<u>Textbook Transformation Grant: Final Grant Report</u> <u>Digital textbook for Survey of Chemistry I Course</u>

General Information

<u>Date:</u> 01/31/2020

Grant Round: 12

Grant Number: 383

Institution Name(s): Perimeter College Georgia State University

Project Lead: Dr. Antara Dutta, Physical Science Dept., Dunwoody campus

<u>Team Members (Name, Title, Department, Institutions if different, and email address for</u> <u>each):</u>

Grant Members:

Dr. Antara Dutta, Associate Professor of Chemistry, Physical Sciences, Dunwoody, Perimeter College GSU,

adutta@gsu.edu

Dr. Maher Atteya, Professor of chemistry, Physical sciences, Clarkston

matteya@gsu.edu

Dr. Jerry Poteat, Professor of Chemistry, Physical sciences, Dunwoody

jpoteat@gsu.edu

Implementation Team:

Dr. Julianne Caton-Williams: Lecturer, Science Dept. Decatur

jcatonwilliams1@gsu.edu

Dr. Stephen James Rudy: Adjunct Instructor, Physical Science dept. Dunwoody, <u>srudy@gsu.edu</u>

Ms. Shalini Jain, Lecturer, Science dept. Alpharetta

sjain11@gsu.edu

Course Name(s) and Course Numbers:

CHEM 1151-003 CRN: 89741(Ms. Jain)

CHEM 1151-066 CRN: 88332(Dr. Williams)

CHEM 1151-072 CRN: 85910 (Dr. Williams)

CHEM 1151-009 CRN: 85493 (Dr. Atteya)

CHEM 1151-054 CRN: 86935 (Dr. Rudy)

CHEM 1151-063 CRN: 86934 (Dr. Poteat)

Semester Project Began: Fall 2018

Final Semester of Implementation: Fall 2019

Total Number of Students Affected During Project: 195

1. Narrative

The goal of this project is to develop a supplemental digital textbook for students taking Survey of Chemistry I course which supports the tenets recommended by vision and change to integrate core concepts and competencies throughout the curriculum, focus on studentcentered 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/1TRwckkFCjEpTinQC1TjTahutWeVZZ3If

and url of the ebook is: https://chemistrylearningbydoing.org

CHEM 1151 course is a nonscience 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 fundamental general chemistry. The course covers a huge amount of general chemistry materials starting with matter, detailed electronic structure theory to solution phase reactions, bonding, stoichiometry, Chemical kinetics, Acid Base reactions etc. At Perimeter college, this course is one of the highest enrollment courses. But the success rate is low 68.6% in Fall 2019) due to vast materials covered and the level of challenges presented to students.

Total 195 students participated in this study. They all have used the ebook except one group(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, parent institution of Perimeter college.

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 short text and lot of videos and simulations. All the text materials are created by grant members. The videos and diagrams are taken from common course licensed materials that are available for free and ready to share and use. Chemistry simulations on General 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. Examples include Phet simulations (University of Denver, Colorado). Merlot, AACT (American Association of Chemistry Teachers), Oneonta (Suny University New York). This etext also has one cumulative chapter quiz that helps 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 Nov. In fall'18 PI met with other two grant members periodically and discussed the learning objectives of all the chapter, organization of the chapters in fall'18. The bulk part of the course was written during the semester break and in spring'19. By the summer'19 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 also contains 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 written on WordPress digital platform which is considered to be university approved digital resource for communicating with students and faculty members. A learning Management System (LMS) was set up on the platform to organize the materials. 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 fall'19. Students performance on quizzes, exams have been recorded, final exam and course grade have been collected for all the courses. PI continuously worked with all the instructors teaching using the ebook during the fall'19 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. Scantron analysis was performed for the final exam. 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 2019 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 March 2019 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 nonscience 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 batch of an instructor. 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. Students also mentioned about their great experience on the Survey form. They are provided positive feedback. Here are some quotes written by the students using the ebook.

"I like the stimulations and how the chapter 1 is broken down into different sections which makes it easier to understand concepts. The explanations are simple, clear, and easy to understand."

"The book talks about the subjects in a way everyone can understand. I especially like the videos attached to some sections."

"This chapter was definitely the easiest to follow along. It might be because I feel confident in balancing chemical equations and somewhat confident in the conversion factors, but this was a great chapter to read. I was having trouble with Avogadro's Number before, but this definitely helped me understand."

"The unit about percent yield is something I struggled with. Overall though, this chapter is precise and straightforward."

"The chapter is so interesting. In this chapter I have understand the concept of acid-base, naming of acid and base, dissociation, and reaction of acids and bases. further more, titration and Stoichiometry of Acid Base Reactions, the buffer system, and PH are discussed briefly."

"E-text book was so helpful, this chapter 9 was understandable and easy compare to the previous ones,I always like to review it for essentials keywords."

"I feel like this chapter went really into depth, more than what we learned in class. I think it is a great thing because it teaches well and highlights the main points that were discussed in lecture class."

"This chapter was actually more understanding than my textbook. It helped when the different units put different videos and other links that I was able to click and watch/read to learn more about the topic. This chapter was really helpful when some of the units also added the word problems and showed the work of the problems to obtain the correct answer."

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: ____195_____

- Positive: <u>100</u>% of _____ number of respondents
- Neutral: ____0 % of _____ number of respondents
- Negative: _____0 % 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:

- ____ 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.

____29.7____% of students, out of a total ____195____ 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 2.56. Students registering for this course come with a minimum to negligible background in science. In the beginning of the transformation period in fall'19, a consent form was given to students to officially recognize them for this study. There were total 195 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 fall'19. The first survey was carried out 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. 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 mot 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 problems on white board and doing learning check problems. Traditional method of teaching worked well for these students with digital content. No major change in teaching method was applied during the transformation period. 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.

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. 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. 100% of the students recommended to use the ebook to other students.

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 although quiz grade improved from 81.3% to 88% but exam average showed minimum increase (71.3% to 73.3%) for this class. 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 the control group instructor didn't teach the same course in spring'19, data from fall'18 course have been presented for comparison.

Below are tabular form of percentage data showing quizzes and exam average for all the courses used in fall'19 implementation phase. For anonymity, individual instructors' names have been replaced by campus name. Also, for instructors teaching multiple sections of the same course using the ebook, average score has been presented.

Quiz Average	Fall'19	Spring'19
Alpharetta	86.9	90
Clarkston	72.95	60.03
Control	88.6	81
Decatur	66.28	64.46
Dunwoody	62	55

Unit Exam Average	Fall'19	Spring'19
Alpharetta	66.2	78
Control	71.9	73.3
Decatur	81.09	81.50
Dunwoody	80	66

**Unit exams were not part of course grade for Clarkston group and hence they are not presented here.

From the data, it is evident that exam averages are either same or above the previous semester average after using the ebook except Alpharetta and Dunwoody group. It is interesting to see how one group of students improved using the ebook (Dunwoody) whereas other group's (Alpharetta) average decreased compared to previous semester. Reasons could be difference in students' population, access to the digital content or the lack of sufficient time for a particular group of students. It is also to be noted that Alpharetta group used the ebook quizzes as a part of the course grade but Dunwoody group took them for practice purpose. Average grades for quizzes for these two groups were 86.9% (Alpharetta) and 62%.(Dunwoody) respectively. It may indicate that some 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:** Nationally standardized ACS (GOB07) exam is used to evaluate students' performance in this course. There are total sixty questions in the exam. The same exam was used as final exam for both fall'18, spring'19 and fall'19 semesters. In this report the detailed final exam analysis has been presented with the comparison study from spring'19. Considering the vastness of the materials covered in this course, results of three main learning objectives topics : 1) "Solution", 2) "Bonding" and 3) "Atoms" has been discussed in this report. From each learning objectives, two questions have been chosen randomly among other questions on the same topic 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 Decatur group data have separated and presented individually. It is noted that for the control section, instead of spring'19 data, fall '18 data have been compared with since the instructor didn't teach the course in spring'19.

For the solution topic, two different questions that reflect understanding and numerical problem solving ability of students (#25 & #43) have been considered in this report. Results below shows the average percent correct response for those two questions.

Final exam: Learning Objective#1(Solutions)	Fall'19	Spring'19
Alpharetta	36.00	62.50
Clarkston	47.15	37.18
Control	38.09	33.87
Decatur(1)	47.72	34.61
Decatur (2)	32.36	34.61
Dunwoody	61.77	50.00

Overall, for questions with harder numerical problems, 47-62% students correctly answered the questions correctly. It may be concluded that the traditional book didn't help the students enough to perform any better on harder numerical problems where they need to apply the Algebra skill and concept of solution concentration. Instructor led classroom teaching is most effective tool in this case. Compared to spring'19 every group of students showed high improvements except Alpharetta group where overall students' performance was lower compared to previous term.

The second learning objective was chosen as bonding. Bonding is another very important concept in this course and two question #16 and #37 of the exam are about deeper concept on this topic. Results show where some groups struggled to understand the concept of bonding (Dunwoody) but some students did gain deeper understanding on the concept specifically control and two Decatur groups. Concept of bonding could be challenging irrespective of traditional and non-traditional format of reading and the results confirm the fact.

Final exam: Learning Objective#2(Bonding)	Fall'19	Spring'19
Alpharetta	38.00	50.00
Clarkston	37.14	43.59
Control	50.00	51.61
Decatur (1)	43.18	30.77
Decatur (2)	57.32	30.77
Dunwoody	29.41	68.76

The third objective that was chosen for analysis is the "Atom". 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# 12 and #45. Results show some group of students performed very well (Decatur group) on those questions but other groups performance remained almost same or a slight decrease from previous semester. Both "Atoms" and "Bonding" concepts are vital in this course and although use of ebook didn't make drastic positive impact on students' performance but overall it can be considered as effective in understanding the concept. Clarkston 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 semesters final exam.

Final exam: Learning Objective#3(Atoms)	Fall'19	Spring'19
Alpharetta	56.00	66.91
Clarkston	31.43	37.15
Control	45.24	51.62
Decatur(1)	65.91	46.15
Decatur(2)	42.65	46.15
Dunwoody	52.94	56.25

Overall final exam results were positive. Average mean percentage ranges from 35% to 45% which is relatively close to mean value of this nationally standardized exam according to composite norm statistics. Here is the summary table for all the groups on fall'19 final exam. Average percent mean score with the absolute values of highest and lowest score on the exam and standard deviation have been recorded. The analysis shows combination of both high and low achieving students performance with steady level of standard deviation among all the groups.

	# Student appeared	% Mean Score	Highest score(abs.)	Lowest score (abs.)	Standard deviation
Alpharetta	25	44.5	51	18	8.49
Clarkston	44	34.8	41	11	7.08
Control	21	41.1	45	15	6.59
Decatur(1)	34	39.1	37	13	6.35
Decatur(2)	22	41.4	49	10	10.07
Dunwoody	17	41.0	33	14	6.04

Below are the individual group performance on the final exam.



Decatur (1) grade distribution



Decatur (2) grade distribution



Alpharetta Grade Distribution



Dunwoody Grade Distribution



Control group Grade Distribution



Clarkston Grade Distribution

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 withdraw for varied reason other than being unsuccessful in the course. In some groups, for example Clarkston, only one student has withdrawn in fall'19 term. In other groups also, D. F percentages are higher than "W" percentage indicating underachieving 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 indicating 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.

Success Rate in Fall'19	# of ABC	# of DFW	Success rate
Alpharetta	20	15	57.2%
Clarkston	36	8	83.7%
Control	14	13	51.9%
Decatur(1)	28	12	70.0%
Decatur (2)	20	5	80.0%
Dunwoody	19	5	79.2%



Comparison of DFW rate:

	DFW Fall'19: 29.7%	DFW Spring'19: 33.0%
Alpharetta	15	10
Clarkston	8	9
Control	13	10
Decatur(1)	12	16
Decatur (2)	5	3
*Dunwoody	5	5

DFW: According to the records, DFW rate has been decreased by the application of the ebook in comparable size of the classes in between spring'19 and fall'19. In spring'19 the rate was 33% and compared to that the fall'19 showed 29.7.7% DFW rate including all the courses. At the individual level, it may be observed that DFW rate has decreased from spring'19. (Clarkston: 9 to 8 students and Decatur: 19 to 17 students).



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 recent years of data.



Here is the comparison of college-wide DFW data for last 2 years Fall'17 through Fall'19.

Learning outcome for the faculty member also very important in this project. Faculty members learned how to use modern method ii 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 2020. 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 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 aterials.
- 2) Monitoring students based on learning data: To monitor students' partcipation level and to provide feedback, instructors can periodically check student learning activity data. The website of the ebook: <u>www.chemistrylearningbydoing.org</u> can be really helpful in this field. Students names as logged in users in the ebook, last login attempt can help 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 learning by doing:** 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. This is the facility that paperback books can never provide.

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 planning to build the Survey of chemistry II 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 non-science major courses at Perimeter College This project was initially presented in spring'19 at Georgia Academy of Science conference. Complete work will be published again at Georgia Academy of Science conference in March spr'20.

Another future plan is to eventually integrate the ebook with college LMS system There are several bugs and restrictions in-built on the website that can be avoided if it is integrated to currently used institution's D2L learning management system. Work is in progress for this process.

6. Photograph

The PI and the grant members would like to thank dept. of Physical Science, Perimeter college Dr. Paulos Yohannes, Dr. Solomon Fesseha Dr. Mike Nelson and Dr. Glenn Nomura for their support and encouragement. PI would also like to mention dept. Senior administrative Secretary Ms. Connie Fickenschire for helping in collecting data on students GPA and other info. 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. Jerry Poteat (co PI).



Dr. Rudy



Dr. Julianne Caton Williams



Ms. Jain

Work published in Georgia Journal of Science in Spring'19.



Chemistry Paper Presentations

<u>CONVERSION OF BIOMASS TO FORMIC ACID AT MODEST TEMPERATURES AND</u> <u>PRESSURES**</u> Savannah L. Hardin*, Lena M. Powell*, and Charles D. Swor

DIGITAL TEXTBOOK FOR SURVEY OF CHEMISTRY I COURSE(IN PROGRESS) Antara Dutta, Maher Atteya, and Jerry Poteat

<u>Preparation, thermal properties, self-assembly and gelation studies of acridine linked cholesteryl</u> <u>carbamate</u> Tyler Sawyer and Ajay Mallia

Self-assembly and gelation studies of N-(hydroxyalkyl)octadecanamides based simply structured low molecular mass gelators. Janaki Patel and Ajay Mallia