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Chemistry Discipline Assessment Report 2014/2015

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**Chemistry Discipline Assessment Report: 2014-2015 Academic Year
Submitted September, 2015**

Three areas were assessed: 1) written communication in first-year Chemistry 1102 (specifically the newly implemented calibrated peer review (CPR) system for laboratory report writing), 2) written communication based on laboratory reports in second year Chem 2322, and 3) oral communication in Chem 4901, the senior seminar 'keystone' course.

CPR Assessment 2015 Chemistry Discipline

Initial Proposed Plan: In Spring 2014, Chem 1102 introduced a written lab report which is graded by peer review using a CPR (Calibrated Peer Review) program developed at UCLA. The intent was to better prepare students for the formal write-ups for Chem 2311 lab. Fall 2014 Chem 2311 lab report scores will be compared to previous years.

Actual Assessment Activities: A thorough explanation of the process and goals is the focus of this report. Some anecdotal information on outcomes is provided and data-based assessments will be done when possible. Future Chem 2311 lab report scores will be compared to previous years. Chem 2311 lab report scores were not included because of two additional variables which is believed to have skewed the student population and background such that an analysis of the data would be unreliable. The first additional variable was the enforcement of the math placement pre-req in an automatic way due to the creation of student groups based on the placement scores. We believe this led to real differences in the composition of the general chemistry course. Further the new WLA requirement may have also influenced student writing making comparisons to older Chem 2311 reports more difficult.

CPR website: <http://cpr.molsci.ucla.edu/Home.aspx>

Calibrated Peer Review (CPR) was introduced by Professor Breyawn Lybbert in Spring 2014 in Chem 1102 and was done again in Spring 2015 by Jennifer Goodnough and Zack Mensinger. Spring 2015 was nearly identical to Spring 2014 as Jenn and Zack were also learning to be CPR administrators. This was a follow-up to an initial writing assignment designed by Professor Jim Togeas in Spring 2013. The 2013 writing assignment was first added for three main reasons:

1. decrease the transition in lab report expectations from Chem 1102 to Chem 2311
2. increase the writing expectations in the chemistry curriculum
3. better assessment of how well students understood the lab they had performed

Several improvements and changes were needed after the first 2013 version based on student, teaching assistant and professor feedback. Issues to be addressed were:

1. workload for graders meant little feedback was provided to students and rubrics were very simple
2. concerns about consistency in grading
3. first year students were not prepared to make a connection between the lab they performed **and** the primary literature source for the experiment **and** the theory behind Beer's Law. (primary literature and Beer's Law are not routinely covered in Chem 1102 lecture)
4. large variations in written work made it clear that the students needed a better understanding of the expectations

Changes in 2014 made to address these concerns included:

1. CPR program was selected to reduce grading workload, expand rubrics, increase consistency and feedback
2. primary literature was removed
3. a different lab was selected based on a topic (pH) which is covered in lecture
4. better instructions were provided to the student about what a written lab report would look like

5. addition of peer review and sample reports mean students are exposed to more written work which increases their understanding of the rubrics and expectations

Almost no changes were needed after the first CPR in 2014 based on student, teaching assistant and professor feedback. Three small issues to be addressed were:

1. decrease time available to complete the assignments since time stamps in the CPR program indicated less than two percent of students logged in during the first of two weeks
2. provide more instruction on HTML
3. use turn-it-in feature available in moodle since the assignment would be similar to the previous year

Timeline of the Writing Assignment:

- Week of Feb 23rd – Student turn in lab report for Lab 4 – Beer’s Law. Lab report is atypical in that the students are not given a structured worksheet to fill out. They are expected to do a mini-report which includes a couple brief paragraphs and they must construct their own data tables.
- Week of March 23rd – Students completed Lab 8 – Acidity Constant of Mandelic and Acetic Acid and Buffers.
- Week of March 30th – Student turn in lab report for Lab 8. Lab report is the typical two page structured worksheet of data, questions and analysis.
- Week of April 6th – Students have graded Lab 8 reports returned.
- April 6th – Instructions are posted on Moodle for CPR (see attached sheet) and they are able to register at the UCLA site.
- April 15th – Writing Assignment based on Lab 8 Due
- May 1st – Calibration and Peer Review Due

Steps of the Writing Assignment:

- Students must login and create an account (free) in the CPR program. There is a tutorial they must complete. This is a well developed and researched program provided by UCLA.
- Students can view the assignment instructions and guiding questions in CPR to help them prepare their written assignment. There is suggested source material and the assignment goals are provided. HTML instructions are provided in Moodle. The assignment is essentially a formal written report of Lab 8 on which they’ve already gotten initial feedback.
- Once all students have turned in their assignments, they must login and review three standard essays written by Professor Lybbert. One essay is really well done, one medium and one poor. The students answer a standard set of questions about those essays and their answers are compared to Professor Lybbert’s answers. The students are then calibrated for when they do peer review. The student has a weighting factor assigned to their scoring so if they are a hard or easy grader it does not impact their peers whom they review. If they are too far outside the range of standard answers they must repeat the calibration. They are given feedback on their calibration.
- Next the student is randomly assigned three peer assignments to grade on the same set of questions as the standard essays.

- Finally the student grades their own essay with the same questions. They are penalized for being overly easy on themselves which is common. Only a few student scores were adjusted for being overly hard on themselves.
- The final grade is based on the peer evaluation of their written work, their calibration of the standard essays, and their evaluation of their peers.

Antecedental Assessment: HTML continues to be a problem in spite of additional instruction and suggestions to use Word to convert to HTML. Perhaps a very small quiz is necessary to force the students to learn the very basic skills of sub/super scripts and tables. SRT comments are few in number but overwhelmingly positive. Contrast that with 2013 when there were many negative comments and no positive about the non-CPR assignment. Turn-it-in was critical in exposing some collaboration that exceeded acceptable levels. Student feedback indicates they felt a deeper understanding of Lab 8 than most of the other labs.

Overall: The CPR program has been so successful that it warrants not only continued use in Chem 1102 labs but consideration for expanded use elsewhere in the chemistry curriculum. Since the program/software has a learning curve, other disciplines in Science and Math could take advantage of the training done for their students in Chem 1102 to use the program as well. Jenn (and Zack) plan to present this option at a future Division meeting.

ItR Rubric Results and Analysis (4 September 2015)

The chemistry discipline uses a detailed rubric for grading the laboratory notebook and final report in the Chem 2322, Introduction to Research II, course. Assessment of these two assignments allows us to assess their writing in good depth, as both assignments represent the culmination of scientific writing skills to date in their undergraduate chemistry careers.

LABORATORY NOTEBOOK. The categories that are assessed are as follows:

- Organization & format: does the student present the notebook information in an organized, easy to follow format?
- Neatness: is the information in the laboratory notebook neat enough to read and follow?
- Detail: can the work that was carried out be repeated based on the amount of detail presented in the lab notebook?
- Analysis: is the notebook peppered with thoughtful analysis, summaries of findings and a thorough discussion of the results?

In addition faculty members are invited to provide illustrative comments and feedback to the students.

The results for assessment of writing in the context of the notebook for spring semester of 2015 are given below. From these results we can conclude that the students are doing good work in the lower-level skills of neatness and organized presentation of information, and reasonable work in the higher-level thinking and writing skills of analysis and providing detailed instruction and reporting.

	Total	org format	neat	detail	disc analysis
	48	9	9	20	9
	46	9	9	18	9
	44	8.5	9	18	8.5
	40	9	8	16	7
	43	9	9	16.5	8.5
	45.5	9	8.5	18	9
	41	8.5	9	15	8.5
	46	8.5	10	18	10
	43	10	10	20	10
	50	9	9	16.5	8.5
	32	7	7	12	6
	41.5	9	8	16	8.5
	45	9.5	9.5	17	9
	44.5	9	9	18	8.5
	29.5	7	8.5	8	6
	38.5	8	8.5	15	7
	38.5	7	9	16.5	6
Average	42.11764706	8.588235294	8.823529412	16.38235294	8.176470588
Std dev	5.152182324	0.844276476	0.705882353	2.799839343	1.259565477
Avg (%)		85.88235294	88.23529412	81.91176471	81.76470588

FINAL REPORT. The categories for assessment of the final written report – a formal scientific paper – are given below:

- Abstract: is the abstract concise and detailed?
- Introduction: does the introduction provide a description of the problem to be studied, the approach, and a review of previous relevant work?
- Experimental: does the experimental follow the accepted ACS (American Chemical Society) format for work of this type? Is it complete and detailed?
- Discussion: clarity and organization of writing, appropriate use of references, support for claims, analysis)
- Presentation: is the paper free of typos; do the authors use appropriate grammar, etc.

Again, the results from spring 2015 are given below. The final report is a group effort. Analysis of these data suggest that our students' ability to write a formal scientific report using the proper/accepted format is very good, but that we could focus our efforts on helping to develop their ability to analyze and present their findings in a clearer and more organized fashion in the main body of the paper.

Total	Abstract	Introduction	Exp	Discussion	Presentn	
37.00	4.50	4.00	9.50	14.00	5.00	
34.00	5.00	5.00	9.00	11.00	4.00	
36.30	4.50	5.00	8.80	13.50	4.00	
35.50	4.50	4.00	9.00	13.00	5.00	
35.30	4.50	4.50	8.80	12.50	5.00	
35.00	4.50	4.50	9.00	12.50	4.50	
35.00	4.50	4.50	9.00	12.50	4.50	
33.00	4.00	4.00	9.00	12.00	4.00	
33.00	4.00	4.00	9.00	12.00	4.00	
33.00	4.00	4.00	9.00	12.00	4.00	
36.00						
36.00						
avg	34.93	4.40	4.35	9.01	12.50	4.40
Std. dev	1.32	0.30	0.39	0.18	0.81	0.44
Avg (%)	87.31	88.00	87.00	90.10	83.33	88.00

Assessment of Oral Communication

Chem 4901 - Chemistry Seminar II

Chemistry 3901 and 4901 (Chemistry Seminar I and II) are a sequence of courses taken by chemistry and biochemistry majors. In Chem 3901, students develop a research topic which is presented in Chem 4901. Presentations in 4901 are assessed by students and faculty using rubrics that have been developed and refined over time. The current student rubric consists of a peer evaluation sheet covering the following areas: (i) quality of the introduction/background; (ii) organization/flow of the presentation; (iii) quality of visual aids; (iv) poise/volume/eye contact/appearance; (v) depth; and (vi) clarity. In addition to the six categories in the student rubric, faculty also assess: (i) content; (ii) quality of references used to prepare the presentation; and (iii) how well the student answered questions during/after the presentation.

Nearly identical student and faculty rubrics were used in the past three academic years (AY 12-13, AY 13-14, and AY 14-15). Each category was scored on a ten point scale. These rubrics were a slightly modified form of what was used in 2008-2009. The modifications were done because the depth was particularly lacking and that was considered one of the critical components of such a capstone experience. We also wanted to test our idea that if the students were scoring each other in the same way the faculty scored the seminars, that they would have a better understanding of the expectations. Table 1 outlines the recent results and Table 2 has the original scoring from AY 09-10.

The tables also include two additional columns: "Over" and "3101". The "Over" column lists the overall student presentation score. The overall score is based on performance in the various categories as well as each student's ability to adhere to the time guidelines for the presentation (students were penalized for talks that were too lengthy or too short). The "3101" column lists student performance in Chem 3101 (Analytical Chemistry) for the cohort of students presenting in Chem 4901 that particular year. Chem 3101 is taken by all chemistry and biochemistry students and the scores serve as comparison data for the Chem 4901 overall scores.

Table 2 includes most of the same columns as Table 1 with the additional rubric of "Get/Kept Audience Interest and Appropriate Level for Audience". Students did not score on individual rubrics but gave only an 'overall' grade.

Table 1. Recent Assessment Data from Faculty and Student Peer Evaluation in Chem 4901 (faculty data in shaded cells)

Year	Intro	Depth (x2)	Content (x2)	Clarity	Org/Flow	Vis. Aid	Poise etc	Ref.	?s	Over	3101
12-13	9.34	9.10	9.33	9.20	9.33	9.36	9.30	9.36	9.45	9.08	8.61
13-14	9.17	8.97	9.21	9.12	9.27	9.24	9.17	9.06	9.17	8.85	8.48
14-15	9.31	9.23	9.36	9.26	9.38	9.27	9.21	9.52	9.31	9.12	8.59
12-13	9.39	9.25	X	9.26	9.43	9.37	9.31	X	X	X	X
13-14	9.33	9.26	X	9.28	9.33	9.38	9.34	X	X	X	X
14-15	9.44	9.35	X	9.30	9.39	9.41	9.36	X	X	X	X

Table 2. Initial Assessment Data from Faculty and Student Peer Evaluation in Chem 4901 (faculty data in shaded cells)

Year	Intro	Depth	Content	Clarity	Org/Flow	Vis. Aid	Poise etc	Ref.	?s	Interest/level	Overall	3101
09-10	8.99	8.48	8.79	8.81	9.07	8.79	8.74	8.76	8.92	8.73	8.40	8.37
09-10	X	X	X	X	X	X	X	X	X	X	7.76	X

Main rubric changes made between 2009-2010 and 2012-2015 include 1) doubling the value of depth and content categories; 2) eliminating the interest/level rubric as a separate rubric and including it in content; 3) Adding + and - options on the rubric (B+, B, B- not just B); and 4) having the students do peer evaluation of each rubric.

In general, there is minimal variance across the categories for student and faculty evaluations in a given year. One bit of useful information from these data is that the “Depth” category remains consistently low in both faculty and student peer evaluations. The Chemistry faculty teaching 4901, however, have been very proactive in stressing the importance of depth in chemistry seminar presentations. Improvement is reflected by the data as the average faculty depth score from AY 09-10 (8.48) has improved in the three years from 2012-15 (three year average = 9.10). Noteworthy also are the means of the scores across all categories which are high and suggest students in Chem 4901 demonstrate strong oral communication skills based on senior seminar presentations. In addition, the use of Chem 3101 comparison data seems reasonable as the same cohort of students performed the lowest in both 4901 and 3101.

The Chemistry Discipline will analyze these data further in AY 15-16 and will adjust both faculty and student rubrics as needed to best assess student oral communication skills in Chem 4901.