Online Assessment Tracking Database

Sam Houston State University (SHSU)
2014 - 2015

Chemistry BS

Goal

Deliver A Curriculum Appropriate For Understanding Fundamentals Of Chemistry

The curriculum will address the discipline specific knowledge dictated by professional societies and/or professionals in the workforce.

Objective (L)

Demonstrate Understanding Of Fundamentals

Chemistry is an intensely sequential discipline. Students must master the material at an average level of understanding in the first semester course (general chemistry I) before they are allowed to attempt the second semester course (general chemistry II). The same is true for each of the first five semester courses in the sequence (general chemistry I, general chemistry II, organic chemistry I, organic chemistry II and physical chemistry I).

The fundamental concepts covered in general chemistry I and II include:
uncertainty in measurement, dimensional analysis, atomic and electronic structure, ionic and molecular formulas, nomenclature, stoichiometry, thermochemistry, bonding theories, valence shell electron pair repulsion theory, properties of gases, intermolecular forces, properties of solutions, kinetics, equilibrium, acid-base chemistry, oxidation-reduction chemistry, chemical thermodynamics and electrochemistry.

Indicator

American Chemical Society (ACS) General Chemistry Test

All chemistry majors will be invited to take a nationally standardized test over general chemistry (written by the American Chemical Society Division of Chemical Education Examinations Institute) near their completion of general chemistry II. In order to encourage participation, the highest individual score is guaranteed scholarship money for a future semester, and additional scholarship monies will be scaled to percentile performance on the examination.

Criterion

ACS General Chemistry Examination Score

Sixty percent of chemistry majors are expected to score within one standard deviation of the mean or higher than one standard deviation above the mean on the ACS standardized general chemistry examination. The major weakness in 2010-2011 was the low number of majors who took the exam. We continue to work to motivate more students to take the exam.

Finding

ACS General Chemistry Result

Of the 18 students that took the exam (73 were invited to do so), 15 (83%) scored within one standard deviation of the mean or higher on the ACS standardized general chemistry examination. The criterion was met and exceeded overall. For chemistry majors (excluding forensic chemistry majors), 4 students took the exam (29 were invited to do) and all 4 of them (100%) scored within one standard deviation of the mean or higher. Thus the criterion was met for the chemistry majors. Overall, the participation rate for the academic year was 18/73 = 25% (and 4/29 = 14% for

chemistry majors and 14/54 = 26% for forensic chemistry majors). We need to keep working on ways to encourage and allow participation in this exam.

Action

Fundamental Knowledge

We think sitting for the ACS General Chemistry exam for chemistry and forensic chemistry majors as they finish CHEM 1412 (General Chemistry II) is important. We think that the scholarship money is a good incentive. This year's participation rate of 25% is down from last year and somewhat disappointing. Offering two opportunities to take the exam in the fall and spring did not lead to a higher participation rate this past year. Since we only sent one email announcement in the spring, we will send out two announcements to see if we can increase participation.

Goal

Deliver A Curriculum Appropriate For Understanding Organic Chemistry

The curriculum will provide students with opportunities to develop the skills typically required of professionals in the area organic chemistry.

Objective (L)

Demonstrate Understanding Of Organic Chemistry

Organic chemistry is covered in the second year of a chemistry degree. It follows a year of general chemistry and precedes physical chemistry.

Students will demonstrate competent knowledge of the topics covered in organic chemistry I and II which include: hydrocarbons (alkanes, alkenes and alkynes), aromatic systems, functional group chemistry (including the chemistry of alkyl halides, ethers and various carbonyl compounds), stereochemistry, and carbohydrate chemistry.

Indicator

ACS Organic Chemistry Test

A nationally standardized test over organic chemistry (written by the American Chemical Society Division of Chemical Education Examinations Institute) will be given to all chemistry majors who take organic chemistry II at Sam Houston State University. This test is given as the final examination for the course.

Criterion

ACS Organic Chemistry Examination Score

Seventy-five percent of chemistry majors are expected to score within one standard deviation of the mean or higher than one standard deviation above the mean on the ACS standardized organic chemistry examination. We will closely follow the performance of forensic chemistry majors who scored slightly lower than chemistry majors in 2010-2011.

Finding

ACS Organic Chemistry Result

Thirteen chemistry majors and 27 forensic chemistry majors took the new exam during the academic year. Ten of the chemistry majors (10/13 = 77%) and 15 of the forensic chemistry majors (15/27 = 56%) scored within one

standard deviation of the mean or higher on the ACS standardized organic chemistry examination. Overall, the rate was 25/40 = 56%. The criterion was not met overall for these students. However, it was met for the chemistry majors. Two years ago, one instructor was identified as being correlated with an increased number of low scores. That instructor again did not teach CHEM 2325 (Organic Chemistry II) this year. Once again, when multiple sections of a course are offered (as they were during the spring semester), the section that filled the fastest had the lowest performance on this exam. Those students who did not meet the criterion will repeat CHEM 2325. Also, a new version of the ACS test was used. In the fall semester, students were given both exams and they did slightly better on the new exam.

Action

Organic Chemistry

Once again (for the third year in a row), we have data for all of the sections of CHEM 2325 (organic chemistry II) that were taught, and the biggest correlation with low performance on the standardized exam is the section that fills most quickly when there are multiple sections. This suggests that some degree of student self-selection--perhaps they are choosing instructors that they perceive to be "easiest" or perhaps it is a time of day issue--is a factor. We will continue to monitor the situation. In the past year, all of the students who failed to meet the criterion repeated the course and subsequently met the criterion. We will continue to assess students' performance.

Goal

Deliver A Curriculum Appropriate For Mastery Of Advanced Chemistry Topics

The curriculum will provide students with opportunities to develop the skills typically required of professionals in the area of advanced chemistry topics.

Objective (L)

Demonstrate Mastery Of Advanced Topics In Chemistry

The material learned by the third year in the chemistry curriculum is refined and supported theoretically in Physical Chemistry I (CHEM 4448). The successful student will demonstrate a mastery of the advanced topics presented in this course. These topics include quantum theory, wave functions, the dipole approximation, electronic configuration, molecular structure, molecular orbital diagrams, symmetry, group theory, and the application of these topics to X-ray, ultraviolet, visible, infrared, Raman, and magnetic resonance spectroscopy. All sections of CHEM 4448 have been taught by Dr. Darren Williams since his arrival at SHSU in 2004.

Indicator

CHM 4448 Final Examination

CHEM 4448 is required of all chemistry majors. The final examination in Physical Chemistry I (CHEM 4448), written by Dr. Darren Williams, is recognized by the faculty of the Department of Chemistry as being comprehensive and

covers all of the advanced topics listed in the objective statement. Dr. Williams is the sole instructor of CHEM 4448 at SHSU having taught all sections of CHEM 4448 since his arrival on campus in 2004. All students are required to complete the final examination. Examples of final exams are on file and secured within the Department of Chemistry and may be viewed by contacting Dr. Williams directly at williams@shsu.edu.

Criterion

75% Of Chemistry Majors Scoring At Least 60%

Seventy-five percent of chemistry majors are expected to demonstrate a mastery of at least sixty percent of the material (score 60%) on the comprehensive final examination.

Finding

Physical Chemistry Final Exam Results

Thirty-six of the 40 students enrolled in CHEM 4448 made at least 60% on the final, so 90% of the students scored >60% on the final exam. The criterion was met.

There were 4 students who scored below 60% on the final exam--two of these were repeating the course having scored below 60% on the final exam. As reported last year, students who had done poorly before had extremely poor time management skills. In an effort to address this, the Dr. Williams required 10 pages of homework to be uploaded each week. This forced the students to document that they were doing a substantial amount of work between lectures and exams. Those who did poorly had a substantial number of zeros on the homework upload requirement, which shows that they were not doing their part to learn the material.

Interestingly, this requirement to upload homework pages to Blackboard received favorable commentary on the class evaluation questionnaire. Here are some quotes from the students:

"This is a difficult class, but having weekly homework assignments helped keep up with the class content."
"I really like how this course was orchestrated. I liked that there were deadlines to meet & I do think there should be consequences to late submissions (lab work/homework) but I found them a bit harsh under certain circumstances."
"Turning in the homework via Blackboard was a good idea & a great way to keep me motivated to do the practice problems. I suggest continuing that."
"With the homework, sometimes it was overbearing because it was a lot to get done in a week. Maybe 10 questions a week but no more. With the other courses being taken, it was very difficult to stay on top of it."

Action

Physical Chemistry Action

Dr. Williams will continue to refine the homework assignments, and is pleased that the students are commenting on how they are being pushed to do more work on their own between the exams.

Goal

Deliver A Curriculum Appropriate For Understanding Instrumental Analytical Methods In Chemistry

The curriculum will provide students with opportunities to develop the skills typically required of professionals in the area of instrumental analytical methods in chemistry.

Objective (L)

Demonstrate Understanding Of Instrumental Analytical Methods In Chemistry

The modern analytical laboratory makes extensive use of electronic instrumentation for the analysis of chemical samples. Our Instrumental Analytical Chemistry course (CHEM 4440) is designed to introduce students to and have them learn the importance and use of spectrophotometric, chromatographic, and mass spectrometric analytical instrumental methods and computers in analytical laboratories. The course's laboratory component includes a focus on complex technical writing and use of the scientific literature. Students must master this material to meet the objective. Dr. Thomas Chasteen has been the instructor for all sections of CHEM 4440 for more than a decade.

Indicator

Examinations In Instrumental Analytical Chemistry

All students in Instrumental Analytical Chemistry (CHEM 4440) are required to master the electronic, sampling, schematic, and computational fundamentals of modern analytical instrumentation as evaluated by 80-minute written tests requiring essays, laboratory data evaluation, and calculator-based computation. There are three tests and a final examination in this course. The testing of this knowledge and its application is standardized within the department across all sections.

Criterion

80% Of Chemistry Majors Meeting Expectations

Eighty percent of chemistry majors are expected to score within one standard deviation of the mean or higher than one standard deviation above the mean on the four examinations in this class. We expect statistical variability from test to test and from year to year.

Finding

Performance On CHEM 4440 Exams

On the first exam, 31 of the 38 students (82%) scored within one standard deviation of the mean or higher. On the second exam, 31 of the 38 students (82%) scored within one standard deviation of the mean or higher. On the third exam, 33 of the 38 students (87%) scored within one standard deviation of the mean or higher. On the final exam, 34 of the 38 students (89%) scored within one standard deviation of the mean or higher. The criterion was met for each exam,

and overall the criterion was met. Clearly intervention is not needed.

Action

Monitor Instrumental Analysis Performance

We will assess student performance in CHEM 4440 on an ongoing basis. Clearly we are seeing year to year variations in student performance, and this is to be expected. We raised the criterion from 75% to 80% the year before last and the students met the criterion on all but one exam. Last year the students met the criterion on all of the exams. Once again this year our students met the criterion on all of the exams. We know that there is year to year variation, but students continue to meet the criteria even with ever increasing numbers of students. We will raise the criterion for the 2015-2016 academic year to 82.5%.

Goal

Deliver A Curriculum With Appropriate Written And Oral Communication Skills Developed

The curriculum will provide opportunities for mastery of written and oral skills.

Objective (L)

Demonstrate Adequate Written And Oral Communication

Students will demonstrate the ability to present to an audience of their peers a talk (seminar) based on their own research or research that has been reported in the scientific literature.

Indicator

Chemistry Seminar Presentation

All chemistry majors are required to take CHEM 4100 "Chemical Literature Seminar". Students typically do so in their senior year. One of the requirements of this course is giving an oral PowerPoint presentation over either their own research or research from the published chemical literature, to the other students in the class.

Criterion

Acceptable Peer-Review Rating

All chemistry majors are required to receive an acceptable peer-rating on a required research presentation. Within the course, each student evaluates all other student presentations. The rubric is the last page of the syllabus. Over the years, we have found that peers tended to rate presenters rather highly. We hope to see more helpful feedback after providing additional instruction in constructive feedback.

Finding

Seminar Presentation

No significant change in CHEM 4100 student comments were observed this past year despite the new emphasis on constructive student comments.

Action

Seminar Action

Next year's seminar will include an even more in depth emphasis about student comments, and the resulting comments will be evaluated again.

Previous Cycle's "Plan for Continuous Improvement"

We assess the same courses year after year for our B.S. programs because the courses, the material, and the requirements of the American Chemical Society do not change. This means that our plans from year to year end up being remarkably similar.

This past year we demonstrated that offering two opportunities for qualified students to take the ACS exam over general chemistry resulted in much higher participation rates, so we will offer the exam at two different times in the spring semester. Depending upon the number of qualified students, we may do the same in the fall semester.

In the area of organic chemistry, we will monitor student performance on the standardized final and check instructor and time correlations. It may be appropriate to shift instructors to specific time slots.

In the area of instrumental analysis, we will monitor student performance through another cycle and see if raising the criterion yet again is appropriate.

We will continue to monitor student progress in physical chemistry, and issues related to time management will be addressed from the beginning of the course.

For the seminar, sample critiques and comments will be presented to students in hopes that more informative comments can be elicited.

Please detail the elements of your previous "Plan for Continuous Improvement" that were implemented. If elements were not implemented please explain why, along with any contextual challenges you may have faced that prevented their implementation.

We offered students two opportunities to take the ACS exam over general chemistry in both the fall and spring semesters of the 2014-2015 academic year, but the participation rate was down compared to last year.

In the area of organic chemistry, once again the section that fills the most quickly when there are multiple sections has the lowest performance. This appears to be independent of instructor.

For physical chemistry, we will continue to monitor student progress. This past year, students were required to upload homework each week which attempted to force the students to do a substantial amount of work between lectures and exams, and hopefully made the students who did not do so to realize why they were doing poorly.

For intstrumental analysis, the students generally met the raised criterion.

For the seminar, the information provided thus far has not yet improved the quality of student feedback.

Plan for Continuous Improvement - Please detail your plan for improvement that you have developed based on what you learned from your 2014 - 2015 Cycle Findings.

As stated previously, we assess the same courses year after year for our B.S. programs because the courses, the material, and the requirements of the American Chemical Society do not change. This means that our plans from year to year end up being remarkably similar.

This past year we offered students two opportunities in the fall and in the spring for qualified students to take ACS exam over general chemistry, but participation rates fell compared to last year. This coming year we will again offer two opportunities to take the exam each semester, but we will endeavor to better advertise it to the students through multiple emails and instructor announcement(s).

In the area of organic chemistry, we will continue to monitor student performance on the standardized final and check instructor and time correlations. This may be a consequence of the registration process--more senior students register first which means that students who did poorly and are repeating the class register first and they may show up disproportionately in the class that fills fastest. This coming year we will pay more attention to the academic history of the students taking the exam.

In the area of physical chemistry, Dr. Williams will continue to stress issues related to time management through required homework assignments.

In the area of instrumental analysis, we will raise the criterion this year.

For the seminar, there will be an increased emphasis on constructive student comments.