

2023-24 Program Review

Program Name: Chemistry
Program Contact: Jeff Flowers
Academic Year: 2023/24
Status: Active
Updated on: [2023 Sep 29](#)

INTRODUCTION: WHAT IS PROGRAM REVIEW FOR?

The goal of program review is to assess how well our programs are doing. Program review asks us to:

- Reflect on the state of student learning or support in our disciplines and programs, by discussing:
 - efforts to achieve equity across student populations and modes of delivery;
 - results of assessment activities aimed at improving or researching student learning;
 - new challenges or changes to the program.
- Identify resources that we need to change and improve.

Though program review is tied to accreditation, ultimately, we want program review to be meaningful for us. This means we want to use program review to highlight and celebrate what is working, identify what isn't and to figure out what we can do about it. Program review also provides an opportunity to assess how those things work in practice, and work to improve our practices to be able to serve our students even better. It also serves to create cross-campus understanding and dialogue and make more informed decisions in our teaching and programs. Program review is also an opportunity to advocate for change and for resources by showing need and equity issues that we need additional support to be able to address.

1. Description of Program (200-400 words)

- Provide a brief description of the program and how it supports the following:
 - [CSM Mission and Values Statements](#)
 - [CSM Statement of Solidarity](#)
 - [CSM's Strategic Priorities](#)
 - [SMCCCD's Strategic Goals](#)
 - [CSM Forward 2028 - Education Master Plan](#)
- Identify any factors, including federal, state, or local initiatives, that have impacted the program and the students served

The Department of Chemistry endeavors to cultivate an environment characterized by dynamism, robust support systems, and intellectual invigoration. Chemistry courses serve as fundamental prerequisites for numerous academic majors, underscoring the pivotal role this discipline plays within our institution. Furthermore, fostering interdisciplinary collaboration remains a pivotal and integral facet of our department's mission, equipping our students with the requisite skills and readiness to excel in their forthcoming academic endeavors.

Specifically, CSM Chemistry serves:

1. First two years of chemistry required for a baccalaureate.
2. Courses required for certificates in programs like nursing, dental, and technologist.

These align with the Board of Trustees' Core Value of a Student-Centered, and CSM's Mission and Values Statements.

The faculty is consistently engaged in the development and implementation of curricular enhancements aimed at advancing student success and mitigating equity disparities. A case in point is the integration and utilization of Supplemental Instruction (SI) programs, along with the cultivation of robust affiliations with student support services such as [MESA](#) and [METaS](#). The incorporation of SI aligns strategically with our institutional objective of expanding access to academic support resources, thereby facilitating overall departmental enhancement, consonant with the overarching strategic goals of College of San Mateo (CSM). We meticulously assess instructional materials, manuals, and traditional in-person curriculum models, thereby fostering greater inclusivity and efficiency.

CSM's Solidarity Statement has served to catalyze interdepartmental dialogues regarding the adoption of a multicultural perspective in the development of our pedagogical materials. Faculty members are encouraged to incorporate, where appropriate, illustrative instances that commemorate the accomplishments of a diverse array of individuals. Furthermore, in select courses, students are now mandated to procure, with the assistance of our Library, an additional 'secondary' textbook, preferably one that is readily accessible, mirroring the student's unique identity and perspective. This initiative is geared towards fostering a more inclusive and personalized learning experience.

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The department consistently seizes upon available professional development (PD) opportunities, exemplified by initiatives such as "Reflecting on the Student Experience at CSM" and "Creating Equity in the Classroom." These training sessions play a pivotal role in fostering faculty growth and comprehension, enabling the integration of inclusive language and practices aimed at establishing an accessible and culturally proficient classroom milieu. The Distance Education (DE) [QOTL II training](#) has significantly augmented and fine-tuned our pedagogical offerings. Looking ahead, there is an emerging need for personalized and individualized approaches to further advance our instructional competencies.

Finally, it is imperative to acknowledge that the department has been functioning in an unconventional manner over the past few years, and only in the recent half-year have we experienced a return to conventional operational procedures. The reintegration into traditional classroom settings has proven to be a challenging endeavor, marked by numerous false starts and unorthodox adaptations. As a collective entity, the department continues to grapple with the process of acclimating to the evolving academic landscape, a situation mirroring the experiences of many other academic institutions. In the interim, it is paramount to recognize, and give due consideration for the demands placed on CSM Chemistry's transitional phase.

2. **Results of Previous Program Review (200-500 words)**

a) Describe the results of your previous Program Review's action plan and identified equity gaps.

- [Previous Goals](#)
- Results Achieved
- Changes Implemented
- Plans still in progress
- Any notable or surprising results and outcomes

Analysis of Equity Gaps:

The chemistry department has worked and continues to work closely with a number of student support services, such as: MESA and METaS. This work includes the selection of tutors, as well as close working ties with out of classroom activities. Chemistry has helped promote and support the [Science in Action series](#), (STEM@CSM) and intends to continue doing so going forward. This series has brought outside voices and talent to all our students' attention.

Chemistry continues to work closely with these organizations well into the future, as they provide additional value to our students and the department as a whole.

Training and Support of Adjuncts:

The rapid transition to online and hybrid modes of course delivery represents a persistent and multifaceted challenge within our educational landscape. While the district has undertaken notable efforts to provide a plethora of professional development (PD) opportunities to help, it becomes increasingly evident that additional measures are needed. It is critical to acknowledge that not all faculty members possess, or will attain, a commensurate level of proficiency in navigating these digital pedagogical tools. Consequently, a comprehensive and critical evaluation of the efficacy of these modalities in meeting the diverse needs of our student body becomes imperative.

Moreover, it is paramount to underscore the pressing need for supplementary support, particularly directed towards adjunct faculty members, who may grapple with distinct challenges when adapting to the intricacies of online and hybrid instructional formats. The indispensable contributions of these faculty to our institution underscore the urgency of providing bespoke professional development initiatives and resources, aimed at facilitating the seamless incorporation of these modalities into their praxis. By prioritizing the provision of targeted support and specialized training, we can foster a more inclusive and equitable educational environment that benefits both our faculty and, most importantly, our students.

[OOTL](#) II will be completed by all this semester, more is still needed. Lastly, the district needs to provide additional technology hardware to all faculty - regardless of their full/part time status.

Incorporation of Anti-Racism Statement:

CSM Chemistry has drafted an anti-racism statement that is to be incorporated into our website. There have been a number of pressing technological challenges that have required priority attenuation, such as working with ITS and continued PD efforts for online/hybrid courses for many of our classrooms. Still, there will be a push to see if this can be put on CSM Chemistry's website via working with ITS and relevant parties.

- b) Explain any curriculum or programmatic changes since last program review
 - To specific courses, or to any discipline as a whole
 - Includes degree, certificate, or course sequences, program delivery or structure, etc.

There has been the creation of late start and short courses added for our general and allied health chemistry students. These include classes in which in person labs are carried out in an open manner and over the weekend. This allows for greater flexibility for students to fit within their schedules.

c) Discipline-level and SLO (Student Learning Outcomes) assessment/Student Services and SAO (Service Area Outcomes) assessment: Describe learning or area assessment plans implemented since last Program Review, including any activities undertaken to address equity or delivery mode gaps. Your summary should explain:

- SLO/SAO
 - What did the assessment focus on?
 - Was it discipline/program/service-specific or interdisciplinary/a collaboration between programs or services?
 - Why was it prioritized (e.g., equity issue, key disciplinary issue, etc.)?
- Assessment results
 - What was the activity or intervention?
 - What were the outcomes?
- Program improvements implemented
 - What did you learn from it?
- What changed?

The research question that we focused upon was on the use of blended or hybrid courses at CSM Chemistry. Briefly, the presentation of this study and results can be found in the following [slide deck](#)¹. With a more detailed analysis provided in the following [document](#)².

The reason our focus around content delivery via hybrid (blended) modalities was due to the ever increasing request for more of these types of classes by administration. The research question we sought to address was: *are hybrid classes promoting student success?*

In order to unpack this question, we employed a mixed methods approach. Mixed methods research combines both qualitative and quantitative research techniques within a single study. It seeks to provide a more comprehensive understanding of a research problem by integrating the strengths of both qualitative exploration and quantitative measurement and analysis.

Quantitative data was in the form of a single chemistry class offered recently. This class was unique as it had three sections, with three different modalities utilized but otherwise identical. This allowed for an unprecedented controlling of confounding variables other than the delivery type. Test scores appear to point to the need for in person content delivery, as those students that only relied upon online materials consistently underperformed.

As for the qualitative portion, full time faculty were asked to write their attitudes and perceptions around the use of blended instructional delivery at CSM. They were given a general topic and there was no set structure given for their responses. The goal behind this approach

¹ https://docs.google.com/presentation/d/17_Uf6ga5jJgtIOBsZEKopVmLsLhuSAsElhQKwA9OcmM/edit?usp=sharing

² https://docs.google.com/document/d/1FUtWdgLPmJcPTm3ba7a2lC49CSUHNfK3Y1pW63_Koxs/edit?usp=sharing

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was to arrive at a personal analysis, free of external bias as best as one could be. All faculty responses were then thematically analyzed using Grounded Theory via a large language model to further control for personal researcher bias. Whilst there were some common positive themes to emerge, such as flexibility of scheduling, there appears to be in general negative feelings towards these delivery modalities with regard to promoting student success.

More research is necessary, and future endeavors are to be centered next on student perspectives. Some ideas are to use pre-validated survey instruments as well as focus groups. This line of study will be deployed in our next SLO analysis.

3. Current Program Review (200-400 words)

Please use the statistics below, which are college-wide, as a reference. Please refer to the Program Review website for individual program data.

College Stats 2022-23	Ethnicity	First Gen	Age	Gender	Total
Headcount (unduplicated)	Latinx 32% White 26% Asian 20% Filipino 7% Multiracial 7% Black 3% Pacific Islander 2% Unknown 3% Native American 0%	45% of our students are the first in their family to go to college.	66% 24 yrs. and under 18% Ages 25-34 17% over 35 yrs.	49% Female 48% Male 3% Non-disclosed or non-binary	13,180 students
Enrollments (duplicated)	Latinx 35% White 26% Asian 16% Filipino 6% Multiracial 8% Black 3% Pacific Islander 3% Unknown 3% Native American 0%	47% of enrollments were by students who are the first in their family to go to college.	76% 24 yrs. and under 13% Ages 25-34 11% over 35 yrs.	48% Female 50% Male 2% Non-disclosed or non-binary	37,014 enrollments

- a) **Student population equity:** Discuss any gaps in student success, persistence, satisfaction, utilization or enrollment across student populations (statistics provided for ethnicity, first-generation, age, gender and total enrollment), or student population served.
- Findings: What has changed from the previous program review?
 - Analysis: What factors do you feel contribute to these gaps?
 - Resources: If you were granted a resource request, please note what that was and the impact it had.
 - Plans to address opportunity gaps: What has your program done to address these gaps? Include information on:
 - interventions implemented
 - any successes in closing gaps
 - ongoing challenges

We see that the prior uptrend from our last program review has been replaced with one that shows a decline across the metrics of *success*, *retention*, and *withdrawal rates*, see Figure 1. The uptrend that was seen in our prior program review came with a number of caveats such as, PRIE's explicit warning that the data was itself highly skewed due to the emerging pandemic. It should be noted that chemistry faculty expressed growing concerns around student readiness with technologies beyond those best described as being highly [opinionated](#). In other words, faculty felt that students were being thrown into situations with which they did not have the comfort with the tools in order to be successful.

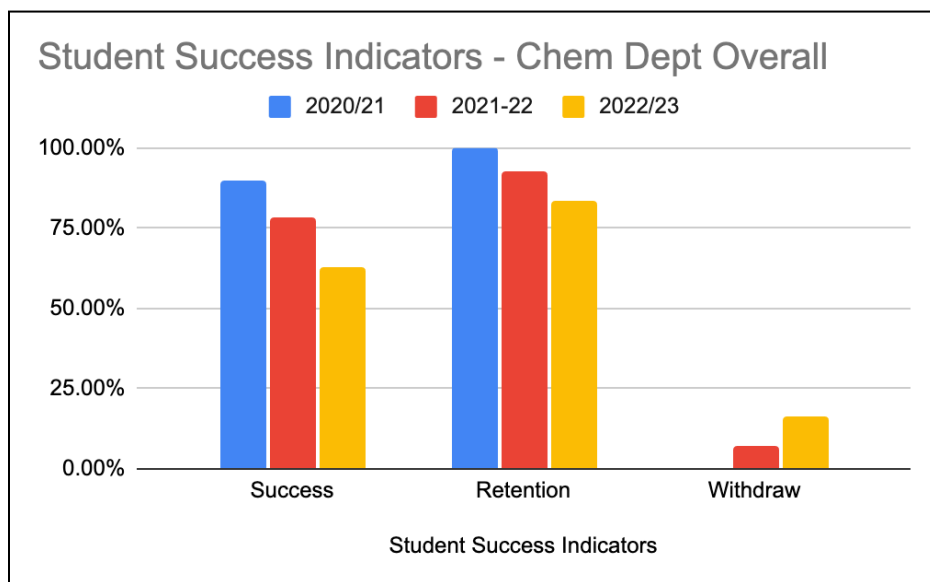


Figure 1. Chem Dept Student Success Indicators ([Source](#)).

Students are still having a hard time negotiating and navigating college chemistry. Some of the challenges rest in the use of technologies that abstract away focus on one being present and surrounded with other learners. This is negatively impacting the formation of communities of learning and support. Also, many faculty see students having an over reliance upon their smartphones instead of general purpose tools like chromebooks. This is even when the student has both of these in hand, many still attempt to use their smartphone to accomplish complex tasks that a full sized keyboard would be better suited for. There is a technology mismatch still, and a general misunderstanding of the role of these tools towards meaningfully connecting with the materials and between one another.

Chemistry continues to work extremely closely with MESA and METaS to address student needs. Looking at enrollments, Figure 2, we see that our Latinx (labeled Hispanic in the source data) comprises our largest community by far at 33.4% as of the 2022/23 academic year. These figures are not a surprise, as College of San Mateo is a [Hispanic-Serving Institution](#) (HSI). What is of note, as seen in Table 1, is the demonstrative proof that MESA and METaS programs are being highly effective at achieving their goal around retention via additional student support services.

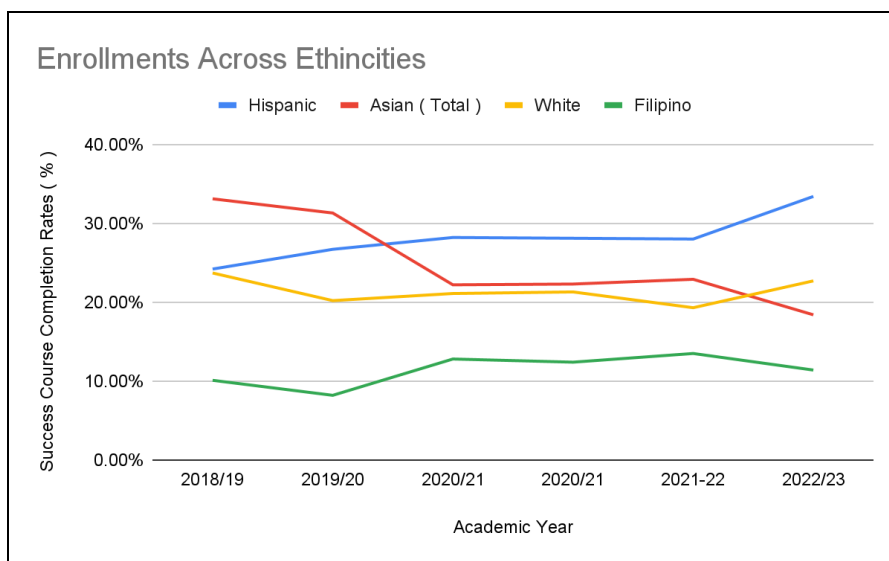


Figure 2. Enrollment as a percentage, top 4 categories (Source).

It should be additionally noted that Table 1 may demonstrate a possible downtrend forming in success measures for Latinx students. That trend is one of decline in both success and retention metrics.

	2018/19	2019/20	2020/21	2021-22	2022/23
Success	58.20%	70.50%	84.50%	76.60%	48.70%
Retention	76.80%	83.20%	100.00%	93.80%	78.30%

Table 1. Latinx Success and Retention (Source).

We see success and retention values peaked during 2020/21 and then decline afterwards. Chemistry will continue to work closely with MESA/METaS, communicating these trends and see if resources and/or additional services may be brought to bear to address what the data is showing.

A trend that was first detected and reported in our last program review continues, that of declining enrollment in non-traditional (age-wise) students, please see Figure 3. The decline that faculty have seen in the past decade or so, mirrors regional trends³. This is in contrast to when nontraditional (age-wise) students were on the rise⁴.

³ [Can California community colleges lure older students post-pandemic?](#)

⁴ [Old School: College's Most Important Trend is the Rise of the Adult Student - The Atlantic](#)

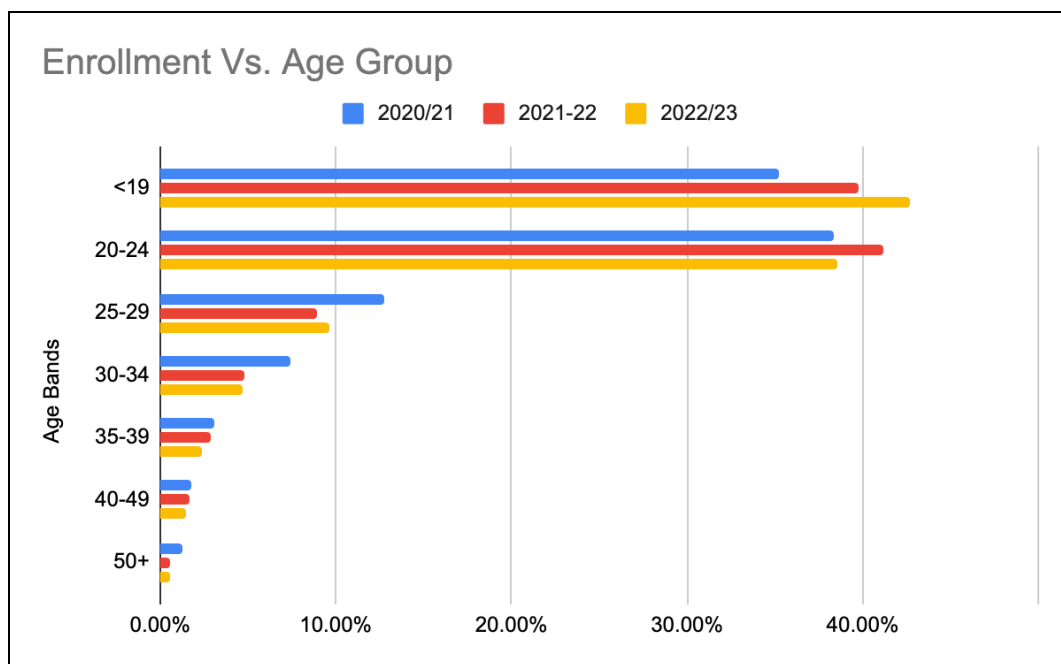


Figure 3. Enrollment as a function of age categories ([Source](#)).

In an effort to turn around this decline, chemistry had begun to experiment with late start/short classes to better suit our older working students. Though there is not enough data to make any definitive statement as to whether or not this intervention has or is being well received; speaking anecdotally with faculty we feel that these classes are helpful. One issue that persists though is around registration. As anyone can sign up for these, older students may not be as savvy in the college registration process and thereby lose out on these limited seats. It may be useful to reserve registration based upon age group, or make the process easier for working individuals that may have been out of school and not well versed in navigating the registration process.

Lastly, we had talked about the sustained and monotonically increasing number of students with disabilities, in our prior program review. This trend continues and we have made strides in streamlining how faculty interacts with CSM DRC. Chemistry feels more confident than ever in our abilities to provide content, via this department, in support of these students due in large part to the professionals that make up this department.

b) **Modes of Delivery equity:** Discuss any gaps in student success, persistence, satisfaction, utilization or enrollment, and student population served across different delivery modes. Please comment on in person services/instruction vs hybrid services options/instruction vs completely online services/instruction.

- Changes since last Program Review: What has changed, in terms of gaps, since last program review?
- Analysis of gaps: What factors do you feel contribute to these gaps?
- Plans to address opportunity gaps: What has your program done to address these equity gaps? Include information on:
 - interventions implemented
 - any successes in closing gaps
 - ongoing challenges

Considering the data provided regarding the modes of delivery, we have an overview as shown in Table 2.

	Face-to-Face (%)	Hybrid (%)	Synchronous (%)
Success	69.20%	55.90%	87.40%
Retention	87.20%	78.30%	99.10%

Table 2. Overall Dept. Success and Retention across modes of delivery ([Source](#)).

Table 2 suggests at first glance that Synchronous (Hybrid like) classes appear to have an edge with regard to either of these two metrics. However, it should be noted that the dataset includes years in which face-to-face classes were not offered at all at CSM. Therefore, we have to account for this systematic bias in the [raw data](#).

CSM has reopened its doors to our community and its students, just recently. Indeed Chemistry was told that we would not be permitted to offer in person classes this past summer due to construction, then having this decision reversed and then reversed again. We have not had any face-to-face classes over summer for nearly four years, and we have again been told that the upcoming summer (2024) may not be possible to offer in person classes. We are working with our administration to see if we can locate physical rooms to conduct these classes. Suffice to say, Chemistry has and is trying to re-engage face-to-face offerings as best as we can, given the current environment.

The department as a whole believes that in person classes help the most vulnerable of our students. Many have not had great prior experiences in Chemistry, or indeed any experiences at all. Watching “Chemistry” is not the same as doing Chemistry. Science is driven via empirical endeavors, and this means working with one’s mind and body.

Whilst we do not believe that we have high quality quantitative data with which to base any reasonable analysis, there is a general feeling amongst faculty (and the students we have spoken with) that blended learning is problematic for our field. Speaking only for the faculty, there are a number of issues that get in the way of the authentic learning of chemistry.

There is the question around engagement, science is a group activity best performed with others physically present to one another, especially for lab based activities⁵. Also, we feel that too many students apply ‘multi-tasking’, and are not adequately giving themselves proper time, attention and focus to be successful. This then requires the use of various ‘tools’ to get caught up, tools such as the many generative AI platforms that have come of age⁶. Whilst these have effectively destroyed other ‘platforms’, such as Chegg *as seen in their stock price this year*, there is tremendous abuse seen by all faculty.

Speaking about my personal experiences with a class offered last semester, I asked students in a hybrid class about their motivations and whether they would retake such a class. Those best described as being *good students* will do what good students do... do good in their classes. This group offered up what can only be described as an indifferent perspective. Students not already possessing great study skills, an understanding of learning styles to try, or lacked other resources struggled immensely in these types of classes. Whilst there was a great number of students in my hybrid classes that dropped, I was able to transition a number of these students into my face-to-face night class. This is how I was able to get such rich information. I should also note that once in person and seeing one another more regularly; I observed the formation of multiple study groups.

(c) Challenges and Opportunities: Describe any **other** particular challenges, opportunities, or other factors that impact the success of your program (e.g., natural or health disasters, assessing whether a degree program is meeting its learning outcomes, developing new degree programs or courses, adapting to a changing student population, keeping a flagging program alive, starting a learning community, resources, etc.).

The continued corporate focus around impact investing⁷ creates increasing opportunities for chemistry graduates. Impact investing is a financial strategy that aims to generate both financial returns and positive societal or environmental outcomes. It involves deploying capital into businesses, organizations, or projects that seek to address pressing global challenges while also delivering financial benefits to investors.

Impact investment continues to play a pivotal role in advancing environmental concerns by going beyond prior green efforts. It represents a shift from merely mitigating harm to actively seeking positive environmental outcomes, aligning financial incentives with sustainable practices, and fostering innovation in sectors where sustainability was overlooked or underfunded. All of this is to say, there is a need for the development and creation of novel chemical systems to support these capital outlays.

⁵ <https://anatomypubs.onlinelibrary.wiley.com/doi/full/10.1002/ase.2186>

⁶ <https://arxiv.org/abs/2305.00290>

⁷ <http://deepimpact.me/>

What started more than a decade ago under the California Green Chemistry Initiative⁸, have radically accelerated due to the private funding. More industries will need highly chemically competent individuals to support these efforts. CSM Chemistry needs to be provided the resources to continue offering these introductory classes for all Californians.

⁸ https://en.wikipedia.org/wiki/California_Green_Chemistry_Initiative

4. Planning

a) **Discipline-level and SLO (Student Learning Outcomes) assessment/Student Services and SAO (Service Area Outcomes) assessment for 2023-2025:** Describe learning or area assessment plans for this Program Review cycle, **including any activities planned to address equity or delivery mode gaps.** Your summary should explain:

- SLO/SAO
 - What will your assessment focus on?
 - Is it discipline/program/service-specific or will it be interdisciplinary/a collaboration between programs or services?
 - Why is it prioritized (e.g., equity issue, key disciplinary issue, etc.)?
- Assessment plan
 - What is the planned activity or intervention?
 - Describe next steps and the timeline for your SLO/SAO assessment
- Resources for SLO/SAO assessment
 - What resources will you need to assess changes (i.e., PRIE support in the form of specific data, surveys, etc.)?

SLOs/SAOs	Assessment Plan	Resources for SLO/SAO assessment
<p>1. Effectiveness of Hybrid courses on student success and retention of CSM Chemistry students.</p> <p>This study will be carried out throughout all of the courses offered by CSM Chemistry, and is focused on if and how best to deliver instruction for students.</p> <p>As CSM Chemistry has been asked to provide more hybrid offerings, we as a department would like to better understand the true impact they may be having on instruction and learning.</p> <p>Are these new class offerings serving all students in an equitable manner?</p>	<p>Mixed methods design of experiment (DOE) will be used.</p> <p>We will be using a pre-validated survey instrument to determine what quantitative data suggests around blended or hybrid classes.</p> <p>As well as engaging students via interviews and focus groups. These will provide context and be analyzed via qualitative techniques.</p>	<p>Chemistry may need resources to procure these instruments.</p> <p>As for the qualitative portion of this study, there are some questions around whether or not IRB will need to be engaged. Therefore, PRIE may need to give clarity around.</p>

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<p>This is really at the heart of the 'why' this focus and our desire to answer whether or not hybrid classes are a great fit for CSM Chemistry.</p> <p>We performed this analysis with a focus on limited data and through the lens of faculty based attitudes and perceptions. This will expand upon this work, and seek out student voices.</p>		
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b) Program goals

Based on your current review of your program’s equity gaps, learning assessments and challenges and opportunities, identify specific goals and plans. Please note that whereas SLOs/SAOs involve assessing and measuring a specific skill or knowledge students will be able to do/understand upon successful completion of a course, program, service, and/or degree/certificate, program goals reflect overall aspects of your program or service you hope to improve.

Please note that closing equity gaps is a College-wide priority. If there are significant equity gaps in student success, persistence, satisfaction, utilization or enrollment, and student population served in your program, these should be addressed in at least one of your goals (see 3a and 3b).

For each goal, you should include:

- A brief description of the issue being addressed (equity gap, etc.)
- What actions you plan to take
- What measurable outcomes you hope to achieve
- A timeline
- Who is responsible
- What support do you anticipate needing in order to achieve your goals and plans, including:
 - Professional development activities
 - Institutional support
 - Collaborations
 - Training
 - Resources

Goal	Actions	Measurable Outcomes	Timeline	Responsible Party	Support Needed
1. QOLT II for all faculty.	Have all faculty sign up for this training.	Have all faculty completed this training?	By 2024	Jeff Flowers	N/A
2. SLO study on Blended instruction via a student focused lens.	Complete and disseminate findings of this study to all faculty.	The creation of a deck of all found results.	End of 2024, Beginning of 2025	Jeff Flowers	Potential IRB support

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3. Family Science Day	Continue taking part in this annual activity	Having faculty and support presence	2024/25	Catherine Ciesla	Presenting using Professional Responsibility Points; however, we may need release time in the future.
4. REAL Lab	Applied for consideration into the program	Acceptance into the program	2024	Jeff Flowers	N/A
5. Chemistry Demos and Hands-On Labs	Chemistry needs to have our budget expanded. Inflation has been incredible of late.	Continue having high quality, hands-on labs for all classes offered at CSM.	2024	Yen Tran	Getting more funding for chemistry, to allow for future growth in hands-on labs. Whilst this has been formally requested in our Dept's resource request, it is of an existential threat and needs to be said here as well. <i>Inflation is real.</i>
6. Full time lab technician (half time biology and half time chemistry)	Enrollment has been consistent and increasing. Both department need extra help if this continue to offer more sections for students to sign up	Hiring another full time lab technician to help both departments as we are hoping to grow and expand	2024	Yen Tran and Kim Meyer	Please see full reasoning from the Resource Request from Yen Tran
7. <i>Integration of culturally appropriate content in OChem Class in order to</i>	Create new content	New Materials	2024/2025	Catherine Ciesla	None

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<i>Introduce more representation</i>					
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