

# **Textbook Transformation Grant: Final Grant Report**

## **Digital textbook for Survey of Chemistry II Course**

### General Information

**Date:** 08/12/2021

**Grant Round:** 17

**Grant Number:** 526

**Institution Name(s):** Perimeter College Georgia State University

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**Course Name(s) and Course Numbers:**

CHEM 1152-016 CRN: 16003( Ms. Jain)

CHEM 1152-028 CRN: 19786( Dr. Williams)

CHEM 1152-006 CRN: 15263 ( Dr. Mativo)

CHEM 1151-022 CRN: 16133 ( Dr. Atteya)

CHEM 1151-020 CRN: 16134 ( Dr.Malincolico)

CHEM 1151-026 CRN: 17865 ( Dr. Kelley)

CHEM 1152-006 CRN: 53187 ( Dr. Atteya)

CHEM 1152-008 CRN: 53188 ( Dr. Phillips)

**Semester Project Began: Summer 2020**

**Final Semester of Implementation: Summer 2021**

**Total Number of Students Affected During Project: 134**

## 1. Narrative

The goal of this project is to develop a supplemental digital textbook for students taking Survey of Chemistry II course that supports the tenets recommended by vision and change to integrate core concepts and competencies throughout the curriculum, focus on student-centered learning for all students and employ relevant, interactive, effective, collaborative, outcome-oriented, engaging learning materials. The outcome is highly positive, encouraging and satisfying. The link to the .pdf file of the written book is: <https://drive.google.com/drive/folders/1TRwckkFCjEpTinQC1TjTahutWeVZZ3lf> and the URL of the ebook is: <https://chemistrylearningbydoing.org/> which is currently relocated to <https://gsusurveychemistry.org/>

CHEM 1152 course is a non-science major pre-requisite chemistry course for students who seek professional career in health science, it is a very important gateway science course of their program of study based on important core concepts Organic and Biochemistry. The course covers a huge amount of organic and Biochemistry materials. At Perimeter College, this course is one of the highest enrollment courses. But the

success rate is low 68.6% in fall 2019 possibly due to vast materials covered and the level of challenges presented to students.

Total 134 students participated in this study during spring'21 and summer'21. They all have used the ebook except "control" group and completed the course successfully. These students took nationally standardized exam for final exam and performed very well on the exam. This study has been approved by Institutional Review Board (IRB) of Georgia State University, Perimeter College.

#### GLOBAL PANDEMIC and IMPACT on eBook:

Work on creation of this eBook started when the world was "normal" and students and teachers used to have an "educational environment". But the team didn't stop when Pandemic hit and we all had to make a transition to "new world of education".

For the students, the most immediate impact has naturally been that the temporary cessation of face to face teaching at Perimeter GSU, undergraduates who are about to finish their college degree, in a completely new situation, without a clear idea of how long it will last, immediate impacts on daily life, costs incurred and financial burdens and, of course, learning continuity and restriction on mobility.

Teachers are also impacted significantly at the workplace and professionally. First, the fact that not all faculty members have strategies for the ONLINE teaching. Also, the most evident impact on teachers is the expectation, if not the demand, of the continuity of teaching activity using a virtual modality.

If there has ever been a time when we need to embrace bold solutions in education, especially to the challenges faced by the underserved, this was the time.

Remote learning may not work for many financially challenged students. Remote instruction is far from ideal for any student, and most teachers lack the skills needed to teach remotely in an effective way. In a national survey of more than twelve hundred K-12 teachers conducted by ClassTag in March, more than half (56.7 percent) of the teachers who responded said they are "not prepared to facilitate remote learning," while a somewhat smaller percentage (42.8 percent) said they alone are responsible for deciding which remote/online tools they use. We know teachers are in need of support, yet not enough attention has been paid to helping them learn how to teach online.

**While preparing this report, one must understand the teachers' mentality and students' acceptance to an eBook which was offered to them when pandemic was at its peak and everyone is fatigued and at end of their "normal" zone of teaching and learning.**

**Creation:** The thought of writing an ebook came into PIs mind from the classroom teaching experience. Students these days are very busy in an open access institution with multiple responsibilities, and knowledge they acquire in a different format, mostly visual and compact way. Traditional textbooks do a great job with detailed descriptions, diagrams and explanation of all the course materials but average students' attention span can't connect to them and they tend to look for most important information from the textbook.

In this process, they miss important links between the materials and learn the materials as a bunch of information only. Coming from a non-science background, students in general are uncomfortable by the details of scientific methods and instead of understanding and enjoying the materials, they tend to memorize the assessment materials or easily get overwhelmed by the huge amount of materials presented to them.

The second burning factor is the skyrocketing price of the current textbooks. Most access institution students are in desperate need for financial aid when they join college and some of them drop out of college just because they can't afford the high cost of college education. They simultaneously do three, four jobs for their living and don't get enough time focus on their study materials. This is the main reason behind making this ebook absolutely free of cost. Students would feel less burdened and focus on learning if other issues are removed from their head.

There is a need to teach these students effectively so they don't feel pressurized by the volume of the content and showing scientific topics in a way that they can figure out easily at the same time no financial barrier should keep them off from learning. The PI discussed these issues with other faculty members who were not hesitant to share their similar experiences. After they kindly agreed to write the textbook for absolutely free of cost, an application to the Textbook transformation grant (ALG) was submitted. The goal is not trying to eliminate any benefits of using the standard textbooks but only to satisfy the need of the modern generation of students by getting interested and involved in high standard education and enhance their success rate.

This ebook has been written with shorter descriptive text and lot of videos and few simulations. All the text materials are created by grant members. They used Creative common licensed materials for images and resources that are available for free and ready to share and use. Chemistry simulations on College Chemistry topics are very popular nowadays as it helps visual learners to understand the materials in an easy way. It also encourages them to be a self-learner as students can play with the variables within the activity and see the cause-effect relationship. There are several standard simulations sites are available and created by different universities and organizations. This ebook also has several short quizzes based off each topic and one cumulative chapter quiz that help to summarize and test the concepts and numerical problems of each chapter. Also, there are

practice questions-answers at the end of each sections as learning check practice questions.

Project work started after the kick out session in summer'20. In summer'20 and fall'20, PI met virtually with other two grant members periodically and discussed the learning objectives of all the chapter, organization part of the eBook. The bulk part of the course was written during the semester break and in fall'20. By the spring'21, construction of course materials was complete.

The content of the ebook is written following the standard course curriculum created for this course. The rigor and depth have been maintained at the appropriate level necessary for the students to crave for the knowledge as well as succeed in this course. Apart from the electronic copy, a website was created for the students to make the content accessible from mobile device and user friendly, interactive way to promote learning. The website contains content materials, short quizzes, summary pages and one cumulative quiz for every chapter as self-assessment test.

Initially it was challenging due to creating new materials, uploading them on website and testing continuously before publishing the materials. But gradually the work became easy and technical part got settled down with continuous exploration and debugging the problems. The ebook has been delivered on WordPress digital platform which is considered to be university approved digital system for communicating with students and faculty members. A learning Management System (LMS) was set up on the platform to organize the materials. LearnDash WPLMS is used by several institutions and faculties in Academia as it builds nicely the structure of a course with review, batches and other options to teach a course. Different plugins were downloaded for extra features like quizzes, Power point slides etc. The PI appreciates the feedback and contribution from other instructors for all the suggestions to improve the materials and technical aspect of the ebook.

The ebook has been used as only textbook for classroom teaching in five different sections across the different campuses at Perimeter College in Spring'21 and two sections in summer'21. This report is primarily based on a pre-final semester pilot as not many courses are offered in summer. Students performance on quizzes, exams have been recorded, final exam and course grade have been collected for all the courses. Among five sections, one Blended and one ONLINE (Online "C") only had eBook as the standalone textbook. Other sections used as supplementary textbook. One of the sections "Hybrid" didn't used any specific textbook but used all online resources available for this course to teach the course. One section data were collected as "Control" as it was using standard textbook in their course.

In summer'21 two sections were considered as part of the study. One section data was used as "Control" using standard textbook (Online A) and another section using ebook (Online-B). Both sections were taught using remote instruction format.

PI continuously worked with all the instructors teaching using the ebook during the spring'21 transformation period. Any typos, missing values were corrected. Students appreciated the layout of course materials, the way materials are presented and the quizzes. Course completion rate was very high. Students' performance were also recoded for quizzes, exams periodically throughout the semester and comprehensive final exams. Online analysis was performed for the final exam which was given on icollege D2L. The final outcome was satisfactory. Students responded spontaneously to three surveys that were conducted in class at different time of the semester. All the responses are very positive indicating the success of this new way of presenting course materials and learning technique.

An application was submitted in July 2020 to University IRB to study of effect of using the ebook in classroom and it was approved. The institutional review board asked PI to revise the informed consent form that was given to the students to get their consent. It was made sure that students would receive extra credit points for using the ebook and no other harm or benefits were associated with this project. The project idea was presented in college faculty development day as well as local conference (GA Academy of Science) in spring 2021 along with other grant members.

The main lesson learned was how-to concise a material, create and use creative common license materials to successfully teach this non-science major chemistry course. The most challenging part of writing the ebook was time limit to complete the project. Since all the project participants are full time teaching faculty occupied with many other professional responsibilities, preparation period was too short to complete a full course textbook writing. In future, the team would like to work on the materials before grant period starts. More preparation before applying for the grant would be immensely helpful. From the students' perspective, the website of the ebook not only serves as a learning resource but it is also used as a unique teaching site. While multiple instructors teaching using the same resource at the same time, WPLMS requires subscription of the students to enroll in a particular. Lack of registration at the proper time, enrollment in proper batch, downloading the grades and other technical issues seemed hectic at the starting of the course.

## 2. Quotes:

So far more than fifty students feedback have been recorded on the ebook website. Some mixed responses were obtained. Here are some quotes written by the students using the ebook.

Summer'21

- Overall, chemistrylearningbydoing.org was easy to use and was very helpful throughout this course. It streamlined the important topics covered in this course, and it provided supplemental instruction that helped me to understand the material presented.
- It was great because we used the same thing for CHEM 1151

Spring'21

- “This amazing it was very helpful and is understandable. especially the videos .
- Ebook is kind of OK to understand the chemistry if we already know some basic chemistry otherwise it is hard to understand the text of ebook.
- I didnt like it because it was hard to follow and not easy to find the material.
- very good
- I had a good experience the book was very accessible
- It was amazing to learn with it
- It was good
- I havent really been able to use the ebook due to it not letting my log in
- My experience with the book was good. It provided good examples and detailed information about the topics.
- Using the ebook has been great. I have learned a lot and it is easy to navigate.
- Very awesome
- It is great when it works. Sometimes it will not let me click on the chapter
- At first I used the online book but later on I went on to purchase the book”

### 3. Quantitative and Qualitative Measures

#### 3a. Uniform Measurements Questions

*The following are uniform questions asked to all grant teams. Please answer these to the best of your knowledge.*

#### **Student Opinion of Materials**

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



Total number of students affected in this project: 134

- Positive: 82.5 % of \_\_\_\_\_ number of respondents
- Neutral: 0 % of \_\_\_\_\_ number of respondents
- Negative: 16.5 % of \_\_\_\_\_ number of respondents

### **Student Learning Outcomes and Grades**

**Was the overall comparative impact on student performance in terms of learning outcomes and grades in the semester(s) of implementation over previous semesters positive, neutral, or negative?**

*Student outcomes should be described in detail in Section 3b.*

Choose One:

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

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

**Was the overall comparative impact on Drop/Fail/Withdraw (DFW) rates in the semester(s) of implementation over previous semesters positive, neutral, or negative?**

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

*Depending on what you and your institution can measure, this may also be known as a drop/failure rate or a withdraw/failure rate.*

20.41 % of students, out of a total 134 students affected, dropped/failed/withdrew from the course in the final semester of implementation.

Choose One:

- ☐ Positive: This is a lower percentage of students with D/F/W than previous semester(s)
- ☐ 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)

### **3b. Measures Narrative:**

The study of the effect of using the ebook was divided in both qualitative and quantitative parts. To start with the analysis, average GPA of students participating in the study was determined and found to be 2.96. Students registering for this course come with a minimum to negligible background in science. In the beginning of the transformation period in spring'21, a consent form was given to students to officially recognize them for this study. There were total 94 consents forms were collected. PI confirmed that students' data would be completely confidential and extra points would be provided for participating in this study.

**Surveys:** There were three survey questionnaire forms filled out by the students periodically throughout the transformation period spring'21. The first survey was conducted to determine the attitude, background skill set and motivation. The study shows that some students have taken chemistry in K-12 level before but didn't have a good experience about it. Some have taken it as a college course before but didn't succeed. All of them have taken Survey I course before taking this course. Students' population is well diverse and split in higher achiever, medium or underachiever which is typical for this course at Perimeter College.

Another survey results on perception shows that most students expect that they would pass the course with grade "A". It indicates that students are motivated by grades and a positive learning experience can help them to succeed and build a professional career in health science. Classroom activities were mainly solving questions on white board and practicing learning check problems. Blended method of teaching worked well for these students with digital content. No major change in delivery or design were applied during the transformation period. In Online (A) section, PowerPoint was voice over narrated and students enjoyed that part. Overall students Instructors taught in their usual method and students used the ebook to complete the course assessments. Some instructors had standard online homework program or instructor-created set of assignments as homework. There was no issue with students having difficulties to comprehend the materials from ebook to complete the course assignments. Students indicated that they were engaged and worked hard to succeed. Several tools they used for learning were power point slides, chapter quizzes from the ebook.

Some students mentioned:

"To have a general understanding about carbons and its attachments as well as further knowledge with the IUPAC naming system."

And

"The expectation level from this course is to just do your work, figure out what strategy works for you, and completing assignments in a timely matter."

The final survey about the experience of the ebook was extremely positive. Many students mentioned that the ebook covered more in depth that was not discussed in class. Students mentioned that the materials are simplified for better understanding, easy to follow.

"This ebook is definitely better than an actual book. the process of being able to go through notes and then have a review powerpoint and a quiz to follow makes it very easy to fully

understand the material. I also love the extra youtube videos that are uploaded to also help learn the material.”

The course got highest rating 5 on most of the survey forms. Students mentioned they found about the interactive quizzes on website was extremely helpful and effective resources to prepare for the exam and other course assignments. Several of their feedback already have been mentioned above under “Quotes” section. Only five students had reservation using the eBook specifically due to server issue and not aligning the test questions with the materials presented in eBook. Though we didn’t get 100% of the students recommended to use the ebook to other students but the overall acceptance rate was very high.

**Quizzes and Exams:** All instructors gave their own unit exam and they all used end of chapter quizzes from ebook except one section that was considered to be the control section. In control section, exam performance was same compared to previous semester. This group of students were not exposed to the ebook materials. The comparison of performance of this class in this study was included to examine the impact of traditional textbook to improve students’ performance. It was found that for Online “A” section, both exam and quiz grades improved from previous course ( 82.52% from 73.9% and 77.15% from 73.96% respectively) but in other courses either exam or quiz average showed minimum increase for their classes. It was also noticeable that hybrid course performed best among all with no specific textbook followed. It is evident from the data that students who used standard textbook to prepare for the exam, perform at the same level as students using other sources to succeed in this course. Since all groups instructor didn’t teach the same course in fall’20, data from their previously taught course have been presented for comparison.

### **Table I**

Below are tabular form of percentage data showing quizzes and exam average for all the courses used in spring’21 implementation phase. For anonymity, individual instructors’ names have been replaced by course modality.

From the data, it is evident that exam averages are either same or above the previous semester average after using the ebook for Online B & C sections. It is interesting to see how Blended section of students improved using the ebook (in quizzes) whereas for tests, average decreased compared to previous semester. Reasons could be difference in students' population, access to

Sections	Spring'21 Unit Exam Av.	Previous term Unit Exam Av.	Spring'21 Quizzes Av.	Previous Term Quizzes Av.
ONLINE(1)-A	82.52	73.9	77.15	73.96
ONLINE(2)-B	77.5	80.49	72.6	73.7
ONLINE(3)-C	87.7	89.9	81.45	86.09
BLENDED	78.56	80.07	84.12	77.97
HYBRID	74.1	70.5	75.3	70.5
CONTROL	82.47	77.01	61.6	57.40

the digital content or the lack of sufficient time for a particular group of students. It is also to be noted that Blended section used the ebook quizzes as a part of the course grade but ONLINE sections took them for practice purpose and as Extra Credit Assignment. Average grades for quizzes for these two groups using only eBook (Blended & Online C) were very high, 81.45% and 84.12% respectively. It may indicate that for other groups, students were able to retain the information for quizzes whereas some students took time to grasp the materials to prepare for the tests.

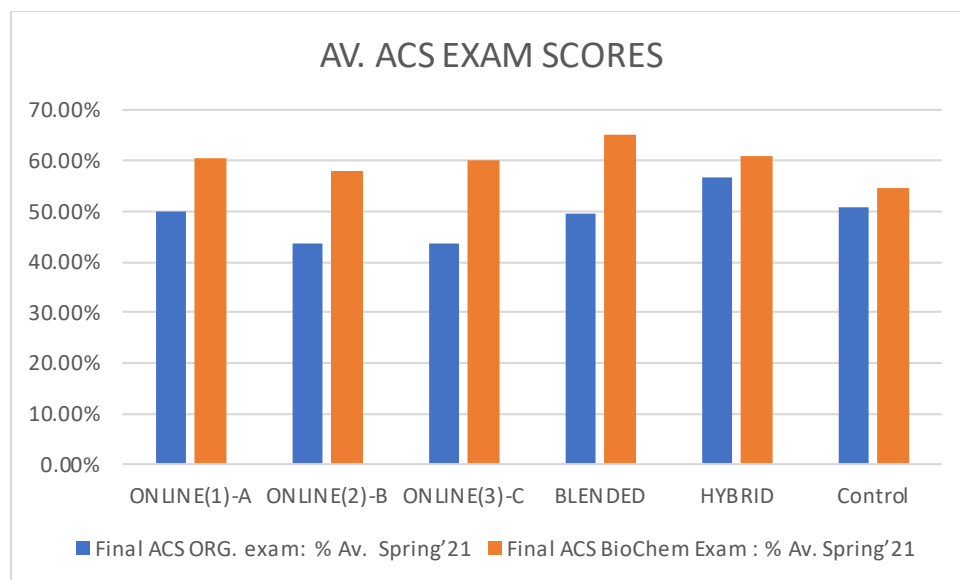
Another important factor is that assigned textbook readings are a common requirement in undergraduate courses, but students often do not complete reading assignments or do not do so until immediately before an exam. This may have detrimental effects on learning and course performance. Instructors assign textbook readings for a variety of reasons, most commonly because it is often impossible to present all necessary course material during class time. Regularly scheduled quizzes on reading material may increase completion of reading assignments and therefore course performance. This study reflects the effectiveness of compulsory, mastery-based, chapter quizzes as a means of improving exam and course performance. Completion of quizzes was related to both better exam and course performance. The study recommends the use of quizzes in undergraduate courses.

**Final exam:** ONLINE ACS FINAL comprehensive exam is used to evaluate students' performance in this course. There are two parts of this exam 1) Organic and 2) Biochemistry and

total sixty questions in each of the exam. The same exam was used as final exam for both fall'20 and spring'21 semesters post pandemic when instructions moved to blended and mostly online. In this report, the detailed final exam analysis has been presented with the comparison study from fall'20 and previous semesters. Considering the vastness of the materials covered in this course, results of two main learning objectives topics from each exam 1) "Organic", and 2) "Biochemistry" have been discussed in this report. Two questions have been chosen randomly among other questions on the same category in the exam. Average percentages of correct responses on chosen questions have been presented in tabular form. Also, to be more precise, two sections of percent correct response data corresponding to organic and biochemistry part have separated and presented individually. It is noted that for the hybrid, Online (C), & Blended section instead of fall'20 data, previous semester data taught by the same instructor have been compared with since the instructor didn't teach the course in fall'20.

**Table II:**

<b>Sections</b>	<b>Final ACS ORG. exam: % Av. Spring'21</b>	<b>Previous term</b>	<b>Final ACS BioChem Exam : % Av. Spring'21</b>	<b>Previous Term</b>
<b>ONLINE(1)-A</b>	49.9%	44.1%	60.47%	56.79%
<b>ONLINE(2)-B</b>	43.7%	35.3%	57.92%	59.98%
<b>ONLINE(3)-C</b>	43.7%	43.0%	60.19%	33.3%
<b>BLENDED</b>	49.38%	45.5%	65.21%	35.6%
<b>HYBRID</b>	56.5%	50.5%	60.83%	51.5%
<b>Control</b>	50.8%	48.5%	54.64%	60.83%



### TABLE III:

#### TABLE III: ACS EXAM: ORGANIC

Comparison study was conducted with data collected for F2F EXAM before SPRING'20 or ONLINE FROM FALL'20 and SPRING'21

Studied % correct responses for Two similar questions based on learning outcomes were observed:

- 1) Functional Group Chemistry <https://gsusurveychemistry.org/lessons/module-10-intro-to-organic-chemistry/>
- 2) Stereochemistry : <https://gsusurveychemistry.org/lessons/module-15-chirality-chiral-molecules/>

#### ACS EXAM: Biochemistry

Comparison study was conducted with data collected for F2F EXAM before SPRING'20 or ONLINE FROM FALL'20 and SPRING'21

Studied % correct responses for two similar questions based on learning outcomes were observed:

1) 1)Glycosidic Bond

<https://gsusurveychemistry.org/topic/chapter-16-unit-7-chemical-reactions-of-monosaccharides-disaccharides-and-polysaccharides/>

2) Enzyme Activity

<https://gsusurveychemistry.org/topic/chapter-20-unit-4-enzyme-actions-models/>

- For the organic topic, two different questions that reflect understanding ability of students have been considered in this report. Results below shows the average percent correct response for those two questions.

Sections	Stereochemistry % correct(Spr'21)	Stereochemistry % correct (Previous term)	Functional Group % Correct (Spring'21)	Functional Group % Correct ( Previous term)
Organic Exam				
ONLINE-A	58%	33%	46%	13%
ONLINE-B	42%	28%	38%	29%
Online-C	31%	42.5%	35%	45%
Blended	62.5%	22.2%	25%	22.2%
Hybrid	70%	48.4	60%	32.3
Control	64%	71%	50%	43%
Sections	Glycosidic Bond% correct(Spr'21)	Glycosidic Bond% correct( Previous term)	Enzyme Activity % Correct(Spring'21)	Enzyme Activity % Correct( Previous term)
Biochem Exam				
ONLINE-A	68%	69.2%	68.0%	46.2%
ONLINE-B	55.0%	16.0%	20.0%	36.6%
Online-C	59.26%	-	11.1%	-

<b>Blended</b>	62.5%	33.3%	50.0%	11.1%
<b>Hybrid</b>	90.0%	13.3%	20.0%	46.7%
<b>Control</b>	57.1%	66.7%	42.9%	66.7%

\*\*\* “-“ Data unavailable

The first learning objective was chosen as concept of stereochemistry and “Chirality”. Students performed in the range of 58-70% correctly answered the questions. It may be concluded that the traditional book didn’t help the students enough to perform any better on the same question where they are provided with numerous diagrams and problems. Instructor led classroom teaching is most effective tool in this case. Compared to previous term every group of students showed high improvements except Online (C) where overall students’ performance was lower compared to previous term.

The second learning objective was chosen as “Acetal” functional group. Structure of acetal is another very important concept in this course and the specific question chosen for this study from exam is about deeper concept on this topic. Results show where some groups struggled to understand the concept of Acetal (25% only for blended) but some students did gain deeper understanding on the concept specifically control and hybrid groups. Concept of carbonyl group reaction could be challenging irrespective of traditional and non-traditional format of reading and the results confirm the fact. Although use of ebook didn’t make drastic positive impact on students’ performance but overall it can be considered as effective with average close to 50% correct responses in understanding the concept.

The third objective that was chosen for analysis is “Glycosidic Bond” from the “Biochemistry” subpart of the exam. This concept is relatively simple but very important for the students to build the foundation of this course and results are presented below based on students’ performance on question. Results show all group of students performed very well on those question they all performed better from previous semester. Concepts of carbohydrates are vital in this course and Online-C group maintained a steady performance in all three learning objectives. The students were able to gain knowledge using the ebook and showed overall improvement in performance compared to previous semester’s final exam.

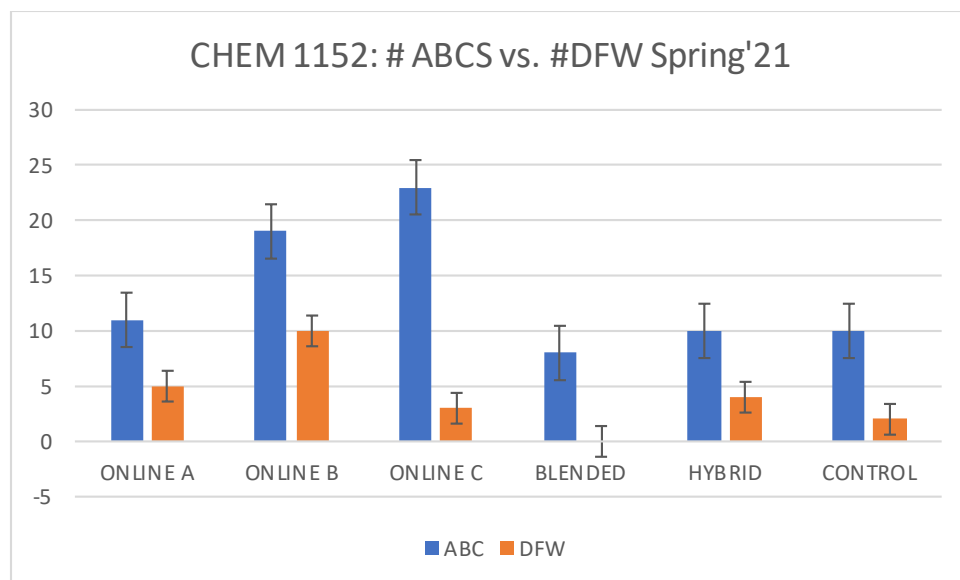
The fourth question was on “Factors Affecting Enzyme Activity” and it is a challenging but very important topic in this course. The questions makes it more challenging as it involves graphical interpretations of the concept which students of this course are usually less comfortable with. But, it is evident that except Online (C) sectional other groups did fairly well and especially Blended section performed remarkably well and way better compared to previous term.



Overall final exam results were very positive. Average mean percentage ranges from 48.68% in Organic to 60.92% in Biochem which is consistent with this exam comparable to nationally standardized exam. Control section was performing with a different trend compared to all the sections under the study and remained unrelated to the success of the eBook.

**Success Ratio:** Usually the success rate of this course is low due to several factors including students' background, retention, adequate time and proper resources to learn the materials. In some classes it was as low as 57.8% and high as 83.7%. But the overall withdrawal rate among different groups is low 5% to high 16%. Students withdrew for varied reason other than being unsuccessful in the course. In some groups, for example Online(C), only one student has withdrawn in sprin'21 term. In other groups also, D. F percentages are higher than "W" percentage indicating any unprepared students didn't withdraw from the course and completed the course regardless of the final outcome. That may reflect the long-term benefits of students learning and retention rate using an effective method of teaching with the helpful resources appropriate to modern age. For each individual groups, percentage values of ABCs are also consistent. About 25% of the passing students received A in class may indicate students are not struggling to succeed in this course. Grade distribution data of each group have been presented with other documents along with the report.

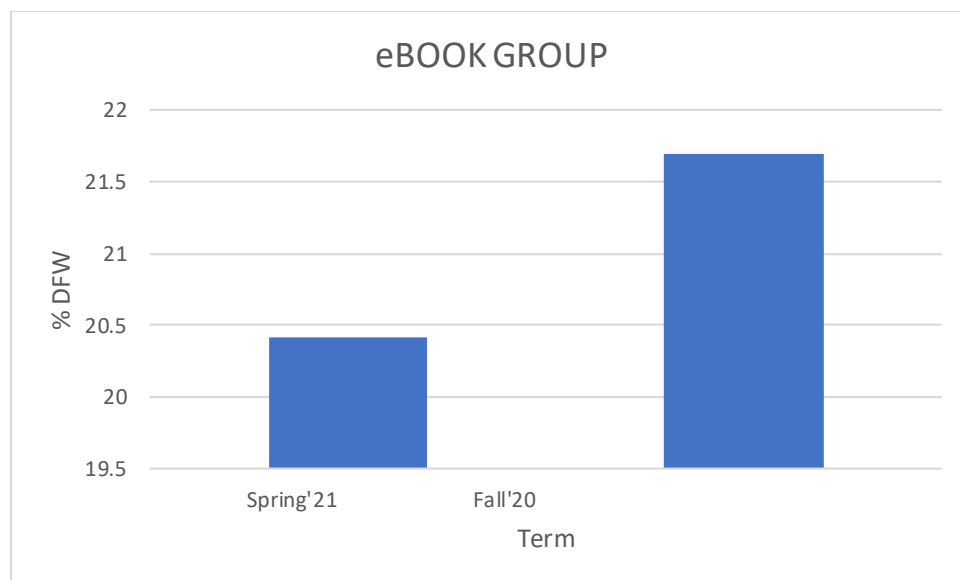
<b>Success Rate in Previous Term</b>	<b># of ABC</b>	<b># DFW</b>	<b>Success rate</b>
<b>ONLINE(A)</b>	11	5	68.75%
<b>ONLINE(B)</b>	19	10	65.52%
<b>ONLINE (C)</b>	23	3	88.46%
<b>BLENDED</b>	8	0	100%
<b>HYBRID</b>	10	4	71.43%
<b>CONTROL</b>	10	2	83.33%



Comparison of DFW rate in the eBook group taught by the same instructors compared to total student population:

	DFW Previous Term: 21.70%	DFW Spring'21: 20.41%
<b>ONLINE(A)</b>	3	5
<b>ONLINE(B)</b>	2	10
<b>ONLINE(C)</b>	5	3
<b>BLENDED</b>	2	0
<b>HYBRID</b>	4	4
<b>CONTROL</b>	3	2

**DFW:** According to the University statistical records, DFW rate has been decreased by the application of the ebook in comparable size of the classes in between fall'20 and spring'21. In spring'21 the college wide rate was 26.67% and compared to that the fall'20 showed 29.7.7% DFW rate including all the sections of this course. At the individual level, it may be observed that DFW rate has decreased from previous term. (Online©: 5 to 3 students and for blended 2 to 0).



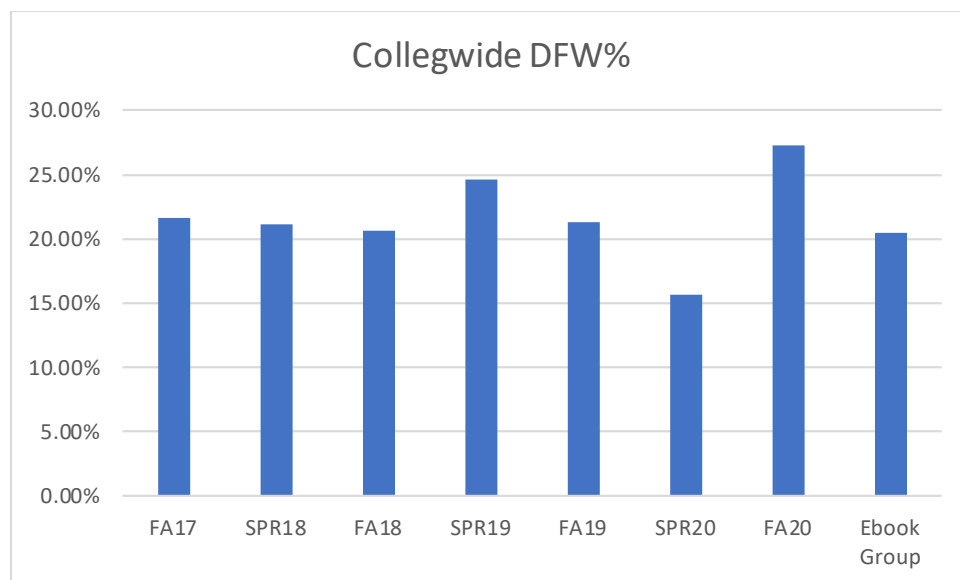
### Summer'21 Results:

Online (A) control section used instructor created exam as Final. Online (B) using the eBook used ACS exam for final. ACS Org. and BioChem exam results were consistent with spring'21 results for Online(B) group.

Courses	Quiz	Exam	ACS Org.	ACS Bio	%ABCs
ONLINE(A)	70.5	75.6	81.3		78.57%
ONLINE(B)	79.3	73.5	42.67	64.51	77.27%

Overall conclusion: Overall all groups of students did well and better than previous semester. They performed well on nationally standardized ACS exam and all learning outcome results were satisfactory to move on and continue with this digital textbook in future classes. Control group of students did fairly well in every category of course assignments. It may indicate that traditional textbook has a definite value in teaching and learning and it will continue to maintain the same impact in student performance. Alternately, when correct materials and appropriate strategies are applied with modern technique of teaching, students perform at the same level and learning can be enjoyed and enhanced. Without losing the academic rigor this course offered a lower rate of DFW compared to previous term data. Especially after pandemic, in blended and mostly ONLINE format, both students and instructors had great difficulties in learning and teaching. During this challenging time our FREE of cost digital textbook was effectively served the purpose of successfully completing the course learning outcomes and perform well in CHEM 1152 course (Survey of Chemistry II course).

Here is the comparison of college-wide DFW data for last few years starting from fall'17 through spring'21.



Learning outcome for the faculty member also very important in this project. Faculty members learned how to use modern method of teaching using simulations, videos and concept chart. Also, creating and scheduling interactive practice tests, quiz helped students to organize with their study materials and keep them focused throughout the semester.

#### 4. Sustainability Plan

Chemistry curriculum committee of Perimeter College has agreed to reserve this course materials as a standalone open source resource to use it in future. This ebook is being successfully implemented on all the campuses in spring 2021. One of the big advantages of digital textbook that it can be updated any time needed. Course grades and student information will be transferred to grant office and will be safely archived.

There were five strategic plans for sustainability of this ebook that were considered while writing the ebook. They were mentioned in the grant proposal. The plans have been executed well to make this project sustainable.

- 1) **Questions and responses:** Questions and responses are the most fundamental and important activities in classroom, and a great way to grasp the understanding level of each student on specific learning contents. This digital textbook has sample questions/answers at the end of each chapter to support them. Instructor can use them to check instant class response for a particular topic after explaining the concept in class. Also students can post feedback after taking quizzes and reading the materials.

- 2) **Monitoring students based on learning data:** To monitor students' participation level and to provide feedback, instructors can periodically check student learning activity data. The website of the ebook: <https://gsusurveychemistry.org/> can be really helpful in this field. Analytics program is used in the ebook which can provide information about last login attempt, most viewed topic etc. that would enable instructor to evaluate the progress of the students effectively.
- 3) **Assessment:** To support assessment, many alternatives to traditional assessment types that can be used to broaden the scope of the instructor's classroom assessment activities. Answering the questions from simulations, grades of end of chapter quiz data can help instructors to effectively evaluate a students' performance. The next generation of digital textbooks will support alternatives as well as traditional types of assessment.
- 4) **Experimental learning and Active Learning:** Involving students with in-class activities is a pedagogical method intended to promote active learning. This digital text-book supports the creation of various activity-based teaching through simulations and videos than can be perceived as experimental learning or learning by doing. Paperback books can never provide this facility.

## 5. Future plan

Overall, this ebook project's future prospect is very bright. This project has immense impact on the students and institution. More and more students are interested in OER resources and a free of cost textbook can really help students with limited financial help. The fear of coming to class without book is not anymore. Students can access course materials anywhere, anytime. For students who don't have proper network service to afford digital information, a .pdf file has been provided for printing off the materials and downloading. Traditional teaching has been adopted using this ebook appropriately. Our team is already preparing General Chemistry Course materials based on OER resources. All the typos, answers to the questions in the current ebook will be revised. Separate quizzes for grading and practice purposes will be used. The ultimate goal is completely eliminating the cost of textbook for both non-science and science major courses at Perimeter College. This work was presented at Georgia Academy of Science conference in April Spring'21 and plan to be presented complete work in next year. Another future plan is create a modified site and eventually integrate the ebook with college LMS system. There are several bugs and restrictions in-built on the website that can be avoided. Currently, migration to new site <https://gsusurveychemistry.org/> is almost complete and planned to start from summer'21. It would be easier for instructors to teach if the eBook is integrated to institution's D2L learning management system. Work is in progress for this process.

## 6. Photograph

The grant members would like to thank dept. of Physical Science, Perimeter College Dr. Mike Nelson(Reviewer), Dr. Paulos Yohannes(Associate Dean of Research), Dr. Solomon Fesseha(Dept. Chair, Phys. Sc.) for their support and encouragement. All the help from Perimeter Grant office is much appreciated. This ebook is dedicated to the students of the Perimeter College who makes the institution proud with their great performances and shine with the glory of true knowledge.

**From left: Dr. Antara Dutta (P.I). Dr. Maher Atteya (Co PI) and Dr. Ahmed Baosman ( co PI).**



# Work published in Virtual Conference of Georgia Journal of Science in Spring'21.



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*Tolulope O. Salami and Olusola A. Ladokun*

### [SYNTHESIS OF HYDROGELS VIA UV PHOTO-INITIATED POLYMERIZATION AND THEIR APPLICATIONS](#)

*Jason Gajda, Allegra Mbwetshangol, William Yoon, and Kiana Treaster*

### [RESEARCH TO ESTABLISH IF THE LEVELS OF NITRITE IN LAKE CHATUGE ARE IN A DEPENDENT RELATIONSHIP WITH THE LEVELS OF POLLUTION\\*\\*](#)

*Colton K. Pritchett and Mikalia Chappelle*