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| Course Outcomes Guide (COG) |
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Course Title: CHM 103

Date: June 2019

Course Team: Veronica Stein, Chris Nelling

Expected Learning Outcomes

1. Apply quantitative thinking processes and reasoning skills to physical laws, stoichiometry, and atomic and molecular structure.
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. Access, process, analyze and synthesize scientific information.
6. Relate chemical concepts to real life scenarios

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

- MasteringChemistry, which is an online homework program, is used to assess applying quantitative thinking process and reasoning skills, 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 assess critical thinking skills and analyze and synthesis of scientific information.
- A Nationalized Final Exam written by the American Chemical Society (ACS) for the first semester of General Chemistry is used as the final exam for CHM 103.

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 1 through 10 in the *Chemistry, A Molecular Approach, 4th 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?)

Our students typically achieve the mean or higher for the national ACS exam 63% of the time using the 2009 version of the exam and 45% with the 2015 version of the exam.

| CHM 103 | | |
|----------|----|------|
| Semester | n | mean |
| 05/FA | 51 | 33.7 |
| 06/SP | 13 | 36.5 |
| 06/SU | 5 | 56.4 |
| 06/FA | 42 | 42.5 |
| 07/SP | 21 | 37.6 |

| CHM 103 | | | out of 70 questions |
|-----------------------------|-----------------------------|-------|---------------------|
| 07/SU | 7 | 42.57 | |
| 07/FA | 53 | 38.21 | |
| 08/SP | 19 | 40.05 | |
| 08/SU | 7 | 43.29 | |
| 08/FA | 54 | 42.67 | |
| 09/SP | 25 | 39.08 | |
| 09/Su | 11 | 38.73 | |
| National 2002 version | 2616 from 32 colleges | 41.03 | |

| CHM 103 | | | out of 70 questions |
|-----------------------------|-----------------------------|-------|---------------------|
| Semester | n | mean | |
| 09/FA | 58 | 41.1 | |
| 10/SP | 23 | 34.6 | |
| 10/SU | 10 | 46.7 | |
| 10/FA | 74 | 39.8 | |
| 11/SP | 31 | 35.7 | |
| 11/SU | 23 | 41.0 | |
| 11/FA | 52 | 40.9 | |
| 12/SP | 34 | 37.1 | |
| 12/SU | 18 | 37.6 | |
| 12/FA | 51 | 41.7 | |
| 13/SP | 27 | 33.1 | |
| 13/SU | 19 | 35.79 | |
| 13/FA | 57 | 42.28 | |
| 14/SP | 22 | 33.82 | |
| 14/SU | 14 | 34.71 | |
| 14/FA | 65 | 41.15 | |
| 15/SP | 17 | 43.41 | |
| 15/SP | 18 | 30.94 | |
| 15/SU | 12 | 37.83 | |
| 15/FA | 56 | 38.66 | |
| 16/SP | 17 | 39.65 | |
| 16/SP | 14 | 37.29 | |
| 16/SU | 19 | 33.8 | |
| 16/FA | 49 | 38.4 | |
| National 2009 version | 3827 from 34 colleges | 37.13 | |

| CHM 103 | | |
|----------|----|------|
| Semester | n | mean |
| 17/SP | 11 | 33.3 |
| 17/SP | 21 | 27.8 |
| 17/SU | 14 | 40.1 |
| 17/FA | 56 | 37.0 |

| CHM 103 | | | |
|-----------------------------|---------------------------------|------|---------------------|
| 18/SP | 15 | 42.2 | |
| 18/SP | 19 | 32.4 | |
| 18/SU | 13 | 41.3 | |
| 18/FA | 71 | 38.4 | |
| 19/SP | 11 | 44.6 | |
| 19/SP | | | |
| National 2015 version | 7347 From 47 institutions | 39.7 | 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. To help students associate chemistry concepts used in lecture with laboratory experiments we will develop videos demonstrating laboratory techniques used in various experiments. Also, we will show how these laboratory techniques are used in industry or in the kitchen.

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

A newer version of the ACS exams should be purchased to keep current with the content in the newer versions of the text books.

Course: CHM 103**SLOA Data****Faculty Team: V 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 | 13 | 74 | 30 | 17 | 93 | 37 | 24 | 75 | 39 | 19 | 80 | 45 |
| % W | 7.7 | 9.5 | 13.3 | 23.5 | 10.8 | 8.1 | 0 | 17.3 | 10.3 | 0 | 26.3 | 4.4 |
| *% walk-away Fs <small>No final exam/grade = F</small> | 0 | 8.1 | 7.7 | 15.4 | 7.2 | 8.8 | 4.2 | 8.1 | 2.9 | | 13.3 | |
| % Success (A,B,C) | 66.7 | 59.2 | 75.9 | 37.5 | 63.3 | 59.5 | 87.5 | 55.7 | 66.7 | 73.7 | 50.6 | 75.0 |
| Mean Common Lab Practical Score | | | | | | | | | | | | |
| Common Comprehensive Final Exam Score (70 questions) | 38.7 | 41.1 | 34.6 | 46.7 | 39.8 | 35.7 | 41.0 | 40.9 | 37.1 | 37.6 | 41.7 | 34.06 |
| Mean course grade | 2.09 | 1.91 | 2.64 | 2.17 | 2.04 | 2.12 | 2.17 | 2.07 | 2.46 | 2.37 | 1.97 | 2.33 |
| % Gen Ed Assessment Score | | | | | | | | | | | 74.3 | 73.0 |
| Item Analysis Weakest Content Areas | | | | | | | | | | | | |

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

Course: CHM 103**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 | 22 | 72 | 29 | 17 | 80 | 58 | 15 | 59 | 41 | 22 | 71 | 36 |
| % W | 9.1 | 19.5 | 6.9 | 11.8 | 15.0 | 12.1 | 6.7 | 5.1 | 17.1 | 13.6 | 15.5 | 2.8 |
| *% walk-away Fs <small>No final exam/grade = F</small> | | 1.4 | | | 1.1 | | | 5.1 | | | 9.8 | |
| % Success (A,B,C) | 68.2 | 55.6 | 50.0 | 56.3 | 61.0 | 58.9 | 73.3 | 61.0 | 61.0 | 68.2 | 56.5 | 58.3 |
| Mean Common Lab Practical Score | | | | | | | | | | | | |
| Common Comprehensive Final Exam Score (70 questions) | 35.8 | 42.3 | 33.8 | 34.71 | 41.2 | 37.8 | 37.8 | 38.7 | 38.6 | 33.8 | 38.5 | 29.7 |
| Mean course grade | 2.75 | 2.17 | 1.85 | 2.57 | 2.12 | 2.06 | 2.62 | 2.11 | 2.21 | 2.26 | 1.90 | 1.97 |
| % Gen Ed Assessment Score | 77.4 | 86.1 | 75.9 | 78.3 | 63.8 | 75.3 | 83.3 | 83.0 | 80.6 | 75.3 | 77.3 | 76.2 |
| Item Analysis Weakest Content Areas | | | | | | | | | | | | |

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

Course: CHM 103**SLOA Data****Faculty Team: V Stein**

| | SU 2017 | FA 2017 | SP 2018 | SU 2018 | FA 2018 | SP 2019 | SU 2019 | FA 2019 | SP 2020 | SU 2021 | FA 2021 | SP 2022 |
|---|------------|------------|------------|--|------------|------------|------------|------------|------------|------------|------------|------------|
| # Active students | 15 | 68 | 44 | | | | | | | | | |
| % W | 6.7 | 8.8 | 6.8 | | | | | | | | | |
| *% walk-away Fs <small>No final exam/grade = F</small> | | | | | | | | | | | | |
| % Success (A,B,C) | 73.3 | 59.1 | 66.7 | | | | | | | | | |
| Mean Common Lab Practical Score | | | | | | | | | | | | |
| Common Comprehensive Final Exam Score (70 questions) | 40.1 | 37.1 | 36.7 | 41.3 | 38.4 | 44.6** | | | | | | |
| Mean course grade | 2.36 | 1.93 | 2.15 | | | | | | | | | |
| % Gen Ed Assessment Score | 94.3 | 85.0 | 77.0 | 81.5 | 83.5 | 88.2** | | | | | | |
| Item Analysis Weakest Content Areas | | | | **Need Chris Nelling's data *** see below | | | | | | | | |

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

Weakest Content Areas

***Using item analysis on the ACS exam, the following concepts need improvements: electron transitions and energy associated with this transition, orbital diagrams, formal charges resonance with Lewis structures polarity of a molecule, Limiting and excess reactants in a reaction, Kinetic molecular theory in gas laws, using bond dissociation energies to determine heat of reaction, intermolecular forces (chapter 11 material, which is not covered until CHM 104).