

Program Review Comprehensive Report



Program Review - Instructional: Chemistry

Supplemental Reports and Attachments

2014 - 2017

Comments or Notes: NCB

Attachments:

[2014-17_CHEMISTRY_SLO_DISCIPLINE.pdf](#)

[2014_17_CHEMISTRY_CurriculumRPT.pdf](#)

[2014_17_CHEMISTRY_SuccessEfficiencyRetentionRPT.pdf](#)

[2014-17_INSTRUCTION_CHEMISTRY_ResourceRequests.xlsx](#)

Program Trends and Updates

2014 - 2017

Program Update Section

Has your unit shifted departments in the PAST 4 years?: The Chemistry discipline had been in the Department of Math, Sciences, and Kinesiology until 2017. However, it became the Department of Sciences and Kinesiology after Math split off to form its own department in January 2017.

Do you anticipate your unit will shift departments in the NEXT 4 years?: No

New certificates programs created by your unit in the PAST 4 years?: The Chemistry discipline established an Associates Degree for Transfer (ADT) agreement with all the Cal State University campuses in 2016, which remains in effect.

New certificate programs anticipated by your unit in the NEXT 4 years?: None

Substantial modifications made to certificates/degrees in the PAST 4 years.: None

Substantial modifications anticipated to certificates/degrees in the NEXT 4 years.: None

Activities in other units that impacted your unit in the PAST 4 years.: The increased number of total science classes offered in succeeding years and the growth in other departments has made it increasingly difficult to get properly equipped lecture rooms (e.g., rooms with periodic tables, adequate white board space, adequate projector space, etc.). This has forced the Chemistry faculty to teach lectures in both ill-equipped lecture rooms and labs where students have to work around chemicals.

Activities in other units that impacted your unit in the NEXT 4 years.: The Chemistry discipline looks forward to the administration providing better teaching facilities for chemistry classes. Improvement of instruction includes having proper lecture room design and equipment in a comfortable viewing platform that enhances student learning.

Previous Program Review Resource Requests

Resource Requests Received: (1) Supplies to maintain the Chemistry discipline's deionized/reverse osmosis (DI/RO) water system including:

- PreSystem PAK filters
- Progard TL1 CL2 W/O
- PE Tank Millipak Filter

These filtration packs are required for the proper functioning of the DI/RO water system, which is used in all chemistry lab courses taught at Norco College.

(2) Six visible (VIS) spectrophotometers for General Chemistry (CHE-1A/1B) that allow for sweep mode or single wavelength absorbance/transmittance determinations.

(3) A set of microscale glassware for the second semester Organic Chemistry (CHE-12B) lab drawers for each student.

(4) Replacement and repair equipment for the Introductory and General Chemistry (CHE-1A/1B) curricula

(5) Corrosive storage cabinet

(6) Overall budget increase from \$7,600 to \$20,341 in Fall 2015

(7) Third set of equipment to supply General Chemistry (CHE-1A/1B) lab drawers

(8) SPARTAN software site license

(9) New balances for Introductory Chemistry (CHE-2A) in room HUM 204

(10) A set of microscale glassware to supply second semester Organic Chemistry lab drawers

How did the resources received impact student learning?: (1) Having a steady supply of DI/RO water for all chemistry labs is one of the backbones of any experimental chemistry program. Without DI/RO water, aqueous standard solutions and other reagent solutions for chemical reactions cannot be made, which would be a crippling problem for the Chemistry program since these solutions are required in nearly every Introductory, General, and Organic Chemistry lab experiment conducted each semester. Upgrading the filtration system with this purchase increased the rate at which our tap water can be purified for use in chemical experiments.

(2) Visible spectrometry is routinely used in General Chemistry (CHE-1A/1B) classes. These new spectrophotometers replaced the very old Spec20 model instruments, many of which were in need of repair. Also, these new instruments have sweep modes for running multiple wavelengths in an automated manner, unlike the the Spec20 instruments.

(3) Purchased in time to launch the second semester of Organic Chemistry (CHE-12B) in the Spring 2016 semester at Norco College.

(4) This item involved the replacement/repair of routine equipment that was needed for the operation of General Chemistry (CHE-1A/1B) courses to ensure that students had the proper equipment for a safe and enhanced learning lab environment.

(5) This cabinet allows for the safe storage of corrosive chemicals and provides Chemistry faculty access to a greater variety of chemicals for expanding our experimental offerings to our students.

(6) This budgetary increase allowed more than a doubling of Chemistry course offerings in just a few years.

(7) Allowed General Chemistry (CHE-1A/1B) students to have their own glassware for lab courses instead of sharing their glassware with other students.

(8) Chemical modeling software is used to predict the three dimensional structures of compounds and is now routinely in Chemistry curricula. This software was used in the first semester of Organic Chemistry (CHE-12A).

(9) Modern balances with greater precision were purchased to labs replaced older lower precision instruments (including some in need of repair) for the Introductory Chemistry (CHE-2A) lab.

(10) Purchased in time to launch second semester of Organic Chemistry (CHE-12B) in Spring 2016 semester.

If you requested resources but did not receive them, how did that impact student learning?: ???

Program Data Highlights Section

Program Goal: Improve CHE-2A Lab Curriculum

Improve the CHE-2A lab curriculum to increase success rates for the course and enhance the student learning experience. This will include introducing more Green Chemistry principles and modifying or changing existing lab experiments. It will also allow key concepts to be better reinforced and practiced and make the lab environment safer and healthier for our students. Some specific tasks linked to this goal include:

- updating and altering current 1st semester Introductory Chemistry (CHE-2A) experiments to increase clarity and minimize

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waste and hazardous chemicals,

- incorporating pre-lab and post-lab questions so that students are better prepared for the lab (safety, conceptual, and procedural questions).
- aligning the lab content with lecture content to increase student understanding and success.

Goal Status: In Progress

Goal Year(s): 2018 - 2021

How do your goals support the Educational Master Plan?: Goal 1 Objective 1

Goal 1 Objective 6

Goal 2 Objective 1

This Program Goal Supports the selected EMP Goal(s) and Objective(s): Goal 1 Objective 1: Improve transfer preparedness (completes 60 transferable units with a 2.0 GPA or higher).

Program Goal: Improve CHE-1A Lab Curriculum

Improve the CHE-1A lab curriculum to increase success rates for the course and enhance the student learning experience. This will include introducing more Green Chemistry principles and modifying or changing existing lab experiments. It will also allow key concepts to be better reinforced and practiced and make the lab environment safer and healthier for our students. Specific activities in this area include:

- updating and altering the current 1st semester General Chemistry (CHE-1A) experiments to increase clarity and to minimize wastes and hazardous chemicals.
- incorporating pre-lab and post-lab questions so that students are better prepared for the lab (safety, conceptual, and procedural questions).
- aligning the lab content with lecture content to increase student understanding and success.

Goal Status: In Progress

How do your goals support the Educational Master Plan?: Goal 1 Objective 1

Goal 1 Objective 6

Goal 2 Objective 1

Program Goal: Improve CHE-1B Lab Curriculum

Improve the CHE-1B lab curriculum to increase success rates for the course and enhance the student learning experience. This will include introducing more Green Chemistry principles and modifying or changing existing lab experiments. It will also allow key concepts to be better reinforced and practiced and make the lab environment will also be safer and healthier for our students. Specific activities in this area include:

- updating and alter current 2nd semester General Chemistry (CHE-1B) experiments to increase clarity and to minimize wastes and hazardous chemicals,
- incorporating pre-lab and post-lab questions so that students are better prepared for the lab (safety, conceptual, and procedural questions), and
- aligning the lab content with lecture content to increase student understanding and success.

Goal Status: In Progress

Goal Year(s): 2018 - 2021

How do your goals support the Educational Master Plan?: Goal 1 Objective 1

Goal 1 Objective 6

Goal 2 Objective 1

This Program Goal Supports the selected EMP Goal(s) and Objective(s): Goal 4 Objective 1:

Program Goal: Begin Offering CHE-3 at Norco College

Offer the CHE-3 lecture and lab course for the first time at Norco College and continue offering it in succeeding years. This means developing both lecture and lab curricula appropriate for science majors in need of a one-semester Chemistry Fundamentals course to prepare them for the 1st semester of General Chemistry (CHE-1A). The lab will include Green Chemistry principles whenever possible to save costs and provide a safer and healthier environment for students. This activity is on hold until more full-time Chemistry faculty are hired.

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Goal Status: On Hold

Goal Year(s): 2018 - 2021

How do your goals support the Educational Master Plan?: Goal 1 Objective 1

Goal 1 Objective 6

Goal 2 Objective 1

Program Goal: Begin Offering CHE-2B at Norco College

Offer CHE-2B at Norco College. (While CHE-2B is currently taught in RCCD, it is not offered at Norco College.) This means developing both lecture and lab curricula appropriate for Allied Health students in need of the second semester of Organic Chemistry and Biochemistry Fundamentals (CHE-2B) for their career paths. The lab will include Green Chemistry principles whenever possible to save costs and provide a safer and healthier environment for our students. This activity is on hold until new full-time Chemistry faculty are hired.

Goal Status: On Hold

Goal Year(s): 2018 - 2021

How do your goals support the Educational Master Plan?: Goal 1 Objective 1

Goal 1 Objective 6

Goal 2 Objective 1

Program Goal: Begin Offering General Chemistry As An Honors Course (CHE-1AH) At Norco College

Offer the 1st semester General Chemistry as an honors course (CHE-1AH) within the next few years. (While CHE-1AH is currently taught in RCCD, it is not offered at Norco College.) This course will include advanced lecture and lab content relative to CHE-1A. The Chemistry discipline anticipates offering one section of this course per semester. This activity is on hold until new full-time Chemistry faculty are hired.

Goal Status: On Hold

Goal Year(s): 2018 - 2021

How do your goals support the Educational Master Plan?: Goal 1 Objective 1

Goal 1 Objective 6

Goal 2 Objective 1

Program Goal: Develop Videos to Teach Lab Techniques

Develop a series of videos that teach lab techniques to enhance the student learning experience and provide increased instruction in key aspects of experimental chemistry. These videos will span a range of difficulty to accommodate students with different levels of lab experience and expertise. They will also stress safety, lab techniques, and experimental methodology. It is anticipated that the videos will be made available to all Norco College chemistry instructors for their use and will also be posted to a secured site for more wide-spread viewing outside of classes. This activity is on hold until new full-time Chemistry faculty are hired.

Goal Status: On Hold

Goal Year(s): 2018 - 2021

How do your goals support the Educational Master Plan?: Goal 1 Objective 1

Goal 1 Objective 6

Goal 2 Objective 1

Goal 7 Objective 5

Program Goal: Reducing Class-Size Caps for General and Introductory Chemistry Courses at Norco College

The Chemistry Discipline at Norco College is seeking to lower the lab capacities (lab caps) of its Introductory Chemistry and General Chemistry courses from 32 to 24 students citing safety concerns for faculty and students. Chemistry lab classes are unique in that faculty have to be constantly vigilant and available to all students to create a safe and optimal learning environment. However, it is very difficult to ensure that safety and effective learning take place in lab class environments of 32 students. Thus, the Norco College Chemistry faculty have two major safety concerns with regard to the college's current lab caps: 1) the ability of instructors to oversee and manage the number of students in a lab class and 2) the amount of individual workspace provided to each student.

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The American Chemical Society (ACS) provides guidelines for lab safety. The ACS is the largest scientific society in the world and the largest professional society for those who work in the chemistry field worldwide. Thus, the ACS is viewed as the authority for all chemistry-related things. In this regard, the "ACS Guidelines for Chemistry for Two-Year College Programs" recommends that academic laboratory classes have no more than 25 students to provide an optimal educational experience that minimizes overcrowding and maintains a safe working environment.

The National Fire Protection Association (NFPA) also provides guidelines for optimal workspace for students in lab classes. The NFPA is a leader in knowledge and resources regarding fire- and hazard-related issues and prevention. In its "Life Safety Code 101-2012 Occupant Load Factor" for educational science labs, the NFPA recommends that each student in an educational lab environment have at least 50 square feet of net work space (net work space is work space that excludes lab tables and benches). We estimate that each student in our Introductory Chemistry lab room has about 24 square feet of net work space and each student in the General Chemistry lab room has about 35 square feet of net work space, which are far below the NFPA safety guidelines.

There is strong evidence that lower lab caps are correlated with a safe lab environment. For example, the National Science Teachers Association published "Overcrowding in the Instructional Space" with data collected from 199 secondary public schools in 2001 on overcrowding in academic lab classes.⁴ While this study used data from middle and high school lab classes, it's likely that the trends can be extended to any academic laboratory environment. This study found that accidents and incidents 1) increased by 82% (from 11% to 20%) when the high school lab class enrollments went from 14-19 students to 20-24 and 2) increased by an astonishing 320% (from 20% to 64%) when the high school lab class enrollments were above 24 high school students.

Moreover, incidents and mishaps increased 473% (from 15% to 71%) as the classroom space per student decreased from greater than 45-60 square feet to less than 45 square feet of net space per student. These data strongly support the concept that lab class sizes of more 24 students and less than 45 square feet of net space per student are not conducive to a safe and effective learning environment for students and faculty.

Several community colleges have adopted lower lab cap standards set by the ACS and the NFPA. In Introductory Chemistry and General Chemistry courses, for example, Golden West Community College has lab caps of 25 students while both Mt. San Antonio and Santiago Canyon Community Colleges have lab caps of 24-26 students. Decreasing lab caps from 32 to 24 students will limit the college's liability by decreasing lab accidents. We are asking that the administration of both the District and Norco College support the reduction of the student lab caps to 24 in all Introductory and General Chemistry lab courses to maintain a workplace that is safe and supports effective learning.

Goal Status: In Progress

Goal Year(s): 2018 - 2021

How do your goals support the Educational Master Plan?: Goal 2 Objective 1
Goal 7 Objective 5