Course Outcomes Guide

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/Program Title: **CHM 101** **Date: January 2015**
Introductory College Chemistry

Course/Program Team: **Nancy Thorpe, Veronica Stein, Judy Peisen, James Stemmle, James Feeser, Peter O'Connor, Karen Wilson**

Expected Learning Outcomes

1. Apply fundamental mathematical skills, scientific notation, and significant figures to chemical concepts and data.
2. Communicate chemical information using symbols, formulas, equations and appropriate IUPAC nomenclature.
3. Organize and evaluate numerical measurements using dimensional analysis to setup and solve problems
4. Make connections between abstract theories of chemistry to the real world.
5. Use technology to make laboratory measurements, analyze and present data, and collect relevant information.
6. Work collaboratively with other to accomplish a task.
7. Apply learned course material and critical thinking in further science courses, such as Human Anatomy and Physiology.
8. 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.)

1. Regular exams with combination of multiple-choice, short answer, problem solving and essay.
2. Online homework assignments.
3. Written laboratory reports with a grading rubric.
4. Common written laboratory mid-term and final exams.
5. In-house common final exam.

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

A common assessment used in CHM 101 is a 50 multiple choice questions developed by Veronica Stein, Nancy Thorpe, Cindy Dove and Judy Peisen. This exam covers material from the first eleven chapter of the book, *Foundations of College Chemistry, 14th edition*, by Hein & Arena . This exam is counted as 2/3 of their final exam grade score, with the remaining 1/3 are questions written by the instructor of that section. The other assessment developed for CHM 101 is a grading rubric for dimensional analysis type problems.

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

Data Table 1 presents the mean to the common final for each section and the overall mean for the semester (combining all sections). The scores for the Fall and Spring semesters appear to be improving for all instructors, whereas the Summer classes have a higher mean. Overall, all sections over the years have stayed fairly steady. Our weakest areas seem to be in problem-solving, the use of dimensional analysis, chemical nomenclature, and

equation writing. Data Table 2 also charts progress for different aspects of the course. The data for most of the semesters listed are based on one professor's sections, due to lack of data collection from adjuncts. Starting fall 2013 we will be collecting data from all instructors.

Follow Up: (How have you used or how will you use the data to improve student learning?)
Over the past six years the scores for the common exam seem to remain fairly constant for all instructors. There appears to be slight fluctuations in scores over the years and for each instructor, but overall the mean and median scores have remained the same. Each instructor receives a question by question analysis of the exam and instructors have used this analysis to work on their areas of weakness. More emphasis has been put on dimensional analysis and problem solving techniques. We have also implemented a plan to have a consistent approach to teaching dimensional analysis in courses with common content such as biology (BIO 099) and math (MAT 099). A new recitation course has been offered to be a co-requisite for CHM101 to help reinforce problem solving but so far it has had low enrollment. Work is continuing for all of the above, with minor changes in teaching styles and techniques to further improve student retention and success. Additional training of adjunct professors for subject matter and features of working in our new STEM building will be held. Plans are in place to develop at least one section of a "flipped" classroom to be compared to other regular face-to-face sections. An online/hybrid section is also being planned to be implemented in fall 2013.

The general education assessment was first used in fall 2012 and revised for spring 2013. The results are fairly consistent with our common final exam scores. This assessment focuses on Learning Outcome 8 and indicates students do well with the access and process of data, but need work with analysis and synthesis of data.

The laboratory mid-term and final exams have not been revised in a few years, so we are planning on looking at them this coming year to make sure they are properly assessing our students.

An Honors section of CHM101 is planned for Fall 2014, but so far there are zero students enrolled. For this course we plan to introduce more critical thinking type questions that the knowledge learned to real-life problems.

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

Science Gen Ed Course __ CHM101 – Introductory College Chemistry

General Education Outcomes for Science	Explain how your course achieves each outcome
Relate a basic core of scientific principles to an open-ended framework	**Course SLO's – 1,2,3,4,7 Problem-based homework assignments Problem solving on exams Common final exam Inquiry-based group work
Demonstrate observational and analytical skills in a structured situation	SLO's – 1,3,4,5,6,7 Problem-based homework assignments Various worksheets Inquiry-based group work Quiz and test questions for both lecture and laboratory Laboratory work Common final exam
Formulate conclusions based on observations and information	SLO's - 2,3,4,5,6 Written laboratory report with post lab questions Inquiry-based group work reports Quiz and exam questions for both lecture and laboratory Various worksheets
Use technology to access scientific information, generate and analyze empirical data, and solve problems	SLO's – 2,3,5,6 Use of Blackboard for course assignments On-line homework system Use of various websites for gathering information or practice Graphing Use of various electronic equipment in laboratory, such as balances and spectrophotometers

****STUDENT LEARNING OUTCOMES FOR CHM101:**

At the completion of this course, students should be able to:

1. Apply fundamental mathematical skills, scientific notation, and significant figures to chemical concepts and data.
2. Communicate chemical information using symbols, formulas, equations and appropriate IUPAC nomenclature.
3. Organize and evaluate numerical measurements using dimensional analysis to setup and solve problems
4. Make connections between abstract theories of chemistry to the real world.
5. Use technology to make laboratory measurements, analyze and present data, and collect relevant information.
6. Work collaboratively with other to accomplish a task.
7. Apply learned course material and critical thinking in further science courses, such as Human Anatomy and Physiology.

Data Table 2.

Course: CHM 101 SLOA Data Faculty Team: N. Thorpe (Data is for Thorpe's sections only through FA12)

	SU 2009	FA 2009	SP 2010	SU 2010	FA 2010	SP 2011	SU 2011	FA 2011	SP 2012	SU 2012	FA 2012	~SP 2013	SU 2013	FA 2013	SP 2014
# Active students		57	72		58	56		69	72		64	89		104	126
%W		8.8	6.9		10.3	3.6		21.7	11.1		8.6	8.4		16.3	7.0
*% walk-away Fs No final exam/grade = F		7.7	6.9		15.4	24.1		14.8	18.8		12.5	10.0		3.8	14.1
% Success (A,B,C)		75.0	62.7		80.8	59.3		74.1	68.8		57.8	49.7			
Mean Common Lab Practical Score											69.4	58.7		71.0	67.1
Common Comprehensive Final Exam Score		67.5	63.3		74.0	72.0		73.0	69.9		66.9	64.7		65.8	68.27
Gen Ed Assessment (for all sections of the course)											n=79 62.5%	n=86 65.0%		n=69 69.0%	n=86 76.0%
Mean course grade		74.8	72.7		74.1	72.9		71.3	74.2		66.2	66.8		75.1	73.4
Item Analysis **Weakest Content Areas**											**	***			

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

~ Data for SP13 combines N. Thorpe and K. Wilson, FA13 and beyond data is average from all instructors teaching the course.

Content Areas

**Dimensional analysis, formula and equation writing

***Ion formation, weighted average problem and empirical formula identification, understanding potential energy, Lewis structures, bonding.