

## Affordable Learning Georgia Textbook Transformation Grants

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Institution Name(s): University of North Georgia

### Team Members:

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Project Lead: Jim Konzelman

Course Name(s) and Course Numbers: Principles of Chemistry I & II, CHEM 1211 and 1212

Semester Project Began: Fall 2015

Semester(s) of Implementation: Fall 2015 and Spring 2016

Average Number of Students Per Course Section:

Number of Course Sections Affected by Implementation: 8

Total Number of Students Affected by Implementation: 321

### 1. Narrative

A. The main goal of our project was to introduce a free and open access chemistry textbook into the two semester freshman chemistry sequence. Traditionally, students must purchase a textbook which is good for both semesters, two lab manuals, safety glasses, a calculator, and online homework access. The costs for all of these items places chemistry as one of the most expensive courses taken by freshmen, especially since the textbook cost is incurred the first semester.

We adopted the Openstax chemistry textbook available free online, and as printable version for a nominal fee. Since this text is free to edit and disseminate, we were able to modify it for to fit our purpose. The link to the text was provided in the course syllabi, so students had free access from the first day of class. In addition, our course website provided smaller portions of the text organized into units that paralleled the courses progress.

The students applauded the fact that the textbook was free, as expected. A surprising number expressed a preference for a physical textbook over the online version, even if they were required to pay for it. So the second semester, we emphasized the option to order the printed text. In the future, we intend to have the bookstore carry the printed version to meet the needs of these students. It is worth noting that the printed version of this open

access textbook is significantly less expensive than those provided by publishers, making the switch worthwhile.

The secondary goal of this project was to build a website to support the open access mission. The concept was to build a website to organize and deliver the course content in one online location. This goal was significantly more challenging and time consuming. First, it involved coordination from two different campuses between two professors to agree on content and delivery. Second, this material had to be developed in a timely fashion into the appropriate media, delivered to our computer expert, and formatted and published to the internet site in the appropriate format. The main challenge was time, as we wanted to create the 'perfect' product, yet had to stay on schedule as we developed materials the same semester as they were used. The great part is we now have an excellent website that is completely under our control, and can be edited and improved upon at any time. We are no longer reliant upon the publishers for our content. In addition, the students can access the course content 24/7 which includes lecture videos, notes, homework, and the text. We are grateful to ALG for providing the resources and opportunity for us to create this website and plan to build upon it each semester. We now have true academic freedom over the course content and delivery, and that is a real transformation.

Lastly, we decided to use the development of this website to 'flip' the classroom, as is a current trend in education. The idea was to have students access all of the course materials on the website. As lectures were pre-recorded and posted, along with the text, there was no longer a need for a traditional lecture. If students were to watch the lectures online, read the text prior to attending class, then the precious and limited class time could be used to address particular questions, and actively practice applying the concepts rather than passively listening to a lecture. This experiment was an uncomfortable experience for a professor who has been lecturing for over 20 years. It was quickly apparent that the students were not ready for this format either. The performance on the first exam was the lowest exam average of this professor's career! The format of the class was flipped back to a more traditional style, with the online materials playing a supportive role than a primary one. Interviews with students revealed that the more mature students tended to prefer the flipped classroom, while the younger and less responsible students relied on lecture to learn and rarely took the initiative to access the online materials. This experiment is worthy of being revisited, but will require more structure to motivate students to prepare.

Overall the students benefited from the free and open access chemistry textbook. We no longer had the few students who did not buy the text because of financial burden, nor did we have those students who were waiting on their text to arrive having purchased it online, nor did we have those waiting on the bookstore to restock their supply. There was an expressed preference for the printed version of the text, so we will be making that available in the future through our bookstore.

The supporting website received overwhelmingly positive reviews. Students appreciated having access to the materials at their disposal, and being able to revisit the lectures multiple times. In the past we have experienced students referring to information

they accessed on other websites, but with the implementation of our supporting website the students seem more focused on the materials being presented within the course structure, and therefore, less distracted. This increased focus is exactly what we hoped to accomplish; creating an environment that is efficient for learning.

In breaking with tradition, and adopting a free and open access chemistry textbook, we expected some resistance from our colleagues. The opportunity to participate in this pilot project was open to all chemistry faculty at UNG, and yet only two chose to participate. Our goal was to demonstrate that the student learning with a free and open access textbook would be at the same level as those with a traditional textbook; that we would have done no harm. We did not expect students to suddenly outperform their counterparts simply because the textbook was cheaper, or the information was presented in a different format, but we did need to ensure that the free textbook was effective enough for student to perform as well as expected. So in many ways, our project was an evaluation of the textbook and its content.

The CHEM 1211 fall semester courses were given a survey at the end of the semester to evaluate student opinions of using a free online textbook. Whereas the responses were overwhelmingly positive for the supplementary materials, the textbook received mixed reviews (38% positive, 38% neutral, 11% negative, with the balance abstaining) We were surprised to learn that there was a preference for a printed version of the textbook over the online only. To accommodate this request, the printed version of the text will be carried in the bookstore in future semesters. As the CHEM 1212 courses were populated by many of the same students, we chose not to administer the survey to these courses.

This project was quite an ambitious undertaking, and perhaps the best lesson learned from this experience would be to include more people in the task to share the workload, or try to make fewer changes at one time. There was a need for the two professors to teach enough sections to collect the data, and this prevented the use of reassigned time to accomplish the necessary workload. It was a great experience, and a worthwhile endeavor; we thank ALG for the opportunity.

## **2. Quotes**

“it was really nice to get everything you needed so quickly”

“having lectures at my personal disposal was great I think it was very effective”

“the textbook was excellent because it was free! And easy to read”

### 3. Quantitative and Qualitative Measures

#### 3a. Overall Measurements

**Was the overall student opinion about the materials used in the course positive, neutral, or negative?**

Total number of students affected in this project:   321  

- Positive:   85   % of   50   number of respondents
- Neutral:            % of            number of respondents
- Negative:   15   % of   50   number of respondents

#### Student Learning

##### Outcomes and Grades

To measure the learning outcomes we had the students in each section take the American Chemical Society's standardized final exam. Two courses, one each for CHEM 1211 and 1212, were used as controls. The raw scores for the CHEM 1211 courses in this study were pooled together and compared to the control group. The same analysis was performed with the CHEM 1212 data. The data was analyzed for differences using the Student t-test, with our null hypothesis being the same for both sets of data: "the means on the ACS exam for the control and test groups are the same, and any differences are random, and therefore not a result of our use of the online textbook."

The analyses were done at the 95% confidence level, and in both cases, our null hypothesis was rejected. We cannot state with confidence that any differences in the data are random. However, the means for the controls and test groups are extremely close, so that no real differences are apparent. It is likely that with collection of more data in the future we will be able to demonstrate a correlation between the two controls and the test subject's performance on the ACS exam. The standard deviations in both the control and test groups are quite high, which lowers the confidence level in the data.

Choose One:

- Positive: Higher performance outcomes measured over previous semester(s)
- X   Neutral: Same performance outcomes over previous semester(s)
- Negative: Lower performance outcomes over previous semester(s)

## **Student Drop/Fail/Withdraw (DFW) Rates**

### **Drop/Fail/Withdraw Rate:**

25% of the students, out of a total 321 students affected, dropped/failed/withdrew from the course in the final semester of implementation. As compared to 34% in the control groups.

Choose One:

- **X** Positive: This is a lower percentage of students with D/F/W than previous semester(s), as compared to the 34% in the control group.
- Neutral: This is the same percentage of students with D/F/W than previous semester(s)
- Negative: This is a higher percentage of students with D/F/W than previous semester(s)

### **4. Sustainability Plan**

Our data supports the continued use of the OpenStax chemistry textbook in our freshman chemistry sequence. Our goal is to continue to collect data on its effectiveness in an effort to convince our colleagues to implement the text in their courses, to benefit even more students.

The supporting website will be edited, updated, improved and built upon as a collaborative effort for the foreseeable future.

### **5. Future Plans**

Participation in this project has led both investigators to pursue development of additional instructional materials to support their courses. We no longer see the need to adopt materials provided at high cost from the traditional publishers. We intend to develop lower cost materials that are more course specific.

We presented our findings at the USG Teaching and Learning Conference in Athens Ga in April 2016.

### **6. Description of Photograph**

From left to right: John Williams, computer guru; Dr. Greta Giles, instructor; Dr. Jim Konzelman, instructor