollment by Ethnicity, Hispanic & White
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Percent Students
FA13
FA14
FA15
FA16
FA17
Semester
Hispanic
White

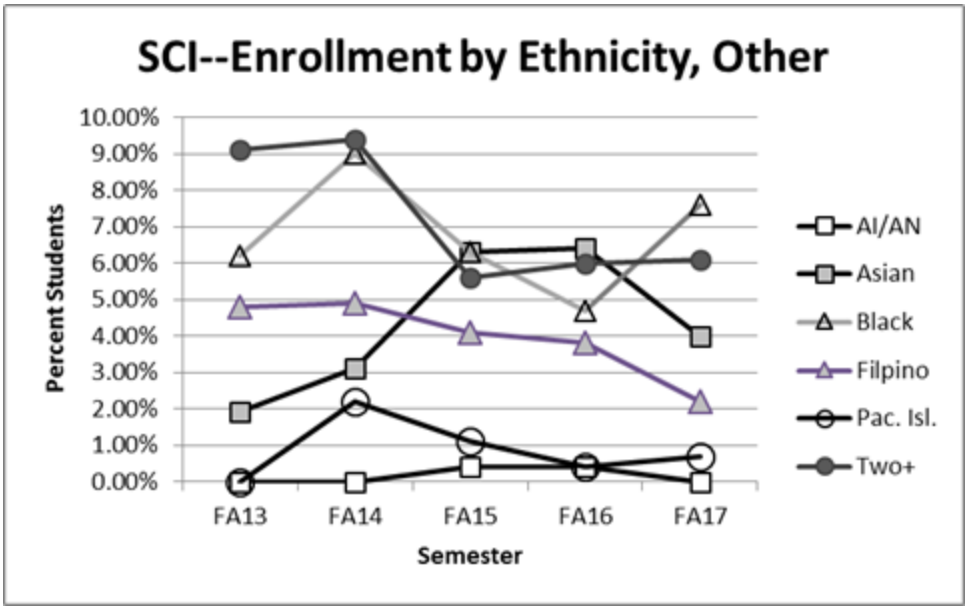


12.3.2 Science



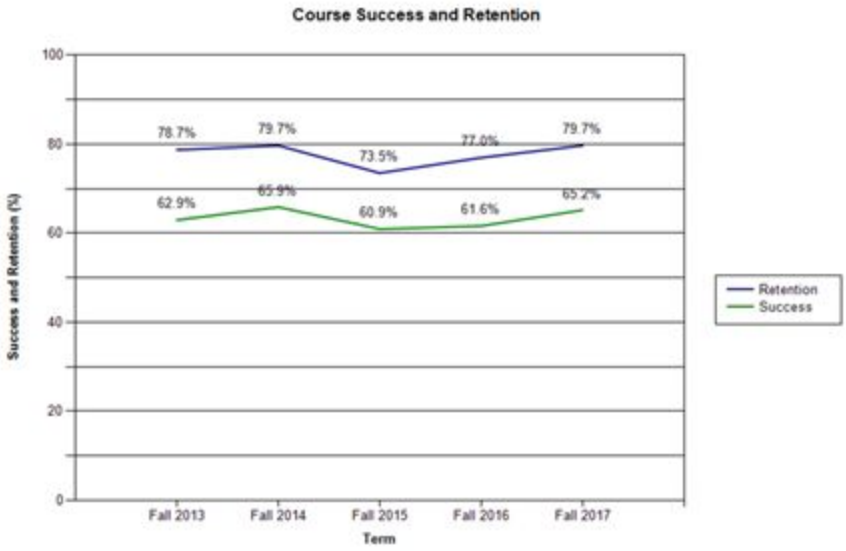

SCI--Enrollment by Age
50.00%
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Percent Students
FA13
FA14
FA15
FA16
FA17
Semester
19 or less
20-24
25-29
30-49
50+

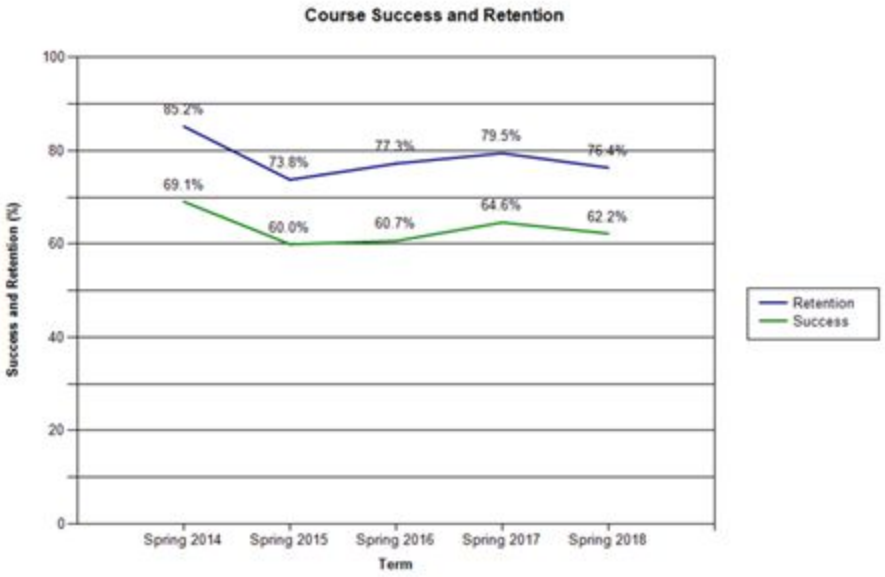

SCI--Enrollment by Ethnicity, Hispanic & White
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Percent Students
FA13
FA14
FA15
FA16
FA17
Semester
Hispanic
White

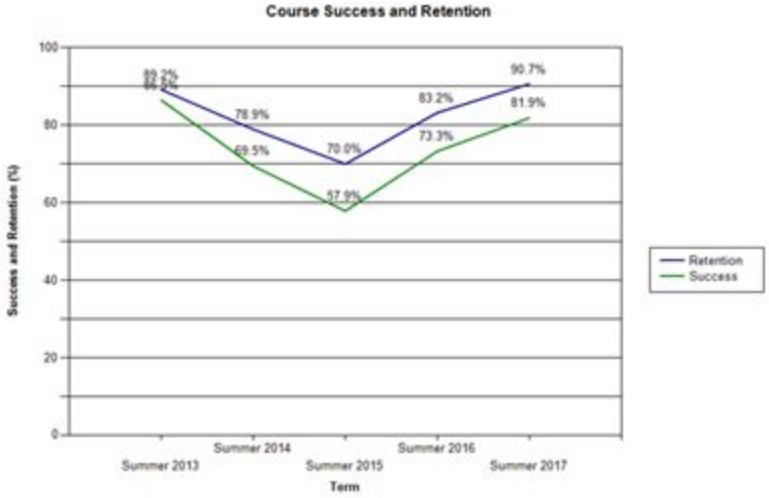


13 Student Success Data

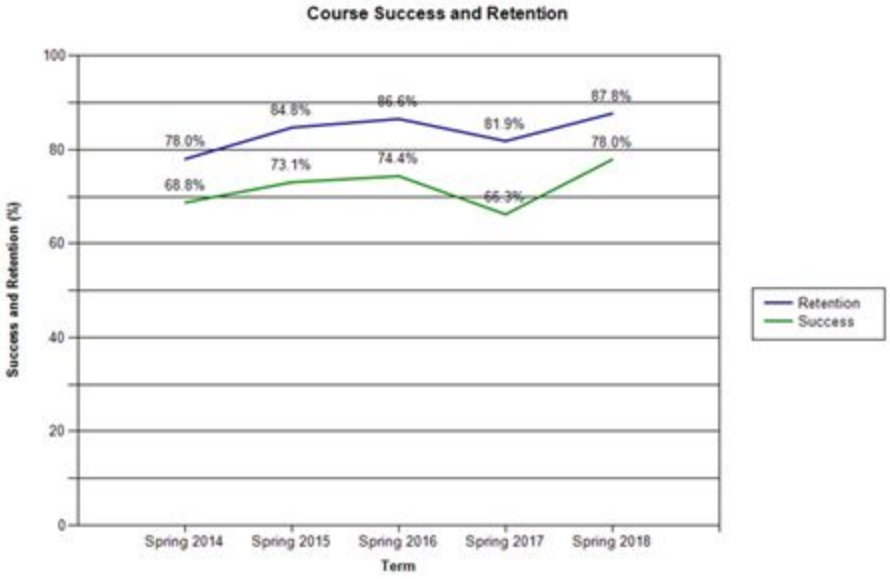
13.0.1 Chemistry




Course Success and Retention
Success and Retention (%)
100
80
60
40
20
0
85.2%
73.8%
77.3%
79.5%
76.4%
69.1%
60.0%
60.7%
64.6%
62.2%
Spring 2014
Spring 2015
Spring 2016
Spring 2017
Spring 2018
Term
Retention
Success

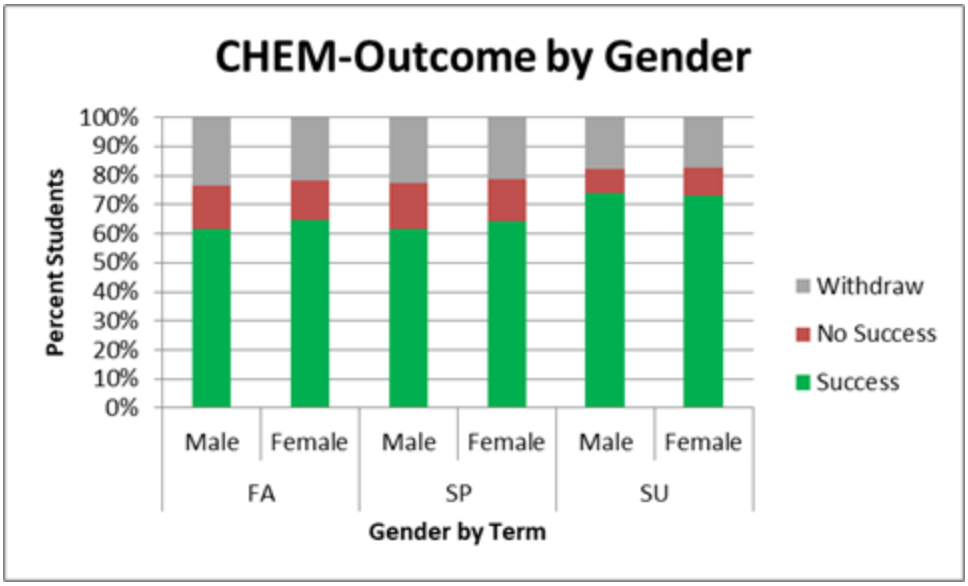

Course Success and Retention
Success and Retention (%)
100
80
60
40
20
0
89.2%
78.9%
70.0%
83.2%
90.7%
86.2%
69.5%
57.9%
73.3%
81.9%
Summer 2013
Summer 2014
Summer 2015
Summer 2016
Summer 2017
Term
Retention
Success

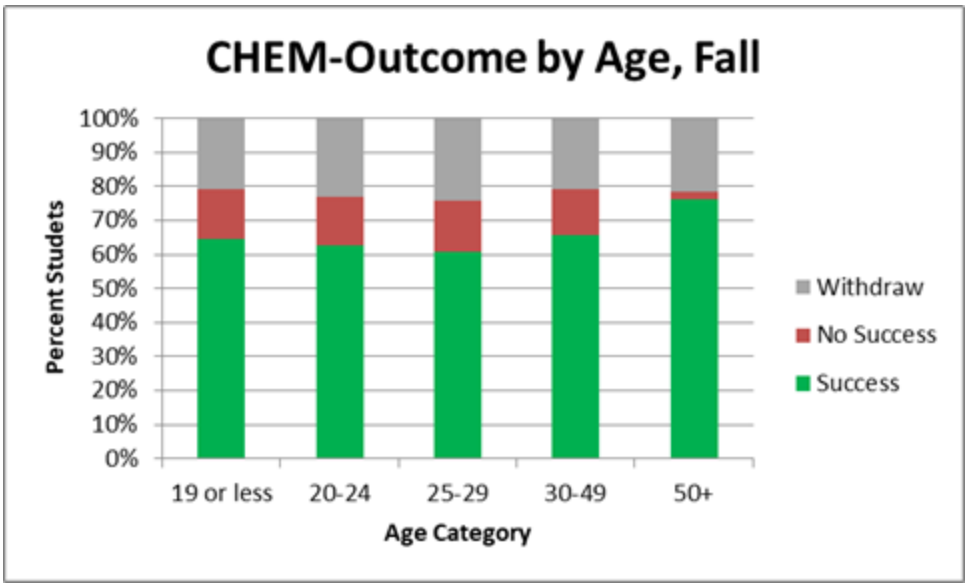
13.0.2 Science



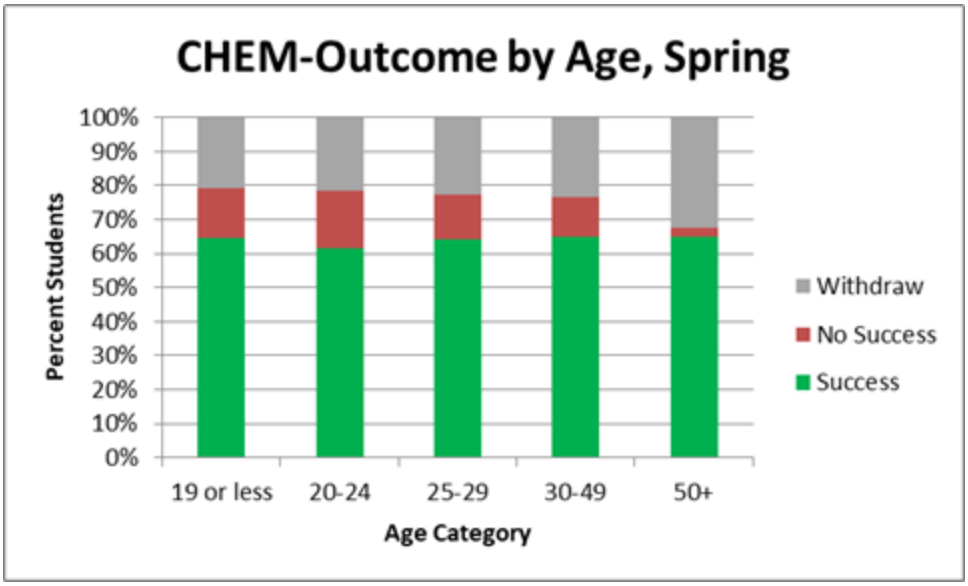
13.1 Student Success & Retention, Disaggregated

13.1.1 Chemistry

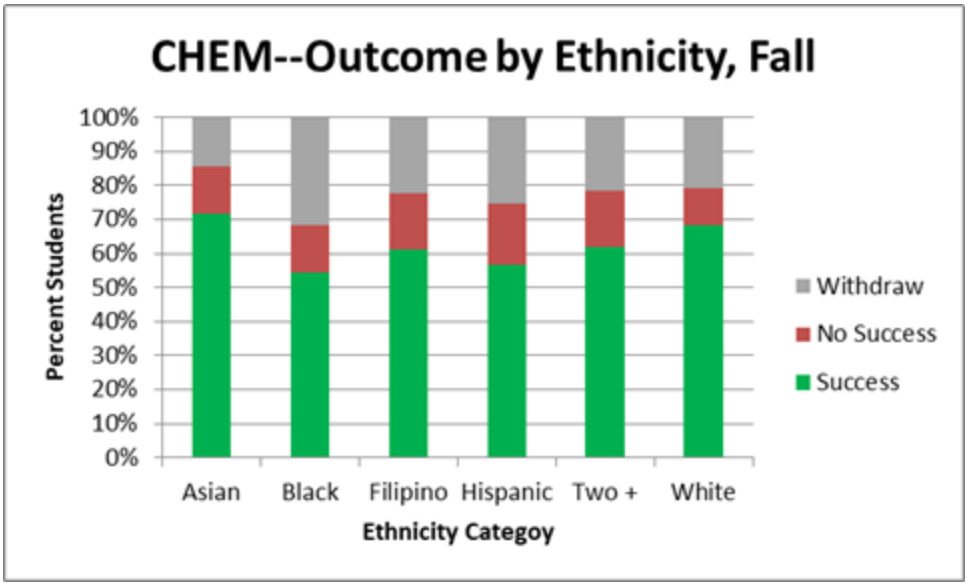




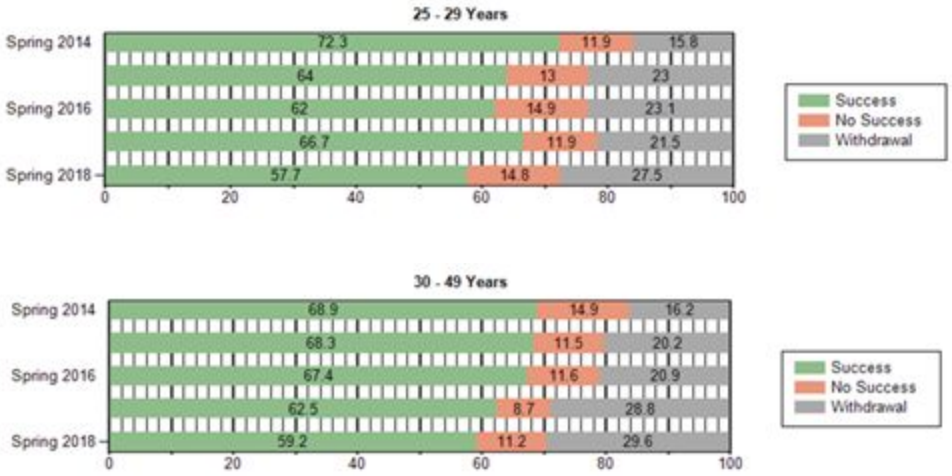
Fall			
	Success	No Succes	Withdraw
19 or less	707	162	229
20-24	1261	290	460
25-29	356	88	143
30-49	306	64	97
50+	32	1	9



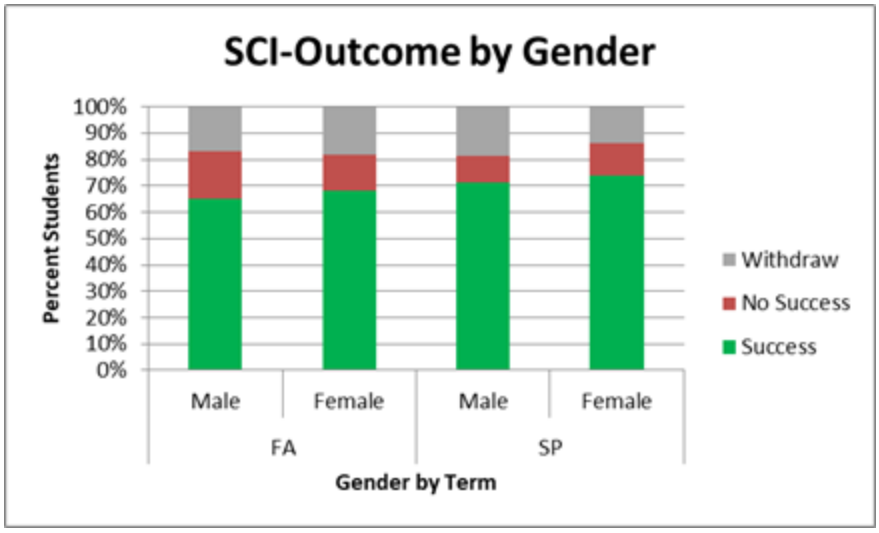
Spring			
	Success	No Succes	Withdraw
19 or less	746	169	240
20-24	1265	346	447
25-29	384	80	135
30-49	303	53	110
50+	26	1	13

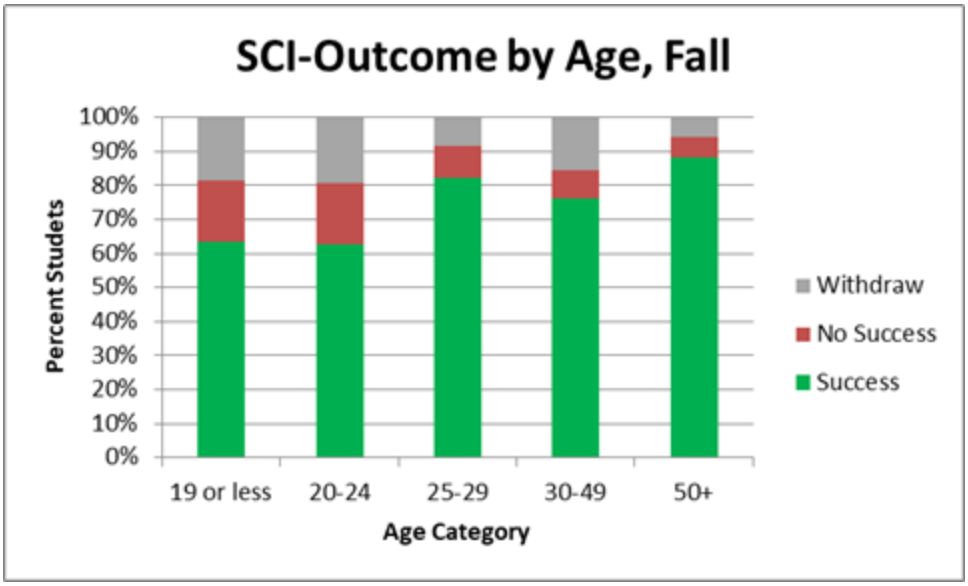


13.1.1.1 Trends Over Time

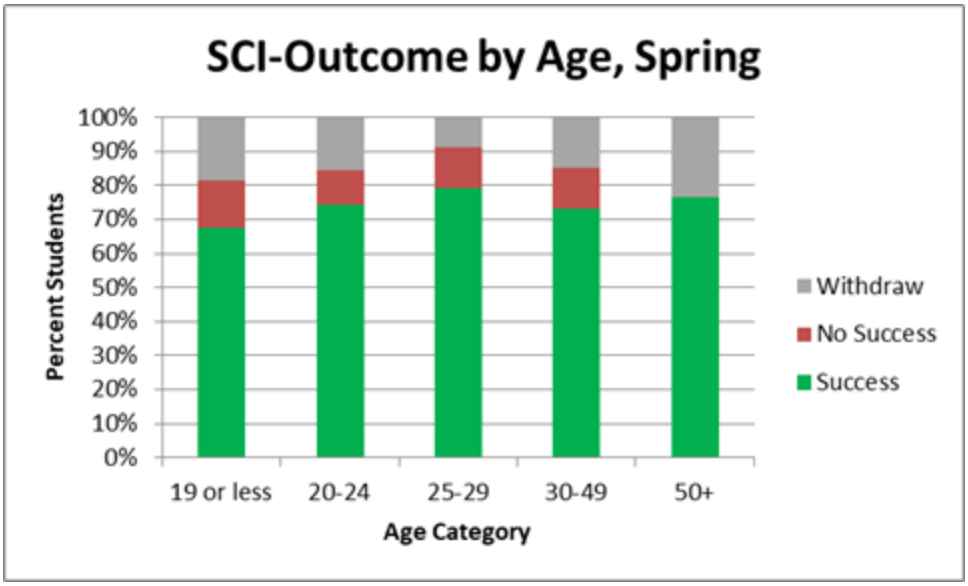


13.1.2 Science

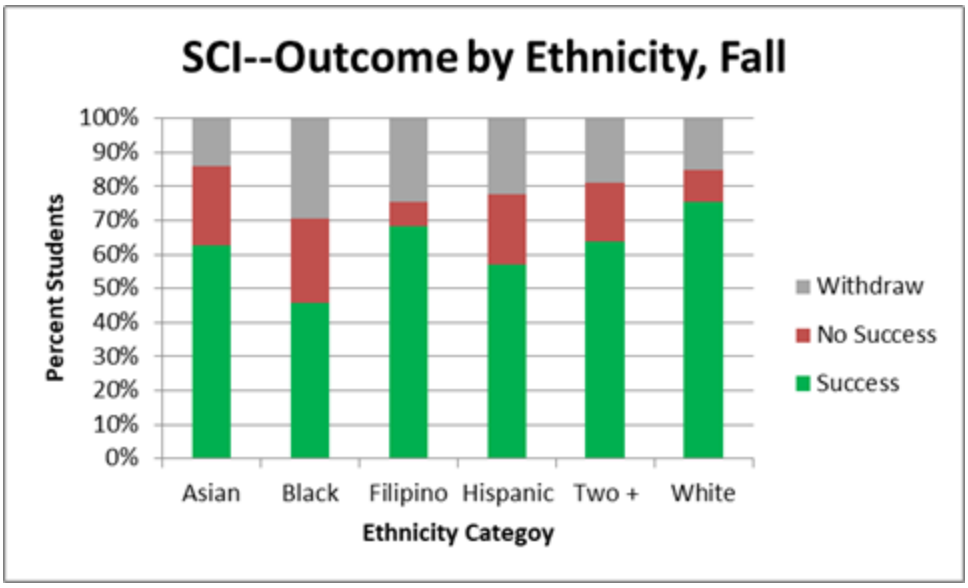




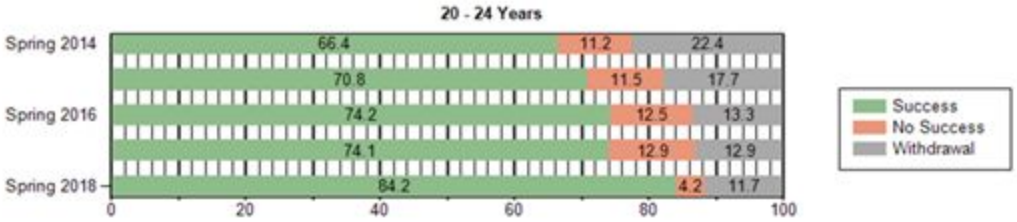
Fall			
	Success	No Succes	Withdraw
19 or less	262	75	77
20-24	339	96	105
25-29	87	10	9
30-49	103	11	21
50+	15	1	1



Spring			
	Success	No Succes	Withdraw
19 or less	203	42	56
20-24	404	56	85
25-29	80	12	9
30-49	84	14	17
50+	13	0	4



13.1.2.1 Trends over Time



14 Checklist Documentation (SLO, Instructional Operations, Articulation Officer, Library)

14.1 Library Resources for Chemistry

14.1.1 Books

The library Chemistry area, comprised of call numbers beginning with QD, has 65 print books and 1,077 electronic books, for a total of 1,142 books. Additionally, the library owns the most recent edition of The CRC Handbook of Chemistry and Physics in electronic book format so students are able to access it from home.

There are also two online reference book collections that contain thousands of entries related to the field of Chemistry. These collections, or databases, are called "Gale Virtual Reference Library" and "Credo."

Books are purchased using a complex allocation formula to ensure that departments get their fair share of this year's (18/19) $80,000 annual library book budget. The allocation formula allows for a book budget of $1186.48 in Chemistry this year – a banner budget year due to a one-time grant funding. However, Chemistry has thus far spent only $332.45 of that budget, and the fiscal year ends soon. Any book suggestions from the faculty in the department would likely result in a purchase – the library takes faculty input very seriously. The library liaison for Chemistry is Patty Morrison.

All electronic materials, whether books or journal articles, can be accessed anytime, anywhere.

14.1.2 Periodicals

Most of the Chemistry periodicals are in electronic format, within library periodical databases. This allows for keyword searching, and anytime, anywhere access.

The library subscribes to a number of multidisciplinary databases, all of which contain tens of thousands of articles related to Chemistry - including Academic OneFile, Academic Search Complete, and Gale General OneFile. Across all the databases the library subscribes to, 690 Chemistry journals are available to students to access from home or on campus.

14.2 Articulation

Date: March 29th, 2019

To: Jeff Lehman, Chemistry Department Faculty

From: M. Denise Aceves, Articulation Officer

Re: Chemistry Department ● Program Review Checklist

The process of articulation is two-fold. First, transferability must be established. A transferable course is one that is taken at a community college and can be used for unit credit at a university. The next step, is the articulation of courses deemed transferrable. Articulation is the formal, written agreement that identifies courses on a "sending" campus that are comparable or acceptable in lieu of specific course requirements at a

“receiving” campus. Thus, articulation identifies courses that a student should take at community college to meet university degree requirements.

In response to your request for articulation information, Chemistry courses at Grossmont College are well-articulated. All formal articulation with our 4-year public education partners can be found at ASSIST.org, which is the public articulation repository available to current and potential college students. Please note that ASSIST.org currently only reflects articulation information through 2016-2017.

All courses in this discipline are transferrable to both CSU and UC Systems. Furthermore, courses in this discipline have been evaluated by the CSU and UC systems to meet requirements for general education. As a result, approved Chemistry courses assist students in meeting CSU General Education Breadth requirements in the area of Scientific Inquiry and Quantitative Reasoning. Similarly, there are approved Chemistry courses in the Physical and Biological Sciences area of IGETC. All courses that have received transferability and general education designations are notated as such at the end of each course description in the Grossmont College Catalog. The courses with course to course articulation by department with specific CSUs and UCs can be found on ASSIST.org.

Locally, our public 4-year educational partners include: San Diego State University (SDSU), California State University San Marcos (CSUSM) and the University of California, San Diego (UCSD). Articulation with the San Diego State Chemistry Department is robust and Grossmont College’s Chemistry courses have attained course to course articulation, click here for a detailed report from ASSIST.org. In addition, Grossmont College has almost complete course to course articulation for the various SDSU majors in Chemistry. However, there is one SDSU Chemistry course in all of the emphasis where the Chemistry Department could pursue articulation, see below.

CHEM 251	Analytical Chemistry	(5)	No Comparable Course

Similarly, the Chemistry Department has existing course to course articulation by department with CSU San Marcos and in their two Chemistry majors. There is one course for which the Chemistry department could pursue articulation, see below.

CHEM 275	Quantitative Investigations in Chemistry	(4)	No Equivalent

Lastly, our courses have been articulated by department with UCSD and in the Chemistry and Biochemistry: Chemistry B.S. major as well as in the other majors. The Chemistry Department is currently working on course to course articulation with UCSD’s Chemistry 143B. Additionally, they are working on establishing course to course articulation with UCSB for their new Organic Chemistry courses. The Chemistry department is encouraged to continue to review their course to course articulations with the other CSUs and UCs on ASSIST.org and work with me, the Articulation Officer, to develop new articulations.

Articulation is facilitated with current, concise and thorough course outlines. It is imperative that the outlines and text books listed be current. The requirement that course outlines be updated every 5 years through the Grossmont College Curriculum process is vital. Students benefit from the many colleges and universities who have articulated our courses in Chemistry. Below I have listed the link to The Course Outline of Record: A

Curriculum Reference Guide Revisited, a document adopted by the Academic Senate for California Community Colleges in Spring 2017, as well as the latest standards for CSU GE Breadth and IGETC.

Curriculum Resources

- The Course Outline of Record: A Curriculum Reference Guide Revisited
- Guiding Notes for General Education Course Reviewers
- Standards, Policies & Procedures for Intersegmental General Education Transfer Curriculum, Version 1.9

You are welcome to contact me directly at mariadenise.aceves@gcccd.edu with any questions regarding this report.

14.3 Student Learning Outcomes

SUBJECT AND NUMBER	DATE APPROVED BY THE GOVERNING BOARD
CHEM 102	December 2014
CHEM 110	December 2014
CHEM 113	December 2014
CHEM 115	December 2014
CHEM 116	April 2005
CHEM 120	December 2014
CHEM 141	December 2014
CHEM 142	December 2014
CHEM 231	December 2016
CHEM 232	December 2016
CHEM 241	December 2016
CHEM 241L	December 2016
CHEM 242	December 2016
CHEM 242L	December 2016

Answer to committee follow up questions. This step is completed *after* the committee reads your report. Add your answers to the digital copy of your report, and email a digital copy to the Program Review Chair.

Chemistry Department Program Review-Follow-up Questions

After reading each report the program review committee develops a list of follow-up questions. This allows us to get a deeper understanding of your department's operations and guides our commendations and recommendations for the next program review cycle (6 years). We have tried to make the questions clear and very specific to minimize the effort needed to answer them. Please have the answers to the questions below back to me by **email no later than October 18, 2019**.

Section/Page	Question	Response
1.2	Previous PR Goal # 3 Seek opportunities to enhance cultural awareness-please describe which faculty have attended which workshops and how that has influenced and/or change teaching. Where is the data created by "critically evaluated outcomes of all of its sections using nationally normed exams"? How do you prepare your students to succeed with these exams? (Rec #1) How are Chemistry tutors recruited? What are your ideas on how to formally track how many students are using tutor services? (Rec#9) What are the learning outcomes measured by the ACS normed exams that your department uses?	Maria Ochoa - Equity Syllabus Design Workshop Heike Paulsen - Class Ethos: The 4th Dimension of NGSS Hima Joshi - American Chemical Society workshop on retention of first-generation college students Tom Olmstead - CA Department of Rehabilitation training in vocational skills for developmental disabilities and Autism. Karen Butland - Workshop on designing an inclusive syllabus. Martin Larter - Workshop on designing and inclusive syllabus. Sarah Dunn - Workshop on creating equity minded syllabi. Diana Vance - Workshop on Transparent Design We use the ACS exams, and we keep track of averages, and how they compare to national averages. We keep these data in the file cabinet where the finals are kept. Each time the exam is administered, the score sheet is updated. The norming is available from the ACS. We take no special steps to prepare students for these exams. Interestingly, the ACS exam is a summative exam over two semesters of general chemistry. So our second semester students take a final that covers both semesters. Tutors are recruited through faculty consultation. Each semester we learn how many tutors are returning, and how many are needed. We then solicit faculty for suggested students. Many years ago the college had said that it would provide the department with Red Canyon software to formally track the number of students utilizing tutoring services, but has failed to do so. Martin Larter and Diana Vance met with the LTC Dean to work on the pilot program for online tutor sign-ups,

		however no tracking system emerged from that meeting. For a time we had the tutors counting the number of students in the center each hour. We also have them keep track of the number of students they work with on a paper. But, it is time consuming to compile this data. The ACS exam assesses the following SLOs. Demonstrate a working knowledge of the language of chemistry. Apply quantitative reasoning to chemical problems Apply a laws and theories to explain and predict the properties of atoms and molecules.
2.1	How is the department evaluating the success of new Chemistry sequence? Are students enrolling? Do transfer institutions still require the course that SCI 110 was designed to fulfil?	Students are enrolling, but early indicators don't show that the splitting of the lab and lecture is solving any problems for students. It is still early, however. Yes, SCI 110 meets CSU GE A3, which is critical thinking
2.2	Why do you feel that learning has not changed? (Neural plasticity, effects of social media)? What is the value of two 3-hour labs a week in CHEM 141 and 142, when this is not done at SDSU? What methods of evaluation does your department engage in to provide insights as to whether or not you are preparing students? What is the learning goal of weekly lab reports that students must complete outside of lab time? Is work underway to update courses that are due for Course Outline review? (see p. 74)	For many years I sought the "Holy Grail" of learning. Some new technology, a new technique. I even convinced many granting bodies to give me money to try things out. What did I learn? There is no replacement for time. There are no shortcuts or magic. Learning occurs when instructors and students are "in it to win it". Learning occurs when students feel valued, are held accountable, understand that their instructor is in their corner, and their instructor presents a carefully planned, organized, and rigorous classroom experience. So what do we do? Rather than trying a bunch of new stuff, we spend more time with students. We started a Science Club to facilitate this interaction. We invite students to our home for parties to watch science films. We go on field trips. We spend more than the 5 office hours in our offices. We make sure to know students' names. People haven't changed fundamentally. They need to feel part of a tribe. Our classrooms need to be that place. A place where students are challenged to do more than they thought they could. You mention social media, but social media only amplifies that which is already there (By the way I tried student blogging and a Twitter account for a number of years back in 2006).

		Time with the material is extremely important. Having two, 3 hour labs allows students to complete a more rigorous lab program, and it affords us the flexibility to meet student needs. Couple this with the benefit of having tied labs and lectures, and you have a terrific educational environment.We see our students for 9 hours per week. We can easily present lecture material in the context of lab. We know exactly where each student is in their lab program. When this author came to Grossmont he had two other offers for other schools. He chose Grossmont because of our lab program. We are not certain that SDSU or UCSD are appropriate yardsticks for the comparison of this situation. Lower division courses are often merely tolerated at 4 year institutions. Our general chem experience is better than that at any of our transfer institutions. Our principal means of evaluation surrounds our final exam scores. All of our courses use a common final exam, so we can keep tabs on particular sections, as well as the course as a whole. In addition, we regularly meet to discuss those things that are not well captured by exam scores. Report writing, for example. Lab reports are crucial to our majors lab program. First, students are instructed and evaluated in the style and content of scientific writing. Second, and more importantly, students must engage with the material in a deeper fashion. Students must explain results, and explain principles. These things are a BIG PAIN to grade. Simple, fill-in-the-blank reports are much easier to grade, but they don't facilitate the deep engagement as a traditional lab report. Student can copy calculations, copy post and pre-lab questions. But it is harder to simply copy a lab report, or to regurgitate something from a lab manual and not get caught. In the physical sciences students often engage with numerical answers and algorithms. The lab reports push them out of their comfort zone, and force them to engage with fundamental principles, explain them, and explain what they accomplished in a lab.

		The updated chemistry 116 outline has been submitted to the Curriculum Committee for review during the 2019-2020 Academic Year. Additionally, a new course, chemistry 117 Introductory Biochemistry, which will help the college with a Nutrition ADT, has been submitted to the Curriculum Committee.
2.3	Clearly there is engagement in Lab settings, what strategies do you use to maintain that level of engagement in a lecture setting? Please provide some examples of how instructors make chemistry relevant to students' daily lives. How do you facilitate good team collaboration in your labs?	That's just it. When you have the same instructor in lab and lecture, it is all one big process. There is a much closer connection to that which we are doing in the real world and that which is happening in lecture. Why does a discipline have to be relevant to daily lives? I am not exactly certain what that means. On a daily basis is the average American concerned about the latest understanding of the 3 center, two electron bond in ClF_3? Does the woman standing in line at the DMV care about the fact that water is more dense in its liquid phase than its solid phase? Is a discipline only as useful as its relevance to daily life? The passengers and crew of The Titanic learned an unforgettable, and for many final, lesson on the relative densities of solid and liquid water. Did they care at the time? Probably not. Those who choose science are inherently interested in such things. Does this mean that instructors eschew any connection to our daily lives? Of course not. However, it is probably easier to find portions of chemistry which AREN'T relevant to daily life.Where does the word, "plumber" come from? Why do they salt roads in cold climates? How does your refrigerator keep your food cold? How much carbon dioxide does your gasoline engine emit while driving to school? Which antacid is the most effective when it comes to neutralizing acid? Does paying extra for a name brand make a difference? These are all regularly addressed by faculty, and formally in our curriculum. We incorporate technology by having the students use Vernier data acquisition devices, IR, GC in addition to basic laboratory and glassware skills. Lab work inherently fosters student collaboration whether the students work as individuals or in small groups. Students often work together during lab and

		outside of lab to problem solve and ask each other questions when they don't understand something. The students end up teaching each other. Instructors facilitate this collaboration by encouraging students to work with a variety of other students throughout the semester. Instructors also walk around the classroom to make sure that all students are actively participating in gathering, organizing, and analyzing data.
2.5	How do you prevent cheating when using the same standardized exams year after year? Explain how the professional development you listed in section 7 positively impacts course outcomes (student success).	The department has several versions of the exams, which are given during different semesters. The exams are not copied, and they are numbered. We have a single class set. In addition, they are cycled periodically as new exams are made available. I don't think the quantification of professional development activity affect on course outcomes can be assessed. Sure, we can talk about how, and what instructors bring to the classroom after such activities, but to say, definitively that there is a positive or negative affect is not possible under these conditions. We would need course success before and after. We would need data over a period of time. We would also need to know the relative preparation of the students. To simply look at a change over a one or two semester time horizon won't tell us much. This being said, there are probably anecdotal results, but we haven't collected any.
3.0	Where is the SLO data you have collected? How has the data been analyzed? How has your analysis changed your teaching strategies (closing the loop)?	The SLO data have been uploaded into TracDat as word files. We have not been able to edit TracDat. We tried for several months, then gave up. Our department chair tried to get this problem solved with three different SLO coordinators. Many support calls. Lots of back and forth. Lots of, "you should be able to edit now". No go. We analyzed the data according to our evaluation mechanism in our SLO documents.The SLO data has been presented and discussed at the department meeting during professional development week. During the spring 2019 semester, the prep chemistry and general chemistry instructors met during professional

		development week to discuss the results of the chemistry 120 SLOs. We looked at the questions on the final exam that were missed in high frequency. This helped the general chemistry instructors to understand what topics students had struggled with in prep chemistry and could take more time on those topics during the semester. The organic chemistry instructors looked over the SLO data for chemistry 116 as well. However, we only offer one section of that course and it was the first time the instructor teaching the course had taught it. The SLO analysis helped to inform the instructor for the next semester she taught the course. Every semester, we meet and look at our average scores on standardized exams, talk to instructors as to how curricular changes are affecting subsequent courses, communicate with our transfer institutions (this is usually informally, and not through any official articulation channels), and discuss the quality of student work.
3.6	How do you know that your teaching methods are impacting student success?	Good question. I think the best gauge is not success rate or GPA, but how students perform in subsequent courses. Some years ago we studied how students fared when taking subsequent courses at SDSU. That is, if a student took a chemistry course at Grossmont, how did they do when they took a subsequent course at SDSU. They did well. In fact, in many cases their GPA was a full grade point above their colleagues. This tells us that we are doing some things well.
4.6	Why does the 3rd stockroom technician needs a separate office space?	There is no room in our stockroom technician office for a 3rd person, and the space that has been carved for the 3rd technician is in our conference room. This has caused difficulty on a number of occasions when meetings interrupt his work.
5.2	Data from statewide chemistry courses is included in the graph on p. 57. Please reevaluate your response to this question after reviewing it. While it is admirable that students are successful when they transfer, how can you help more students attain that level? What is a reasonable expectation of time spent outside of class for a 4 unit and a 5 unit course? Are students meeting these expectations?	The best way to impact students is with a stable cadre of instructors. While we have a number of competent part-time instructors, there is no substitute for full-time instructors who are fully engaged on campus. This would do more than any other single intervention to improve the number of successful students. The typical rule of thumb is 2-3 hours outside of class per unit of instruction. Many students spend the requisite time.

	How do you review your content delivery methods? How often is “regularly”?	Experienced science majors know the time required. The sciences are very time consuming. Unless you have experienced this, you do not know the magnitude of such things. Students in introductory courses require more reminding in this regard. This is why there are homework assignments, lab reports, and other activities to fill their outside time. Showing up every day, doing all the homework, and writing your lab reports does not get you an “A”. That is the kind of work that allows one to pass. It also takes study. The department is very standardized. We have common final exams, common ways of teaching certain subjects, common textbooks, and all substantive curriculum changes are agreed upon by the department. Delivery is up to the instructor, however. We have online courses, hybrid courses, and traditional courses. In terms of regularity, it seems that changes come in fits and starts. There are times when there is a flurry of activity. This may be with a text change, or a lab change. At other times, and for some courses, it may be a period of years before there is a critical evaluation.
5.6	What are the details of the issue with the ADT for Chemistry? What is the benefit of obtaining the COA in Chemistry for a student?	In June 2018 the department looked to see how many community colleges were able to have the chemistry ADT. The answer was 18, none of which are in San Diego County. A Degree with a Guarantee list as of 6/14/18 1. Allan Handcock College A.S.T. 2. Bakersfield College AST 3. Cerritos College 4. College of the Desert 5. College of the Sequoias 6. Columbia College

		7. Crafton Hills College 8. Cypress College 9. Gavilan College 10. Hartnell College 11. Los Medanos College 12. Merced College 13. Modesto Junior College 14. Norco College 15. Reedley College 16. Rio Hondo College 17. Santa Ana College 18. Sierra College The two main problems for Grossmont College are math and organic chemistry. For math the ADT wants eight units of Single Variable Calculus, however Math 180 is a five unit math course. This gives us nine units for math. For organic chemistry, the ADT required eight units of organic chemistry with lab in both semesters. Our organic chemistry sequence is ten units. We had hoped that splitting the organic chemistry lecture and lab would allow us to use six units of lecture and two units of lab and thus met the requirement, but it does not because the lab units would only be in one semester instead of two.
6.2	Do faculty use the Chemistry tutoring center for office hours? Are they well utilized?	Now that the tutoring center is staffed with tutors, faculty aren't holding office hours in there as much. I would say that faculty are in there regularly and some choose to hold some or all of their office hours in there. Instructors help with tutor questions.

		Assist students with data analysis, and with online HW. Students in the tutoring center know that if an instructor is not immediately present in the tutoring center they can walk down the hall to the chemistry instructor offices and often get help as well. The tutors are well utilized.
7.0	Please tell us more about Gear Up. How many sessions have been offered and how successful are students who have participated?	The Gear Up sessions depend on the availability of faculty. We have done these gratis. It has become increasingly difficult to recruit instructors to run the Gear Ups because the Professional Development Committee decided that at Grossmont College faculty could not use the time spent with students at Gear Ups as professional development We have not tracked students. However, it will be difficult to compare, as students who have the forethought and motivation to attend a Gear Up session are probably those who will be more successful anyway. Rather like open tutoring. One can't definitely say that students who attend tutoring are more successful because of the tutoring. Students who choose to engage with the material outside of class, and with vigor are more likely to be successful anyway.
7.1	Which activities that you list in your grid have a "direct impact on students"? What is you understanding of transparent design and your stated expectation for student frustration? Which courses offer OER materials to students? Please describe which off-campus activities lead to classroom learning experiences.	I am not certain what "direct impact" means? How does one assess direct impact? Transparent design surrounds faculty/student discussion prior to an assignment or series of assignments as to its purpose, intended goals, required skills and tasks to complete, and criteria for success with examples. What often takes first-time students of physical science by surprise is their level of frustration when learning. Science is hard. Learning science is hard. Difficult things cause frustration. This is a normal occurrence in learning science. To be an effective learner in science, students need to know how to deal with frustration. They need to know that it is normal, and that it isn't only them. Being transparent about the role that frustration plays in the learning and practice of science is incredibly important. Science happens when we persevere in the face of frustration. This is

		why we provide as much faculty and tutor availability as possible. During the time period of this program review the department did not have any courses that utilized OER materials However, we are considering one for our general chem course. Also, we allow older editions of each of our texts to help reduce cost. Most off campus activities surround the Science Club. Students visit local businesses and schools. At times they are in an educational mode with elementary students, and others a learning mode with local scientists.
7.3	What is your department's process for informing faculty of professional development opportunities and requesting funds that may be available? How would attending the American Chemical Society meeting regularly "go a long way to promote faculty engagement and student success"?	Our department has no formal means for informing colleagues about opportunities. Email and department meetings are where such things are brought forward, but we have no formal process. Discipline-specific professional development is best. Professional development that only surrounds whatever campus-wide initiative dujour does not energize faculty as much as coming together with their discipline colleagues. When I go to a chemistry conference I know that all of my colleagues have had approximately the same formal education as I have had. I know that they suffer the same issues that I do. I know that they intimately understand my discipline, and its idiosyncrasies. I know that they know that frustration is a regular part of learning science. I know that they know how it is to take a class schedule that includes a math class, and science classes that have 12-14 hours of lab per week to complete. I know that while they were busy writing lab reports, or studying in the library, they had roommates and friends in other disciplines who always had time to watch TV, go to a movie, or goof off with friends. At a discipline-specific conference I am surrounded by "my people". Nothing is more energizing than being surrounded by your tribe, when you are trying to solve a problem.
8.2	What is your department process for deciding when to add/remove sections?	This is a tough question. We look at enrollment trends and wait lists primarily, as well as our course progression. We need to make sure that we have an adequate number of courses to get

	How do you determine whether single, double or triple sections are more appropriate?	students through. Couple this conversation with adjunct preference, and it becomes even more complicated. We are not unique, however, as this is a problem faced by all department. In general we try to offer enough sections to fill. It is very difficult to cut sections late in the game. With adjunct preference this causes a cascading effect that never ends well. Single, double and triple sections primarily exist to be able to offer a greater number of sections in a more efficient manner. It is also governed by room availability. They also allow us to offer enough load to adjuncts to keep them, and to receive medical benefits.
8.8	Please explain the process of pooling TA hours and how faculty share those TA's.	As a department we have decided that all multi-section classes will have graders for the labs. This means that all faculty who receive TA hours assign them to one person, and we draw from that one account. This helps to provide some grading uniformity across our multi-section introductory courses. It also assists those instructors with higher enrollment courses. This isn't always "fair" in that some instructors get additional TA hours due to large enrollments, while others don't. In the end, however, this pooling helps everybody, and the net result is the same. The high enrollment sections get grade relief as well as the smaller sections.
9.2	Please revise your answers. This section refers to "student" retention, not "faculty" retention.	Our answer is that outreach and engagement is compromised when you don't have faculty to do such things. For example, this semester I was teaching a 128% load. I also advise the Science Club. This is a weekly meeting plus our outreach activities: Science Olympiad judging, elementary school science activities, field trips, and such. This takes time. Now, due to the departure of a faculty member mid-semester I have 148% load. I am not unique. The lack of full-time faculty has a direct impact on the program. Many of the full-time instructors have been working overload for several semesters or longer. Adjunct instructors teach at multiple campuses and as a result end up teaching an overload when their combined loads are taken into account. This makes

		it difficult for instructors to have the time to email students when they miss class, use the data analytics provided by the homework platforms to see what homework problems students are missing. The department instructors continue to share our best strategies for student success and retention during our department meetings and throughout the semester. We have created Canvas shells to further share materials and resources including videos, rubrics, etc. We learn the students' names, engage with them during lecture and lab. Checking in with students after exams on their progress in the course. Talking with them about study skills, study strategies, time management, and their personal goals.

GROSSMONT COLLEGE
FALL 2019 **CHEMISTRY**

PROGRAM REVIEW COMMITTEE
SUMMARY EVALUATION

The committee recommends maintaining this program. Following are the committee's specific commendations and recommendations.

The Program Review Committee commends the department for:

1. Creating new curriculum and collaborating with other departments to ensure transfer students can complete lower division prep
2. Maintaining consistency in grading practices by collaborating with transfer institutions (SDSU)
3. Submitting test scores to the American Chemical Society to see how GC students are faring on a national level
4. Supporting and mentoring the Science Club
5. Recruiting and mentoring tutors for the SLC, providing a valuable resource to students
6. Creating opportunities for students to take Chemistry classes during non-traditional times, such as Friday evenings and Saturdays
7. WSCH/FTEF over 500 in most semesters

Committee recommends the following:

1. Complete professional development and implement the latest practices in improving equity and student success, such as transparent assignment design, as well as evaluating time spent in and out of class by students and how assignments contribute to learning
2. Student Learning Outcomes:
    a. Analyze SLO data more deeply to make informed decisions on how to improve teaching and learning
    b. Look at models of departments (History, ESL, Math) that are successful in SLO data utilization and adopt one that matches your program structure
    c. Enter data into TracDat
3. Develop a formal process to create a schedule that allows students to take multiple courses in STEM majors concurrently, including coordination between Bio, Chemistry & Physics, and courses at Cuyamaca
4. Work with your Dean to align courses to meet the out-of-class time expectations (set forth by the Carnegie definition of lecture/lab)
5. Continue working on a way to implement the Chemistry AST
6. Manage course offerings to increase % fill

College President

Program or Department Chair

Academic Program Review Chair

CHEMISTRY

Academic Year	Fall		Spring	
	% Fill	WSCH/FTEF	% Fill	WSCH/FTEF
2013-14	98.8	531.1	101.1	556.6
2014-15	102.3	538.2	94.0	520.9
2015-16	97.7	547.4	92.2	513.8
2016-17	95.4	517.2	84.1	472.3
2017-18	88.4	482.8	87.0	477.5