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Chemistry: Academic Program Assessment Report

Abstract

CNAHS 2018-2019 Chemistry BS BA Academic Assessment Report

Keywords

CNAHS, 2018-2019, Chemistry, Assessment Report

2018-2019

Academic Program Assessment Report

INSTRUCTIONS: Page 1 of this document serves as the program's annual assessment plan. Please complete page 1 by **December 15, 2018**. Pages 2-3 serve as the program's annual assessment report. Please complete pages 2-3 by **June 30, 2019**.

COLLEGE: College of Natural, Applied and Health Sciences

ENTER PROGRAM NAME (e.g. M.A. Communication): B.S. / B.A. Chemistry

ACADEMIC YEAR: 2018-2019

REPORT AUTHOR: Yeung-gyo Shin

PROGRAM STUDENT LEARNING OUTCOMES (CHECK OFF THE SLOs BEING ASSESSED):

- SLO1: Demonstrate a firm understanding of basic chemical principles as demonstrated by the reviewing of the primary literature and dictated by the American Chemical Society. (KU 1, 4) (GE K1, S3, S4, S5, GEV5)
- SLO2: Analyze multiple sources of data to synthesize scientific conclusions. (KU 1, 4) (GE K1, S3, S4, S5)
- SLO3: Articulate the importance of chemical issues in the context of its impact on society. (KU 1, 3, 4) (GE K1, S1, S2, S3, S4, S5)
- SLO4: Report and present chemical issues with modern technology in correct scientific format. (KU 1, 4) (GE K3, S1, S2, S5)

DIRECT MEASURE:

DESCRIBE THE STUDENT WORK SAMPLE AND THE DIRECT MEASURE (E.G. RUBRIC) USED.

SLO 1: We have been using ACS exams for all sub-disciplines of chemistry at the end of course sequences, i.e. General Chemistry II, Organic Chemistry II, Instrumental Methods of Analysis, Biochemistry, Physical Chemistry II and Inorganic Chemistry Lab. Our record indicates that unauthorized copies of the ACS exams, especially General and Organic Chemistry, are found online. To ensure the objectivity of the testing, we are going back to departmental exams for General and Organic Chemistry. In addition, General Chemistry will use blackboard to administer the exam. In light of this change, we need to establish the compatibility of our departmental exams with ACS exams.

SLO 4: During the last assessment cycle, we found a troublesome trend in students' writing sample. Many reports do not address the chemical knowledge expected of chemistry majors, but staying at a popular science level. In addition to the GE writing rubric, we would like to generate a document to guide students in writing chemistry aspect of their reports professionally. It will be used in upper level chemistry courses, i.e. Instrumental Analysis, Physical Chemistry Lab I and Seminar in Chemistry.

TARGET:

SPECIFY THE EXPECTATION FOR STUDENT PERFORMANCE (e.g. minimum cut score, minimum percentage of correct answers, etc.). Include basis/rationale for the target expectation.

SLO 1: Each ACS exam has the required number of correct answers to pass the course, i.e. 17 for General Chemistry. We think the new departmental final exams are closely matched with ACS exams in topics and level of difficulties. Therefore, we will be using the same guideline that was used in previous years. If a student correctly answers more than the prescribed number of questions, he/she is eligible to pass the course with D or better grade. We anticipate that 90% of students who finished the course will meet the requirement.

It is important that we scrutinize this years' final exam results to insure they have similar distributions as ACS exams. Our comparative study will use the data we collected on the performance of our students in ACS exams for several years.

SLO 4: We will continue to use the modified GE writing rubric developed last year for Seminar in Chemistry to evaluate the quality of the writing. In addition, we will produce a document handling the chemistry aspect of students' reports. We hope to see a better consistency among different courses and improve DFW rate through the new document.

Student reports should show concrete understanding of the underlying chemical principles, explore pros and cons, address importance of studying the selected topic(s) and project its impact on society. We expect at least 85 % of students who finished the course will score overall report grade of 70% or better

DATA COLLECTION AND RESULTS:

Mean scores of ACS exams and written assignments:

Category/Criterion	Fall 2015			Spring 2016		
	#sec./#st.	Mean	St. Dev.	#sec./#st.	Mean	St. Dev.
ACS Exam Grade						
General Chemistry*	7 / 112	29.5/70	8.6	7 / 111	31.8/70	9.6
Organic Chemistry**				2 / 45	44.2/75	8.4
Org Chem (MC only)				2 / 45	23.5/50	7.2
Analytical Chemistry				2/22	21.4/50	5.6
Physical Chemistry	1 / 4	26.8/60	7.4			
Writing Assignment	#sec./#st.	Mean	St. Dev.	#sec./#st.	Mean	St. Dev.
Physical Chem Lab I				1 / 5	30.0/35	15.5
Seminar in Chemistry				1 / 8	84.9/100	8.0

* A departmental final in the same format as ACS exam.

** 1/3 of the score came from open ended questions.

Distribution of Scores:

Standard deviation of exam grades are about 12-15 % of the maximum possible points for all courses. Raw data can be found in the attached Excel file, CHEM_AssessmentData_19. In addition to reported courses, we have instituted the final exam for organic chemistry labs for selected sections which are included in the attached file.

Discussion of Findings:

Results of Final Exam

At the end of a yearlong general chemistry courses, we used to administer ACS comprehensive exam. This year, we started to administer the departmental exam internally developed on Blackboard. This exam was modeled after ACS exam but included questions pooling several similar questions so that different students will get different questions. With enough permutations, each student will end up with his/her unique exam covering the same materials.

Organic chemistry introduced open-ended questions accounting for 1/3 of the final exam grade ending up with 75 pts total. To compare it with the ACS comprehensive exam, we adjusted ACS exam statistics by multiplying 75/70 to each value.

General Chemistry	Nat'l average	Nat'l St.Dev.	Kean Average	Kean St.Dev.
ACS Exam	55.7%	18.3%	51.3%	14.4%
Fall 2018			42.2%	12.3%
Spring 2019			45.4%	13.7%
Organic Chemistry	Nat'l average	Nat'l St.Dev.	Kean Average	Kean St.Dev.
2018	52.8%	15.2%	48.1%	12.0%
Spring 2019 (total)			58.9%	13.4%
Spring 2019 (MC)			47.0%	14.5%

In General Chemistry, the average ACS exam grade of Kean students steadily increased from 28.3 to 29.0 to 32.1 to 35.9 in the span of 2015 and 2018 as more students obtained leaked ACS exam problems. This year's average of 29.5 and 31.8 pts neatly fall within the range of previous exams as we introduced the internally generated final exam administered via Blackboard. This indicates difficulty of our problems were in line with ACS Exam and we feel this justifies use of our internally generated final exam in place of ACS exam. We plan to follow the average of this final exam closely in next few years if this approach can deter violation of academic integrity. 13 out 223 students score 17 or lower out of 70 questions or 94.8% all students who took the final exam passed the final exam.

In Organic Chemistry, the multiple choice portion tracks closed to what we saw previously. Introduction of open-ended questions seems to have boosted the final grade. We conclude that our multiple choice portion of the final exam is equivalent to what ACS exam. No students scored 17 or less on the final exam.

In general, final exam averages have been tracking close to what we have seen previous years at Kean even though we introduced internally generated final exams in place of ACS exams. We are continually monitoring all final exam results whether it is internally generated or nationally available ACS exam. The average of our students are about 1 standard deviation lower than that was published by ACS.

Written assignment grades

A large portion of content oriented grade in Seminar in Chemistry is based on the written assignment (33 %) whereas it is only a small portion of physical chemistry lab I (14 %). Unlike last year when the average grade varies wildly when compared among different courses, this year's averages are much more consistent, around 85 %. This is also reflected in the graduating senior survey showing 7 students strongly agree and 2 students somewhat agree that they have learned how to write. Only 1 student didn't score 70% or more.

Graduating Chemistry Student Survey result:

The survey asks students to rate their mastery of two specific course contents: "I learned to write review papers and/or technical report" and "I feel comfortable presenting chemistry related topics to peers." Students answered:

	strongly agree	somewhat agree	neutral	somewhat disagree	Strongly disagree
Writing	7	2	0	0	0
Presentation	5	3	0	1	1

Curricular Actions/Closing the Loop:

For our multi section courses, General Chemistry and Organic Chemistry, we successfully transitioned to internally generated departmental exams using Blackboard from paper passed ACS exam. We were able

to established two exams are at a similar level of difficulties based on average scores collected over several years. We will keep monitoring the averages of these exams.

We managed to standardize the average grades of writing assignments. However, class size of 3 and 9, were too small to conclude confidently. Communication among instructors may have improved the consistency of grades. We will continue to work on our individual grading habits to be consistent among different courses.

Majority of students reported that they have learned to write technical reports and present chemical facts to peers (full survey report is attached). As we reported last year, this trend is not dependent on if students entered Kean as true freshmen or as transfer students with AS degrees. We plan to introduce technical writing systematically at lower level courses as well, especially to laboratory portion/courses.

Some ACS exam results could not be reported because we had hard time offering upper level courses such as Physical Chemistry Lab II, Advanced Inorganic Chemistry, Inorganic Chemistry Lab, 20th century Physics, etc. We may be able to combine physical chemistry lab I and II to streamline the course requirement and offer more independent research opportunity for individual student.

Supporting Evidence (data):

Please check this box to indicate:

Supporting Evidence (Data) is attached.

Excel file, CHEM_AssessmentData_19

Pdf file, CHEM_GSS_reprot_19