

Comprehensive Program Review Report



Program Review - Chemistry

Program Summary

2020-2021

Prepared by: Julie Rodriguez, Ryan Froese, Teresa Mendoza, Daudi Bogonko, Jennifer Verissimo

What are the strengths of your area?: Please note most data referenced in this summary are available in related documents, (in graphical form), at the bottom of this page.

One of the strengths of our chemistry program is the partnerships that students build with the faculty members. Unlike large, impersonal introductory courses at many colleges and universities, the chemistry classes at COS have a maximum enrollment of 24 students. Small classes and labs make certain that students receive individualized attention and ensure greater success in chemistry.

Our dedication to teaching and supporting student learning is another strength of the department. Our department faculty also collaborate often and work well together to construct a successful chemistry program. Our success in this area is evidenced by our course fill rates. We have observed fill rates ranging from 99-101% at census from 2013-2018.

The new institution-set standard is a minimum of 67 % for course completion . Although our average course success rates overall have been between 51 - 54 % in the last three years, we are working hard to raise that metric. We have recruited, trained and grown leaders who are working in the Math Engineering and Science Achievement (MESA) center. The data shows this, as there is a 20% improvement in the success rate for students in Chem 1 and Chem 12 who attend MESA versus the students who do not. These courses are each the first in their series, and therefore quite challenging for the students. In the 2018-2019 academic year, our success in Chem 20 and Chem 1 (our two introductory courses), was 49 % and 54 % respectively. This, however, is not the end of the story; once students passed their first chemistry course here at COS, their success rate increased to 69 % in Chem 2. This just exceeds the minimum institution-set standard. Our organic chemistry tells a similar story, the success in Chem 12 and Chem 13 are 59 % and 75 % respectively. A note must be made at this point, the 59% in Chem 12 was affected by adding a new Chem 12 course in Spring, an "off sequence" course. This drew students who failed the Fall course and failed at other institutions. Some of these did not pass, so some students double-counted. The students who are taking their fourth or fifth chemistry course at COS, (depending on where they started), are exceeding the institution-set standard. Some of these students have reported back to us, and are finding success in chemistry courses in both the CSU and UC system upon transfer. Another revealing fact from the data is found when comparing the total number of students who are taking our courses with the overall success rates. The number of students who took chemistry in 2016 - 2018 was 723, 847, and 843, respectively; our department served 120 more students in 2018 than in 2016. Our success rates in 2016 - 2018 were 55%, 51%, and 54 % respectively. Although our success rates are the same over those three years, we have been able to serve more students, and therefore more students are getting through.

We have been utilizing the REALM program as a method to raise success rates in chemistry. Students accepted into the REALM program are funneled into Chem 20 courses with reserved seats, which helps to build a community among cohorts of students. Community is one of the central factors we believe in the MESA center's ability to increase student success. In addition to this, Daudi Bogonko, Ryan Froese and Teresa Mendoza are currently guiding students through a student-centered Supplemental Instruction (SI) program for their introductory and general chemistry courses. The SI sessions have been widely popular, well attended and shown marked improvement when all other variables (that can be controlled) remain constant. One example pulled from data, Ryan Froese's Chem 20 with an SI saw a 44% success increase and a 47% retention increase for students attending SI sessions. The Spring 2019 data is still being analyzed. As an addendum, we also find that SI sessions build excellent community in the classrooms, and tend to aid in the formation of study groups.

Another two strengths in the Chemistry Department are the increase in the use of instrumentation, as well as the acquisition of instruments that are essential for students' university and career readiness. This was previously identified as a weakness, but our efforts have transformed it into a strength. The students in Organic Chemistry now utilize GC-MS, FT-IR, Polarimetry, and NMR instruments, giving them a better experience of what they would have in the same course at a 4-year institution. The unique individual instruction provided by staff in the use of this equipment accentuates this experience making it superior to any 4-year institution. Our students finish this course ready for further study upon transfer, and/or work as a chemist in Industry. Preparing our students for work in a high-tech field helps to fulfill the mission of the district, "to help our diverse student population achieve its transfer and/or occupational objectives and to advance the economic growth and global competitiveness of business and industry within our region." This brings our department into alignment with the institution as a whole, which amplifies our success. We like to think of this vertical alignment as the Chemistry Department metaphorically "rowing with the team." A current COS student who is a chemistry major received a part-time job running a local chemistry lab after having been exposed to the instrumentation that the chemistry department now provides to the students. He was chosen from a pool of four applicants and credited his laboratory experiences here at COS for his current opportunity. He graduated last year, and the local lab will work with him to keep his job while he finishes his bachelor's degree.

We are continuing to look for ways to grow the Chemistry program out at the Tulare Center. The satellite campuses have been a challenging area in the past for our department, as there were no full-time faculty members to support these programs. In an effort to remedy this, we hired a new faculty member and our most senior faculty (Julie Rodriguez) moved out to Tulare to grow this program. This has allowed us to offer a major's class at a Satellite campus for the first time in COS history. In Fall 2021, Ryan Froese, our Department Chair will request to teach a chemistry 20 class out at the Tulare Center. We also hope that we will eventually be able to hire another chemist who will teach at least part of their load out in Tulare so that the program continues to grow.

What improvements are needed?: One effort we have made to increase success and retention is the creation of a new course. Many students need a lab science as part of their general education (GE) and have chosen Chem 20. Chem 20 is a course designed for Allied Health Majors as well as Science Majors beginning their chemistry series. Chem 253 was closer to the needs of the students using the course for general education, but it did not count due to the lack of a lab. For this reason, Julie Rodriguez has written a Chem 10 course. This course will fulfill the GE requirements for a lab physical science, but be designed for this purpose and therefore the appropriate level and focus. We think the students in general education would be far more successful in this course than Chem 20, while still receiving what they need to prepare them for future courses and careers. Chem 10 is currently being taught for the first time by Jennifer Verissimo, our newest faculty member. We are waiting to see the success rates of this class, as well as how it affects our Chem 20 course and the College's success rates as students complete their educational objectives with courses more tailored to their needs. As the data comes in, we will work to improve our course offering to meet our students' needs.

One major area for improvement that remains is the instrumentation that students are exposed to in our majors' courses so that they can be competitive when they transfer to research institutions. At Clovis Community College, Reedley College, Fresno City College, and the Madera Center, students have 7 different instruments that they use in their courses. Here at COS, we have 4 instruments for our students to use. Clovis Community has a GC-FID, 2 GC-MS's, LC-MS, FT-IR, FT-IR with ATR, NMR, Cary 60 UV-Vis, 2 FlaskScrubber's and 2 SteamScrubbers's. We currently have an NMR, GC-MS, FR-IR with ATR, and one FlaskScrubber. As an important note, this is an improvement over two years ago when we did not have the GC-MS. Our next instrument purchase to improve in this area would be an HPLC (High Performance Liquid Chromatograph) which is essentially a much more affordable, (though less capable), version of the LC-MS. We will be attaching the documentation which provides the proof that surrounding community colleges possess Instrumentation that far surpasses what we have to offer our students.

We are in need of an additional faculty member. We cannot seem to offer enough chemistry classes. Our fill rates were 107 % at the census in the 18-19 year, and many of the courses that we offer are waitlist-full before normal registration begins. All of our Chem 20 courses are usually full within a couple of weeks. In addition to full classes and full wait-lists, in Chem 20 we observe about 5-7 people per section are trying to "crash" the class on the first day in hopes of enrolling in the course if a registered student drops. In Chem 1, we are beginning to see similar trends. Our Chem 1 classes' wait-lists are full as well. We think it is important to note that unlike other classes, we are unable to add extra students because our laboratory rooms will only hold 24 students. It poses a safety hazard to exceed this number, and we do not have the glassware to do so if we were so inclined.

Describe any external opportunities or challenges.: We strive to improve our success and retention without compromising our standards. We find this most challenging in our majors' courses where we receive many students from local high schools who lack the skills necessary to succeed in a majors level chemistry course. The Department is searching for ways to improve success in our majors' courses through the use of technology, and we have utilized the REALM grant to support these efforts. Ryan Froese has written and begun to teach an online-hybrid Chemistry 20 course. This is a course where low success rates abound across instructors, and discussions have revealed two reasons why. The first is that students have jobs that make attending class

4-5 times per week impossible. In response to this issue, the face-to-face courses are often scheduled for 2 lecture meetings per week. This has created a situation where too much information is covered in one class to be comprehensible by students. Surveys from the course show the online format has helped to provide more access to students who would otherwise be unable to take the class. Many students had glowing reviews of the format, but many others wrote they struggled to succeed due to time management and their own procrastination. The online format makes this procrastination even more possible than usual and has exhibited lower success rates. Much of these lower success rates is explained by an increase in access; the students who can only take the online format also have busy lives that inhibit success. We need to improve our sorting mechanism, so the students who are directed to take the hybrid course are the students for whom it is a good fit. Ryan Froese will be working on ideas for improving this "funnel" in the coming year. Ryan Froese is also currently working on a project to increase engagement for online students by creating chemical demonstration videos. This will give the students some of the comparable engaging experiences the face-to-face students get.

Overall SLO Achievement: : Our department is still filtering through large changes in the area of SLO's. After previously noting an absence of useful data from SLO's, we determined that the SLO's themselves were the culprits. We collaboratively constructed new SLO's, PLO's, designed new assessment methods and scheduled assessments. We are excited about the new SLO's and PLO's, as they align much better between courses and with the program as a whole. They also create much better goals for student achievement that align more closely with the mission of the district. Instead of a myopic focus on individual paper-based skills, they broaden the scope to conceptual connections, exhibiting deep awareness of the underlying principles of both chemistry and critical thinking. They also broaden the scope of our goals to laboratory-based skills, which prepare the students for their careers. We have some preliminary SLO data, though we still need to get through more cycles for it to gain statistical accuracy.

Preliminary Data: Teresa Mendoza calculated that Chem 1 and Chem 2 are showing the most promising results with 85.9% and 80.8% respectively as an average SLO achievement for each course. This far exceeds our goal and speaks to the quality of instruction provided in these courses. Chem 12 and 13 showed an average SLO achievement of 69.0% and 69.2% respectively. These numbers were not surprising as these courses are quite challenging regardless of the institution in which they are taught. The one SLO that brought the number down the farthest was "Synthesis". Since this is literally "Synthesis or Creation" on Bloom's taxonomy, it was not surprising to see the students struggle exceptionally in this area.

Changes Based on SLO Achievement: Ryan Froese is working to format Chem 12 with more emphasis on higher-order thinking woven into the course's instruction to improve this SLO, thereby bringing the average SLO for Chem 12 and 13 up to the target range. We have also included the part-time faculty in the SLO process to some degree and are incorporating their data to develop a more complete image of the department as a whole. We have much growth needed in this area and would like to include adjunct faculty in our SLO data beyond simply incorporating their data. We have also requested an HPLC to give students more laboratory experience, which is one of our main SLO's vertically aligned throughout the program.

Overall PLO Achievement: Ryan Froese mapped our course SLO's to our newly created PLO's and tabulated the data. Any course that met the SLO goal we have set was counted as achieved. Our PLO's were as follows:

Quantitative Analysis: 4 SLO's met of 4 SLO's mapped to this PLO.

Qualitative Analysis: 7 SLO's met of 8 SLO's mapped to this PLO (Synthesis in Chem 12 is the culprit here).

Laboratory Skills: 4 SLO's met of 4 SLO's mapped to this PLO.

Changes Based on PLO Achievement: From this data, we have begun to discuss the incorporation of more critical thinking in the form of qualitative questioning in the program from the outset. We have also considered giving the ACS exam as a final for some of our courses so that we can compare our students' achievements with students across the nation. Finally, would like to further incorporate our adjunct instructors in the SLO discussion process and the workings of our department in general. To address the Chem 12 Synthesis SLO, we have begun discussions on how to increase the Brigg's level in previous courses by requiring students to answer more questions involving "Synthesis or Creation". This may better prepare students for the level of this expectation in Chem 12.

Outcome cycle evaluation: This year we have done some major work on our program. We used last year's cycle data to launch some major program overhaul, as well as start discussions of the next steps. The hard work of our department faculty is evident from the following bird's eye view of our changes.

We created new SLO's/PLO's to present students with a more cohesive program, and glean more relevant data. From the transformation of our SLO's/PLO's, we realized that Chem 253 was not meeting the needs of our students. We redesigned it to do so, which will now be Chem 10. This was also in response to the qualitative data showing Chem 20 contained many misplaced students, who will benefit from this new course. We created and started to teach a Chem 20 hybrid course to meet the needs of working students, and students who are family caregivers. We also did this to mitigate our student's poor study skills and increase access to content. We continue discussions and efforts to increase success in this course. The department realized students were not getting enough experience running equipment to prepare them for lab jobs in our community and further university studies, so we purchased and have begun to use new equipment in Chem 12 & 13. We have further objectives

in this area and are actively seeking more equipment for students to gain experience on. As a final step, we have realized our last hurdle is course offerings. We have seen the majority of our courses get waitlist-full status shortly after registration has opened. We need to offer more courses to build on and continue the work we have done, so we have requested another full-time instructor. Finally, we have seen excellent results from SI sessions from the limited data that we have but would like to get more data specific to this area.

All of these changes take a student-first approach, as the rationale behind each change demonstrates. We have striven to meet the needs of both our students and our community and look forward to continuing to do so.

Related Documents:

[CHEM - 2020 Program Review Data.pdf](#)

Action: 2019-2020 Glassware/Equipment to Expand Tulare Offerings

Purchase of glassware/equipment to support our new full-time position.

Leave Blank:

Implementation Timeline: 2019 - 2020

Leave Blank:

Leave Blank:

Identify related course/program outcomes: District Goal I. College of the Sequoias will increase student enrollment relative to population growth and educational workforce development needs. (This expansion of course offerings will support and accelerate our growth in Tulare)

District Goal II. College of the Sequoias will improve the rate at which its students' complete degrees, certificates, and transfer objectives. (Tulare students are currently not afforded the same opportunities to take majors-level chemistry courses)

Person(s) Responsible (Name and Position): Julie Rodriguez

Rationale (With supporting data):

Priority: High

Safety Issue: Yes

External Mandate: No

Safety/Mandate Explanation:

Update on Action

Updates

Update Year: 2020 - 2021

10/01/2020

Status: Action Completed

Items were purchased and stocked. Chemistry 2 will be offered out at the Tulare Center in Spring 2022. Most of the equipment will get used by our Chemistry 1 students and even our Chemistry 20 students out at the Tulare Center right away.

Impact on District Objectives/Unit Outcomes (Not Required):

Resources Description

Equipment - Instructional - Equipment to teach chemistry 2 and support chemistry 1 at the Tulare Center, which has not previously been taught there. (Active)

Why is this resource required for this action?: The chemistry department has expanded its course offerings in Tulare to include chemistry 1; previously, we had been teaching only chemistry 10 (253) and chemistry 20. Chemistry 1 filled quickly (within a week) and is still currently at 26 students. We will offer Chem 1 again this coming Spring. Next year, we will expand things even further with a Chem 2 offering in the Spring so that the Tulare students will be able to take Chem 1 and Chem 2 at the Tulare center. This glassware and equipment money would help us purchase much-needed supplies out at the Tulare center so that our Chem 1 and Chem 2 students in Tulare will receive an equitable experience with our students on the Visalia campus.

Notes (optional):

Cost of Request (Nothing will be funded over the amount listed.): 3039.14

Link Actions to District Objectives

Program Review - Chemistry

District Objectives: 2018-2021

District Objective 1.1 - The District will increase FTES by 1.75% over the three years

District Objective 2.1 - Increase the percentage of students who earn an associate degree or certificate (CTE and Non-CTE) by 5 percentage points over three years

District Objective 2.2 - Increase the number of students who transfer to a four-year institution by 10 percent over three years

Action: 2019/2020 - HPLC - Continue to Improve the Preparedness of our Transfer Students

We would like to make sure that our students are as adequately prepared to transfer as they are in the other community colleges in our area.

Leave Blank: Nonessential/Nice to have

Implementation Timeline: 2019 - 2020

Leave Blank:

Leave Blank:

Identify related course/program outcomes: District Objectives: 2015-2018

District Objectives - 2.1 - Increase the number of students who are transfer-prepared annually.

District Objectives - 3.1 - Reduce the achievement gap of disproportionately impacted student groups annually, as identified in the Student Equity Plan.

District Objectives - 3.2 - Increase training for academic and student services staff and faculty to respond to the unique needs of our student population.

Person(s) Responsible (Name and Position): Chemistry Faculty

Rationale (With supporting data): We need to improve the Instrumentation that are students are exposed to in our majors courses so that they can be competitive when they transfer. At Clovis Community College, Reedley College, Fresno City College, and the Madera Center, students have 7 different instruments that they use in their courses. Here at COS, we have 3 instruments for our students to use. As an important note, this is an improvement over last year, when we had 2 instruments. Our next instrument purchase to improve in this area would be an HPLC (High Performance Liquid Chromatograph) We will be attaching the documentation which provides the proof that surrounding community colleges possess Instrumentation that far surpasses what we have to offer our students.

Priority: Medium

Safety Issue: No

External Mandate: No

Safety/Mandate Explanation:

Update on Action

Updates

Update Year: 2020 - 2021

10/01/2020

Status: Action Discontinued

We are not going to remove this item from our action summary. We are predicting a tough financial year and we may need to wait until better times to request this item.

Impact on District Objectives/Unit Outcomes (Not Required):

Resources Description

Instructional equipment - We would like to improve our Instrumentation lab by purchasing an HPLC, a high performance liquid chromatograph. (Active)

Why is this resource required for this action?: We need to improve the Instrumentation that are students are exposed to in our majors courses so that they can be competitive when they transfer. At Clovis Community College, Reedley College, Fresno City College, and the Madera Center, students have 7 different instruments that they use in their courses. Here at COS, we have 4 instruments for our students to use. As an important note, this is an improvement over last year, when we had 2 instruments. Our next instrument purchase to improve in this area would be an HPLC (High Performance Liquid

Program Review - Chemistry

Chromatograph) We will be attaching the documentation which provides the proof that surrounding community colleges possess Instrumentation that far surpasses what we have to offer our students.

Notes (optional): For a System with an RID detector, the cost would be \$36,000. The \$44,700 is the price for a system with a UV-VIS detector. The UV-VIS system is preferred but the RID system would be sufficient.

Cost of Request (Nothing will be funded over the amount listed.): 45630

Link Actions to District Objectives

District Objectives: 2018-2021

District Objective 2.2 - Increase the number of students who transfer to a four-year institution by 10 percent over three years

District Objectives: 2015-2018

District Objectives - 2.1 - Increase the number of students who are transfer-prepared annually.

District Objectives - 3.1 - Reduce the achievement gap of disproportionately impacted student groups annually, as identified in the Student Equity Plan.

District Objectives - 3.2 - Increase training for academic and student services staff and faculty to respond to the unique needs of our student population.

Action: 2020-2021 (Above Base) Replace broken Verniers for all chemistry courses

We need to replace the Verniers, of which many of our class set has died. We will be able to use the remaining old Verniers to cobble together two sets possibly to support our expanded course offerings.

Leave Blank:

Implementation Timeline: 2020 - 2021

Leave Blank:

Leave Blank:

Identify related course/program outcomes:

Person(s) Responsible (Name and Position): Ryan Froese, Teresa Mendoza, Jenifer Verisimo, Daudi Bogonko

Rationale (With supporting data): These are used in every single course we teach in the chemistry department in multiple labs. The set we have has been dying one by one, which means students now have to share. This means they will not have the same learning experience.

Priority: High

Safety Issue: No

External Mandate: No

Safety/Mandate Explanation:

Resources Description

Equipment - Instructional - A class set of Vernier devices and pH probes for the Visalia Campus. (Active)

Why is this resource required for this action?: This is a student success issue. Our Vernier handheld units are beginning to break on the Visalia campus. They are used multiple times in Chem 20, Chem 1 and Chem 2 labs. Many of them are no longer functioning, and more are dying by the day. Since we only have one class-set, each device that dies means that another student does not have the necessary tools to complete the lab on an individual basis, and receive that learning experience.

Notes (optional):

Cost of Request (Nothing will be funded over the amount listed.): 10143.1

Equipment - Instructional - Verniers are used in almost all of our labs and they are getting old. We need to replace some of these Verniers that no longer work so that we can continue to use them in our labs. (Active)

Why is this resource required for this action?:

Notes (optional):

Program Review - Chemistry

Cost of Request (Nothing will be funded over the amount listed.):

Link Actions to District Objectives

District Objectives: 2018-2021

District Objective 2.1 - Increase the percentage of students who earn an associate degree or certificate (CTE and Non-CTE) by 5 percentage points over three years

District Objective 2.2 - Increase the number of students who transfer to a four-year institution by 10 percent over three years

Action: 2020/2021 - (Faculty Position) - Expand Course Offerings in Visalia and Tulare

We would like to hire a full time chemistry faculty member in order to expand our course offerings in Visalia and Tulare.

Leave Blank:

Implementation Timeline: 2020 - 2021

Leave Blank:

Leave Blank:

Identify related course/program outcomes:

Person(s) Responsible (Name and Position): Julie Rodriguez, Ryan Froese

Rationale (With supporting data): We need to increase our course offerings in order to help the college grow, however, we struggle to find qualified applicants to fill our adjunct faculty pool. So, growth by hiring more adjunct faculty is difficult. Instead, we hope to be able to hire another full time faculty member next year to at least teach part of their load at the Tulare campus. This will help us expand our offerings at this campus and will provide much needed stability to the chemistry program out at the Tulare center.

Priority: High

Safety Issue: No

External Mandate: No

Safety/Mandate Explanation:

Resources Description

Personnel - Faculty - We would like to hire another full-time Faculty member in Chemistry to expand our offerings on both the Visalia and Tulare Campus. (Active)

Why is this resource required for this action?:

Notes (optional):

Cost of Request (Nothing will be funded over the amount listed.):

Related Documents:

[CHEM - 2020 Program Review Data.pdf](#)

Link Actions to District Objectives

District Objectives: 2018-2021

District Objective 1.1 - The District will increase FTES by 1.75% over the three years

District Objective 2.1 - Increase the percentage of students who earn an associate degree or certificate (CTE and Non-CTE) by 5 percentage points over three years

District Objective 2.2 - Increase the number of students who transfer to a four-year institution by 10 percent over three years