

## 2021 Annual Assessment Report- Chemistry

### I. Assessment Meetings.

Professors Bailey and Burwell met formally on **May 10, 2020**, to talk about Chemistry assessment. In addition, there were multiple additional formal and informal discussions held during lunchtime throughout the academic year. Work presented in this report span both the 2019-2020 and 2020-2021 academic year.

### II. Closing the Loop.

In our spring 2017 Chemistry Assessment Report we had indicated a concern about the use (or lack thereof) of the textbook by students in the Introductory Chemistry sequence (Chem107 and Chem108). We indicated that the textbook itself is quite large and often found its primary use as that of a doorstop. The action plan for the 2017-2018 academic year included having students purchase a loose-leaf version of the text, which would allow them to bring individual chapters to class. The goal of this was to address objective 1a, *“Has a working knowledge of the concepts and principles presented in class.”*

Our 2018 Chemistry Assessment Report concluded that simply having the students purchase the loose-leaf version of the textbook did not significantly change the learning outcome. Students still did not see the importance of using the textbook and, again, in too many cases did not even see the import of purchasing the textbook, even though that purchase gave them access to the graded homework assignments. Because the action plan did not bear fruit in 2017-2018, we intend to continue to work on *getting students more engaged with their textbook* for the 2018-2019 academic year. We proposed developing specific exercises and other means which would require the students to utilize their textbook directly.

The syllabus for the Chem 107 and Chem 108 courses have always included, for each class meeting, an indication of the sections in the textbook (both by chapter headings and page numbers) which will be covered that day. For the 2018-2019 academic year there were additional indications made on the syllabus of which specific Tables and other information from the textbook should be brought to class on a respective day; these indications were given in red type.

Also new this year were a series of “Questions to Ponder,” questions based on the assigned reading for that day, which were projected in the 10 or so minutes prior to the official start of each class period. These were intended to get students to look at the books again prior to the class starting and hopefully engender some conversation between students as they waited. For example, for the second day of class, the following questions were projected:

- 2-1. What are the three components of an atom?
- 2-2. What are the differences between the atomic number ( $Z$ ) and mass number ( $A$ ) of an atom?
- 2-3. Do all atoms of a particular element have the same composition?
- 2-4. Why aren't the atomic weights on the Periodic Table whole numbers?

It was observed that many students would look at these questions and talk about them with their

neighbors prior to the start of the class period.

### III. Examination of Assessment Data.

We indicated the use of quizzes, homework, and exams to assess whether students were better gaining “a *working knowledge of the concepts and principles presented in class.*” Quizzes were given in-class and covered material introduced during a previous class period. The syllabus indicated that Quizzes might be given during any course meeting and so the number and nature of the set of quizzes may be different for each semester; in fact, in Springs 2017 & 2019 no quizzes were given. Homework was done through OWLv2 (Online Web-based Learning), an integrated online course system provided by Cengage, the publisher of the course textbook, and which allows the faculty member to create and customize assignments. I put together daily homework sets for both semesters, which included Tutorials (often including video or animation), Mastery Questions, and Review Questions (based on material from a previous class period). These assignments are graded by OWL and provide immediate feedback to the student. Access to OWL is via a code which comes with the purchase of the textbook. The student’s syllabus included for each class period specific readings from the textbook to be completed prior to each respective class meeting and a list of all OWL assignments to be completed. Exams were written by the faculty member; two were given during the fall semester (mid-term and final) and three during the spring semester. The Final Grades for the course are based on the quizzes, exams, and homework examined here, plus lab grades and other work.

Our success criteria was 70% of students scoring at or above the C level.

TABLE 1.	Chemistry 107L			Chemistry 108L		
	Fall 2016 ( <i>n</i> =41)	Fall 2017 ( <i>n</i> =37)	Fall 2018 ( <i>n</i> =54)	Spring 2017 ( <i>n</i> =32)	Spring 2018 ( <i>n</i> =25)	Spring 2019 ( <i>n</i> =31)
TEXTBOOK	Hard Cover	Loose-Leaf	Loose-Leaf	Hard Cover	Loose-Leaf	Loose-Leaf
QUIZES						
Average/10	7.2	7.1	7.7	<i>no quizzes</i>	8.0	<i>no quizzes</i>
% C or better	64.9%	73.2%	68.5%	<i>given</i>	84.0%	<i>given</i>
HOMEWORK						
Average/10	9.2	9.2	7.0	8.8	8.9	8.1
% C or better	91.9%	87.9%	77.8%	96.8	96.0	83.8%
EXAMS						
Average/100	64.4	60.6	63.0	69.5	67.5	69.8
% C or better	43.2%	41.5%	49.0%	43.8%	52.0%	45.2%
FINAL GRADE						
Average/100	80.0	73.8	73.4%	80.6	80.2	79.0
% C or better	83.8%	75.6%	66.7%	89.2%	87.0%	83.8%

Table 1 includes data collected from the General Chemistry course (Chem 107L) from Fall 2016 (hardcover book) and Falls 2017 & 2018 (loose-leaf book), and from the Chemical Analysis course (Chem 108L) from Spring 2017 (hardcover book) and Springs 2018 & 2019 (loose-leaf book). For each category (Quizzes, Homework, Exams, and Final Grade) the average student grade for all of that type of assignment is given, followed by the percentage of students whose average grade was above 70%, our success criteria.

As can be seen, neither changing the format of the textbook, nor adding the “Questions To Ponder,” changed the statistics significantly. What does stick out are the final grades for the fall semesters, with the huge drop in fall 2017 being continued in fall 2018. When we first initiated the plan to get students to use their textbooks more the problem was that, although most if not all students were purchasing the textbook, a large number just weren’t using it effectively. What we have seen in the past two falls is that large numbers of students just aren’t purchasing the textbook at all, which, again, means that they can’t do the homework. In the Fall 2018 seven students did not do the majority of the homework and four didn’t even show up for the final. In the absence of these seven the averages for the homework would have been 8.2/10 (93.3% C or better), for the exams 72.4/100 (59% C or better), and overall 78.4/100 (80.0% C or better).

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Second, about five weeks into the Fall 2017 course we recognized that a large number of students had failing grades for the course. This was, in large part, because they were not doing the on-line homework, which is accessed through the Cengage portal, OWL. When we spoke with those students they each indicated that they had not, even at that late date, purchased the textbook. The lack of a book and access code would have, after the first two weeks of the semester, prevented those students from accessing their OWL homework and earning points for completing it. When asked why they had not purchased the textbook, the response from all but one student was that “the bookstore had run out”. When then asked whether they had had the bookstore order them a copy they each looked very confused, like they were hearing a foreign language and didn’t understand the words. It is our conclusion that we have come to a generation of students who may have never been inside an actual brick-and-mortar bookstore and so didn’t know that ordering out-of-stock books is something a bookstore just does.

Third, at the end of the first semester, a couple students approached the instructor to indicate that they were disappointed that we “hadn’t used the textbook more for the class”. These students were shown a copy of the syllabus, which indicated that for every class period there were a number of specified pages in the book that they were to have read beforehand, plus the assigned problems from the end of each respective chapter. Even though this information had been presented by the instructor at the beginning of the semester, appeared on the syllabus, appeared on the calendar for Moodle, and was referenced multiple times during the semester, these students never got the connection between their syllabus and work required of them through use of the textbook. Several indicated that their primary means of gathering information outside the classroom was through on-line videos.

#### **IV. Program Changes for the Upcoming Year.**

Based on the results reported above, we need to find better ways of getting students to engage more with their assigned textbooks, particularly at the freshman level. However, we do not feel that this requires any programmatic changes at this time.

## **V. Action Plan for the Upcoming Year.**

The above data recorded textbook usage for the 2018-2019 academic year. During the 2020-2021 academic year CHEM 107L and CHEM 108L course format changed dramatically due to the COVID19 pandemic. This new format flipped the classroom where students were given access to video lectures and then came to class to work through problem sets and activities. The Chemistry Department would like to analyze the impact this alternative mode to teaching had on student engagement and outcomes.

This year the Chemistry department would also like to work on objective 3a and rework the lab report writing process in CHEM 213L and CHEM 214L. This year post lab assignments are going to be written in a lab report outline to help students understand what data and information belongs in the respective sections of a lab report. At the end of each semester students will be able to pick one lab to write up as an official lab report. Using both the graded post lab and detailed rubric students should have a clearer understanding lab report organization.

For the upcoming year the Chemistry department would also like to continually work on their curriculum map as they reassess the learning objective for each course taught in the program.