

Summer 2017

Biochemistry

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Grants Collection

Georgia College and State University



UNIVERSITY SYSTEM
OF GEORGIA

Chavonda Mills, Shaundra Walker

Biochemistry





Grants Collection

Affordable Learning Georgia Grants Collections are intended to provide faculty with the frameworks to quickly implement or revise the same materials as a Textbook Transformation Grants team, along with the aims and lessons learned from project teams during the implementation process.

Each collection contains the following materials:

- **Linked Syllabus**
 - The syllabus should provide the framework for both direct implementation of the grant team's selected and created materials and the adaptation/transformation of these materials.
- **Initial Proposal**
 - The initial proposal describes the grant project's aims in detail.
- **Final Report**
 - The final report describes the outcomes of the project and any lessons learned.



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Initial Proposal

Application Details

Manage Application: ALG Textbook Transformation Grants Round Five

Award Cycle: Round 5

Internal Submission Deadline: Tuesday, December 15, 2015

Application Title: 193

Submitter First Name: Kelli

Submitter Last Name: Brown

Submitter Title: Provost

Submitter Email Address: grants@gcsu.edu

Submitter Phone Number: 478-445-2754

Submitter Campus Role: Sponsored Programs Office

Applicant First Name: Chavonda

Applicant Last Name: Mills

Co-Applicant Name(s): Shaundra Walker

Applicant Email Address: Chavonda.Mills@gcsu.edu

Applicant Phone Number: 478-445-0819

Primary Appointment Title: Associate Professor of Chemistry

Institution Name(s): Georgia College & State University

Team Members (Name, Title, Department, Institutions if different, and email address for each. Include the applicant in this list.):

Dr. Shaundra Walker, Associate Director for Instruction and Research, Russell Library, shaundra.walker@gcsu.edu

Dr. Chavonda Mills, Associate Professor of Chemistry, Department of Chemistry, Physics & Astronomy, chavonda.mills@gcsu.edu

Sponsor, (Name, Title, Department, Institution):

Dr. Kelli Brown, Provost, Academic Affairs, Georgia College & State University

Proposal Title: 193

Course Names, Course Numbers, and Semesters Offered:

CHEM 3711 Biochemistry I, Fall

CHEM 3712 Biochemistry 2, Spring

Final Semester of Instruction (This is your final semester of the project): Spring 2017

Average Number of Students per Course Section: 20-40

Number of Course Sections Affected by Implementation in Academic Year: 4

Total Number of Students Affected by Implementation in Academic Year: 160

List the original course materials for students (including title, whether optional or required, & cost for each item): Lehninger Principles of Biochemistry Sixth Edition by David L. Nelson (Author), Michael M. Cox (Author) - \$303.50, required text

Proposal Categories: No-Cost-to-Students Learning Materials

Requested Amount of Funding: \$10,800

Original per Student Cost: \$303.50

Post-Proposal Projected Student Cost: \$0

Projected Per Student Savings: 100%

Plan for Hosting Materials: LibGuides

Project Goals:

We propose to address the rising cost in college textbooks as well as the need for high-impact pedagogy in higher education by initiating a no-cost-to-students inquiry-based Biochemistry course transformation. The project goals are to:

- Redesign and implement an inquiry-based Biochemistry course using no-cost learning materials.
- Assess the effectiveness of a no-cost inquiry-based Biochemistry course transformation on student success and course success.
- Host open educational resources on existing LibGuides and Institutional Repository sites.
- Expand access to timely and relevant knowledge via library-owned and open-educational resources.

This work will result in a model that will assist other USG Colleges and Departments in their efforts to develop strong, sustainable no-cost-to-students Biochemistry courses.

Statement of Transformation:

In efforts to provide high-impact pedagogy not offered by traditional textbooks, project team member Dr. Chavonda Mills recently designed biochemistry course materials with emphasis on guided inquiry and active learning. Transformation of the current, traditional Biochemistry course to a no-cost course will provide students online access to the aforementioned course materials with the aim of improving student learning and engagement.

The inquiry-based course materials foundation will be a no-cost Biochemistry Free and Easy textbook (Ahern and Rajagopal; <http://biochem.science.oregonstate.edu/biochemistryfree-and-easy>) and additional learning resources identified by project team members. Transforming the course to a no-cost model, particularly by the inclusion of supplemental resources that are available to students via GALILEO, other library subscriptions and open education resources, has the potential to maximize the benefit of existing library resources and also helps to supplement existing course content with the most up-to-date content available. For example, the tau protein, as opposed to the long believed medical culprit beta-amyloid plaque, was recently identified by researchers as a critical component in the development of Alzheimer's disease, a disease state often reviewed in Biochemistry courses during instruction on protein misfolding (Moussa, et. al.). While it is unlikely that the proposed open textbook, which was published in 2012 with an updated version currently in preparation, includes this information, the proposed model will allow the faculty member and librarian to work collaboratively to identify supplemental materials to support this need and provide information to the students in a time-sensitive manner.

Stakeholders affected by the transformation include students enrolled in Biochemistry courses and faculty that teach Biochemistry. Not only does the transformation provide each student a financial savings of approximately \$303.00, a 100% reduction in textbook costs, but, it also presents the opportunity for increased student success by incorporating pedagogy proven to foster student learning (Olson and Riordan). Faculty that adopt the proposed no-cost inquiry-based course model have the potential to improve the success of their courses by using resources which promote student learning through innovative engaged learning activities. Furthermore, the inclusion of resources which offer current and up-to-date biochemical information ensures an optimal learning environment. The inclusion of relevant resources from GALILEO and other library-purchased materials has the potential to extend the institutional value of investment that has been made in purchasing these resources.

Transformation Action Plan:

The proposed transformation action plan, as detailed in the timeline, addresses project objectives and provides activities, a projected timeline, and the responsible party necessary to complete each objective. Responsible parties for completion of project activities include Dr. Chavonda Mills, Associate Professor of Chemistry, and Dr. Shaundra Walker, Associate Director for Instruction and Research. Dr. Mills is the primary instructor for Biochemistry within the department. In Fall 2016, Dr. Mills is scheduled to teach one section of Biochemistry I,

approximately 40 students. This course will serve as the focal point of the pilot study. Dr. Mills will redesign the course to rely solely on no-cost texts and learning resources, including the Ahern's Biochemistry Free and Easy text, self-authored inquiry-based course materials, and purchased biochemistry model kits . Learning outcomes and course concepts will be mapped to selected no-cost resources. At the conclusion of the pilot course, quantitative and qualitative measures will be used to assess student success and course success. Dr. Walker will provide the necessary technical support to host the open-educational and other resources for this project. Dr. Walker will assist Dr. Mills by (1) identifying and accessing supplemental resources to support the course, (2) assisting with the publication of her self-authored inquiry-based course materials on the institutional repository, (3) facilitating access to the resources on the LibGuide and in the institutional repository (Knowledge Box), (4) monitoring access to the resources on both platforms, and (5) providing quantitative usage statistics that will assist in evaluating students' use of the course materials.

Quantitative & Qualitative Measures: The following methods will be used to measure students' success in meeting learning outcomes including national and course-level measures as well as course success.

Quantitative Measures

Standardized Exam: The American Chemistry Society, the national professional society for chemists, offers standardized exams for Biochemistry courses (henceforth referred to as ACS exams). These also come with normalized data for percentiles and the national mean for the exam. Thus, we are able to compare our students to students across the U.S as well as to baseline data collected from Georgia College students during previous semesters. We have set the standard measure of achievement for ACS exams to be within one standard deviation of the national mean. In addition, pre- and post-test data is taken, to ensure that a significant increase has occurred.

DWF rates: The number of students who Drop, Fail, Withdraw (DFW) from the course will be tracked and compared with baseline data from previously offered course sections.

Qualitative Measures

Using Qualtrics survey software, project team members will develop and administer a reflective survey to students in an effort to collect student feedback and provide additional evidence of student success in the transformed course. The survey instrument will allow students to report their gains in knowledge, skills, and dispositions using a 5-point Likert scale and with comments.

Timeline:

I. Redesign and implement a Biochemistry course using no-cost learning materials

- Identify no-cost learning materials and instructional resources (Jan-May 2016)
- Review, select, and adopt no-cost learning materials and instruction resources best suited for meeting course outcomes (Jan-May 2016)
- Course redesign, which includes identifying measurable learning outcomes, activities, and assessments (May-July 2016)

- Purchase biochemistry model kits for classroom use and library study check-out (July 2016)
- Draft course syllabus, which includes course pacing schedule, available resources for each content area, and instruction on accessing selected no-cost learning materials (May-July 2016)
- Implement and pilot redesigned course, including administering ACS pre-and post-exams and reflective survey (Fall 2016)

II. Assess the effectiveness of a no-cost Biochemistry course transformation on student success and course success

- Develop a reflective survey for students in Qualtrics (July 2016)
- Complete data analysis (December 2016)

- DFW rates
- ACS pre-and post-exams
- Student reflective survey

- Review LibGuides and institutional repository statistics to determine student usage. (November 2016)

III. Host open educational resources on existing LibGuides and Institutional Repository sites.

- Create and design new LibGuide for course (May-July 2016)
- Publish inquiry-based course materials in the library's existing institutional repository, including assignment of creative commons and copyright licenses (Ongoing)
- Link inquiry-based course materials and open access textbook to LibGuide (Ongoing)
- Add supplemental resources to LibGuide to support open textbook and inquiry-based course materials in consultation with Dr. Mills (Ongoing)
- Maintain accuracy of resource links and revise content as needed (Ongoing)

IV. Submit Final Report (January 2017)

Budget:

\$10,000 will be used for salary and benefits for Dr. Mills and Dr. Walker

\$800 will be used for attendance to the mandatory kick-off meeting and to purchase model kits @ \$114/each (www.shop3dmoleculardesigns.com/Flow-of-Genetic-Information-Field-Test-Kitp/fgik.htm) as classroom resources and for library use to enhance the learning of the students in each class. Five kits will stay in the department available for the teaching faculty to bring into the class or for enhanced instruction during office hours. Two kits will be housed at the circulation desk in Russell Library available for students studying to check out for use in the library.

Sustainability Plan:

Following successful project completion and assessment, the no-cost model will be implemented in all Biochemistry courses, which are offered fall, spring and summer semesters.

The platforms that support the project, such as LibGuides and the institutional repository, currently comprise integral parts of the library's infrastructure and will be maintained and enhanced for the foreseeable future. Dr. Walker will set up search alerts on relevant database platforms to identify new published research of potential interest to Dr. Mills, store the research using a citation management program, and provide Dr. Mills with access to the resources for her review and consideration. Course learning materials and resources will be reviewed and updated annually. The Provost has committed to reviewing the course and library model kits every three years for wear & tear and the need for replacement necessary to maintain seven full kits. Dissemination of the model at statewide and national Scholarship of Teaching and Learning (SoTL) conferences presents the potential for course adoption and adaption across USG institutions and beyond.

courses, the development of which will be spearheaded by Associate Professor of Chemistry, Dr. Chavonda Mills, and supported by Associate Director for Instruction and Research of Russell Library, Shaundra Walker. Each year, Georgia College provides 6,600 undergraduate and graduate students with an exceptional learning environment that extends beyond the classroom, with hands-on involvement with faculty research, community service, residential learning communities, study abroad, and internships. We are the only public institution named as a “College of Distinction” in Georgia for the 8th consecutive year, and our institution is regularly named as a “Best Southeastern College” by the Princeton Review, which places us in the top 25 percent of the nation’s four-year colleges.

As Georgia’s designated Public Liberal Arts University, our institution seeks to combine the education experience of private liberal arts colleges with the *affordability* of public higher education. In recent years, affordability has become more and more of a challenge for Georgia’s students, especially with regard to the cost of textbooks. Though the College Board estimates that the average student attending a four-year public college spent \$1,200 on books and supplies in 2012, Georgia College students spent an average of \$1,350 on textbooks during the 2012-2013 academic year. As a growing body of literature suggests, no-cost learning materials are crucial to ensuring student retention and completion of courses. If Georgia College is to contribute to the additional 250,000 graduates needed to enter our state’s growing workforce by 2020, it is imperative that we lower the cost of college for students through initiatives such as the ALG Textbook Transformation program.

Dr. Mills’ project will support the creation of online learning materials for Biochemistry I and II, which are required courses for chemistry majors. Approximately 108 students in six course sections will benefit from replacing the textbook *Principles of Biochemistry* (which normally retails for \$303) with free online materials, including the open access textbook, *Biochemistry Free and Easy* by Drs. Kevin Ahern and Indra Rajagopal. In addition to supporting faculty time to customize online resources, funding will go toward purchasing seven *Flow of Genetic Information* field test kits, which are hands-on learning materials that allow students to model DNA replication, RNA transcription, and translation/protein synthesis. Five kits will be housed in the GC Chemistry Department, and two kits will be available for student checkout in Russell Library. Model kits will be reviewed every three years for wear & tear and evaluated for replacement in order to maintain seven full kits. The Office of the Provost, along with the Office of Grants and Sponsored Projects, will ensure compliance with all State, Board of Regents, and institutional policies and procedures, should we receive funding.

Thank you for your favorable consideration of Georgia College’s application. Please contact me should you have any questions regarding this project.

Best Regards,



Dr. Kelli Brown

Milledgeville • Macon • Warner Robins

Georgia College, the state’s designated public liberal arts university, combines the educational experience expected at esteemed private liberal arts colleges with the *affordability* of public higher education.

**Affordable Learning Georgia Textbook Transformation Grants
Rounds Three, Four, and Five**

1.8 REFERENCES

Ahern, K.; Rajagopal, I., (2012) Biochemistry Free and Easy, Retrieved from:
<http://biochem.science.oregonstate.edu/biochemistry-free-and-easy>.

Moussa, C.; Schachter, J.; Chen, W.; Hebron, M.; Lonskaya, I. Tau deletion impairs intracellular beta-amyloid-42 clearance and leads to more extracellular plaque deposition in gene transfer models. *Molecular Neurodegeneration* [online] 2014, 9:46 (accessed November 24, 2014).

Olson, S.; Riordan, D. G. Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics. Report to the President; Executive Office of the President: 2012.

Syllabus

CHEM 3510: BIOCHEMISTRY

COURSE AND INSTRUCTOR INFORMATION

Professor: Dr. Chavonda Mills	
Email: chavonda.mills@gcsu.edu	Phone: (478) 445-0819
Office: Herty Hall 311 or A&S 2-50	Office Hours: M, W: 10am-12pm; R, 2pm-4pm
Lecture: T, R 11:00 AM – 12:15 PM	Lecture Room: Herty Hall 313

COURSE DESCRIPTION

CHEM 3510 will provide an in-depth study of selected topics in biochemistry. The course will be taught by lecture/discussion and guided activities covering (but not limited to) the following topics: fundamental building blocks of biomolecules, amino acids & proteins, lipids & membranes, kinetics and mechanisms of biological catalysts, carbohydrates & polysaccharides, bioenergetics, metabolic cycles: glycolysis, gluconeogenesis, krebs cycle, oxidative phosphorylation, and fatty acid catabolism.

PRE-REQUISITES

Pre-Requisite: CHEM 3361 and 3361L

COURSE MATERIALS

Required Resources

1. Access to Course Website : <http://libguides.gcsu.edu/millsbiochem>
2. Aher and Rajagopal, *Biochemistry Free for All*
<http://biochem.science.oregonstate.edu/content/biochemistry-free-and-easy>
3. Access to GeorgiaVIEW D2L <https://gcsu.view.usg.edu/>

Student Learning Outcomes

Student learning outcomes for the course reflect the many components involved in developing the skills, abilities and dispositions necessary for proficiency in biochemical science. Students will (i) develop a broad understanding of the fundamental biochemical concepts of living organism, (ii) apply biochemistry concepts to human health and disease, (iii) communicate scientific information/data in both written and oral format, and (iv) enrich his/her quantitative, qualitative, and critical thinking skills.

CHEM 3510 and CHEM 3711: Biochemistry

Professor: Dr. Chavonda Mills

Required Resources

Access to Course Website:

<http://libguides.gcsu.edu/millsbiochem>

Ahern and Rajagopal, *Biochemistry Free for All*

<http://biochem.science.oregonstate.edu/content/biochemistry-free-and-easy>

Week	Topic	Activity	Notes
1	Introduction; Biomolecules in Water		http://libguides.gcsu.edu/c.php?g=609762&p=4233137 http://libguides.gcsu.edu/c.php?g=609762&p=4233138
2	Amino Acids, Peptides, Proteins		http://libguides.gcsu.edu/c.php?g=609762&p=4233139
3	Protein Structure & Function		http://libguides.gcsu.edu/c.php?g=609762&p=4233140
4	Protein Structure & Function		http://libguides.gcsu.edu/c.php?g=609762&p=4233140
5	Properties of Enzymes	Exam 1 (R)	http://libguides.gcsu.edu/c.php?g=609762&p=4233141
6	Properties and Mechanisms of Enzymes		http://libguides.gcsu.edu/c.php?g=609762&p=4233142
7	Carbohydrates		http://libguides.gcsu.edu/c.php?g=609762&p=4233143
8	Carbohydrates; Lipids & Membranes		http://libguides.gcsu.edu/c.php?g=609762&p=4233144
9	Lipids & Membranes	Exam 2 (R)	http://libguides.gcsu.edu/c.php?g=609762&p=4233144
10	Biosignaling; Bioenergetics		http://libguides.gcsu.edu/c.php?g=609762&p=4233145 http://libguides.gcsu.edu/c.php?g=609762&p=4233146
11	Spring Break (M-F)		
12	Glycolysis		http://libguides.gcsu.edu/c.php?g=609762&p=4233147
13	Gluconeogenesis	Exam 3 (R)	http://libguides.gcsu.edu/c.php?g=609762&p=4269635
14	Krebs Cycle		http://libguides.gcsu.edu/c.php?g=609762&p=4233151
15	Fatty Acid Catabolism		http://libguides.gcsu.edu/c.php?g=609762&p=4233153
16	Oxidative Phosphorylation	Exam 4 (R)	http://libguides.gcsu.edu/c.php?g=609762&p=4233154
17	Final Exam (F 10:30-12:45)		

Final Report

Affordable Learning Georgia Textbook Transformation Grants

Final Report

Date: May 16, 2017

Grant Number: 193

Institution Name(s): Georgia College & State University (hereafter referred to as Georgia College or GC)

Team Members (Name, Title, Department, Institutions if different, and email address for each): Dr. Chavonda Mills, Professor of Chemistry, chavonda.mills@gcsu.edu; Dr. Shaundra Walker, Interim Director of Libraries, Associate Director for Instruction and Research, shaundra.walker@gcsu.edu

Project Lead: Dr. Chavonda Mills

Course Name(s) and Course Numbers: CHEM 3711 Biochemistry I; CHEM 3510 Biochemistry

Semester Project Began: Spring/Summer 2016

Semester(s) of Implementation: Fall 2016; Spring 2017

Average Number of Students Per Course Section: CHEM 3711 (7); CHEM 3510 (40)

Number of Course Sections Affected by Implementation: CHEM 3711 (2); CHEM 3510 (1) – total 3

Total Number of Students Affected by Implementation: 54

1. Narrative

A. Describe the key outcomes, whether positive, negative, or interesting, of your project. Include:

- Summary of your transformation experience, including challenges and accomplishments
- Transformative impacts on your instruction
- Transformative impacts on your students and their performance

Transformation Experience

The proposed project looked to address the rising cost in college textbooks as well as the need for high-impact pedagogy in higher education by initiating a no-cost-to-students inquiry-based Biochemistry course transformation. The project goals were to:

1. Redesign and implement an inquiry-based Biochemistry course using no-cost learning materials.

2. Assess the effectiveness of a no-cost inquiry-based Biochemistry course transformation on student success and course success.
3. Host open educational resources on existing LibGuides and Institutional Repository sites.
4. Expand access to timely and relevant knowledge via library-owned and open-educational resources.

During the redesign phase, Dr. Mills, course instructor, identified potential no-cost learning materials and instruction resources for the course. After extensive research and textbook reviews, Drs. Kevin Ahern and Indira Rajagoopal's free online textbook, [Biochemistry Free and Easy](#), was identified as the primary content resource for the course transformation. Online lectures videos, animations, primary literature, and Dr. Mills' self-authored inquiry-based course materials were used to supplement the primary textbook. All supplemental materials were hosted on the [course LibGuides site \(http://libguides.gcsu.edu/millsbiochem3510\)](http://libguides.gcsu.edu/millsbiochem3510), easily accessible to both students and instructors. Following the first semester of implementation, Ahern and Rajagoopal published an updated and more in depth version of their free online textbook, [Biochemistry Free For All](#), which was adopted for the course.

Dr. Walker's role for the grant primarily involved building, maintaining, assessing, and providing access to the LibGuide that was used to host the course content. She provided guidance and support to facilitate the proper and ethical use of licensed resources, particularly copyrighted articles, in an online environment. Where available, she located freely available open-access copies of articles or resources that were available via GALILEO or through subscriptions purchased by the library. In instances where licenses were needed, she served as a liaison between the teaching faculty member and the library's acquisitions department to determine the rights' holder and to arrange for payment. Dr. Walker also ensured that licensed resources were provided in a manner that is consistent with University System of Georgia Copyright Policy.

Overall, the course transformation was a success. As reported in section 3 of this report, a comparison of DFW rates, American Chemical Society standardized test scores, and student self-reflections were used to determine the impact of the no-cost course transformation. The total savings for students enrolled in the no-cost textbook sections of CHEM 3510 Biochemistry and CHEM 3711 Biochemistry I during fall 2016 and spring 2017 was \$16,362.00 (\$303.50/student).

Challenges

For majority of their academic careers, students have been accustomed to using a hard copy textbook as the primary source for course content. It was unexpectedly challenging to convince students to access the online textbook just as they would a hard copy textbook. At the beginning of the semester, very few students accessed the online textbook on a regular basis. Instead, they relied heavily on the instructor's lecture notes, provided electronically and during face-to-face lectures. Eventually, students recognized the necessity to use the online textbook as a primary

source of information and, based on periodic formative surveys and website views statistics, most students regularly accessed the online textbook by midterm.

One of the unforeseen challenges of this grant was not initially anticipating having to secure the rights to use some of the supplemental articles in the course. Based on initial conversations, Dr. Walker's understanding was that all of the supplemental resources were either already licensed or were available via GALILEO or through one of the library's existing subscriptions. After reviewing the materials, Dr. Walker realized that it would be necessary to secure the proper rights to use the materials in the course. There was at least one instance where the rights holder did not respond to our request, so we were unable to use the material in the course. Additionally, because we needed to restrict the materials to only students who were enrolled in the course, we had to provide access via GC's learning management system Desire to Learn (D2L) so that users could be properly authenticated.

Another unforeseen challenge occurred with the use of the YouTube videos that are embedded in several of the modules. Dr. Mills desired to have the videos start at particular intervals, but the embed option did not support different start times. Additionally, LibGuides do not record views on video embeds, so it was difficult to assess how many students actually viewed the video content.

LibGuides is an evolving product and there was one particular feature that we'd hoped to utilize for the course, but unfortunately, Dr. Walker was not able to get it implemented before the course began. This particular feature, called LibGuides Automagic, embeds content directly into the learning management system, resulting in a better user experience than simply presenting a link. Dr. Walker worked with GC's Library Technical Associate who liaised with D2L support at the system level to implement it, but unfortunately, we were already into the semester once the feature was available.

Accomplishments

As listed above, the grant proposal had four major outcomes. All of the outcomes were achieved with varying degrees of success.

Redesign and implement an inquiry-based Biochemistry course using no-cost learning materials. The course was successfully redesigned as an inquiry-based course with emphasis on student engagement and critical thinking. The no-cost model saved each student \$303.00, for a total savings of \$16,362.00. Students expressed appreciation for not having to purchase course materials as science textbooks normally costs upward of \$250 (section 2, student quotes). Students also expressed gratitude for access to course supplemental materials – video lectures, animations, course lecture notes – in one location via the course website.

Assess the effectiveness of a no-cost inquiry-based Biochemistry course transformation on student success and course success.

As illustrated in section 3 of this report, the DFW rate for the no-cost course transformation, 3.7%, is less than that of previous semester, 6.1%. This is a strong indication that the course transformation had a positive impact on student success. While student performance on the standardized American Chemical Society exam did not improve drastically and remained similar to previous years, the fact that there was no decrease in test performance is notable.

Host open educational resources on existing LibGuides and Institutional Repository sites.

Resources successfully hosted on GC's LibGuides site and students granted additional access via D2L. As indicated by supporting files, LibGuides Access Data, the course website received over 500 views in Fall 2016 and over 1200 views in Spring 2017. Students accessed individual files at varying degrees, with file access declining as the semester progressed.

According to Dr. Walker, this experience allowed her to further develop her skills in developing LibGuides for non-traditional purposes. Although she has used the Springshare platform for eight years, this was her first time working so closely with a teaching faculty member to develop content to be used throughout an entire course. Dr. Walker states that she now has a better understanding of some of the limitations of the platform generally and specifically as it relates to open textbooks. Obtaining the necessary permissions to use licensed materials in an online environment was also a new experience for her and one that provided an opportunity to apply her existing knowledge of copyright, as well as gain new knowledge in this area. Based on Dr. Walker's work with the grant, she developed an internal workflow for managing similar requests from faculty in the future. Collectively, she states that these experiences have prepared her to offer similar text book alternatives to faculty and students outside of the ALG grant program.

Expand access to timely and relevant knowledge via library-owned and open-educational resources.

Using a keywords algorithm, relevant peer-reviewed literature was made available to students via a real-time News Feed on the course LibGuides site allowing students to make connections to course content and current events.

Transformative impacts on instruction

The LibGuides course had a positive impact on course instruction as all course materials and resources were concentrated on one website. During face-to-face lecture periods, it was convenient and easy for the instructor to access the course website to draw students' attention to resources or video animations. Throughout the semester, the instructor was able to update the website and share materials with students fairly easily. Another positive impact was the real-time newsfeed of current events and published articles related to course content. Students were able to connect course content to real-world events and applications, which heightened the level of engagement in the course.

Transformative impacts on students and their performance

The inquiry based instruction model paired with no-cost materials proved impactful on student learning and success. The instructor of record found that students were well-prepared for class and highly engaged during face-to-face lecture periods. Of the students surveyed, 62.4% indicated that the free online textbook was useful to their learning for the course. In addition, no-cost study aids that enhanced their performance to a great or moderate extent were instructor PowerPoints and video animations. Interestingly, only 45.9% of students indicated that YouTube lecture videos enhanced their performance. A meager 13.5% felt that journal articles enhanced their performance; as such, more emphasis needs to be placed on the importance of primary literature and its role in advancing the field of biochemistry.

B. Describe lessons learned, including any things you would do differently next time.

As mentioned previously, one of the lessons learned was about the limitations of the LibGuides platform. Although a LibGuide can host a variety of types of content, the platform does not provide the same level of statistics for every type of content. For example, this project used several videos from YouTube, which were presented on the LibGuide via embeds of widget code. Although students could view the videos on the LibGuide, it did not provide any information about how many video views took place or how much of each video was actually viewed. For future iterations of the LibGuide, Dr. Walker would definitely explore using a combination of LibGuides statistics and statistics from Google Analytics.

Another change would be to host the LibGuide directly in the D2L environment. Now that we have implemented the new feature in LibGuides that allows such integrations, we are poised to provide direct access via D2L the next time the course is taught. Dr. Walker believes providing such access would make for a better experience for the students, as well as address the authentication issues that we faced for the resources that had to be licensed and restricted to only those enrolled in the course.

It was quite disappointing that students didn't take a greater interest in accessing primary literature made available via the course website. In the future, the instructor will be more intentional with integration of primary literature during lectures and possibly including questions regarding the literature articles on course assessments.

2. Quotes

"It was nice to have since all other classes required an expensive book. I used it to clear up any uncertainties or check information from slides for understanding"

"For so many classes I have had to waste money on textbook that I never even used, so this option was great!"

"It's very helpful and you save so much money. You can access it anywhere whereas if you left your textbook at home it would be useless."

3. Quantitative and Qualitative Measures

3a. Overall Measurements

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: _____

- Positive: 66 % of 47 number of respondents
- Neutral: 19 % of 47 number of respondents
- Negative: 14 % of 47 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:

4.5 % of students, 2 out of a total 44 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. Narrative

Standardized American Chemical Society Exam

The American Chemistry Society (henceforth referred to as ACS), the national professional society for chemists, offers standardized exams for Biochemistry courses. ACS exams allows for comparison of GC students to students nationwide as well as to baseline data collected from previous semesters. Fifty percent of students enrolled in no-cost textbook sections performed above the 50th percentile, with 22% performing about the 70th percentile and two students performing above the 90th percentile. This is slightly less than previous semesters where an average of 65% of students performed about the 50th percentile.

DFW rates

Table I: DFW rates

Semester	Course	DFW rate
Fall 2016	CHEM 3711, Biochemistry I	0 % (out of 10 students)
Spring 2017	CHEM 3711, Biochemistry I	0% (out of 4 students)
Spring 2017	CHEM 3510 Biochemistry	5% (out of 40 students)
	Total	3.7% (out of 54 students)

It is important to note that the course transformation DFW rate is less than previous semesters' average DFW rate of 6.1%.

Reflective Survey

Please see Appendix A for complete survey results

As indicted by the survey, Instructor PowerPoints and video animations were the most frequently used course materials. Surprisingly, only 45.6% of students used the online textbook often or somewhat often with 37.8% reporting to have read very little of the textbook or didn't read it at all. Those that read the textbook indicated that they found it easy or somewhat easy to understand. An overwhelming majority of students downloaded the textbook as a pdf to a computer or tablet. Majority of students indicted that instructor PowerPoints and video animations had the most impact on enhancing their in the course.

Most encouraging was the positive response to the no cost model as 73% of students surveyed agreed that more courses should provide free online textbooks and 91.9% are very likely or somewhat likely to enroll in another course that uses a free online textbook.

Student Usage

Please see supporting file for complete data on LibGuides student usage

As indicated by supporting files, LibGuides Access Data, the course website received over 500 views in Fall 2016 and over 1200 views in Spring 2017. Students accessed individual files at

varying degrees, with file access declining as the semester progressed. As one would expect, the website homepage received the most number of views.

4. Sustainability Plan

Dr. Mills will continue to teach CHEM 3510 and CHEM 3711 at no cost to students. The course website has been shared with other faculty members, and is currently (summer 2017) taught by another faculty member in the department. Dr. Mills will continue to work with Dr. Walker to update the website and add new course materials, as needed.

Dr. Walker will continue to maintain and update the LibGuide. The library has a long-standing investment in the LibGuides product, one that Dr. Walker sees only growing in the future. Going forward, she anticipates sustaining this work by checking the links to make sure that they are not broken, adding, and removing content at the request of the professor and seeking opportunities to integrate new LibGuides features as they become available.

5. Future Plans

In the future, the faculty instructor will consider adopting no cost course materials for other courses. The course was well-received by students and majority expressed extreme gratitude for the cost savings. The current course will continue to be updated and improved, as required. Dr. Mills and Walker are planning to present their project findings at the 2018 USG SoTL conference and publish this work in a discipline-specific and/or SoTL journal.

6. Description of Photograph

(left-right) Dr. Shaundra Walker, Interim Director of Libraries & Assistant Director of Instruction and Research, library liaison; Dr. Chavonda Mills, Professor of Chemistry, team lead and instructor of record.

Appendix A: Biochemistry: Open-Access Textbook Survey

Please note that this survey is anonymous and confidential. We ask that you compare your experiences in this course to other courses that required a traditional printed textbook. Answer the following questions honestly and objectively.

1. During my college career, for most courses I normally:
 - a. Purchase a printed course textbook (new or used) **32.4%**
 - b. Rent a printed course textbook (online or from the College bookstore) **51.4%**
 - c. Rent an online course e-book **2.7%**
 - d. Borrow a textbook from one of my classmates **2.7%**
 - e. None of the above – I usually don't use textbooks for studying purposes **8.1%**
2. If you didn't purchase or rent a textbook for a previous course, what was the reason?
 - a. The instructor told me it wasn't necessary to do well in the course **64.9%**
 - b. A student told me it wasn't necessary to do well in the course **21.6%**
 - c. The textbook was too expensive **8.1%**
 - d. I have always purchased a textbook for every course **5.4%**
3. How useful to your learning was the free online textbook recommended for this course?
 - a. Very helpful **24.6%**
 - b. Somewhat helpful **37.8%**
 - c. Not very helpful **10.8%**
 - d. Not helpful at all – I never used it **21.6%**
4. If a free textbook were not provided for this course, how likely is it that you would have purchased or rented a textbook this semester?
 - a. I would have definitely purchased or rented a textbook for this course **24.3%**
 - b. There is a good chance that I would have purchased or rented a textbook **35.1%**
 - c. There is a good chance that I wouldn't have purchased or rented a textbook **35.1%**
 - d. I definitely wouldn't have purchased or rented a textbook for this course **2.7%**

Appendix A: Biochemistry: Open-Access Textbook Survey

5. Did you purchase or borrow a printed textbook for the course even though the free online textbook was available?
- a. Yes, I purchased a printed textbook for studying purposes **0.0%**
 - b. Yes, I borrowed a printed textbook for studying purpose **10.8%**
 - c. No, I only used the free online textbook for studying purpose **81.1%**
 - d. I used both a printed textbook and the free online textbook for studying purposes **2.7%**

Questions 6-7 asks about the learning resources available during the course.

6. How often did you use the no-cost study aid listed below to support your learning outside of class?

Please Respond

Often (O) Somewhat Often (SO) Very Little (VL) Never (N)

_____ a. Free online course e-book: *Biochemistry, Free for All*

Often (O) **16.2%** Somewhat Often (SO) **29.7%** Very Little (VL) **24.3%** Never (N) **21.6%**

_____ b. Instructor PowerPoints

Often (O) **86.5%** Somewhat Often (SO) **10.8 %** Very Little (VL) **2.7%** Never (N) **0.0%**

_____ c. YouTube lecture videos

Often (O) **16.2%** Somewhat Often (SO) **27.0%** Very Little (VL) **37.8%** Never (N) **16.2%**

_____ d. Journal Articles

Often (O) **5.3%** Somewhat Often (SO) **5.3%** Very Little (VL) **36.8%** Never (N) **31.6%**

_____ e. Video Animations

Often (O) **27.0%** Somewhat Often (SO) **51.4%** Very Little (VL) **10.8%** Never (N) **8.1%**

Biochemistry: Open-Access Textbook Survey

7. To what extent did the no-cost study aid listed below enhance your performance in this course?

Please Respond

Great Extent (**GE**) Moderate Extent (**ME**) Very Little (**VL**) Not at All (**NA**)

_____ a. Free online course e-book: *Biochemistry, Free for All*

Great Extent (**GE**) **5.4%** Moderate Extent (**ME**) **37.8%** Very Little (**VL**) **24.3%** Not at All (**NA**) **0.0%**

_____ b. Instructor PowerPoints

Great Extent (**GE**) **73.0%** Moderate Extent (**ME**) **16.2%** Very Little (**VL**) **5.4%** Not at All (**NA**) **0.0%**

_____ c. YouTube lecture videos

Great Extent (**GE**) **18.9%** Moderate Extent (**ME**) **27.0%** Very Little (**VL**) **37.8%** Not at All (**NA**) **13.5%**

_____ d. Journal Articles

Great Extent (**GE**) **2.7%** Moderate Extent (**ME**) **10.8%** Very Little (**VL**) **40.5%** Not at All (**NA**) **37.8%**

_____ e. Video Animations

Great Extent (**GE**) **21.6%** Moderate Extent (**ME**) **45.9%** Very Little (**VL**) **24.3%** Not at All (**NA**) **5.4%**

8. How much of the free online textbook did you read during the semester?

- a. I read all of the chapters that we covered in class. **5.4%**
- b. I read most of the chapters that we covered in class. **13.5%**
- c. I read some of the chapters that we covered in class. **35.1%**
- d. I read very little of the textbook. **18.9%**
- e. I didn't read the textbook at all. **18.9%**

9. How did the free online textbook used in this course compare to other chemistry textbooks that you have used in other courses?

- a. The textbook was much better than other textbooks that I have used. **25.0%**
- b. The textbook was somewhat better than other textbooks that I have used. **65.6%**
- c. The textbook was much worse than other textbooks that I have used. **6.3%**

Biochemistry: Open-Access Textbook Survey

10. How easy was the textbook to understand?
- a. The textbook was very easy to understand and provided good examples of concepts. **38.7%**
 - b. The textbook was somewhat easy to understand. **54.8%**
 - c. The textbook was somewhat difficult to understand and the concepts were not clearly explained. **6.5%**
 - d. The textbook was challenging and difficult to understand and I did not find it useful to the learning process. **0.0%**
11. Which format of the textbook did you use?
- a. Read textbook online **15.2%**
 - b. Downloaded PDF to computer or tablet **75.8%**
 - c. Printed PDF of the textbook **6.1%**
12. Did use/view any of the links (videos, etc.) provided in the textbook?
- a. Yes **41.7%**
 - b. No **55.6%**
13. Do you think more courses should provide free online textbooks?
- a. Yes- all of them **73.0%**
 - b. It might be useful for some courses but not all of them **24.3%**
 - c. No – I would rather buy or rent a traditional printed textbook **0.0%**
14. How likely are you to enroll in another course that uses a free online textbook?
- a. Very likely **56.8%**
 - b. Somewhat likely **35.1%**
 - c. Likely **2.7%**
 - d. Not very likely **2.7%**
15. How accessible did you find the free online textbook on the library's website?
- a. Very accessible **80.0%**
 - b. Somewhat accessible **14.3%**
 - c. Not very accessible **2.9%**

Biochemistry: Open-Access Textbook Survey

16. On which platform would you prefer to access the free online textbook?

- a. Library's website (LibGuide) **30.6%**
- b. D2L **66.7%**

17. How could the design of the free online textbook be improved?

Questions 18-19 ask about your demographics.

18. What is your classification?

- a. Freshman
- b. Sophomore
- c. Junior **32.4%**
- d. Senior **59.5%**
- e. Continuing Education
- f. Prefer not to respond

19. Which best describes your gender

- a. Female **48.6%**
- b. Male **48.6%**
- c. Other
- d. Prefer not to respond

20. Please provide comments about the value of free, open-access textbooks for students – how is it helpful (if at all)?
