Course Outcomes Guide (COG)

Directions: Please complete this form to document your progress toward improving student learning. For each item, indicate your progress and your anticipated next steps. Thank you!

Course Title: CHM 104 **Date: June 2016**

Course Team: Veronica Stein, Chris Nelling

Expected Learning Outcomes

1. Apply quantitative thinking processes and reasoning skills to core content of the second semester of general chemistry.
2. Communicate core course concepts in writing while using appropriate technology.
3. Solve quantitative chemistry problems and demonstrate reasoning clearly and completely. Integrate multiple ideas in the problem solving process. Check results to make sure they are physically reasonable.
4. Collect, analyze, and evaluate empirical data to substantiate chemical concepts.
5. Apply course content to environmental issues (e.g., pollution, global warming, and toxicology).
6. Relate chemical concepts to real life scenarios.
7. Access, process, analyze and synthesize scientific information.

Assessment (How do or will students demonstrate achievement of each outcome? Please attach a copy of your assessment electronically.)

A Nationalized Final Exam written by the American Chemical Society (ACS) for the second semester of General Chemistry is used as the final exam for CHM 104.
MasteringChemistry which is an online homework program is used to assess applying quantitative thinking process and reasoning skills, and solving quantitative chemistry problems and demonstrate reasoning clearly and completely.
Exams, consisting of a combination of multiple-choice, short answer and problem solving questions, are given in the lecture and lab sections of the course. The exams access critical thinking skills and analyze and synthesis of scientific information.

Validation (What methods have you used or will you use to validate your assessment?)

We compare our students to the national average of the ACS exam. This exam covers material from chapters 11 through 20 in the *Chemistry, A Molecular Approach, 3rd edition*, by Tro.

Results (What do your assessment data show? If you have not yet assessed student achievement of your learning outcomes, when is assessment planned?)

For the 2002 version of the ACS exam, each year the students improved their scores on the final exam in general. We updated the exam to the latest version offered by the American Chemical Society. The newer version has ten fewer questions and they do not ask questions on the topics of organic chemistry or properties of various elemental groups. This is an improvement, since I have not been able to cover the chapters on elemental groups.

For the 2010 version of the ACS exam, student scores are generally close to the national mean.

CHM 104			
Semester	n	mean	
06/SP	30	30.8	
06/FA	8	27.6	
07/SP	18	44.5	
07/FA	16	32.3	
08/SP	25	38.92	
08/FA	11	33.18	
09/SP	28	40.04	
09/FA	16	41.3	
10/SP	35	42.8	
10/FA	9	40.3	
11/SP	30	45.2	
11/FA	17	45.8	
National 2002 version	*1321 From 17 colleges*	*39.09*	*out of 80 questions*

CHM 104			
Semester	n	mean	
12/SP	20	41.2	
12/FA	18	36.1	
13/SP	23	42.6	
13/FA	18	33.4	
14/SP	22	41.9	
14/SU	10	35.9	
14/FA	9	32.9	
15/SP	33	37.8	
15/SU	17	33.1	
15/FA	12	30.6	
16/SP	37	38.0	
National 2010 version	*Not provided From ACS*	*36.19*	*out of 70 questions*

Follow-up (How have you used or how will you use the data to improve student learning?)

I made an Excel spreadsheet table for our adjuncts and me, which correlates the item analysis of the exam to chemistry concepts. Using this we can see which concepts we need to develop better curriculum (practice problems, labs, additional material) for students.

For example, to engage the students more in the various concepts, the flipped classroom method should be tried for topics of equilibrium, kinetics and buffers.

Budget Justification (What resources are necessary to improve student learning?)

The newest version of the ACS exam for 2nd semester general chemistry was purchased and used for the first time in the Spring 2012 CHM 104 course. We plan to use this version of the ACS exam until the next version is available in 2017.

Course: CHM 104 **SLOA Data** **Faculty Team Veronica Stein**

	SU 2009	FA 2009	SP 2010	SU 2010	FA 2010	SP 2011	SU 2011	FA 2011	SP 2012	SU 2012	FA 2012	SP 2013
# Active students	Not offered	18	40	Not offered	13	48	Not offered	19	22	Not offered	22	34
%W		11.1	7.5		0	20.8		0	4.5		9.1	8.8
*% walk-away Fs No final exam/grade = F		0	5.4		30.7	13.2		0	0			11.1
% Success (A,B,C)		72.2	72.5		69.2	51.1		88.2	71.4		85.0	72.7
Mean Common Lab Practical Score												
Common Comprehensive Final Exam Scor (out of 70 questions)		41.3	42.8		40.3	45.2		45.8	41.2		36.1	42.6
Mean course grade		2.31	2.24		2.15	1.83		2.82	2.25		2.78	2.33
% Gen Ed Assessment Score											70.9	87.4
Item Analysis **Weakest Content Areas**												

*% Walk-away Fs = did not take the final exam and received a grade of F.

Content Areas

Course: CHM 104 **SLOA Data** **Faculty Team: V Stein**

	SU 2013	FA 2013	SP 2014	SU 2014	FA 2014	SP 2015	SU 2015	FA 2015	SP 2016	SU 2016	FA 2016	SP 2017
# Active students	Not offered	22	31	11	12	47	22	18	37			
%W		4.5	12.9	9.1	8.3	14.9	13.6	16.7	16.2			
*% walk-away Fs No final exam/grade = F			16.1			10.6			13.5			
% Success (A,B,C)		60.0	64.5	90.0	58.3	57.8	50.0	44.4	48.6			
Mean Common Lab Practical Score												
Common Comprehensive Final Exam Score (out of 70 questions)		33.4	41.9	35.9	32.9	37.8	33.1	30.6	38.0			
Mean course grade		2.21	2.11	3.30	2.18	1.95	1.79	1.64	1.82			
% Gen Ed Assessment Score		87.1	89.1	89.0	85.6	82.4	77.6	77.5	83.5			
Item Analysis **Weakest Content Areas**							**	**	**			

*% Walk-away Fs = did not take the final exam and received a grade of F.

****Content Areas**

Summer 2015: Identifying a buffer, percent ionization of weak acid, galvanic cell diagram, visual representation of a reaction at equilibrium, Arrhenius equation, order of reaction, rate law mechanisms, unit cell diagrams of an ionic compound, heating curves involving phase changes, signs on Gibb's free energy and kinetics.

Fall 2015: Identifying a buffer, percent ionization of weak acid, galvanic cell diagram, electrolysis reactions, visual representation of a reaction at equilibrium, Arrhenius equation, order of reaction, unit cell diagrams of an ionic compound, signs on Gibb's free energy, entropy, and kinetics.

Spring 2016: Adding a base to a buffer, ionization of a polyprotic acid, visual representation of a reaction at equilibrium, Arrhenius equation, rate laws based on reaction mechanisms, unit cell diagrams of an ionic compound, signs on Gibb's free energy and kinetics.