There are two General Education student learning outcomes for the Natural Sciences. Assessment data for the two outcomes are to be submitted on separate report forms.

**Natural Science Student Learning Outcome #1:**

*Students are able to demonstrate their knowledge of the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.*

**Sources of Assessment Data on Outcome #1:**

Data can be test scores from items on exams testing a specific understanding of the scientific method; data can also be scores on laboratory reports that evaluate students’ understanding of scientific method; or other sources as specified below.

**Semester(s) in which reported assessment data were collected:**

- Fall 2014
- Spring 2015
- Both

**Below briefly describe how you collected these assessment data.** What specific assessment methods—exams, assignments, or instruments did you use to acquire the data reported. Use of a rubric is recommended for less-quantitative assessments.

- Students are assessed on their ability to apply the scientific method in a practical setting via the data that they generate for each experiment. All data are recorded onto a worksheet/datasheet, which is turned in by each student at the end of lab and subsequently graded. The design of the worksheets is to have the students record their observations, collect data in an organized fashion (usually in a chart or table), and, based on the information gathered and knowledge they have obtained in lecture, draw key conclusions about their experiment. In addition, since all experiment results are known to the instructor, the instructor can accurately assess each student’s ability to apply the scientific method in a laboratory setting based on the datasheet that each student submits after every lab.

- Students successfully determined unknown compounds based on experimental data collected in lab. Students were required to take detailed notes on observations while performing the experiment and, based on their notes and/or observations, correctly identify the chemical compound assigned.

- Students also had to keep detailed records because multiple confirmation experiments were necessary to narrow the possible identity of their unknown compounds based on a chart that listed all 15 possible compounds.

- Final Confirmations – The students had to use all experimental data, observations, and their knowledge of solubility rules to write the chemical equation which correctly demonstrates the formation of their unknown chemical compound.

- Short Answer Questions from Exam #2: Students were required to use their knowledge obtained though experimentation and in lecture about the scientific method to explain why philosophers’ theories were never validated. Students’ answers had to be based on the fact that, according to the scientific method, all theories should be tested through experimentation.

**Enter the total number of students from whom you collected the assessment data.**

\[ N = 26 \]
In the spaces provided below, enter the number of students (and percent of total) who scored in each of the achievement levels indicated:

<table>
<thead>
<tr>
<th>Achievement Level</th>
<th>Number of students who reached this level</th>
<th>Percent of total students assessed who reached this level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceeded (A/B) 80-100 %</td>
<td>14</td>
<td>53.8%</td>
</tr>
<tr>
<td>Met Criterion (C) 70.00-79.99%</td>
<td>8</td>
<td>30.8%</td>
</tr>
<tr>
<td>Approached Criterion (D) 60.00-79.99%</td>
<td>1</td>
<td>3.8%</td>
</tr>
<tr>
<td>Did Not Meet Criterion (E) &lt;59.99%</td>
<td>3</td>
<td>11.5%</td>
</tr>
</tbody>
</table>

**Closing the Loop Recommendations:** After examining these assessment results, do you find any weaknesses in student performance on this specific student learning outcome that you plan to address by changes in course content, curricular emphasis, instructional approaches? If so, please describe the need for improvement and what you will do. Also, even if you have reached your desired criterion, you should have a plan to go beyond this level in the performance expectations on this outcome.

Assessing students’ understanding of the scientific method was something that I never conducted in my prior teaching experiences. Therefore, it was a challenge to choose an effective way of assessing their understanding of this topic. In future assessments, I will explore other strategies. Nevertheless, based on the data collected, the majority of the students (84.6%) either met or exceeded the criterion of adhering to the scientific method as described in lecture and as performed in laboratory experiments in order to successfully identify their unknown compound.

With only 84.6 % of students meeting or exceeding expectations, I realize that I am below my desired threshold of 90% of students who meet expectations. Therefore, the methods I have employed of simply stating the scientific method in lecture and occasionally reviewing the process during laboratory experimentation resulted in 15.4% of the students not being able to clearly identify and/or use the scientific method to produce reasonable results. Due to the fact that this is a class that focuses on the fundamentals of understanding science and the scientific process, new strategies will be implemented to help reduce the number of students who have not met the targeted expectations.

The following undertaking will be incorporated into CHM 121 to enhance students’ understanding and their ability to apply the scientific method. During lecture/lab, a concerted effort to ask discussion questions, in which students will use critical thinking skills to identify how the scientific method was either implemented or could be implemented to the topic of interest. These questions will be asked such that students are given the opportunity to discuss the questions first in small groups and then collectively as a class. Currently, students only turn in pre-designed worksheets upon which data collected from each experiment is recorded. Therefore, for the following and subsequent semesters, I will include a summary question on each laboratory worksheet. In order to receive full credit, the students must identify how they used the scientific process to obtain their results. Lastly, I will choose two labs as assessments labs, one before and after midterm, and have the students write a formal response. The response will ask them to describe how the scientific method was incorporated within the experiment performed. I believe these changes should help increase the number of students who meet or exceed expectations to the desired threshold and above.