Spring 2018

Principles of Chemistry I & II (GA Southern)

Lea Padgett
Georgia Southern University, lea.padgett@armstrong.edu

Catherine MacGowan
Georgia Southern University, catherine.macgowan@armstrong.edu

Gary Guillet
Georgia Southern University, gguillet@georgiasouthern.edu

Todd Hizer
Georgia Southern University, todd.hizer@armstrong.edu

Grants Collection
Armstrong State University

UNIVERSITY SYSTEM OF GEORGIA

Lea Padgett, Catherine MacGowan, Gary Guillet, and Todd Hizer

Principles of Chemistry I & II

Affordable Learning Georgia

Georgia's Virtual Library GALILEO
An Initiative of the University System of Georgia

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.

Initial Proposal

Application Details

Manage Application: Textbook Transformation Grants Round Seven

Award Cycle:	Round 7
Internal Submission Deadline:	Sunday, September 4, 2016

Application Title:	261
Application ID:	#001159
Submitter First Name:	Lea
Submitter Last Name:	Padgett
Submitter Title:	Senior Lecturer
Submitter Email Address:	lea.padgett@armstrong.edu
Submitter Phone Number:	912.344.2946
Submitter Campus Role:	Proposal Investigator (Primary or additional)
Applicant First Name:	Lea
Applicant Last Name:	Padgett
Applicant Email Address:	lea.padgett@armstrong.edu
Applicant Phone Number:	912.344.2946
Primary Appointment Title:	Senior Lecturer, Department of Chemistry and Physics
Institution Name(s):	Armstrong State University
Proposal Category:	OpenStax Textbooks
Submission Date:	Tuesday, September 6, 2016

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

Dr. Catherine MacGowan, Assistant Professor, Department of Chemistry and Physics, Armstrong State University

Catherine.macgowan@armstrong.edu

Dr. Gary Guillet, Assistant Professor, Department of Chemistry and Physics, Armstrong State University

Gary.guillet@armstrong.edu

Dr. Todd Hizer, Assistant Professor, Department of Chemistry and Physics, Armstrong

State University

Todd.hizer@armstrong.edu

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

Dr. Robert T. Smith

Provost and Vice President for Academic Affairs

Professor of Mathematics

Armstrong State University

Final Semester of Instruction:	Fall 2017
Proposal Title:	261

Course Names, Course Numbers and Semesters Offered:

CHEM 1211 Principles of Chemistry I

CHEM 1212 Principles of Chemistry II

Each course is offered every Fall, Spring, and Summer semester; Changes from this proposal will go into effect Fall 2017 and continue into Spring 2018

Average Number of Students per Course Section:	30
Number of Course Sections Affected by Implementation in Academic Year:	32
Total Number of Students Affected by Implementation in Academic Year:	960
List the original course materials for students (including title, whether optional or required, & cost for each item):	Principles of Chemistry: A Molecular Approach, 3rd Edition by Nivaldo J. Tro (Required)$244.93 at campus bookstoreMastering Chemistry online access (Required)$65.95 directly from publisher website
Requested Amount of Funding:	$21,400

Original per Student Cost:	$310.88 if purchased separately; $280.69 when bundled new from bookstore
Post-Proposal Projected Student Cost:	$65 for two semesters; $32.50 when prorated by course
Projected Per Student Savings:	$215.69 from new bundled price
Projected Total Annual Student Savings:	$110,000

Creation and Hosting Platforms (Use "n/a" if none):

D2L will be used to share materials within the department and with students.

Materials will be made available to others using the Community Resources partnership OpenStax has with OER Commons

Project Goals:

There is wide-reaching debate over the costs of college attendance and the long-term ramifications on each student. One way students reduce their total outlay is by not buying textbooks suggested or required for the course. This fact is especially true for Armstrong State students as many are first generation college students from lower income areas in southeast Georgia. Textbook costs have risen dramatically over the last 30 years, outpacing inflation, home prices, and healthcare cost.[1] Choosing to avoid the cost of books, however, is not a success strategy for most students. Studies have shown a correlation between not purchasing textbooks and increased likelihood of failure or withdrawal from courses.[2]

Textbooks are marketed not to students, but to faculty, for whom cost is not as determining a factor. There is an increasing availability of low-cost or free materials available to students and faculty, but the adoption of a new textbook carries a large, possibly prohibitive, time commitment from the faculty teaching those courses.[3,4] Integration of electronic materials into the university's learning management system or an online homework platform is particularly time-consuming. We seek funding to compensate faculty for the time and effort that a switch to free, openly-available course textbook published by Openstax would entail. This includes creating course materials (lecture slides, online homework templates, and clicker questions) of comparable quality to those provided by publishers with the adoption of mainstream, high-cost textbooks. Specific goals to this project are:

Reduce costs to students by adopting a no-cost textbook.
Review course content for currency, relevance, and programmatic needs.
Develop ancillary materials similar to those provided by publishers to support use of the OpenStax textbook by all faculty in the department.
Assess student and faculty satisfaction with the no- or low-cost textbook option and resources produced.

References

Weissmann, J. Why are college textbooks so absurdly expensive? *The Atlantic*. **2013**. Available at: http://www.theatlantic.com/business/archive/2013/01/why-are-college-textbooks-so-absurdly-expensive/266801

Florida Distance Learning Consortium. (2011, September). Florida Student Textbook Survey. Tallahassee, FL. http://www.openaccesstextbooks.org/projectInfo.html

Hilton III, J., Wiley, D. A., and Lutz, N. Examining the Reuse of Open Textbooks. *The International Review of Research in Open and Distance Learning*. **2012**, *13(2)*, 45-58.

Everard, A. and St. Pierre, K. A Case for Student Adoption of Open Textbooks. *Journal of the Academy of Business Education*. **2014**, 66-76.

Statement of Transformation:

The Principles of Chemistry I (CHEM 1211) and II (CHEM 1212) sequence is required by a range of disciplines in the Colleges of Science and Technology and Health Professions at Armstrong State University. Approximately 500 new students begin this sequence each year, thus defining the primary stakeholders at Armstrong State. These classes are listed in the Top 100 undergraduate courses as impacting large numbers of students. The students are currently required to purchase a physical textbook as well as an access code to an online homework system from the same publisher, costing $280.69 when purchased as a bundle. There is a reduced cost for the publisher's online textbook, which can be purchased as an eText with the online homework access code for $136.30, but with this option the students lose access to the book when their subscriptions expire. For many of these students, the book is a helpful resource they need to retain for future classes or to review for licensing exams, so selling the book back or losing access to it are not favorable options. Many students also delay purchasing the book or the homework access because they do not have the funds available to get all the course materials at the beginning of the semester, resulting in their falling behind and increasing their chances of not successfully completing the course.

Assuming every student purchased a new physical textbook, the cost savings for switching to the free, online OpenStax textbook may reach over $110,000 each year. For those students that wish to have a hard copy of the textbook,[5] OpenStax offers a bound version that costs one-fourth the cost of the currently used textbook. We feel that this is a significant advantage of the OpenStax book over other open resources, as there are studies that show not all students can use the electronic textbooks as efficiently as hard copies.[6] The live web version and the downloadable pdf version of the OpenStax book are free. We still plan to use an online homework system, but would switch to Sapling Learning, which can be used with any book and is often marketed for use with the OpenStax books. The cost for Sapling ($65) is approximately the same as the current online homework system for the student. The

instructions for this proposal indicate an expectation of $35 cost of materials to the student; we feel that this online homework fits the spirit of that cost limitation since it will be used for two semesters of coursework, and is thus less than $35 per class.

In our department, decisions regarding book selection and homework systems are made by the General Chemistry Committee, from which the project applicants are derived. As members of the General Chemistry Committee, the applicants have experience with providing curriculum materials via electronic media, as we have previously moved the CHEM 1211 and CHEM 1212 laboratory materials to an on-line platform (Desire2Learn). Reduction of cost to the students was one significant factor in making this change. The work performed by the applicants will be distributed for use throughout the entire department, so the primary task within this proposal is the preparation of materials for use by all instructors, including temporary faculty. If funded, the project team will review all of the content areas currently taught for currency and relevance to the discipline and the degree programs we serve. The material in the new textbook will be carefully reviewed and an online homework template made available to all instructors. Lecture materials, clicker-type questions, and worked examples will also have to be produced for the chapters, as there are limited materials of these types currently available from OpenStax. We anticipate preparing the first-run of these materials and the course integration with our learning management software during the summer 2017 semester, with revisions occurring over the following two semesters.

Baek, E-O. and Monaghan, J. Journey to Textbook Affordability: An Investigation of Students' Use of eTextbooks at Multiple Campuses. *The International Review of Research in Open and Distance Learning*. **2013**, *14(3)*, 1-26.
Daniel, D. B. and Woody, W. D. E-textbooks: At what cost? Performance and use of electronic v. print texts. *Computers and Education*. **2013**, *62,* 18-23.

Transformation Action Plan:

Alignment of the course objectives and redesign of both course syllabi will be accomplished during spring 2017. Assessment materials will be assembled and/or developed during the spring semester 2017 and submitted for IRB approval.

Drs. Guillet, Hizer, MacGowan and Padgett (lead instructors) will be trained from the OpenStax publisher and Sapling Learning on best practices with their course materials.

The course content and supplemental curriculum materials for CHEM 1211 and CHEM 1212 will be identified and/or developed (e.g. online homework, lecture materials), during the spring and summer semesters of 2017.

Course materials will be uploaded and incorporated into the University's *Desire-to-Learn (D2L)* website during summer 2017. All course content and supplemental curriculum materials (e.g. clicker questions, power points slides, answer keys and assessment tools) will

be freely accessible for all CHEM 1211 and CHEM 1212 instructors at Armstrong State starting in the fall semester 2017. These materials will also be made freely available to the public in the Community Resources partnership OpenStax has with OER Commons.

Drs. Guillet, Hizer, MacGowan and Padgett will provide training on course content material and the organizational structure to all department faculty assigned to teach CHEM 1211 and CHEM 1212 during fall 2017 and/or spring 2018 in a workshop format in August, prior to the semester start.

Feedback and assessment data on whether or not the grant's objectives were met will be collected throughout the 2017-2018 academic year. Retooling, as necessary, of the organization of the course and/or curriculum materials will take place in spring 2018. Updates will be made available as they are created for use in subsequent semesters.

Quantitative & Qualitative Measures:

Assessment of the project will focus around four questions:Do students perform similarly to previous semesters in which materials from mainstream publishers were employed?What are student perceptions of eTexts and open educational resources (OER), and do these perceptions change after use of the OpenStax textbook?Are students satisfied with the quality of the materials available for this class?Are faculty satisfied with the quality and scope of the materials produced from the work done under this proposal? Student performance will be evaluated through mostly quantitative measures. We want to ensure that the textbook and materials produced can be used to effect the same or better learning gains in the students. The chemistry faculty at Armstrong have data on the percentage of students earning D or F grades or withdrawing (W) from CHEM 1211 and CHEM 1212. These historic percentages for courses using a traditional textbook will be compared to classes that use the Openstax textbook. Both courses in the general chemistry curriculum use a standardized final exam written by the American Chemical Society. The average scores on this exam for courses that use the Openstax textbook will be compared to historic data from courses that used a traditional textbook. Similar percentages for DFW percentage and standardized exam scores would indicate that the Openstax textbook is sufficient to meet the needs of our curriculum. Faculty will also be asked for their perceptions of student performance, including engagement during class.Student perceptions of OER materials and eTexts will be evaluated qualitatively through surveys. A short survey will be given at the beginning of the semester, containing questions such as:What advantages do you feel open-source textbooks have compared to traditional textbooks?What concerns do you have about using an open-source textbook?Would you primarily identify yourself as a “highlighter” or a “note-taker” when describing how you use textbooks?For a chemistry course, if offered the choice, would you choose an eText or a hard-copy

textbook and why? The questions will also be presented on an end-of-semester survey along with additional questions investigating student satisfaction with the book and the materials produced by the grant authors. Examples of these additional questions are:How easy was it to find and use topics in the book?How comfortable were you reading the electronic version of the text compared to a hard-copy text?Did you meet the instructor's expectations for reading material in the textbook?If you chose to buy a hard-copy of the OpenStax book or print large amounts of text, why did you make that choice?If your instructor used lecture slides, did you find them to complement the material in the textbook?Were there enough problems for you to practice difficult concepts?Does the accessible-anywhere nature of the book make you more likely to consult it to answer questions? The student survey questions will be developed spring 2017 and submitted for IRB approval prior to use in Fall 2017 and subsequent semesters.As all instructors that teach general chemistry will be impacted by the textbook and online homework system change, we will also assess faculty satisfaction with the OpenStax textbook and the ancillary materials produced by the grant authors. Faculty will be surveyed regarding the consistency, completeness, and ease of further customization of the new ancillary materials. Suggestions for additions and improvements will also be solicited. A survey form will be generated that faculty can use to submit their responses at the end of each chapter. A meeting will be held every month between the grant authors and any interested faculty to review the survey responses and plan on-going improvements for the subsequent semester.

Timeline:

Spring 2017

Kick-off meeting

Investigators will:

Become familiar with the materials available through OpenStax and the associated on-line homework system available through Sapling Learning.

Receive thorough training in utilizing the OpenStax online textbook and Sapling Learning online homework system.
Course objectives will be realigned, and the course syllabi for CHEM 1211 and CHEM 1212 will undergo some revision.

May - August 2017

The OpenStax material will be aligned with our objectives and our paradigm.
Ancillary materials to supplement those available through OpenStax will be developed. An on-line homework regimen, based on the Sapling system, will be developed.
These materials will be made available to students through Desire to Learn, to which all Armstrong students have free access.

August 2017

Investigators will provide training on accessing and using the new materials at a workshop held prior to the beginning of fall classes.

January 2018

Feedback from students and faculty will be collected both terms. Effectiveness of the course transformation will be assessed as described in section 1.4. Identified weaknesses will be addressed and improvements/adjustments made beginning in the spring semester.

January – May 2018

Course will be executed again with modifications.

May 2018

Meet and assess two semesters of data from qualitative and quantitative assessments.
Prepare final report.

Budget:

Item	Justification	Amount ($)

Release time for Dr.Gary Guillet	Dr. Guillet will need time to develop web content and assessment tools; coordinate lecture and laboratory content with team members; to disseminate and train department faculty members on new course curriculum materials and attend meetings.	5000
Release time for Dr.Todd Hizer	Dr. Hizer will need time to develop web content and assessment tools; coordinate lecture and laboratory content with team members; to disseminate and train department faculty members on new course curriculum materials and attend meetings.	5000
Release time for Dr. Catherine MacGowan	Dr. MacGowan will need time to develop web content and assessment tools; coordinate lecture and laboratory content with team members; to disseminate and train department faculty members on new course curriculum materials and attend meetings.	5000
Release time for Dr. Lea Padgett	Dr. Padgett will need time to develop web content and assessment tools; coordinate lecture and laboratory content with team members; to disseminate and train department faculty members on new course curriculum materials and attend meetings.	5000
Travel for Drs. MacGowan and Padgett	Travel funds for USG grant kick-off training/implementation meeting	800

Materials	American Chemical Society standardized testing materials for comparisons to national/state averages	600
	Grand Total	21,400

Sustainability Plan:

The Department of Chemistry and Physics at Armstrong State University has an established General Chemistry Committee that oversees this sequence. Numerous sections of each course are offered every semester. All course instructors use the same textbook and will have access to all ancillary materials produced, with the ability to further adapt them at any time. The committee will ensure continuity and consistency in the materials available to our department. The produced materials will be uploaded to the Community Resources partnership with OER Commons; significant revisions or continued educational products will be uploaded to this community forum as they are produced. The committee will also continue monitoring and evaluating student-focused outcomes. Revisions will be made as needed to provide a positive learning experience for the students.

Armstrong
STATE UNIVERSITY

Provost and Vice President for Academic Affairs
11935 Abercorn Street | Savannah, Georgia 31419
912.344.2589 | Fax 912.344.3492 | armstrong.edu

August 26, 2016

To Whom It May Concern,

On behalf of Armstrong State University, I am very pleased to be writing this letter of support for the Affordable Learning Georgia Textbook Transformation grant proposal authored by Drs. Leah Padgett, Catherine MacGowan, Gary Guillet and Todd Hizer of Armstrong's Department of Chemistry and Physics. Their proposal, entitled, "Making Chemistry Affordable" intends to develop a no-cost textbook and ancillaries to support students in two courses: CHEM 1211 (Principles of Chemistry I) and CHEM 1212 (Principles of Chemistry II). This project will have a broad impact on our campus and beyond, as Armstrong has a very strong program in Chemistry and since many additional students take these courses in support of other majors, with approximately 500 students taking this course sequence each year. Moreover, this team of faculty is very well positioned to implement the project that they have proposed.

It is important to recognize that commercially published General Chemistry textbooks are generally quite expensive. Further, due to the very high cost, many students feel that they cannot afford to purchase the text and hence, do not do so. Thus, developing such a no-cost alternative to a traditional textbook will have a significant impact on both students' cost for taking CHEM 1211 and 1212, as well as their performance, by making high-quality free materials available to all students.

Armstrong recognizes the importance of engaging our students in the STEM disciplines and the proposed project will further this objective, by utilizing modern technology and multimedia presentations to assist student learning in this challenging area. Further, the Provost's office will support this campus team, working with the Department of Chemistry and Physics, as well as the rest of the campus, to broaden the university's adoption of open source materials wherever appropriate. It is hoped that this team will develop a campus model that will assist other faculty and departments in their efforts to investigate and adapt open source material, leading to broader implementation of the open textbook concept at Armstrong. I am very pleased to recommend this project wholeheartedly.

Sincerely,

Robert T. Smith, Ph.D.
Provost and Vice President for Academic Affairs
Professor of Mathematics

Affordable Learning Georgia Textbook Transformation Grants

Rounds Six, Seven, and Eight

For Implementations beginning Fall Semester 2016

Running Through Fall Semester 2017

Proposal Form and Narrative

Submitter Name	Lea W. Padgett
Submitter Title	Senior Lecturer
Submitter Email	Lea.padgett@armstrong.edu
Submitter Phone Number	912.344.2946
Submitter Campus Role	Proposal Investigator
Applicant Name	Lea Padgett
Applicant Email	Lea.padgett@armstrong.edu
Applicant Phone Number	912.344.2946
Primary Appointment Title	Senior Lecturer, Department of Chemistry and Physics
Institution Name(s)	Armstrong State University

Team Members	**Dr. Catherine MacGowan, Assistant Professor, Department of Chemistry and Physics, Armstrong State University** **Catherine.macgowan@armstrong.edu** **Dr. Gary Guillet, Assistant Professor, Department of Chemistry and Physics, Armstrong State University** **Gary.guillet@armstrong.edu** **Dr. Todd Hizer, Assistant Professor, Department of Chemistry and Physics, Armstrong State University** **Todd.hizer@armstrong.edu**				
Sponsor, Title, Department, Institution	Dr. Robert T. Smith Provost and Vice President for Academic Affairs Professor of Mathematics Armstrong State University				
Proposal Title	Making Chemistry Affordable				
Course Names, Course Numbers and Semesters Offered	CHEM 1211 Principles of Chemistry I CHEM 1212 Principles of Chemistry II Each course is offered every Fall, Spring, and Summer semester; Changes from this proposal will go into effect Fall 2017 and continue into Spring 2018				
Final Semester of Instruction	Fall 2017				
Average Number of Students Per Course Section	30	**Number of Course Sections Affected by Implementation in Academic Year**	**32**	**Total Number of Students Affected by Implementation in Academic Year**	960
Award Category	☐ No-or-Low-Cost-to-Students Learning Materials ☒ OpenStax Textbooks				

(pick one)	☐ Interactive Course-Authoring Tools and Software ☐ Specific Top 100 Undergraduate Courses
List the original course materials for students (including title, whether optional or required, & cost for each item)	Principles of Chemistry: A Molecular Approach, 3rd Edition by Nivaldo J. Tro (Required) $244.93 at campus bookstore Mastering Chemistry online access (Required) $65.95 directly from publisher website
Requested Amount of Funding	$21,400
Original Per Student Cost	$310.88 if purchased separately; $280.69 when bundled new from bookstore
Post-Proposal Projected Per Student Cost	$65 **for two semesters**; $32.50 when prorated by course
Projected Per Student Savings	$215.69 from new bundled price
Projected Total Annual Student Savings	$110,000
Creation and Hosting Platforms Used	D2L will be used to share materials within the department and with students. Materials will be made available to others using the Community Resources partnership OpenStax has with OER Commons

NARRATIVE

1.1 PROJECT GOALS

There is wide-reaching debate over the costs of college attendance and the long-term ramifications on each student. One way students reduce their total outlay is by not buying textbooks suggested or required for the course. This fact is especially true for Armstrong State students as many are first generation college students from lower income areas in southeast Georgia. Textbook costs have risen dramatically over the last 30 years, outpacing inflation, home prices, and healthcare cost.[1] Choosing to avoid the cost of books, however, is not a success strategy for most students. Studies have shown a correlation between not purchasing textbooks and increased likelihood of failure or withdrawal from courses.[2]

Textbooks are marketed not to students, but to faculty, for whom cost is not as determining a factor. There is an increasing availability of low-cost or free materials available to students and faculty, but the adoption of a new textbook carries a large, possibly prohibitive, time commitment from the faculty teaching those courses.[3,4] Integration of electronic materials into the university's learning management system or an online homework platform is particularly time-consuming. We seek funding to compensate faculty for the time and effort that a switch to free, openly-available course textbook published by Openstax would entail. This includes creating course materials (lecture slides, online homework templates, and clicker questions) of comparable quality to those provided by publishers with the adoption of mainstream, high-cost textbooks. Specific goals to this project are:

1. Reduce costs to students by adopting a no-cost textbook.
2. Review course content for currency, relevance, and programmatic needs.
3. Develop ancillary materials similar to those provided by publishers to support use of the OpenStax textbook by all faculty in the department.
4. Assess student and faculty satisfaction with the no- or low-cost textbook option and resources produced.

1.2 STATEMENT OF TRANSFORMATION

The Principles of Chemistry I (CHEM 1211) and II (CHEM 1212) sequence is required by a range of disciplines in the Colleges of Science and Technology and Health Professions at Armstrong State University. Approximately 500 new students begin this sequence each year, thus defining the primary stakeholders at Armstrong State. These classes are listed in the Top 100 undergraduate courses as impacting large numbers of students. The students are currently required to purchase a physical textbook as well as an access code to an online homework system from the same publisher, costing $280.69 when purchased as a bundle. There is a reduced cost for the publisher's online textbook, which can be purchased as an eText with the online homework access code for $136.30, but with this option the students lose access to the book when their subscriptions expire. For many of these students, the book is a helpful resource they need to retain for future classes or to review for licensing exams, so selling the book back or losing access to it are not favorable options. Many students also delay purchasing the book or the homework access because they do not have the funds available to get all the course materials at the beginning of the semester, resulting in their falling behind and increasing their chances of not successfully completing the course.

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in making this change. The work performed by the applicants will be distributed for use throughout the entire department, so the primary task within this proposal is the preparation of materials for use by all instructors, including temporary faculty. If funded, the project team will review all of the content areas currently taught for currency and relevance to the discipline and the degree programs we serve. The material in the new textbook will be carefully reviewed and an online homework template made available to all instructors. Lecture materials, clicker-type questions, and worked examples will also have to be produced for the chapters, as there are limited materials of these types currently available from OpenStax. We anticipate preparing the first-run of these materials and the course integration with our learning management software during the summer 2017 semester, with revisions occurring over the following two semesters.

1.3 TRANSFORMATION ACTION PLAN

- Alignment of the course objectives and redesign of both course syllabi will be accomplished during spring 2017. Assessment materials will be assembled and/or developed during the spring semester 2017 and submitted for IRB approval.

- Drs. Guillet, Hizer, MacGowan and Padgett (lead instructors) will be trained from the OpenStax publisher and Sapling Learning on best practices with their course materials.

- The course content and supplemental curriculum materials for CHEM 1211 and CHEM 1212 will be identified and/or developed (e.g. online homework, lecture materials), during the spring and summer semesters of 2017.

- Course materials will be uploaded and incorporated into the University's *Desire-to-Learn (D2L)* website during summer 2017. All course content and supplemental curriculum materials (e.g. clicker questions, power points slides, answer keys and assessment tools) will be freely accessible for all CHEM 1211 and CHEM 1212 instructors at Armstrong State starting in the fall semester 2017. These materials will also be made freely available to the public in the Community Resources partnership OpenStax has with OER Commons.

- Drs. Guillet, Hizer, MacGowan and Padgett will provide training on course content material and the organizational structure to all department faculty assigned to teach CHEM 1211 and CHEM 1212 during fall 2017 and/or spring 2018 in a workshop format in August, prior to the semester start.

- Feedback and assessment data on whether or not the grant's objectives were met will be collected throughout the 2017-2018 academic year. Retooling, as necessary, of the organization of the course and/or curriculum materials will take place in spring 2018. Updates will be made available as they are created for use in subsequent semesters.

1.4 QUANTITATIVE AND QUALITATIVE MEASURES

Assessment of the project will focus around four questions:

1. Do students perform similarly to previous semesters in which materials from mainstream publishers were employed?
2. What are student perceptions of eTexts and open educational resources (OER), and do these perceptions change after use of the OpenStax textbook?
3. Are students satisfied with the quality of the materials available for this class?
4. Are faculty satisfied with the quality and scope of the materials produced from the work done under this proposal?

Student performance will be evaluated through mostly quantitative measures. We want to ensure that the textbook and materials produced can be used to effect the same or better learning gains in the students. The chemistry faculty at Armstrong have data on the percentage of students earning D or F grades or withdrawing (W) from CHEM 1211 and CHEM 1212. These historic percentages for courses using a traditional textbook will be compared to classes that use the Openstax textbook. Both courses in the general chemistry curriculum use a standardized final exam written by the American Chemical Society. The average scores on this exam for courses that use the Openstax textbook will be compared to historic data from courses that used a traditional textbook. Similar percentages for DFW percentage and standardized exam scores would indicate that the Openstax textbook is sufficient to meet the needs of our curriculum. Faculty will also be asked for their perceptions of student performance, including engagement during class.

Student perceptions of OER materials and eTexts will be evaluated qualitatively through surveys. A short survey will be given at the beginning of the semester, containing questions such as:

1. What advantages do you feel open-source textbooks have compared to traditional textbooks?
2. What concerns do you have about using an open-source textbook?
3. Would you primarily identify yourself as a “highlighter” or a “note-taker” when describing how you use textbooks?
4. For a chemistry course, if offered the choice, would you choose an eText or a hard-copy textbook and why?

The questions will also be presented on an end-of-semester survey along with additional questions investigating student satisfaction with the book and the materials produced by the grant authors. Examples of these additional questions are:

1. How easy was it to find and use topics in the book?
2. How comfortable were you reading the electronic version of the text compared to a hard-copy text?
3. Did you meet the instructor’s expectations for reading material in the textbook?
4. If you chose to buy a hard-copy of the OpenStax book or print large amounts of text, why did you make that choice?

5. If your instructor used lecture slides, did you find them to complement the material in the textbook?
6. Were there enough problems for you to practice difficult concepts?
7. Does the accessible-anywhere nature of the book make you more likely to consult it to answer questions?

The student survey questions will be developed spring 2017 and submitted for IRB approval prior to use in Fall 2017 and subsequent semesters.

As all instructors that teach general chemistry will be impacted by the textbook and online homework system change, we will also assess faculty satisfaction with the OpenStax textbook and the ancillary materials produced by the grant authors. Faculty will be surveyed regarding the consistency, completeness, and ease of further customization of the new ancillary materials. Suggestions for additions and improvements will also be solicited. A survey form will be generated that faculty can use to submit their responses at the end of each chapter. A meeting will be held every month between the grant authors and any interested faculty to review the survey responses and plan on-going improvements for the subsequent semester.

1.5 TIMELINE

Spring 2017

- Kick-off meeting
- Investigators will:
    - Become familiar with the materials available through OpenStax and the associated on-line homework system available through Sapling Learning.
    - Receive thorough training in utilizing the OpenStax online textbook and Sapling Learning online homework system.
- Course objectives will be realigned, and the course syllabi for CHEM 1211 and CHEM 1212 will undergo some revision.

May - August 2017

- The OpenStax material will be aligned with our objectives and our paradigm.
- Ancillary materials to supplement those available through OpenStax will be developed. An on-line homework regimen, based on the Sapling system, will be developed.
- These materials will be made available to students through Desire to Learn, to which all Armstrong students have free access.

August 2017

- Investigators will provide training on accessing and using the new materials at a workshop held prior to the beginning of fall classes.

January 2018

- Feedback from students and faculty will be collected both terms. Effectiveness of the course transformation will be assessed as described in section 1.4. Identified weaknesses will be addressed and improvements/adjustments made beginning in the spring semester.

January – May 2018

- Course will be executed again with modifications.

May 2018

- Meet and assess two semesters of data from qualitative and quantitative assessments.
- Prepare final report.

1.6 BUDGET

Include Personnel & Projected Expenses as appropriate for the category.

Proposals must involve teams of at least teams of 2 or more of any of the following: faculty, faculty librarians, instructional designers, subject matter experts, editors, graphic designers, or others as needed. It is required to include the $800 for overall project expenses and travel in this section.

Two levels of funding are available based on the scale of the project proposed:

Standard-Scale Transformation: Textbook transformation projects within one or more ***1.6 Budget: Multiple Sections/Course/Department-Wide Implementation***

Item	Justification	Amount ($)
Release time for Dr. Gary Guillet	Dr. Guillet will need time to develop web content and assessment tools; coordinate lecture and laboratory content with team members and to disseminate and train department faculty members on new course curriculum materials.	5000
Release time for Dr. Todd Hizer	Dr. Hizer will need time to develop web content and assessment tools; coordinate lecture and laboratory content with team members and to disseminate and train department faculty members on new course curriculum materials.	5000
Release time for Dr. Catherine MacGowan	Dr. MacGowan will need time to develop web content and assessment tools; coordinate lecture and laboratory content with team members; to disseminate and train department faculty members on new course curriculum materials and attend meetings.	5000
Release time for Dr. Lea Padgett	Dr. Padgett will need time to develop web content and assessment tools; coordinate lecture and laboratory content with team members; to disseminate and train department faculty members	5000

	on new course curriculum materials and attend meetings.	
Travel for Drs. MacGowan and Padgett	Travel funds for USG grant kick-off training/implementation meeting	800
Materials:	American Chemical Society standardized testing materials for comparisons to national/state averages	600
	GRAND TOTAL	$21,400

1.7 SUSTAINABILITY PLAN

The Department of Chemistry and Physics at Armstrong State University has an established General Chemistry Committee that oversees this sequence. Numerous sections of each course are offered every semester. All course instructors use the same textbook and will have access to all ancillary materials produced, with the ability to further adapt them at any time. The committee will ensure continuity and consistency in the materials available to our department. The produced materials will be uploaded to the Community Resources partnership with OER Commons; significant revisions or continued educational products will be uploaded to this community forum as they are produced. The committee will also continue monitoring and evaluating student-focused outcomes. Revisions will be made as needed to provide a positive learning experience for the students.

1.8 REFERENCES & ATTACHMENTS

1) Weissmann, J. Why are college textbooks so absurdly expensive? *The Atlantic*. **2013**. Available at: http://www.theatlantic.com/business/archive/2013/01/why-are-college-textbooks-so-absurdly-expensive/266801

2) Florida Distance Learning Consortium. (2011, September). Florida Student Textbook Survey. Tallahassee, FL. http://www.openaccesstextbooks.org/projectInfo.html

3) Hilton III, J., Wiley, D. A., and Lutz, N. Examining the Reuse of Open Textbooks. *The International Review of Research in Open and Distance Learning*. **2012**, *13(2)*, 45-58.

4) Everard, A. and St. Pierre, K. A Case for Student Adoption of Open Textbooks. *Journal of the Academy of Business Education*. **2014**, 66-76.

5) Baek, E-O. and Monaghan, J. Journey to Textbook Affordability: An Investigation of Students' Use of eTextbooks at Multiple Campuses. *The International Review of Research in Open and Distance Learning*. **2013**, *14(3)*, 1-26.

6) Daniel, D. B. and Woody, W. D. E-textbooks: At what cost? Performance and use of electronic v. print texts. *Computers and Education*. **2013**, *62*, 18-23.

Syllabus

CHEM 1211 Tentative Lecture Schedule, Fall 2017:

OS = OpenStax Chemistry Textbook; SW = Smartwork5 Online homework; Videos are available on D2L

Class #	Day	Date	Topic	Homework
1	M	14-Aug-2017	Syllabus, science math	Read the syllabus SW: Introduction Reading assignment on units and dimensional analysis OS-1.4 to 1.6 Measurement/units activity handout Watch video on accuracy and precision (2:28)
2	W	16-Aug-2017	Making measurements and expressing the results: Units, sig figs, precision and accuracy	SW F2: SF, precision, accuracy, and the SI system Read OS sections 1.2-1.3
3	F	18-Aug-2017	Matter classification	SW F3: classification of matter and its properties Read OS 2.1-2.3 and doc about scientific method Watch video Introduction to atomic theory (6:09) Watch videos-Millikan Oil drop (1:14), Thomson cathode Ray experiment (1:48), Rutherford (6:26), laws of composition (5:14)
4	M	21-Aug-2017	Early ideas about the building blocks of matter; laws of matter **Solar Eclipse!**	SW F4: Dalton and early atomic theory Read OS 2.3 Watch video The Nucleus (10:11) **No Class – Go watch the eclipse but don't stare at the sun!!!**
5	W	23-Aug-2017	Subatomic particles, isotopes	Read OS 6.1 SW F5: Nuclear Composition Watch Frequency, Wavelength, and the speed of light (9:26) and Quantum Mechanics I (8:45)
6	F	25-Aug-2017	Light, energy, and the Photoelectric effect	SW F6: Light and the photoelectric effect Read OS 6.2-6.3 to the Quantum Mechanical model of the atom Watch video The double slit experiment (7:39), Single photon interference (6:00), Heisenberg Uncertainty Principle (4:11), and Schrodinger's Cat (1:48)
7	M	28-Aug-2017	development of quantum theory	SW F7: Quantum Mechanics Finish reading OS 6.3
8	W	30-Aug-2017	Quantum numbers	Read OS 6.4 Watch video Orbital filling rules (4:16) SW F8: Quantum Numbers
9	F	1-Sep-2017	Orbital diagrams and electron configuration	Read OS 2.4-2.6, 7.1 SW F9: Electron Configuration
	M	4-Sep-2017	**Labor Day Holiday**	**No class**
10	W	6-Sep-2017	Electron configuration and the Periodic table	Read OS 6.5 SW F10: The periodic table
11	F	8-Sep-2017	effective nuclear charge and periodic trends	Study for Test

12	**M**	**11-Sep-2017**	**Test 1**	Watch video: Bonding types (2 min) Watch video: Nomenclature part 1 (10:51) SW F11: Periodic Trends Read OS 2.6-2.7
13	W	13-Sep-2017	Ionic bonding	Watch video Nomenclature part 2 (5:39) Read OS 7.2 SW F13: Ionic Compounds
14	F	15-Sep-2017	Covalent bonding	Watch video: Moles and molar mass (12 min) SW F14: naming molecular compounds Read OS 3.1
15	M	18-Sep-2017	Formula mass and the mole concept	Watch video: Empirical and molecular formulas Read OS 3.2 Watch video: Percent composition from formulas (3 min) SW F15: Grams to moles to molecules
16	W	20-Sep-2017	Molecular and empirical formula, % composition	Read OS 3.3-3.4 SW F16: Molecular formula and percent composition Watch video: Solution preparation Watch video: Solutions II (3:36)
17	F	22-Sep-2017	Solutions and concentration Density	Watch video: Balancing equations (3:26) Read OS 4.1 SW F17:solutions
18	M	25-Sep-2017	Balancing equations, physical and chemical changes	SW F18: Balancing equations Watch videos: Precipitation reactions (11:30) Types of reactions (1:30)
19	W	27-Sep-2017	Molecular and net ionic equations	SW F19: Net ionic equations Read OS 4.2
20	F	29-Sep-2017	Solubility and electrolytes	Study for Test
21	**M**	**2-Oct-2017**	**Test 2**	SW F20: Solubility and electrolytes Watch video Oxidation Number Practice (5:01)
22	W	4-Oct-2017 **Mid-term**	Types of reactions and oxidation numbers	SW F22: Types of reactions Read OS 4.3 Watch Theoretical, actual, and percent yields (5:52)
23	F	6-Oct-2017	Yields, stoichiometry	SW F23: Stoichiometry I Watch Limiting reactant (8:02) Read OS 4.4
24	M	9-Oct-2017	Limiting reactant	Read OS 4.5 SW F24: Limiting Reactant
25	W	11-Oct-2017	Solutions and titration	SW F25: Titration Watch Video: Combustion Analysis (5:26)

26	F	13-Oct-2017	Combustion analysis	Read OS 5.1 part of 5.3 (pp 249-253) Watch video First law of thermodynamics (4:37) Watch video Conservation of Energy (4:08) SW F26: Combustion analysis
27	M	16-Oct-2017	Heat, enthalpy, and work	Read OS 5.2 SW F27: Thermochemistry Watch video Calorimetry (4:53)
28	W	18-Oct-2017	Calorimetry	SW F28: Calorimetry Read OS 5.3
29	F	20-Oct-2017	Hess's law	SW F29: Hess's Law
30	M	23-Oct-2017	Enthalpy of formation	SW F30: enthalpy of formation Read OS 7.1-7.2
31	W	25-Oct-2017	Lattice energy, ionic bonds, electronegativity and percent ionic character	Study for Test
32	**F**	**27-Oct-2017**	**Test 3**	SW F31: Electronegativity Read OS 7.3
33	M	30-Oct-2017	Lewis structures	Read OS 7.4 Watch video Resonance structures (4:09) SW F33: Lewis Structures
34	W	1-Nov-2017	Resonance and formal charge	Watch video: Bond energy (6:04) Finish Lewis structure sheets SW F34: Resonance and Formal Charge Read OS 7.5
35	F	3-Nov-2017	Bond energy and length	Read OS 7.6, stop at Molecular polarity SW F35: Bond energy and length
36	M	6-Nov-2017	VSEPR	Read remainder of OS 7.6, molecular polarity and dipole moment Watch video Polar molecules (4:43) SW F36: Molecular Geometry
37	W	8-Nov-2017	Molecular polarity	Watch video Valence Bond Theory (8:39) Read OS 8.1-8.3 SW F37: Polarity
38	F	10-Nov-2017	Hybridization	Watch video Magnetic Oxygen (2:50) Watch video Overview of Bonding from quantum mechanical perspective (10:51) Watch video MO theory I (5:07) and MO theory II (3:44) SW F38: Valence Bond Theory Read OS 8.4
39	M	13-Nov-2017	Molecular orbital theory	Watch video: Temperature and Pressure (3:08) SW F39: MO Theory Read OS 9.1

40	W	15-Nov-2017	Kinetic molecular theory	Need to finish pHET if not completed in class SW F40: Gases Read OS 9.2-9.3
41	F	17-Nov-2017	Ideal gas law	Watch video Movement in gases (11:26) SW F41: Ideal gases Read OS 9.4-9.6
	M-F		**Thanksgiving week**	**No class**
42	M	27-Nov-2017	Density, effusion, gas stoichiometry	Study for Test
43	**W**	**29-Nov-2017**	**Test 4**	SW F42: Gases II
44	F	1-Dec-2017	Review	Reflect on what you don't feel confident about and come to class with questions
	M	**4 Dec 2017**	**ACS Final Exam, 8:00-10:00 am**	**Study for the cumulative final exam**

Final Report

Affordable Learning Georgia Textbook Transformation Grants

Final Report

Instructions:

A. Your final report submission must include four separate component files:

1. *Completed report form. Please complete per inline instructions. The italicized text is provided for your assistance; please delete the italicized text before submitting your report.*
2. *Course Outline document with links to the materials as used per day, week, or unit, organized chronologically. View Course Outline Example*
3. *Supporting data on the impact of your Textbook Transformation (survey, analyzed data collected, etc.)*
4. *A photograph of your team and/or your students for use in ALG website and materials.*
    a. *Photograph must be 800x600 pixels at minimum (length x height).*
    b. *Photograph must be taken together: individual team member photographs and website headshots not accepted.*

B. Go to http://affordablelearninggeorgia.org/site/final_report_submission to submit these four components of your final report. Follow the instructions on the webpage for uploading your documents. You will receive a confirmation email. Based on receipt of this report, ALG will process the final payment for your grant. ALG may follow up with additional questions or to request your participation in a publication, presentation, or other event.

Date: 22 Dec 2017

Grant Number: 261

Institution Name(s): Armstrong State University

Team Members (Name, Title, Department, Institutions if different, and email address for each): Lea Padgett, Senior Lecturer, Chemistry and Physics, lea.padgett@armstrong.edu

Catherine MacGowan, Assistant Professor, Chemistry and Physics, Catherine.macgowan@armstrong.edu

Gary Guillet, Assistant Professor, Chemistry and Physics, Gary.guillet@armstrong.edu

Todd Hizer, Associate Professor, Chemistry and Physics, todd.hizer@armstrong.edu

Project Lead: Lea Padgett

Course Name(s) and Course Numbers: CHEM 1211 and CHEM 1212

Semester Project Began: Spring 2017

Semester(s) of Implementation: Fall 2017

Average Number of Students Per Course Section: 28

Number of Course Sections Affected by Implementation: 10 (Summer and Fall 2017)

Total Number of Students Affected by Implementation: 250

1. Narrative

Our project was to develop ancillary materials for the Openstax textbook, *Chemistry*. The main outcome would be to produce a set of PowerPoint slides that faculty could use for lectures that were aligned with the text and complied with expectations for accessibility for all learners. We also changed online homework systems to one we believed would be more student-friendly and match adequately to the new textbook, since Openstax does not have a dedicated platform like the large, for-profit publishers. Because we, as faculty, are responsible for choosing what is best for the students, the project team also developed a survey for the students to examine their perceptions of online textbooks and their willingness to pay for a printed version. The questions on this survey grew out of concerns that were expressed by faculty on behalf of the students as we discussed adopting an open-source textbook. We wished to have some way to measure whether our observation and prediction of student concerns and needs matched with reality.

The timeline for this project was always too compressed for us to complete all aspects of this project without increasing the financial burden on the students, which is contrary to the spirit of the program. We were unwilling to ask students to change books in the middle of a course sequence, since that could have an unnecessary, negative impact on student performance. We have to remember, as content experts, we don't become mired in details such as slight changes in process and terminology like novice learners do. Changing homework systems also has a negative financial impact since many of the publishers, including the one we were moving away from, offer their products at a higher price, but guarantee a longer term of access. This means that students only pay once for both semesters, but if we change books in the middle, students would have to purchase two systems, costing them additional money and not making full use of the materials they purchased for the first semester. This has prevented us from using the materials with second semester students outside of a small pilot group within the timeframe allowed by this report. Full-scale use of the second semester slides will be implemented in Spring 2018. Following that, we will have a completed version that is appropriate for use by others who wish to adopt them. We have produced a first-semester set of slides that will be available to

post to the OER commons once we have a final check by the project officer for Creative Commons compliance.

There are no changes that we would make to the original design of the project if we were to do this again. Most of the difficulties we encountered were directly connected to the consolidation between Armstrong State University and Georgia Southern University that was announced right after we began the project. This consumed enormous amounts of faculty time and significant losses in support staff, such as the instructional designers on campus. The project would have gone more smoothly if we had been able to focus more on this project instead of major curriculum changes and logistical facets of merging two universities. For example, we did not manage to get our survey online and computer labs booked to have the students complete it, which cut into the quantity of data collected and required more time to process the data. This situation is further discussed in section 3b.

We do not believe that this project was "transformative". It did result in a change in the textbook adopted by our department and the homework system used by the students. However, as veteran instructors, we know that the textbook is only one tool used by the students. We use classtime to enhance what the students could get on their own, as such, the differences between textbooks is not the highest contributor to student success. There are certainly differences, but several textbooks would have met our needs. The advantages of an electronic textbook were available with the book we used previously, as the students could choose to purchase the eText rather than the hardcopy. The difference with the Openstax text is that the students had the option to get the book at lower (for the hardcopy) or no cost. The response to the cost savings was positive from the students, but many of them still purchased the hardcopy for a variety of reasons. Student outcomes appear to be comparable to semesters past when several difficulties described in section 3b are considered. The classes were delivered in the same fashion that they were previous semesters; this project did not result in a department-wide shift in pedagogy or instructional model. Our faculty already have a wide range of styles in use, which allows some choices to the students. The team members did experience some professional development opportunities in preparing lecture materials under the guidelines of Creative Commons licensing and 504 compliance. The development of surveys and resulting discussions on the analysis of the data with a skilled evaluator at our institution are also areas in which the project team experienced individual growth.

2. Quotes

We have included more than three quotes so that we can reflect both the positive and negative viewpoints that the students expressed. The following are representative of the comments expressed by the students after using the book for one semester.

"Free online versions help with not making cost a worry when thinking about extra expenses associated with college."

"I think having the textbooks free and online for students is easier and one less thing for us to worry about."

"I like the free online textbook. I am more likely to use and read the book because it is free."

"I believe this is beneficial to students. The younger generations are very tech savvy. I'm an older student and prefer hard text. This is a great way to insure students can have access to textbook for free. It's a good idea."

"I would rather use an affordable printed one but I'm glad there's a free one available online for emergencies."

"I honestly don't like the online textbook, I'd rather have a hard copy. I tend to learn better with a hard copy text."

"I feel better prepared for class having a hardcopy textbook, but I do not believe having only an online textbook would significantly affect my ability to be successful at Armstrong."

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: __208 students in Fall 2017_____

- Positive: __63.9_____ % of ___72_____ number of respondents
- Neutral: __1.4_____ % of ___72_____ number of respondents
- Negative: _31.9_____ % of __72_____ number of respondents

Note: As we did not ask the students this question directly, we have decided to use the survey question that asked the students if they would choose a free, online textbook for their course over a hardcopy. An affirmative response is considered positive for their interaction with the course materials. There was not a significant change in this value when compared with students who were asked the same question a previous semester where the book was not in use.

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)
- _X_ 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:

_32.2_____% of students, out of a total __208_____ 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)
- _X_ Negative: This is a higher percentage of students with D/F/W than previous semester(s)

3b. Narrative

While developing this proposal, we felt there were three primary facets to the assessment plan: 1) How do student outcomes compare to previous semesters? 2) What are

student perceptions of online textbooks? And 3) Are faculty satisfied with the materials produced?

An initial comparison of student outcomes is not favorable. There are a number of significant contributing factors that must be considered when looking at this data, which are described in detail later in this section. The DFW percentage increased from 24.4% and 26.3% in the Fall 2016 and Spring 2017 semesters, respectively, to 32.2% in Fall 2017. The average GPA decreased from 2.69 in Fall 2016 and 2.50 in Spring 2017 to 2.43 in Fall 2017. Our department has chosen to use the American Chemical Society (ACS) standardized exams as final exams in all courses for which there is a test available. We have done this in general chemistry for many years and have a strong understanding of the expected performance of our students on this metric. These exams are nationally normed, and we began using the current version of the First-semester General Chemistry exam in Fall 2016. The national percentiles for our students are 36.2 in Fall 2016, 30.5 in Spring 2017, and 35.2 in Fall 2017. Of the students who completed the course and final exam, there is no difference in performance for the fall semester using the traditional, hardcopy textbook and the fall semester using the online textbook. The spring semesters are traditionally lower performing due to the pre-requisite structure of the curriculum.

We prepared a survey to assess student perceptions of the textbook (attached). As we have only used the full implementation with first-semester students at the time of this writing, we have not completed an analysis of the results using inferential statistics. Instead, we will conduct those analyses once we have students who have used the textbook for an entire sequence and submit that information as a follow-up to this report in Spring 2018. A simple comparison of the descriptive statistics with the data we currently have do not suggest large effects from the use of the online textbook on the perceptions of the students. There may have been a significant difference in the student responses when they were asked to choose from a list of strengths to online textbooks. The student population that used the textbook indicated higher agreement with the advantages of being able to download the book to multiple devices and to being able to access the text offline. It is certainly logical to conclude having downloaded the book or witnessed others do the same would lessen this as a concern and demonstrate how simple and advantageous this characteristic of online texts can be. Students also indicated less agreement with the weaknesses of “Loss of visual accomplishment from progress through pages of a book” and “more tiring to read, more awkward to read digital screen” in the population that used the online book. This may suggest that students were worried about the change in medium, but those fears did not manifest in practice. Further analysis will have to be performed to determine the statistical significance of the differences.

We chose to go with the Openstax textbook because it was the only one of which we were aware that offered a nice, hardbound version similar to the traditional textbooks for those students who did not want to use an electronic version for whatever reasons. We chose to ask on the survey how much they were willing to pay for a print version of the text when they already had access to a free, online one. We felt this would be a way to access how much value, in a standard unit, the students place on having a physical text. In both populations, those who did not use the textbook and those who took the survey after a semester of working with the book, there were students willing to pay a wide range of prices, with approximately 30 percent of each set stating they would just use the free book. The bulk of the students responded in the range of $40-80, which is the cost of the Openstax book when purchased online or at the bookstore. This suggests that the price point of the book is reasonable in the eyes of the students. We also asked for a summary assessment of which book the students would like to use, a free, online text or a hardcopy. Both before and after using the Openstax text, about 63% of the students chose the free, online book. The fact that over 30% of the students say they want the hardcopy validates the proposal team's feeling that we did not want to deprive students of a hardcopy if it made them more comfortable to employ that medium. The students were still able to save money since the hardcopy was much cheaper than our previous book and the advantages of an online text were still available to the students who purchased a hardcopy if they wanted to take advantage of them.

Confounding variables.

This past calendar year has been a tumultuous one for Armstrong. Right when we were set to begin this project in Spring 2017, it was announced that we would be consolidated into Georgia Southern University. The consolidation has consumed vast amounts of faculty time across campus, and thrown into question whether we would be able to continue using the book that we had adopted or would be required to conform to the materials and laboratory activities currently used at the other campus. At the time of this writing, it appears that we will maintain the autonomy to continue the use of the Openstax book on our campus. The consolidation has also had an impact on the students directly; many of them are uncertain about the future of their programs at Armstrong and some chose to transfer rather than wait it out. Our athletes were forced to go to other schools because their teams were disbanded. Many of the incoming freshmen expressed concerns about coming here, although some saw it as a chance to ease their transition into the engineering program at Georgia Southern. All of this adds up to confounding effects in the data analysis since there appears by all anecdotal accounts to be a difference in the freshman class this year compared with years past. Those students represent a significant percentage of the students who enrolled in the course and completed the survey. While we

cannot be certain that this is a factor, the high DFW numbers for the semester are suggestive of a negative impact that may be due to factors other than this proposal.

In addition to the consolidation, we were also closed and evacuated for a hurricane about one month into the semester. This occurred right around the time the first exams were scheduled, and most instructors report that the student scores on those exams were lower than expected from previous semesters. The unanticipated break disrupted the flow of the course and it took a bit of time to resettle all the students and faculty once we returned. The administration also made the decision not to extend the semester into December any additional days to make up for the lost instructional time. This meant that our final exam week became regular class days and we had to devise alternative summative assessments than those originally planned. Because we use the standardized ACS final exam for our courses, we scheduled evening exam slots for the students to attend the final two days of class. We anticipate that a reduction in scores on the exams, both the fourth in-class exam and the ACS final, is inevitable given the reduction in time for students to prepare and the number of students that completed both exams on the same day of class.

A third impact on the performance reported in the data was directly related to changes made for this proposal. We had assumed that we could change homework systems with a minimum of disruption. While we did observe some difficulties in using a homework system written to accompany a different book than we were using, which is discussed in section five of this report, the biggest problem was that the system experienced some significant technical difficulties that resulted in a lot of errors and frustration on the part of both students and faculty. While students were assured their grades would be corrected in the end, there was definitely a heightened antipathy toward the program beyond the usual dislike of online homework systems in general. While it would be difficult to measure the effect of this problem directly, the project team recognizes this as a negative impact on student performance, since practice with the material is the key developing automaticity needed to be successful in a course such as chemistry.

The time consumed by the consolidation and hurricane has put us behind schedule in preparing the materials for dissemination; they are sufficient to use in our own classes for Spring 2018, but we were unable to produce a polished version for the second semester and will have to continue work on those throughout the spring semester. The first semester lecture slides are complete and will be posted once we receive word from the project officer that we have adhered to the necessary Creative Commons licensing standards. We also do not have as much assessment data as we planned to collect and will send that in a follow-up document at the end of the Spring 2018. We particularly need to survey the faculty about the materials we have produced to ensure they meet everyone's expectations. Casual conversation suggests that they are adequate for everyone's needs.

4. Sustainability Plan

As of the end of Fall 2017, our team has produced a set of slides for the chapters that we cover in the Openstax textbook. There are several chapters at the end of the book that are covered by some schools, but that are often excluded, so much so that the previous textbook we used sold two version, one with and one without that material. The first semester slides have been used by all instructors teaching the course in Fall 2017, and were first piloted in Summer 2017 by the team member who took responsibility for producing the first draft of the slides. She has also produced a set of slides for the second semester of the course sequence and piloted them in her course during Fall 2017. In Spring 2018, everyone will use those slides and provide feedback. Those slides still need to revised based on those comments and after scrutiny by the team member that is doing a detailed technical and content review of the slides.

Following completion of the final draft of the slides in May 2018, they will be available for download on the OER commons. Other users can add to them or make edits to suit their individual courses. We will continue to use them in the department, and individual faculty will customize them to their tastes based on the pedagogy and style used in the courses. Our department faculty employ a wide range of teaching styles and throughout this project, there have been different uses of the materials by those individuals. The slides are based on the Openstax book, so unless there are significant changes to that work, we do not anticipate there being a need for major changes in the materials produced. Now that we have switched over to the Openstax book, it is unlikely that we will review or adopt a different book for at least three years. The consolidation between our campus and the Georgia Southern campus in Statesboro leaves many things undecided, but we are hoping for autonomy as regards course materials on each campus, and indeed may encourage some of the faculty at the other campus to move to the Openstax book.

Openstax does not come with a homework system. We chose one system to use in Fall 2017, but we found it to be unsatisfactory for a number of reasons. We are trying a different program in Spring 2018. Following that semester, if we find it satisfactory, we will be able to provide feedback to other users of the textbook as to the suitability of the system in question.

5. Future Plans

There are two main impacts from this project. The first is that, as we expected, the textbook isn't the most important piece for the students to learn the material. We know that many of the students don't read the textbook, or they do so in a limited capacity. This textbook had a very different focus, presumably due to the authors' preferences,

than our last one. That had limited effect on what the individual instructors chose to focus on or the pedagogy they chose to employ. For those of us with years of experience teaching, the textbook is a tool of lesser consequence than our own observations of where the students need the most support and guidance to understand and apply the material. Based on our survey data, there is still a desire from many students to have a physical, hardcopy textbook, so we feel that we made the correct choice in adopting the Openstax textbook. It was the only choice we are familiar with that provided an affordable, high-quality bound version for those who wanted it. Even for those students that purchased a hardcopy, having the online access provided a convenient backup if they were studying somewhere and needed their book, even if it was not their primary mode of interaction with the text. If having a textbook that was more affordable and had multiple modes for access helped even a few students find reliable information when they needed it, then we would consider it a worthwhile switch.

The second impact is that we have had to put a lot of time into discussing what is right for us and our students when choosing a homework system. The program we adopted had a number of advantages among those we looked at, but had several shortfalls when used in practice. A mismatch in language between the textbook and the homework system has a major impact on the students, and will always be a problem in a situation such as this where the textbook and the homework questions are produced by different authors. Even with the system we used before we saw this occasionally, because the question authors are not necessarily the authors of the textbook, and to a novice, even a slight change in wording is enough to send them down the wrong path.

Adaptive components to the homework systems are also a big selling point lately for the producers of those products. One of the team members attempted to use those features of the homework system and has uncovered several disadvantages to that component that may or may not apply to all adaptive products. Three main concerns that will have to be addressed satisfactorily by any program employing those features before they will be assigned again are: 1) How to view exactly what each student saw and responded so as to better help them with difficulties when they come during office hours. Since the experience is different for each user and the program chooses which questions they receive, this is potential weakness if students are to be aided on an individual level by the instructor. 2) How to control the length of time the assignment can be for an individual student. Of course, for a student that is struggling, the program will have to give that individual more questions in order to have them “master” the concept. However, several students at one time or another fell into a loop with the program that they couldn’t escape and spent several hours on one assignment. That might be satisfactory if they had then been very confident and skilled on that topic when it was

over, but they were still unable to do the material successfully, and now very demoralized and frustrated. The students don't want to do homework, but most of them will make an effort if the exercise seems worthwhile; we don't want them to view it as a punishment. 3) Related to the previous concern, the system in use did not provide students correct answers to problems that they missed, or indeed any feedback other than an "incorrect", which would have allowed them to work backwards and determine their own mistakes. This reflective activity is extremely valuable and by not providing any feedback, the students were not able to capitalize on their time spent to improve their learning. Indeed, if the error was simply a negative sign or an incorrectly moved decimal, if I were grading by hand that question would receive most of the credit because the main concepts would be correct. The computer is unable to be that discriminating—not a problem if the students can analyze their work and improve upon it.

As of this writing we do not have any presentations lined up; however, once all the data are in from the student perceptions and impacts, we hope to submit an abstract to either the USG Teaching and Learning conference in Spring 2019. The conference in 2018 has a thread for ALG, but we do not believe we would be ready to present our findings before the close of the Spring 2018 semester. Another venue would be the 2019 meeting of the Southeastern Region of the American Chemical Society, which we will be hosting here in Savannah. There is a large chemical education section, which would be an appropriate place to submit a presentation.

6. Description of Photograph

(left-right) Gary Guillet; Lea Padgett, team lead; Catherine MacGowan; Todd Hizer. All members are instructors of record for the affected courses.