Cañada College

# Program Review - Instructional Program Plan

Program Title Chemistry

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## Executive Summary

Please summarize your program's strengths, opportunities/challenges, and action plans. This information will be presented to the Board of Trustees. (1000 word limit)

The chemistry department provides educational opportunities for students to acquire discipline specific fundamental background and laboratory skills necessary to be successful in chemistry related fields. Analytical laboratory instrumentation such as Gas Chromatography and Infrared Spectroscopy is an integral part of the curriculum. Additional advanced instrumentation is used by students conducting undergraduate research. The department plans to develop laboratory curriculum to make these instruments available to all students in general chemistry and organic chemistry. The need for support staff with expertise in chemical instrumentation was identified. The department continuously improves its effectiveness by: (1) identifying areas of improvement from SLOs and (2) incorporating strategies and methodologies in response to student's academic needs and accessibility needs. A chemistry placement test and a new preparatory course to increase student success will be developed. A day hybrid CHEM 410 course will be piloted as an alternative to the evening hybrid course.

## Program Context

1. Mission: Please identify how your program aligns with the college's mission by selecting the appropriate check box(es):

   ✓Career Technical ☐Basic Skills ✓Transfer ✓Lifelong Learning

   If your program has a mission statement, include it here.
   The mission of the chemisty department is to offer rigorous, sufficient and updated course work to support all students in achieving their individual academic goals: Associate degree in Physical Sciences; preparation for transfer into STEM fields; general education; and personal enrichment are the current exit points.

2. Articulation: Describe how your program's articulation may be impacted by changes in curriculum and degree requirements at high schools and 4-year institutions. Describe your efforts to accommodate these changes.
   The approved TMC for the Associate Degree for transfer in Chemistry (ADT in Chemistry) allows for only 8 units of Organic Chemistry for a total of 34 STEM core courses units. Our Organic Chemistry sequence consists of two-five-unit classes. They both include three-hour lectures and six-hour labs per week. If we decide to offer the ADT pathway, we will need to remove the lab

component from the second semester organic chemistry course. This is a conversation that needs to take place District-wide. Articulation of this revision would have to be resumitted for approval to all CSU and UC.

3. Community and Labor Needs: Describe how changes in community needs, employment needs, technology, licensing, or accreditation affect your program. CTE programs should identify the dates of their advisory group meetings.
   Not applicable

**Looking Back**

4. Curricular Changes: List any significant changes that have occurred in your program's curricular offerings, scheduling, or mode of delivery. Explain the rationale for these changes.
   1. Organic Chemistry II lecture, CHEM 235 and Organic Chemistry II lab, CHEM 238 were combined into Organic Chemistry II, CHEM 232 to be in agreement with College of San Mateo. CHEM 232 will be offered in Spring 2015 for teh first time.
   2. Increased the number of Elementary Chemistry (CHEM 192) sections offered. This is in response to making this class a pre-requisite for General Chemistry I (CHEM 210).
   3. Day CHEM 410 had higher enrollment than evening CHEM 410.
   4. Honors contracts are being offered in Organic Chemistry instead of dual CRN. The contract format offers a convenient way to meet the need of the low number of students who are intersted in honors in Chemistry.
   5. Contextualized learning is being applied in laboratories to connect abstract concepts and chemical instrumentation to common everyday use materials.
   6. Increased student demand for undegraduate research.
   7. There is a need for qualified support staff to maintain chemical instrumentation for teaching and research labortaories.
   8. There is a need to standardize laboratory curriculum in CHEM 192 and 210.
   9. There is a need to create a policy on laboratory curriculum changes.
   10. There is a need to identify measures to determine the appropriate placement of students in chemistry classes.

5. Progress Report: Provide your responses to all recommendations received on your last program review and report on progress made on previous action plans and toward your strategic goals.
   Link: 2013-2014 Program Plan and Feedback forms
   1. Response to recommendations:
   There was only one recommendation which is addressed below.
   The chemistry faculty had a discussion with the physics and astronomy faculty during Flex day to create a common instrument to evaluate the Physical Sciences Program PLOs. We determined that a formal lab report including a specified set of sections is appropriate. We need to communicate with the Earth Sciences faculty to establish a working group to design this common instrument.

   2. Progress towards action plans and strategic goals:

a. Minimization of laboratory manual costs: CHEM 410 is using a lab manual that can either be packaged with the textbook or in an online-format.

b. Minimization of hazardous waste by greener lab alternatives: Most, if not all the CHEM 410 labs use household materials such as vinegar, oil, eggs, detergent, etc. The Benedict's test that uses copper solution to analyze carbohydrates was replaced by using keto-stick strips used in doctor's offices. Solutions amounts were reduced from 5-10 mL to about 1 mL by using well plates instead of test tubes for analyses.

c. Math supplemental course: The existing online math remediation course is not appropriate for CHEM 192 or CHEM 410. Chemistry faculty will select relevant topics to create a new math-chemistry preparatory course.

d. Instructional delivery: Hybrid evening CHEM 410 course was unsuccessful. We are currently offering a hybrid day CHEM course. Student success will give us information regarding its appropriateness.

f. Curriculum development: A radioactivity laboratory unit was developed for CHEM 410. An atomic structure experiment/activity was developed for CHEM 210.

g. SLO analysis identified needs: Instrument replacement and maintanance schedule were created but we need specialized support staff to implement them. The request for the radioactivity unit instructional materials submitted last year was approved but we are still waiting for them to be purchased. This unit was introduced as a demonstration while waiting. The laptop cart to help instructional delivery was not approved. It will be requested again.

h. Alternative online homework system: Connect plus from McGraw Hill was tested. We still favor Mastering Chemistry. Sapling was not evaluated.

i. Streamlining grading: no progress made.

6. Impact of resource allocations: Describe the impact to-date that each new resource (staff, non-instructional assignment, equipment, facilities, research, funding) has had on your program and measures of student success.
   1. There were no staff, non-instructional assignment, facilities, or research resources requested.
   2. Funding supported CHEM 695 research projects by purchasing specialized parts and solvents to run a donated HPLC instrument.
   3. Equipment –
   a. Spectrum tubes – Used in CHEM 210 atomic structure laoratory unit, currently impacting up to 60 students depending on enrollment.
   b. Geiger counters with kit – approved and ordered but has not been received.
   c. Plasticware sets – are being used in 2 sections of CHEM 410 (64 students) and 3 sections of CHEM 192 (80 students) for students to conduct experiments in a safer manner (minimizing glass breakage risk).

d. Metal-ware sets - are being used in 2 sections of CHEM 410 (64 students) and 3 sections of CHEM 192 (80 students) for students to conduct experiments without the need to have assigned drawers.
e. Laser for FT-IR/ Certified diagnostics – Not approved. Budget request must go into the repair ad maintanance category. We have not been able to use this instrument in general chemistry or organic chemistry laboratories for two years. Infrared spectroscopy is an integral part of the organic chemistry curriculum.
f. Pipetman Starter Kit – This equipment is used on a weekly basis in the undergarduate research laboratory by students conducting CHEM 695, independent research and honors contracts.
g. Laboratory ovens – They are used by all students in CHEM 192, CHEM 210, CHEM 220, CHEM 231 and CHEM 232 to dry glassware and chemical samples as part of their corresponding laboratory experiments.
h. Bomb calorimeter – Not approved. The Department decided to use online demonstrations.
i. Molecular model kits – Approved but not been received.
j. Hydrolysis apparatus set – Not approved. The Department decided to use online demonstrations.
k. AA Standard set – We need support staff to calibrate and maintain the AA instrument. Also to train faculty and students, run routine samples and trouble shoot the instrument.

## Current State of the Program

Data packets link http://www.canadacollege.edu/programreview/datapackets1314.php

7. Connection & Entry:
   A. Observation: Describe trends in program and course enrollments, FTES, LOAD and Fill Rates. Cite quantitative data and specific tables from the data packets.

**Productivity by Year**

| | Census Headcount | End of Term Headcount | FTEF | FTES | WSCH | Load | Sections | Max Enroll | Fill Rates |
|---|---|---|---|---|---|---|---|---|---|
| 2009/10 | 453 | 358 | 5.72 | **114.00** | 3,420 | 598 | 22 | 594 | 76.3% |
| 2010/11 | 511 | 399 | 6.36 | **130.86** | 3,926 | 617 | 20 | 567 | 90.1% |
| 2011/12 | 587 | 466 | 8.00 | **136.09** | 4,083 | 510 | 24 | 673 | 87.2% |
| 2012/13 | 571 | 454 | 8.48 | **147.47** | 4,424 | 522 | 25 | 658 | 86.8% |
| 2013/14 | 592 | 465 | 8.64 | **156.13** | 4,684 | 542 | 23 | 645 | 91.8% |

According to the data in the table above, the metrics used to determine productivity (FTES and LOAD) show an acceptable Department productivity. The fill rate has been high (above 86% ) for the last four academic years.

   B. Evaluation: What changes could be implemented, including changes to course scheduling (times/days/duration/delivery mode/number of sections), marketing, and articulation that may improve these trends?
   No changes required at these time

8. Progress & Completion:

A. Observation: Describe trends in student success and retention disaggregated by: ethnicity, gender, age, enrollment status, day/evening. Cite quantitative data and specific tables from the data packets.

**Annual Retention and Success**

| | Enrollments | Success Count | Success Rate | Success Rate Goal | Success Rate Diff | Retention Count | Retention Rate | Retention Rate Goal | Retention Rate Diff |
|---|---|---|---|---|---|---|---|---|---|
| 2009/2010 | 569 | 443 | 78% | 70% | 8% | 488 | 86% | 84% | 2% |
| 2010/2011 | 578 | 451 | 78% | 70% | 8% | 480 | 83% | 84% | -1% |
| 2011/2012 | 691 | 541 | 78% | 70% | 8% | 582 | 84% | 84% | 0% |
| 2012/2013 | 691 | 509 | 74% | 70% | 4% | 567 | 82% | 84% | -2% |
| 2013/2014 | 728 | 526 | 72% | 70% | 2% | 582 | 80% | 84% | -4% |

Overall retention and success is consistent and within the set goals for the department.

Retention and Success by ethnicity (Refer to "Success and Retention 2009/10 to 2013/14" data package pages 2-3):
Similar patterns of retention and success are observed during this time period. The retention of African-American, Filipino and Hispanic is approximately 10% lower than the retention of White. The difference is not really statistically significant due to the small sample size. For example, the retention of Native American is 100% in 2011-2102 but drops to 75% in 2012-2013. The sample size remained a three students in each case. Asian have a higher retention rate than White. The rate of success is lower than the rate of retention for all ethnicities, except for Asian and White in some years.

Retention and success by gender (Refer to "Success and Retention 2009/10 to 2013/14" data package pages 3):
The retention rate has been approximately constant at around 85% ± 3% from 2009 to 2014 for both female and male. Males are retained at a marginally higher percentage, except in 2014 when males were retained 8% higher than females. The success of females and males was between 5% and 8% lower than their respective retention rates.

Retention and success by age (Refer to "Success and Retention 2009/10 to 2013/14" data package pages 4-5):
The largest group of students fall in the 18-22 category with a consistent 79-85% retention and a consistent success of about 7% lower. The under 18 group is only about 50 students with a high percent (over 90%) retention and high percent (over 90%) success.

Retention and success by enrollment status (Refer to "Success and Retention 2009/10 to 2013/14" data package pages 5-6):
Continuing students make up the largest group with a retention of approximately 80% and a success of approximately 73%. The percentage of first-time students and first-time transfer students is low. Their retention and success is high but varies from year to year.

Retention and success by Day/Evening (Refer to "Success and Retention 2009/10 to 2013/14" data package page 6):

**Retention and Success by Day or Evening**

| | | Headcount | Success Count | Success Rate | Retention Count | Retention Rate |
|---|---|---|---|---|---|---|
| 2009/2010 | Day | 520 | 412 | **79%** | 449 | **86%** |
| | Evening | 49 | 31 | **63%** | 39 | **80%** |
| 2010/2011 | Day | 486 | 386 | **79%** | 409 | **84%** |
| | Evening | 92 | 65 | **71%** | 71 | **77%** |
| 2011/2012 | Day | 601 | 489 | **81%** | 516 | **86%** |
| | Evening | 90 | 52 | **58%** | 66 | **73%** |
| 2012/2013 | Day | 583 | 446 | **77%** | 489 | **84%** |
| | Evening | 108 | 63 | **58%** | 78 | **72%** |
| 2013/2014 | Day | 618 | 470 | **76%** | 513 | **83%** |
| | Evening | 110 | 56 | **51%** | 69 | **63%** |

There is a significant difference between the performance of the day classes and the evening classes. Day sections have consistently higher retention and success

B. Observation: For online courses describe any significant differences in the success and retention of students who are taking online courses compared to face-to-face courses.

**Retention and Success by Distance Ed Description**

| | | Headcount | Success Count | Success Rate | Retention Count | Retention Rate |
|---|---|---|---|---|---|---|
| 2009/2010 | Not Online | 569 | 443 | **78%** | 488 | **86%** |
| 2010/2011 | Not Online | 578 | 451 | **78%** | 480 | **83%** |
| 2011/2012 | Hybrid | 27 | 12 | **44%** | 21 | **78%** |
| | Not Online | 637 | 513 | **81%** | 543 | **85%** |
| | Web Assisted | 27 | 16 | **59%** | 18 | **67%** |
| 2012/2013 | Hybrid | 63 | 42 | **67%** | 50 | **79%** |
| | Not Online | 600 | 451 | **75%** | 500 | **83%** |
| | Web Assisted | 28 | 16 | **57%** | 17 | **61%** |
| 2013/2014 | Hybrid | 30 | 20 | **67%** | 21 | **70%** |
| | Not Online | 618 | 470 | **76%** | 513 | **83%** |
| | Web Assisted | 80 | 36 | **45%** | 48 | **60%** |
| **Total** | | 3,257 | 2,470 | **76%** | 2,699 | **83%** |

Distance education courses are fairly new to the chemistry department. The data shows that the greater the degree of personal contact the higher the rate of retention and success.

C. Evaluation: Based on these trends, what do you feel are significant factors or barriers influencing student success in your courses and program? What changes (e.g. in curriculum, pedagogy, scheduling, modality) could be implemented to improve these trends?
The most significant findings come from the Day/Evening data and the distance education data. Evening students come from a long day of work to a 3 hour laboratory session. It is challenging to stay focused for that many hours. However, it is not convenient for students who work during the day to come to campus more than once a week for shorter periods of time. Regarding distance education, it is evident that face-to-face contact is crucial. Chemistry works on abstract concepts challenging to grasp for students on their own. Changes might include an extended student support system such as EPIC leaders in the evening. These students can help evening students get connected with other resources on campus. Regarding distance education, trying a hybrid day section instead of a hybrid evening section might be a plausible alternative to students.

9. SLO Assessment:
https://smccd.sharepoint.com/sites/can/CANSLOAC/default.aspx

A. Are all course SLOs being systematically assessed at least once/4 years? Describe the coordination of SLO assessment across sections and over time.
Yes. Every semester a decision is made regarding which SLO to evaluate. Fulltime and adjunct faculty teaching the various courses collect the agreed upon data. The data is submitted to Jeanette Medina who inputs it tracdat.

B. Summarize the dialogue that has resulted from these assessments. What are some improvements in your courses that have been implemented through SLO assessment? How has student learning been improved by changes in teaching? Cite specific examples.
Conversations about SLO results pointed out the need to give students additional practice opportunities in certain laboratory techniques. A titration virtual lab is now performed before having students perform a live titration lab. Analysis of CHEM 192 SLO results indicated that students had a difficult time understanding the particulate nature of matter, a concept that is crucial to understand chemistry. A University of Colorado PHet Interactive animation about states of matter is now shown to students early in the semester. Students have shown a better understanding of chemical concepts. Analysis of CHEM 210 data indicated that students have difficulty decoding relevant information from word problems, connecting number meaning to physical meaning, and applying chemical concepts to related situations without seeing an example before. The Department is researching appropriate content to create a ne preparatory chemistry course.

10. PLO Assessment:
PLO Assessment link https://smccd.sharepoint.com/sites/can/prie/_layouts/15/start.aspx#/

A. Describe your program's Program Learning Outcomes assessment plans and results of direct and indirect assessments.

PLO assessment is discussed every semester as a flex day activity involving Physical Sciences faculty. We choose a PLO to be assessed per year. We discuss the means of assessment to be used depending on the PLO to be assessed. A typical direct assessment method is a laboratory report where students can demonstrate the use of the scientific method; their ability to effectively communicate scientific information; and the ability to critically analyze data. Results of PLO assessment have helped us identify areas of improvement in technical report writing. Students are given examples of the sections to include in a laboratory report. Explanation of the format and content of each section is also given.

B. Summarize the major findings of your program's PLO assessments. What are some improvements that have been, or can be, implemented as a result of PLO assessment?
Students were unclear on the meaning of technical writing. Students were unable to produce conclusions justified by experimental evidence. Examples of well-written laboratory reports are now given to students. A laboratory report guidelines document is available to students. Students participate on a workshop on how to write an appropriate lab report in organic chemistry.

## Looking Ahead

11. Strategic goal & action plans:

How will you address the opportunities for improvement that you identified above in Articulation, Community & Labor Needs, Connection & Entry, Progress & Completion and PLO Assessment? Identify timelines for implementation, responsible party, and resource requirements.

| Action Plan | Timeline | Responsible party | Resources required |
|---|---|---|---|
| Chemistry Placement Exam | March – April 2015- Collect examples of placement tests at other Community Colleges. Research the methods to validate the placement test results.<br>May 2015 – Write a placement test model.<br>Fall 2015- Pilot the administration of the placement test to entering Spring 2016 CHEM 210.<br>Fall 2015 – Analyze the data collected from piloting the test.<br>Spring 2016- Write two additional | Jeanette Medina, Robert Tricca, Nicholas DeMello | Staff to do the preliminary research. Staff to write the tests. Staff to administer the test, collect the results and make recommendations to place students. Counseling staff or standard policy to help students transition between classes when needed to help students register. Duplicating budget. |

| | | | |
|---|---|---|---|
| | versions of the test if positive results were obtained. Administer the test to the entering Fall 2016 class. | | |
| Chemistry Preparatory course | Spring 15-Collect examples of comparable courses.<br>Fall 2015 -Create the course and submit to Curriculum Committee.<br>Spring 2016- Offer the new Chemistry Preparatory course as an alternative to fulfill the CHEM 210 pre-requirement | Jeanette Medina, Robert Tricca, Nicholas DeMello | Staff and a lecture room to teach the course. |
| Develop HPLC laboratory curriculum | Spring 2015 – Learn the fundamentals of HPLC instrument. Duplicate simple experiments found in the literature.<br>Fall 2015 – Write an experimental protocol for organic chemistry and test it.<br>Spring 2015 – Add the HPLC lab to the curriculum. | Jeanette Medina<br>Robert Tricca | HPLC supplies budget.<br>Staff to write and test the experiment. |
| Develop AA laboratory curriculum | Fall 2015 – Learn the fundamentals of the AA instrument. Duplicate simple experiments found in the literature.<br>Spring 2015 – Write an experimental protocol for general chemistry and test it. | Jeanette Medina<br>Robert Tricca | AA supplies budget.<br>Staff to write and test the experiment. |

| | | | |
|---|---|---|---|
| | Fall 2016 – Add the AA lab to the curriculum. | | |
| Standardize lab curriculum and procedure for experiment changes | Fall 2015 – Gather all laboratory instructional materials being currently used in CHEM 210.<br>Meet to select the materials to go in a permanent lab binder and to determine the means of distribution to students.<br>Spring 2016- Implement standardized use of the CHEM 210 lab binder. | Robert Tricca, Nicholas DeMello, Safiyyah Forbes, Roslind Young | NA |

Complete the Resource Request form to request instructional equipment, IT equipment, facilities, professional development, research, or funding (if needed) and submit with this form to your Division Dean.
Link to resource request form http://www.canadacollege.edu/programreview/instruction-forms.php