1. **AGSC Content Area of Alignment:** Area III: Science and Math

2. **SLO(s) being assessed:** Student will..

   SLO 10: Students will understand and appreciate methods and issues of science and technology.

3. **Assessment Method(s):**

   [Explain how assessment for the measures associated with this SLO - not grading for the course as a whole - was conducted. You my cut/paste rubrics for inclusion here, identify faculty reviewing committees, or identify specific kinds of test questions important to your method. Is this the method you initially planned to use? Provide a separate paragraph for each method.]

   The Freshman Chemistry CORE SLO Assessment Devise was administered to all students taking freshman Chemistry at the end of the Spring 2011 semester. Students taking the exam were given 5 points towards their grade to increase student participation and ensure the questions were being answered to the best of their abilities. The exams were organized and proctored by the Freshman Chemistry Coordinator, Steve Swann, and were graded by Steve and his staff. The five chemistry courses described below were given the test:Chem1020- second semester of a terminal course sequence that combines general and organic chemistry.Chem1030 and 1040-two semester general chemistry courses.Chem1120-second semester of general chemistry for scientists and engineersChem1127-second semester of honors chemistry.The exam was comprised of 25 multiple choice questions, and were constructed so that each question covered a subsection of SLO#10 as listed below:Questions 1-5/SLO10-1 Historic perspectiveQuestions 6-10/SLO10-2Scientific methodQuestions 11-15/SLO10-3Data interpretationQuestions 16-20/SLO10-4Social ImpactQuestions 21-25/SLO10-5Demonstrate understanding of science.The historic perspective questions were modified based on the material covered in each respective course. All other questions related to a specific subsection of SLO10 were the same. There was a definitive answer for SLO1,2,3, and 5. The questions for SLO-5 were subjective based on how the course changed their view on different social issues. The answers were: A. Strongly agree, B. Agree, C. no difference, D. disagree, E. strongly disagree. The exams for the five courses are available to the committee upon request.

4. **Findings: What assessment data did each assessment method produce?**

   The findings from the Freshman chemistry CORE SLO Assessment Devise are presented in Table 1Table 1. Number of Participants and % correct answers from 2012 assessmentParticipantsSLO1SLO2SLO3SLO4SLO5Chem102013442504427(A+B)/47(C)40Chem10307254514337(A+B)/48(C)52Chem104053364505133(A+B)/41(C)73Chem11208179 606429(A+B)/48(C)86Chem11278784686639(A+B)/46(C)90Chem1020-out of the 134 students that took the exam the average correct answers for the exam for SLO1,2,3 and 5 were less than 50%. The majority of students felt that their understanding of specific Social Impacts (SLO4) was no different from when they started the course.Chem1030-out of the 725 students that took the exam the average correct answers for the exam for SLO1,2,3 and 5 were at 50% or less. The majority of students felt that their understanding of specific Social Impacts (SLO4) was not different from when they started the course. Chem1040-out of the 533 students that took the exam the average correct answers for SLO2 and 3 were at 50%. There was a clear increase in the percent of correctly answered questions related to Historical Perspective (SLO1) compared to Chem1030. The Historical Perspective is related to Scientists correlated with specific principles covered in the course. While unclear, the increase in correct answers may reflect the student being exposed to these principles in both Chem1030 and 1040. This was also observed in their understanding of Science (SLO5), which significantly increased in the second semester of General Chemistry. The majority of students felt that their understanding of specific Social Impacts (SLO4) was no different from when they started the
course. Chem1120-out of the 81 students that took the exam there was a significant increase in the average correct answers for SLO1,2,3 and 5 compared to Chem1040 students. This is a second semester course; therefore, many of the concepts have been reinforced over two semesters. In addition to the course being more rigorous than the General Chemistry courses (Chem1030 and 1040), these students may have taken advanced chemistry courses in high school. The majority of students felt that their understanding of specific Social Impacts (SLO4) was no different from when they started the course. Chem1127-out of the 87 students that took the exam there was an increase in the correct answers for SLO1,2,3, and 5 compared to Chem1040 and Chem1120 students. The majority of students felt that their understanding of specific Social Impacts (SLO4) was no different from when they started the course. Since the honors laboratories and the honors lectures are coupled together the course material is reinforced during lab time. In addition, these students often have taken advanced chemistry courses in high school.

5. How did you (or will you) use the findings for improvement?

[What questions / issues / concerns did your data raise for the faculty teaching the course? What discussion did the faculty have about the findings? What future actions to improve student attainment of this outcome will the department / program take as a result of this analysis?]

A similar rubrics was used in 2011 with the findings listed below.

Participants SLO1 SLO2 SLO3 SLO4 SLO5 Written Chem102011741374733 (A+B)/46 (C)372.3/3.5/24 Chem103063935526336 (A+B)/45 (C)643.3/3.5/2.8 Chem104044746557141 (A+B)/42 (C)763.6/4.7/3.8 Chem11208057567337 (A+B)/44 (C)863.6/4.4/4.3 Chem11277479737833 (A+B)/32 (C)933.1/4.8/3.9 Having findings from two different academic years allowed for a more quantitative assessment of student performance. The written portion was removed for the 2012 assessment due to the substantial time required to grade over 1000 exams. Overall there was not a significant difference between the 2010 and 2011 findings. There is an obvious need for improvement in the General Chemistry courses based on the assessment. A primary difference between the General Chemistry and Honors courses is the direct coupling of lecture and lab. Therefore, we need to devise a method to stress the concepts learned in class in the General Chemistry courses in the laboratory environment. In addition, the top Graduate Students in the department are the Graduate Teaching Assistants for the Honors chemistry courses. These students are selected based on their course performance and teaching abilities. Therefore, we need the resources to be able to recruit and compete with other institutions for outstanding graduate students, which we are unable to do at this time due to limited resources. The history component of the SLO does not correlate with the major STEM initiatives as outlined by the National Research Council. It would be beneficial if the Core curriculum Assessment committee met with our department to discuss how the assessment can better address the guidelines established by the STEM initiative.

6. Additional Comments:

[What else would you like the Committee to know about your assessment of this course or plans for the future?]

7. Committee Comments

Mean of rubric score = 2.44 (out of 4) Comments several chemistry courses were evaluated at once such that CHEM 1020 was included in discussion and 1021 was not specifically discussed, writer of report concerned that core curriculum SOLs do not address STEM and Grad Teaching assistants are involved with Honors courses, cite lack of money for support as a problem meeting core. Reviewer is not sure if CHEM provider of assessment was using the correct SOL criteria.
Assessment Methods:

The Freshman Chemistry CORE SLO Assessment Devise was administered to all students taking freshman Chemistry at the end of the Spring 2011 semester. Students taking the exam were given 5 points towards their grade to increase student participation and ensure the questions were being answered to the best of their abilities. The exams were organized and proctored by the Freshman Chemistry Coordinator, Steve Swann, and were graded by Steve and his staff. The five chemistry courses described below were given the test:
Chem1020- second semester of a terminal course sequence that combines general and organic chemistry.
Chem1030 and 1040-two semester general chemistry courses.
Chem1120-second semester of general chemistry for scientists and engineers
Chem1127-second semester of honors chemistry.

The exam was comprised of 25 multiple choice questions, and were constructed so that each question covered a subsection of SLO#10 as listed below:
Questions 1-5/SLO10-1 Historic perspective
Questions 6-10/SLO10-2 Scientific method
Questions 11-15/SLO10-3 Data interpretation
Questions 16-20/SLO10-4 Social Impact
Questions 21-25/SLO10-5 Demonstrate understanding of science.

The historic perspective questions were modified based on the material covered in that respective course. All other questions related to a specific subsection of SLO10 were the same. There was a definitive answer for SLO1,2,3, and 5. The questions for SLO-5 were subjective based on how the course changed their view on different social issues. The answers were: A. Strongly agree, B. Agree, C. no difference, D. disagree, E. strongly disagree.

The exams for the five courses are available to the committee upon request.

Findings

The findings from the Freshman chemistry CORE SLO Assessment Devise are presented in Table 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Participants</th>
<th>SLO1</th>
<th>SLO2</th>
<th>SLO3</th>
<th>SLO4</th>
<th>SLO5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem1020</td>
<td>134</td>
<td>42</td>
<td>50</td>
<td>44</td>
<td>27(A+B)/47(C)</td>
<td>40</td>
</tr>
<tr>
<td>Chem1030</td>
<td>725</td>
<td>40</td>
<td>51</td>
<td>43</td>
<td>37(A+B)/48(C)</td>
<td>52</td>
</tr>
<tr>
<td>Chem1040</td>
<td>533</td>
<td>64</td>
<td>50</td>
<td>51</td>
<td>33(A+B)/41(C)</td>
<td>73</td>
</tr>
<tr>
<td>Chem1120</td>
<td>81</td>
<td>79</td>
<td>60</td>
<td>64</td>
<td>29(A+B)/48(C)</td>
<td>86</td>
</tr>
<tr>
<td>Chem1127</td>
<td>87</td>
<td>84</td>
<td>68</td>
<td>66</td>
<td>39(A+B)/46(C)</td>
<td>90</td>
</tr>
</tbody>
</table>
Chem1020-out of the 134 students that took the exam the average correct answers for the exam for SLO1,2,3 and 5 were less than 50%. The majority of students felt that their understanding of specific Social Impacts (SLO4) was no different from when they started the course.

Chem1030-out of the 725 students that took the exam the average correct answers for the exam for SLO1,2,3 and 5 were at 50% or less. The majority of students felt that their understanding of specific Social Impacts (SLO4) was no different from when they started the course.

Chem1040-out of the 533 students that took the exam the average correct answers for SLO2 and 3 were at 50%. There was a clear increase in the percent of correctly answered questions related to Historical Perspective (SLO1) compared to Chem1030. The Historical Perspective is related to Scientists correlated with specific principles covered in the course. While unclear, the increase in correct answers may reflect the student being exposed to these principles in both Chem1030 and 1040. This was also observed in their understanding of Science (SLO5), which significantly increased in the second semester of General Chemistry. The majority of students felt that their understanding of specific Social Impacts (SLO4) was no different from when they started the course.

Chem1120-out of the 81 students that took the exam there was a significant increase in the average correct answers for SLO1,2,3 and 5 compared to Chem1040 students. This is a second semester course; therefore, many of the concepts have been reinforced over two semesters. In addition to the course being more rigorous than the General Chemistry courses (Chem1030 and 1040), these students may have taken advanced chemistry courses in high school. The majority of students felt that their understanding of specific Social Impacts (SLO4) was no different from when they started the course.

Chem1127-out of the 87 students that took the exam there was an increase in the correct answers for SLO1,2,3, and 5 compared to Chem1040 and Chem1120 students. The majority of students felt that their understanding of specific Social Impacts (SLO4) was no different from when they started the course. Since the honors laboratories and the honors lectures are coupled together the course material is reinforced during lab time. In addition, these students often have taken advanced chemistry courses in high school.

**Improvement**

A similar rubrics was used in 2011 with the findings listed below.

<table>
<thead>
<tr>
<th></th>
<th>Participants</th>
<th>SLO1</th>
<th>SLO2</th>
<th>SLO3</th>
<th>SLO4</th>
<th>SLO5</th>
<th>Written</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem1020</td>
<td>117</td>
<td>41</td>
<td>37</td>
<td>47</td>
<td>33(A+B)/46(C)</td>
<td>37</td>
<td>2.3/3.5/2.4</td>
</tr>
<tr>
<td>Chem1030</td>
<td>639</td>
<td>35</td>
<td>52</td>
<td>63</td>
<td>36(A+B)/45(C)</td>
<td>64</td>
<td>3.3/3.5/2.8</td>
</tr>
<tr>
<td>Chem1040</td>
<td>447</td>
<td>46</td>
<td>55</td>
<td>71</td>
<td>41(A+B)/42(C)</td>
<td>76</td>
<td>3.6/4.7/3.8</td>
</tr>
<tr>
<td>Chem1120</td>
<td>80</td>
<td>57</td>
<td>56</td>
<td>73</td>
<td>37(A+B)/44(C)</td>
<td>86</td>
<td>3.6/4.4/3.8</td>
</tr>
<tr>
<td>Chem1127</td>
<td>74</td>
<td>79</td>
<td>73</td>
<td>78</td>
<td>33(A+B)/32(C)</td>
<td>93</td>
<td>3.1/4.8/3.9</td>
</tr>
</tbody>
</table>

Having findings from two different academic years allowed for a more quantitative assessment of student performance. The written portion was removed for the 2012 assessment due to the substantial time required to grade over 1000 exams. Overall there was not a significant difference between the 2010 and 2011 findings.
There is an obvious need for improvement in the General Chemistry courses based on the assessment. A primary difference between the General Chemistry and Honors courses is the direct coupling of lecture and lab. Therefore, we need to devise a method to stress the concepts learned in class in the General Chemistry courses in the laboratory environment. In addition, the top Graduate Students in the department are the Graduate Teaching Assistants for the Honors chemistry courses. These students are selected based on their course performance and teaching abilities. Therefore, we need the resources to be able to recruit and compete with other institutions for outstanding graduate students, which we are unable to do at this time due to limited resources. The history component of the SLO does not correlate with the major STEM initiatives as outlined by the National Research Council. It would be beneficial if the Core curriculum Assessment committee met with our department to discuss how the assessment can better address the guidelines established by the STEM initiative.