Instructional Program Review

Program Name: **Chemistry**
Program Contact: **Ciesla, Catherine**
Academic Year: **2016-2017**
Status: **Submitted for review**
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1. Description of Program

Provide a brief description of the program and how it supports the college's College Mission and Diversity Statements, CSM Strategic Goals 2013/14 to 2015/16, and other Institutional Program Planning as appropriate. What is the program's vision for sustaining and improving student learning and success over the next three years?

The Chemistry program offers the first two years of chemistry courses to serve two major tracks:

1)The first two years of chemistry are required for a baccalaureate in various majors such as biology, chemistry, and engineering.

2)Various chemical courses are required for certificate or two year programs such as nursing, dental assisting, and lab technologist.

Which track a student will take depends on their educational goals. Both tracks align with the Board of Trustees' Core Value of a Student-Centered Mission, as well as College of San Mateo's Mission Statements.

The chemistry program supports the College Priorities as identified in the mission statement.

1. Improve Student Success and
2. Promote Academic Excellence
3. Develop responsive high quality programs and services.

The faculty are continually engaged in developing and utilizing new teaching methodologies and systems to improve student success and promote academic excellence. Examples of efforts in these areas include but are not limited to; concentrating face to face schedules to provide classes that supports accessibility for students who have limited time in which to attend classes. The continued use of Reading Apprenticeship methodologies that focus on pre-reading exercises to facilitate comprehension and learning of complex ideas and material. The implementation of and consistent use of supplemental instruction in our classes establishing a collegial environment of peer supported learning. The use of SI also meets the strategic goal of increasing students access to academic support services and improving those services offered through the department. Team evaluation of laboratory manuals and development of new laboratory experiments, introduction of supplemental teaching videos, active involvement in the integrated learning center to provide tutoring help to students. The installation of new fume hoods in the general chemistry laboratory to improve laboratory efficiency and safety. The use of third party on-line systems that are used as homework and assisted study aids and working with the CSM learning center to identify and support qualified tutors there.

1. Support professional development

Skills acquired during professional development activities are implemented in our classrooms. Professional development is essential for faculty to stay engaged, abreast of the latest developments in teaching and connected to our fellow colleagues. A key requirement for effective professional development is for faculty to have a load that can support participation and curriculum development.

1. Promote Integrated Planning, fiscal stability and efficient use of resources

Efficient use of resources is another area we focused on this past year. Recognizing the increasing demand on our laboratory technician, we are reviewing all experiments offered and are aiming to narrow them down to a standard set of experiments which instructors may choose from. This work is in progress. The department plans well. Working closely with the division dean, course offerings fill and, overall, meet student demand quite well. The load for chemistry always exceeds 500.

1. Enhance Institutional Dialogue

Faculty from the department participate in institutional dialogue by participating in student success initiatives such as reading Apprenticeship (RA) and outreach (Family Science Day). Chemistry faculty, along with Biology and Reading Faculty, implemented the use of Reading Apprenticeship (RA) at the College of San Mateo. Since the summer of 2012, the faculty at CSM have been leaders in the adoption and implementation of the Reading Apprenticeship program. Currently, one Chemistry faculty and seven Biology faculty are part of an RA STEM grant to develop and assess STEM curriculum using the RA framework. The RA STEM grant, funded by the Helmsley Trust, is managed by WestEd, an educational research and development organization. Department faculty are also members of College committees such as CSM Scholarship Committee, Reading Apprenticeship (RA) Committee and all full time faculty are involved in one or more tenure committees.

Courses offered in chemistry include:

Chem 192 Elementary Chemistry – a first introductory course in chemistry for non-science majors, remedial preparation or some certificate programs. Prereq: Math 110 or one semester algebra. Recommended: enroll concurrently in MATH 115 or MATH 120 or 122.

Chem 210 General Chemistry I – first semester general chemistry for science majors. Prereq: MATH 120 with a grade of C or higher and CHEM 192 with a grade of C or better or equivalent; eligibility for ENGL 838/848 and one course in physics.

Chem 220 General Chemistry II – second semester general chemistry for science majors. Prereq: Chem 210 with a grade of C or higher.

Chem 231 Organic Chemistry I – first semester organic chemistry for science majors. Prereq: Chem 220 or 225 with a grade of C or higher.

Chem 232 Organic Chemistry II – second semester organic chemistry for science majors. Prereq: Chem 231 with a grade of C or higher.

Chem 410 Health Science Chemistry I – a first introductory course in general chemistry for some health professions. Prereq: None Recommended: MATH 110 or one semester course of algebra, eligibility for ENGL 848.

Chem 420 Health Science Chemistry II – a first introductory course in organic/biochem for some health professionals. Prereq: Chem 410 with a grade of C or higher.

2. Student Learning and Program Data

A. Discuss Student Learning Outcomes Assessment

1. Reflect on recent SLO assessment results for courses and degrees and certificates offered by the program.
Specify how SLO assessment informs curriculum development and changes to curriculum.

The Chemistry department is current with our SLO assessments in all courses. There is close coordination and collaboration between fulltime and part-time faculty in designing, implementing and reviewing our SLO process. In addition, our SLO assessment schedule master plan, SLO statements as well as assessment resources and data are all centrally stored and accessible on our departmental WebAccess.

Below is our results and reflections on SLO assessments on all chemistry courses.

Chem 210 - This course's SLO's were assessed in fall 2014. SLO 1 was the final exam question "Carbon obeys the octet rule". The student had to score at least a C on the question to consider it as meeting the SLO criterion. 78% of the 45 students assessed answered this question correctly thus meeting the success criterion. SLO 2 was the Hess's Law day 2 lab report grade. The student had to score at least a C on the lab report to consider it as meeting the SLO criterion. All of the 45 students assessed earned at least a C on this lab report thus meeting the success criterion. SLO 3 was the final exam question "Methane has a 90 degree bond angle." The student had to score at least a C on the question to consider it as meeting the SLO criterion. 84% of the 45 students assessed answered this question correctly thus meeting the success criterion. SLO 4 was the final grade in the lab portion of the course. The student had to score at least a C in the lab portion of the course in order to consider it as meeting the SLO criterion. All of the 45 students assessed earned at least a C in the lab portion of this course thus meeting the success criterion. The chemistry department feels that no action is required at the present time. It should be noted that this course will be assessed again in fall 2017. As of fall 2016 Chem 192 was removed as a prerequisite for the Chem 210 course.

Chem 220 - This course's SLO's were assessed in spring 2014 using the performance on three questions on the final exam. The student had to score at least a C on the question to consider it as meeting the SLO criterion. The question for SLO 1 had 73.9 % of the 88 students taking the final exam scoring at least a C. The question for SLO 2 had 85.2% of the 88 students taking the final exam scoring at least a C. The question for SLO 3 had four parts. Part A had 90.9% of the 88 students taking the final exam scoring at least a C. Part B had 93.2% of the 88 students taking the final exam scoring at least a C. Part C had 96.6% of the 88 students taking the final exam scoring at least a C. Part D had 89.8% of the 88 students taking the final exam scoring at least a C. The chemistry department feels that no action is required at the present time. It should be noted that this course will be assessed again in spring 2017.

CHEM 192 was assessed in fall 2014. Students' attitudes and perceptions were assessed using a Likert-type scale applied to quick write responses. 90% or more of students agreed or strongly agreed that requirements for SLO1, SLO2, and SLO3 were met or exceeded. The chemistry department feels that no action is required at the present time. This course will be assessed again in fall 2017.

CHEM 231 was assessed in fall 2014. SLO statement 3 was assessed - “Demonstrate understanding of theories of stereochemistry and relate theories to structure and properties (Comprehension/analysis). Assessment is based on question on final exam given on 12/17/14. In summary: success criteria was set at 75% of students passing with a grade C or better. In all, there were 33% grade A’s; 51% AB’s, 86% ABC’s. Therefore, 86% of the class passed with a grade C or better. Criterion is met and no modification needed for this SLO. The course is due for assessment again fall 2017

CHEM 232: All 4 SLO’s were assessed during spring 2016 using a google form to assess student attitudes and perceptions instrument using a Likert-type scale. SLO’s were assessed for all chemistry 232 courses in 2016 and will be reassessed Spring 2019. Here are the SLO’s for CHEM 232:

Students agreed/highly agreed (88.4%) that they were able to apply structure-reactivity principles to relate observable physical and chemical properties of organic molecules to their three-dimensional structures and polarities. (SLO 1)

Students agreed/highly agreed (96%) that they were able to predict products of chemical reactions and propose a detailed reaction mechanism to explain the experimental results observed; extend these mechanisms by analogy to similar system. (SLO 2)

Students agreed/highly agreed (92%) that they could use information from several sources and combine these data into a consistent model to determine structures of unknown molecules. (SLO 3)

Students agreed/highly agreed (96%) that they can perform classical and modern analytical and purification techniques on more complex mixtures and are able to record the experimental observations in a logical order. (SLO 4)

In summary, success criteria was set at 75% of students passing with a grade of C or better. In all, there were 32% A’s, 82% AB’s, 89% ABC’s. It was established that 89% of the class passed with a C or better meaning the criterion was met and that no modification is needed for the SLO’s. The course is due for reassessment in spring 2019.

CHEM 410 assessment will continue to use a student attitudes and perceptions’ instrument using a Likert-type scale. SLOs were assessed for all chemistry 410 courses in 2014 and will be reassessed Fall 2017. Here are the SLOs for CHEM 410:

Students agreed/highly agreed (94%) that they were better able to understand the nanoscale particle nature of matter (SLO 1).

Students indicated that they were better able to represent the chemical elements and chemical compounds after having taken this class: 94% agreeing/highly agreeing (SLO 2).

Students indicating that they are more able to work quantitative problems involving concentrations, and other chemical calculations after having taken this class: 87% agreeing/highly agreeing (SLO 3).

We are pleased that each of these three SLOs’ of CHEM 410 demonstrated such high success rates. Efforts are ongoing to ensure that the materials taught in these classes align with student needs across all three campuses of the district. Because the content need and intended audience varies at each of the sister colleges, efforts are underway to rename and renumber this course at the three colleges. CSM Chemistry is in close communication with the interested parties at our sister colleges as well as counseling.

CHEM 420 assessment will continue to use a student attitudes and perceptions’ instrument using a Likert-type scale. SLOs were assessed for all chemistry 420 courses in 2014 and will be reassessed in Spring 2017. Here are the SLOs for CHEM 420:

Students indicating that they are better able to represent chemical reactions and biochemical mechanisms: 94% agreeing/highly agreeing.

Students indicating that they are better able to solve quantitative problems involving behavior and reactions of various chemical substances: 78% agreeing/highly agreeing.

Students indicating that they are more familiar with organic functional groups and their reactive behaviors as well as the complex biologically relevant chemical systems: 89% agreeing/highly agreeing.

We are pleased that each of CHEM 420's three SLOs demonstrated such high success rates. Still greater care in the presentation of labs is needed. CSM Chemistry are in the process of expanding our online WebAccess course specific pages that will provide our students with greater information to help them succeed.

At this point all SLO assessments meet the success threshold of the department and no action will be taken at this time. Efforts are being focused on bringing classes into alignment and centralizing resources for adjunct and full time faculty.

2. Comment on the success rates in the program SLOs that are aligned with specific course SLOs. What do the program SLO and course data reveal about students completing the program? Identify trends and discuss areas in need of improvement. Is the alignment between course and program SLOs appropriate and informative? Describe any additional methods used to assess program SLOs and reflect on the results of those assessments. See course-to-program SLO alignment mapping.

It is difficult to predict trends with respect to students completing the the program due to the small number of students completing the AS degree exit survey, 8 students, and it is likely that the sample size will remain small as students are usually taking chemistry to satisfy another major like biology or engineering. Survey of Degree Applicants shows that 100% of the students agree, or strongly agree that they are successful in all four program SLOs. In fact, for three out of 4, 75% of the students strongly agree that they have met the SLO. The data demonstrates that the combination of instructional techniques used by the chemistry faculty are successful.

While this is gratifying, the student sample was small (8 students) and continued tracking of the date will be needed to ensure success. Also, 75% leaves room for improvement and suggest a continued focus on student success. Despite this, the alignment between the course SLO's and the program SLO's seem reasonable. Each program SLO is represented by more than one course SLO.

The program SLO's and the corresponding courses that contain supporting course SLO's are:

- Demonstrate preparedness to transfer to a 4 year institution. (CHEM210, CHEM231,CHEM 232)
- Critically analyze and apply general chemistry and organic chemistry concepts (Critical Thinking). (CHEM210,CHEM220, CHEM231, CHEM232)
- Perform quantitative analysis relating but not limited to graphical and numerical data obtained from laboratory experiments, and apply general chemistry and organic chemistry theories to solve problems (Quantitative Skill.) (CHEM210,CHEM220, CHEM231, CHEM232)
- Effectivity explain general chemistry and organic chemistry theories and concepts (Effective Communication.) (CHEM210,CHEM220, CHEM231, CHEM232)

3. For any courses in the program that satisfy a GE requirement, which GE SLOs are supported or reinforced by the course SLOs? What do assessment results for the course SLOs (and for the GE SLOs, if available) reveal about student attainment of the GE SLOs? See GE SLO Alignment Summary Report or All Courses GE SLO Alignment Data.

The GE SLO's and the corresponding classes that contain supporting course SLO's are:

- Quantitative skills :

Each chemistry class has at least 3 supporting course SLO's (CHEM 410, CHEM 420, CHEM210,CHEM220, CHEM231, CHEM232). Through mastering techniques and equipment in the chemistry laboratory as well as the ability to perform calculations and analysis of chemical processes and reactions, they hone their quantitative skills.

- Critical thinking:

Each chemistry class has at least 3 supporting course SLO's (CHEM 410, CHEM 420, CHEM210,CHEM220, CHEM231, CHEM232).

This is GE SLO is supported through students building schema and mastery of concepts then applying critical thinking and problem solving strategies to solve novel complex problems.

- Effective communication:

Each chemistry class has at least 1 supporting course SLO's (CHEM 410, CHEM 420, CHEM210,CHEM220, CHEM231, CHEM232). Students show the ability to effectively communicate through writing and oral communication. Students are also required to work in groups and may work on open ended projects which culminate in an oral presentation of their findings.

As discussed in section II, A 1, assessment of students demonstrates very positive outcomes for course SLO success. It is reasonable to infer that the successes of these course level SLOs For all course SLO's assessments are above 80% which suggests that students are able to demonstrate these GE SLO's in the context of their chemistry courses.

B. Student Success Indicators

1. Review Student Success and Core Program Indicators and discuss any differences in student success indicators across demographic variables. Also refer to the College Index and other relevant sections of the Educational Master Plan: Update, 2012, e.g., Student Outcomes and Student Outcomes: Transfer. Basic Skills programs should also refer to ARCC data.

The student success indicators for the 2015-2016 academic year were 68.7% success with a retention value of 82.3%. There has been a drop in the success % value from 2014-2015 values (74.3%) that appear to indicate a downward trend in success values for the chemistry department. The department success value of 68.7% is below the overall college value of 70.2% but above the division value at 65.4%.

The retention values for the chemistry department dropped from 84.6% in 2014-2015 to 82.3% in 2015-2016. The retention value of 82.3% is in line with the retention value for the division at 80.8% and slightly below the overall college retention rate of 85.3%. The data seems to suggest that the trend in retention values mirrors that of the success values in that there is a slight downward trend. This downward trend can also be seen for both the division and the college.

In summary there is recognition of the need to direct efforts towards retaining students and focusing on increasing student success especially those students from under represented populations.

For the demographic identifying as Black the percent success in 2015-2016 for the chemistry department was 44.4% (18 students) which is an increase on the 2013-2014 value of 26.3% (19 students) but it is lower than the 2014-2015 value of 57.1% (14 students), the value for the division at 50.0% (364 students) and the college overall, 64.1% (1434 students).

The retention rate in the chemistry department for the demographic identifying as Black dropped from 78.6% for the 2013-2014 academic year to 72.2 % 2015-2016. The department retention values are in line with the division values of 72.8% but below the college value of 82.4% for 2015-2016.

No individuals identifying as Native American enrolled in the Chemistry course in the year 2015-2016.

For the demographic identifying as Hispanic the percent success in 2015-2016 for the chemistry department was 53.0% (117 students), which is a drop from the value of 58.9%(95 students) in 2014-2015 for the chemistry department. The success rate is slightly lower than the division success rate at 54.5% (2394 students) and significantly lower than the college success rate of 63.7% (8585 students).

The retention rate of the demographic identifying as Hispanic had a retention rate of 70.1% for 2015-2016 which is a slight drop from

2014-2015 number of 72.6% and is lower than the division retention rate of 74.2 % and the overall college retention rate of 82.1%.

For the demographic identifying as Pacific Islander the percent success in 2015-2016 for the chemistry department was 55.6% (9 students), which is a drop from the value 66.7% (9 students) in 2014-2015 but it was a marked increase from the 2013-2014 value of 14.3% (7 students) for the chemistry department. The success rate 2015-2016 was higher than the division success rate at 52.5% (265 students) but lower than the college success rate of 66.6% (1203 students).

The retention rate of the demographic identifying as Pacific Islanders for 2015-2016 was 55.6% which was much lower than the retention rate of the previous year at 88.9% for 2014-15. The retention rate for 2015-2016 is significantly lower than the division retention rate of 76.2% and the overall college retention rate of 85.5%.

There has been a significant drop in the percent success of groups identifying as Black, Hispanic and Pacific Islanders. This drop in success values is also reflected in a lower retention rate for those demographics. Efforts to improve success rates and retention rates are a major focus for the department. The Division has been awarded an HSI STEM grant which will be used to improve the success rates of underserved students. The department is looking forward to being actively involved in this initiative.

2. Discuss any differences in student success indicators across modes of delivery (on-campus versus distance education). Refer to Delivery Mode Course Comparison.

CSM Chemistry courses are only offered on campus. Every class has a laboratory component which must meet , face to face. The experimental class CHEM100 was offered in Fall 2015 as an on-line lecture class but was discontinued as the class did not have a significant audience.

At this time, every chemistry course is either using WebACCESS or CANVAS in addition to other web-assisted technologies. Faculty are increasingly using online technologies to enhance their classes: video recording of live lectures, pre-recorded laboratory demos for lab experiments, online homework systems and use of WebAccess for posting lecture materials, assessment, communication and grading. There is a definite cultural change in the way students expect and sometimes directly request such resources. Significant progress has been made to make more materials are available on-line for both faculty and students to ensure that students receive a more consistent experience in all of our classes. The move towards more classes being taught by adjuncts necessitates effective communication and easily accessible resources for the faculty. To do this the department has been making greater use of technology and plans to continue with this effort in our future plans.

C. Program Efficiency Indicators. Do we deliver programs efficiently given our resources?

Summarize trends in program efficiency as indicated in the Student Success and Core Program Indicators (LOAD, Full-time and Part-time FTEF, etc.)

The three-year average LOAD using Fall, Spring, and Summer sessions is now at 579 (WSCH/FTEF) with the latest data available for summer 2015. This number exceeds the state productivity and efficiency number of 525 (WSCH/FTEF). Overall, these measures of program efficiency do suggests that the CSM Chemistry department has seen a drop in LOAD over the past 3 years compared to the average from 2011-2013 where the average LOAD was 635 (WSCH/FTEF). The drop in LOAD is a trend that is reflected for the college and the division. Despite the downward trend in the department's average LOAD, the average LOAD numbers are still higher than the Math Science division average LOAD at 521 (WSCH/FTEF) and the the College average LOAD at 506 (WSCH/FTEF) and reflect the large loads that the chemistry faculty typically have.

Adjunct FTEF has increased around its three-year averages. In 2013 the average FTEF for faculty was 60% full time faculty to 40% adjunct compared to 2015 where the average FTEF for faculty was 46% full time faculty to 54% adjunct. The FTEF values for 2015 were measured before one of our full time faculty retired, meaning that going forward an even larger majority of the chemistry classes will be taught by adjuncts and this must be taken into account for the departments future plans.

The high average LOAD for the full time faculty and FTEF values showing that the full time faculty will have even more non-teaching

responsibilities presents challenges for the implementation of departmental plans and must be taken into account.

The Biology, Chemistry and Physics departments have coordinated the scheduling of the major courses so that students have a clear path to scheduling their required classes efficiently. Fall 2016 is the first semester where the classes are being run using the new schedule.

3. Additional Factors

Discuss additional factors as applicable that impact the program, including changes in student populations, state-wide initiatives, transfer requirements, advisory committee recommendations, legal mandates, workforce development and employment opportunities, community needs. See Institutional Research as needed.

After studying the information on the Institutional Research web-page a number of interesting factors can be identified:

- 0.3% of CSM students declared chemistry as a major in fall 2012, but greater than 50% of CSM students identify transfer as a goal. This confirms faculty observation that, while there are not many chemistry majors, sections fill quickly and so load is high
- CSM's percent of total district enrollment has declined from 50% in fall of 1985 to 37.1% in 2012. Faculty have observed anecdotally that more students are taking classes at 2 or more colleges. CSM is not their sole educational choice.
- Among the top 50 county employers you find companies like Tesla, Applied Materials Inc., and Lawrence Livermore Laboratories. Among the top 50 occupations in the county you find nursing and healthcare (job increase projection of 22% from 2011 to 2017), healthcare technicians (job increase projection of 14%) and life scientists (job increase projection of 7%). While there are many other examples, all these employers and each of the job categories require knowledge of chemistry, though not necessarily a chemistry degree.
- The 4th and 5th most popular majors declared by incoming students are nursing and biology. A strong background in chemistry is required for both of these majors.
- Better than 50% of students taking the placement exams place into basic skills mathematics. An interesting thing about chemistry is, chemistry homework problems are actually a very prescribed set of word problems in mathematics. As students struggle with traditional mathematics courses, their struggles are also reflected in chemistry.

4. Planning

A. Results of Program Plans and Actions

Describe results, including measurable outcomes, from plans and actions in recent program reviews.

Plans to improve the health and safety of the stock room and the laboratories were implemented and completed in the spring and summer of 2016. Vented chemical storage cabinets were installed as well as two new six foot fume hoods in the two general chemistry laboratories. Faculty have reported that the extra fume hood space improves efficiency of the setup and execution of the experiments and has a direct impact on the safety of the class room when working with hazardous materials.

A new Infrared spectrometer was purchased by the end of the 2015-2016 academic year. The acquisition of this new instrument has helped with student throughput efficiency in the laboratory. The new instrument is designed to be robust and should require minimal maintenance which will satisfy our intention to optimize or efficiency and resources.

A new oven and new milligram balances were purchased in 2016. The balances in particular are essential tools in the laboratory and are heavily used. The purchase of new laboratory equipment meets our departmental goal of providing high quality tools for the students to use and learn from as well as ensuring efficient planning and use of resources going forward.

SI was successfully introduced into general chemistry 210 classrooms and the OChem 231 classroom. Preliminary data has shown that the introduction of SI is directly impacting student success in their classes. Plans to continue the SI program and expand it into other Chemistry classes are being put into place for the future. The downward trend in % success must be addressed and SI has been identified as an effective and direct way in which to impact this.

The purchase of 40+ google chromebooks has clearly been shown to be a success and the ease of access to on-line tools means that more faculty are willing to use them as an integral part of their teaching. These computers provide near instant access to our students to such web assets like WebAccess. Furthermore, due to these devices being thin clients (i.e. no software/OS/hardware) that may become damaged or in need of expert configuration – these units have had 100% uptime. The introduction of this technology has increased access to on-line tools that would normally be used as out of class resources such as homework and study packages. It is now possible to use these powerful tools in a classroom setting as all students can have access to the technology at one time.

The MeasureNet laboratory system had multiple major components replaced and is now stable and working satisfactorily. It is hoped that the department's move to make the MeasureNet system more robust means that it will be be low maintenance and reliable for the foreseeable future.

In response to the college's documented need for a focus on student success faculty are involved in programs designed to directly improve student success. Catherine Ciesla is continuing to use tools learned from district-wide Reading Apprenticeship (RA) program in her classes as well as incorporating SI instruction into the first semester organic chemistry class. It is hoped that using SI instruction in the second semester organic chemistry class may be possible going forward. Yin Mei has begun to introduce elements from the "flipped-classroom" approach to a 410 class with the introduction of frequent self-assessment as part of her pedagogy. As well as working on the content of the Chem 410 class, Yin Mei has also incorporated SI instruction into her classroom and is enthusiastic about expanding the program. No data is yet available, but student feedback is highly encouraging of this method of content delivery. Chemistry faculty are actively involved in the Integrated Science center with two full time faculty members holding their regular office hours in the center.

B. Future Program Plans and Actions

Prioritize the plans to be carried out to sustain and improve student success. Briefly describe each plan and how it supports the CSM Strategic Goals 2013/14 to 2015/16. For each plan, list actions and measurable outcomes. Plans may extend beyond a single year. Describe the professional activities and institutional collaborations that would be most effective in carrying out the program's vision to improve student learning and success.

As a department, our vision for the program over the next three years is in line and supportive of the college mission statements and institutional priorities.

Plan: Targeted and centralized curriculum

Having resources available on a centralized location leads to a faculty who are efficiently prepared with materials that we as a department have approved as being of the highest quality and responsive to the needs of our varied and diverse group of

students(IP1, IP2, IP3). It also moves us towards providing a consistent experience for our students so that they can expect a similar high quality experience with all of our instructors.

The faculty plan to continue the development of general chemistry materials primarily for the classes of Chem 210 and 220, 231 and 232. Assessment of the laboratory offerings for Chem 410 and Chem 192 are also planned. This satisfies requirements of our Institutional Priorities (IP3:development of responsive high quality services, IP2: Promote academic excellence, IP1: Improve student success)

The faculty will create model courses of each course offering that will be placed on WebAccess as a centralized resource. This resource satisfies requirements of our Institutional Priorities (IP3:development of responsive high quality services, IP5: efficient use of resources)

These plans are already in progress. For general chemistry classes a move toward open source text books have been made to minimize the reliance on expensive publishers material therefore minimizing costs to our students. Given the scope of the project (curriculum development, organization of materials and training and support of adjuncts) and that it is being done by faculty who are typically working overloads, it will take a long term commitment from the department to realize this goal and progress has been slow but steady.

Action: Continue the curation of chemistry course content and resources to a central cloud based solution.

Outcome Fall 18: Core course materials can be accessed for all chemistry class offerings on a central accessible site.

Plan: Expansion of Supplemental Instruction into our classes (SI)

Supplemental instruction (SI) has been introduced into Chem 210 (first semester general chemistry) and Chem 231 (first semester organic chemistry). The inclusion of SI was based on strong evidence that the integration of the SI model significantly improves student success in the student's courses. Based on our trending success % numbers, especially for under represented students, this is a priority of the department and the division. We plan as a department to expand SI leaders to more broadly in the chemistry department. We hope to participate in the HIS STEM grant awarded to the division as a vehicle to support the expansion of the SI program.

This satisfies requirements of our Institutional Priorities (IP2:Promote academic excellence, IP1: Improve student success)

Action:

Recruit SI leaders and prepare faculty for the inclusion of SI in their classes.

Liaise with the learning center with regard to training of SI leaders and faculty for the effective roll out of the program expansion.

Outcome Fall 18:

Assess and compare success % and retention % rates in chemistry classes with and without SI. We anticipate seeing a demonstrable improvement in our numbers.

Plan: Training and support of adjunct faculty.

With the FTEF shifting toward the majority of our classes being taught by adjunct faculty, it is becoming more and more important for us to ensure that our adjuncts are trained and supported in the latest teaching methods. Training that is less content focused and more students learning focused, allows us to prepare better teaching materials and better serve our students in how we communicate with them within our virtual and physical classroom. In the next three years our aim is to continue to increase the number of faculty members who participate in student focused training programs with a view to incorporating methods into their teaching. As we move towards CANVAS as a college, the adjunct faculty will need help and support to make that transition.

The department currently has a group of adjuncts that are very committed and experienced and are very self-sufficient, however as a result of reviewing and implementing changes to our curriculum it has become clear that our adjuncts require more communication and support of these changes and new expectations. Our adjuncts are working at multiple schools that use multiple formats for content delivery and this inevitably leads to inertia around adopting new practices. Jeff Flowers has initiated one on one meetings

with individual faculty to get them up and running on cloud based solutions but the process takes time and a great deal of work on the part of both parties. The development of effective communication between full time and part time faculty is proving to be essential as our people are our most valuable resource and it is important that they are employed effectively and their time used efficiently (IP5).

Action:

Schedule training meetings with adjuncts on using cloud based tools.

Encourage adjuncts to participate in student centered trainings.

Obtain regular feedback from adjuncts in the form of surveys or meeting minutes.

Outcome Fall 18:

All adjunct faculty will be transitioned to an on-line platform for their content delivery, will have centralized resources and will have SI instruction in their class.

Meetings with all the adjuncts should take place at least twice a semester.

5. Program Maintenance

A. Course Outline Updates

Review the course outline update record. List the courses that will be updated in the next academic year. For each course that will be updated, provide a faculty contact and the planned submission month. See the Committee on Instruction website for course submission instructions. Contact your division's COI representatives if you have questions about submission deadlines. **Career and Technical Education courses must be updated every two years.**

Courses to be updated	Faculty contact	Submission month
Chem 220	Jeff Flowers	Fall 2020
Chem 231	Catherine Ciesla	Fall 2016
Chem 232	Catherine Ciesla	Fall 2016

The TBAs have been removed from all chemistry courses.

B. Website Review

Review the program's website(s) annually and update as needed.

Faculty contact(s)	Date of next review/update
Jeff Flowers	December 2017

C. SLO Assessment Contacts

Faculty contact(s)	Date of next review/update
Chem 210 Jeff Flowers	Fall 2017
Chem 220 Jeff Flowers	Spring 2017
Chem 192 Jeff Flowers	Fall 2017
Chem 231 Catherine Ciesla	Fall 2017
Chem 232 Catherine Ciesla	Spring 2016
Chem 410 Yin Mei Lawrence	Fall 2017
Chem 420 Yin Mei Lawrence	Spring 2017

6. Dominant Themes Summary for IPC

Briefly summarize the dominant, most important themes or trends contained in this program review, for division deans to collect and forward to the Institutional Planning Committee. What are the key program issues that matter most? (Brief paragraph or bullet points acceptable).

1. A need to focus on programs that will directly impact student success and retention.
2. New teaching methods (flipped classroom, on-line homework, use of SI or tutors)
3. Incorporation of technology in the classroom (Chrome books, on-line resources).
4. Centralized resources for all faculty for course content and institutional memory purposes.
5. Improve communication between full time and adjunct faculty.
6. Working with the learning center (e.g. SI instruction and tutor selection) to effectively implement programs that will directly impact student success.