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Application Summary

Competition Details

Competition Title:	Textbook Transformation Grants, Round Twelve (Fall 2018-2019)
Category:	University System of Georgia
Award Cycle:	Round 12
Submission Deadline:	09/13/2018 at 11:59 PM

Application Information

Submitted By:	Glenn Pfeifer
Appplication ID:	2581
Application Title:	383
Date Submitted:	09/11/2018 at 8:27 AM

Personal Details

Institution Name(s):	Georgia State University
Applicant First Name:	Antara
Applicant Last Name:	Dutta
Applicant Email Address:	adutta@gsu.edu
Applicant Phone Number:	770-274-5066
Primary Appointment Title:	Associate Professor of Chemistry
Submitter First Name:	Glenn
Submitter Last Name:	Pfeifer
Submitter Email Address:	gpfeifer@gsu.edu
Submitter Phone Number:	678-891-2528
Submitter Title:	Director, Grants Development and Administration

Application Details

Proposal Title
383

Final Semester of Project
Fall 2019

Requested Amount of Funding
$10,800.00

Type of Grant

No-or-Low-Cost-to-Students Learning Materials

Course Title(s)
Survey of Chemistry I

Course Number(s)
CHEM 1151

Team Member 1 Name
Jerry Poteat

Team Member 1 Email
jpoteat@gsu.edu

Team Member 2 Name
Maher Atteya

Team Member 2 Email
matteya@gsu.edu

Team Member 3 Name

Team Member 3 Email

Team Member 4 Name

Team Member 4 Email

Additional Team Members (Name and email address for each)

Sponsor Name
Dr. Paulos Yohannes

Sponsor Title
Associate Dean

Sponsor Department
Science, Perimeter College, Georgia State University

Original Required Commercial Materials (title, author, price)
General, Organic and Biological Chemistry, Structures of Life by Karen Timberlake-$171.00

Average Number of Students per Course Section Affected by Project in One Academic Year
28

Average Number of Sections Affected by Project in One Academic Year
42

Total Number of Students Affected by Project in One Academic Year
1156

Average Number of Students Affected per Summer Semester
262

Average Number of Students Affected per Fall Semester
629

Average Number of Students Affected per Spring Semester
527

Original Total Cost per Student
$171.00

Post-Project Cost per Student
$5.00

Post-Project Savings per Student
$0-however upon adopting the OER in curriculum, there would be a savings of $166/student. This is the initial step in the design for the Chemistry textbook

Projected Total Annual Student Savings per Academic Year
$104,414 if adopted college-wide

Using OpenStax Textbook?
No

Project Goals

OVERREACHING GOAL:

Develop a supplementary digital textbook for students taking Survey of Chemistry I course which supports the tenets recommended by Vision and Change to integrate core concepts and competencies throughout the curriculum, focus on student-centered learning for all students and employ relevant, interactive, effective, collaborative, outcome-oriented, engaging learning materials.

SPECIFIC GOALS:

1. Identify student learning outcomes from each chapter content, keep students engaged through different learning activities (active learning).
2. Assign homework questions based on the learning objectives, encourage collaborative work through group questions and various different types.
3. Include glossary terms, sample questions/answers, sample problems, self-assessment test within each module and topic commonly taught in the course
4. Include feedback for the interactive quiz section in each module. Students will get a clear explanation on their work as well as they will be able to comment on peer's responses.
5. Arrange the difficulty level of questions in such a way to help students from novice learner to more intermediate and advanced level.
6. Improve course retention and student success by making the content available at a very low cost to zero expense.
7. Improve students' attitudes (Survey results) of the relevance and importance of Chemistry in everyday life.
8. Ensure that the course, learning outcomes and assignments adhere to the philosophy of transparency in teaching and learning.
9. Provide the entire content online so students can download the materials on their mobile devices.
10. Provide self-paced and self-controlled learner oriented, personalized space so that students can make decisions regarding their learning.
11. Disseminate the resources and results of this project at a state-wide meeting (Georgia Academy of Science Spring 2019) and national meeting (ACS National Meeting).
12. Publish the materials as completely free Open resource materials for Survey of Chemistry I students.

Statement of Transformation

VISION AND CHANGE IN UNDERGRADUATE EDUCATION:

The student population at access institutions is drastically changing year after year. The current generation of students prefers to get information on the go, not at the designated time and any specific part of the day. In their busy multitasking life, students need knowledge in a different format, in terms of imagination, visualization, practice and mastery. Unfortunately, change is not easy and although change is occurring, it is occurring slowly and in isolated pockets. In a traditionally taught classroom, students are encouraged to follow the textbook but sometimes they get frustrated when a new edition is published. Students can't sell back their book anymore but the new editions are still missing the crucial linkage between materials. Coming from a non-science background, it is difficult for the students to grasp content materials if the concept is incomplete, presented in a complex way and if the flow of the material is disconnected.

Another big obstacle for student success is the modern expensive higher education system. Tuition costs are not the only thing driving up the cost of higher education. Textbook prices have skyrocketed in recent years. Since 2006, the cost of a college textbook has increased by 73 percent or more than four times the rate of inflation — according to a new report from the non-profit Student PIRGs (Public Interest Research Groups). It's not uncommon for an individual book to cost more than $200, and some have price tags that go as high as $400, the report said. At access institutions many students cannot afford to have a textbook and therefore they fall behind in class due to lack of a standard reference to understand the concept and gain the mastery of the content materials.

Today we find that institutions are gradually shifting from publisher-produced printed or electronic format materials to creating and adopting Open Educational Resources (OERs). OERs are materials that are openly licensed, giving users the legal permission to retain, reuse, revise, remix, and redistribute the material (Wiley, 2017). OERs range from comprehensive materials such as curriculum and textbooks to individual videos, syllabi, lecture notes, and tests. Emerging research finds that students using OERs are no worse in course performance than those using costly printed materials (Lane Fischer, 2015). In a non-experimental case study, Hilton and Laman (Feldstein, 2012) compared the performance of 690 students using an open textbook in an introductory psychology class to the performance of 370 students who used a traditional textbook in a previous semester. They concluded that students who used the open textbook achieved better grades in the course, had a lower withdrawal rate, and scored better on the final examination.

The objective of this project is to prepare an open source free resource for the non-science major students who are taking college level Survey of Chemistry Course I. The students registering for this course come from a non-science background and often get overwhelmed with college-level textbook materials, impeding their critical thinking and problem solving skills. The goal of the digital course content developed in this project is to prepare structured course material with all needed benefits of the regular textbook to assist students in being able to read and understand the material and build up their foundational knowledge. The digital course content will provide them with a supplementary resource to help in improving their performance. The content will also include engaging learning activities tied to visual diagrams and interactive quizzes that would exemplify core concepts, and introduce and reinforce competencies (Junco, 2015). Since the students enrolled in this course are primarily from non-science backgrounds, a high level of visual content of the concept with real life examples will be implemented in concept building. The final outcome of this project is to develop a full OER textbook and make it available as open source free materials to the students.

STAKEHOLDERS

Students are the central stakeholders in this endeavor. While not a prerequisite for biology, students are encouraged to complete the Survey of Chemistry I prior to enrolling in biology. Having the foundational chemical knowledge of living organisms before taking biology can increase the likelihood that a student is successful. It is essential to engage students in relevant curriculum, ensure the development of foundational skills and grow scientific literacy.

Faculty teaching the course are also stakeholders as is the institution offering the course. Faculty outside the discipline are also stakeholders. Since the broadly based skills acquired in these foundational, general educational courses are needed by students to complete upper level courses in other non-science major courses.

Georgia and society in general, are stakeholders in the success of students in this course and their solid understanding of science. These students may not become chemists or teachers but need a foundational understanding of science to be productive, knowledgeable and contributing members of society.

IMPACT ON STAKEHOLDERS AND COURSE SUCCESS

Impact on Students:

1. Financial: Standard textbooks are very expensive and unaffordable to many students. Typically, college bookstores do not buy the used access codes for online resources that often accompany the standard textbook. As a result, students do not receive very much money for their used textbooks. This supplementary

textbook will be free during the implementation semester and will be available to students in subsequent semesters for $5.00.
2. Skill Development: Foundational skills (graphing, critical thinking, cognitive knowledge, effective comprehension) that will be introduced and developed in this course will not only serve the students throughout their time in higher education but throughout their careers, as these skills are frequently cited as important to employers.
3. Science literacy/relevance: The importance of science and technology in today's world is indisputable. Students will have a better understanding of science and technology at the completion of this course.

Impact on Faculty:

1. Faculty will be able to use the materials as they are or customize the materials to suit their own learning objectives of the course.
2. Faculty will be provided with access to the 24/7 helpdesk by Tophat to resolve any technical issue.
3. Implementation of this digital textbook may encourage faculty to implement these practices in other chemistry courses.

Impact on the Institution:

1. Successful implementation should lead to increased student success and higher retention in the course.
2. A positive experience in the course may lead some students to select a STEM pathway. Successful implementation of the digital textbook would potentially increase the number of students in the STEM pathway.
3. The proposed digital textbook would align the college's curriculum with the current expectations.

Impact on the State:

1. Georgia would have a more Science(Chemistry) literate citizenry.
2. Graduates will have stronger workforce-required skills.

IMPACT ON THE COURSE, PROGRAM, DEPARTMENT, INSTITUTIONS, ACCESS INSTITUTION, AND/OR MULTIPLE COURSES:

The potential impact of this digital textbook as envisioned could be significant. At the course level, this digital textbook could increase engagement, student success and retention. The Survey of Chemistry I course serves as a general education science requirement for a large number of students. These students may decide to matriculate in science major if they enjoy and are successful in this course. The department and institution will benefit from increased retention and student success. Although all students benefit from active learning strategies, students with academic deficits exhibit the greatest academic gains when these strategies are introduced into the curriculum. The skills acquired in this course will lay the foundation for future courses. Students will learn how to be better students and move from novice learners to intermediate learners which will benefit faculty teaching these students in other courses.

Transformation Action Plan

THE IDENTIFICATION, SELECTION, ADOPTION/ADAPTION/CREATION, AND REVIEWS OF THE NEW COURSE MATERIALS:

Currently there is not a complete introductory chemistry textbook for non-science majors available through open access venue. In recent conversations with representatives of Tophat, it appears that there is some interest in this project because there is currently nothing in development that would assist students taking this course. Preliminary library research of open commons and other royalty free materials found significant listings of activities for the K-12 educational sector while little materials are available for the higher education sector.

As the costs of textbooks continue to rise, students are avoiding buying a book more than before and looking for more free online resources. This project will endeavor to create modules that are fully online and free of cost.

The PI of this project. Dr. Antara Dutta serves as the Principal Investigator of this project and brings a wealth of prior experience in writing course materials. In 2013-2016 she was the Principle Investigator of an initiative on learning methods and strategies for non-science major students that was funded by a USG grant.

I. Topic Identification and Selection:

Topics for Survey of Chemistry I (CHEM 1151) are fairly standard. However, the pedagogical approach can vary widely. The textbook was created after consulting with the following:

A. Topic Review of major standard textbooks

B. Topic Review from campuses within Institution taught

C. Syllabus solicitation from colleagues

II. Design:

Concepts are discussed in QA based format for students to focus on the key materials. All the numerical problems and additional questions are solved following the current textbook (Timberlake) used in this course. For homework and self-assessment tests, a reference textbook (Smith) is used. A variety of other visual contents and questions are developed or collected from standard available web resources.

1. Typical Topics

A. Matter, Measurement & Energy

B. Atoms and Periodic Table

C. Chemical Bonding

D. Chemical reactions and Quantities

E. Gases

F. Solutions

G. Chemical Kinetics and Equilibrium

H. Acids and Bases

I. Nuclear Chemistry

2. Module Structure

Module: Matter, Measurement & Energy

A. Key terms

B. Sample questions and answers to the main important topics with homework questions

C. Worked out solutions to the problems from currently existing textbook

D. Self-Assessment Quiz

III. Delivery:

The design of the syllabus will be still at the discretion of the instructor.

As a broad, general science course, Survey of Chemistry I (CHEM 1151) has been taught chapter by chapter starting with a brief history and definition of Chemistry and the scientific method. Often chemistry has been taught in chunks and it has been left up to the students to connect the chunks. Unfortunately, those connections are not always obvious to the students. Faculty, as expert learners, frequently are unaware that their novice learner students are not “getting it”. Without those connections that build on previous knowledge, true learning does not occur. Learning is easier when the connection is evident and students can build a cognitive knowledge map. Some form of repetition in which concepts are introduced one week and then reinforced in activities during a succeeding week can be beneficial. Learning requires repetition and repeated exposure to a concept. As a part of the project, team members will explore ways to connect the modules conceptually and repeat the exercises. Different pedagogical approaches to optimize the active learning and integrative conceptual cognitive mapping will be observed.

Review: Materials would be circulated within the Chemistry Curriculum Committee for review and comment. Their comments will be used for appropriate revisions considered.

THE ACTIVITIES EXPECTED FROM EACH TEAM MEMBER AND THEIR ROLE(S):

All three faculty members of this project teach this course on a regular basis either face to face or online.

Credentials of Dr. Antara Dutta:

Chemistry Professor with 10 years of experience teaching at the college level. Dr. Dutta is committed to helping college students develop their full potential in their studies. Dr. Dutta has a strong philosophy of teaching in which she frequently applies modern technologies in her instruction to motivate and engage students to improve their performance in their courses. Dr. Dutta is constantly engaged in science educational research to improve learning methods and strategies. She is dedicated to University service programs and professional society outreach events in promoting learning and supporting the community. Dr. Dutta completed her Ph.D. in Theoretical Computational Chemistry and has published work in reputed international journals such as the Journal of Physical Chemistry, Theochem, etc. Dr. Dutta presented her research work on Chemical Education at the National ACS meeting in 2016. She was the recipient of the Governor’s Teaching Fellow Award in 2016.

Credentials of Dr. Maher Atteya:

Dr. Atteya has been teaching for more than twenty years at Perimeter College. Dr. Atteya completed his Ph.D. in Applied Chemistry at the University of Colorado and has received numerous honors and recognitions throughout his career. He has developed flipped classroom models for the Survey of Chemistry I lecture. To his credit he has developed an online laboratory for CHEM 1151 course as well as a hybrid model of lab. He is the co-advisor of the Perimeter College Science and Pre-Professional Chemistry clubs. He is the recipient of the 2017 Outstanding Senior Faculty Award, and the 2018 NISOD Award for Excellence in Teaching.

Credentials of Dr. Jerry Poteat:

Dr. Poteat has been teaching at Perimeter College since August 2000 and attained the rank of professor in August 2015. He completed a Ph.D. in Polymer Chemistry at Texas A & M University. Working with Atteya and other colleagues, Dr. Poteat led the development of the first viable model for a hybrid chemistry lab course for non-majors science students at Perimeter College. The results from this project were presented at the 2013 Southeast Regional Meeting of the American Chemical Society. Additionally, he has taught chemistry courses at various levels and in varying formats including GOB, general chemistry and organic chemistry, face-to-face, online, and hybrid. In 2013, Poteat received the Phi Theta Kappa International Honor Society Award for Teaching Excellence. In addition, Poteat was selected as one of twenty-six faculty nationwide to participate in the Cengage Project Tomorrow Research Study which was an initiative to determine the effectiveness of online homework software. Poteat also chaired the Chemistry Curriculum Committee for two years, overseeing the management and selections of course materials for all twelve chemistry courses offered at Perimeter College.

Dr. Atteya and Dr. Poteat will divide the topics equally. Each of them will be responsible for developing a part of the content (videos, quizzes, homework questions, self-assessment test). They will also develop concept maps and similar devices for linking module concepts and recommend assessment strategies.

Dr. Dutta will create the course framework and serve as the primary editor for the materials. This digital textbook will be continuously updated. She will serve as the PI with regard to communication with the other two faculty partners of this project. Dr. Dutta has credentials in institutional research and she will oversee implementation efforts.

Materials will be provided to the faculty through access to Tophat platform, a resource for open source course materials. Faculty can choose the availability period of any module when the students have free access to them. Faculty will be able to select homework questions and assessment tests from within the various modules based on the time allotted per module. Tophat representatives will assist the faculty in order to control this process.

Quantitative & Qualitative Measures

QUALITATIVE MEASURES:

1. Student's attitudes toward Chemistry: Students will be surveyed at the beginning and at the end of the semester using iCollege Survey tool.
2. Student Focus group: Students will be asked at mid-point and at the end of the semester to respond to a set of questions regarding their perceptions on the efficacy of the course approach and offer constructive criticism.
3. Discussion sessions will be held with peer faculty members to reflect on the improvement and suggestions of this ebook.

QUANTITATIVE MEASURES:

1. Student success data will be gathered through institutional research. ABCD and WF rates will be calculated and compared to previous semesters. The college-wide success rate (students earning an A, B, C, D) for students in the Survey of Chemistry I course is 72.3% in recent years. Approximately 27.3% of the students enrolled in this course earn a D, W or F grade. Although this DFW rate is not exceptionally high for an introductory non-science major chemistry course at an access institution, improving the pass rate profoundly affects the student's chances of making academic progress and remaining in college. Additionally, a significant focus of this digital textbook is to improve student's understanding and literacy in Chemistry with minimum cost. Although the gains in retention and success is expected, gains in learning are the major goal.
2. To assess the effectiveness of the book, student usage data (number of login attempts and amount of time spent) will be collected from the publishers group for certain assignments. An engagement index is planned to be created based on this data. Student success rates will be compared with this engagement index.
3. Knowledge development: College-wide nationally standardized final exam average raw scores will be compared with engagement index to evaluate the effectiveness of this ebook.

Timeline

FALL 2018

1. Attend the Kick-Off meeting.

2. Create course framework.

3. Divide and assign topic content development.

SPRING 2019

1. Complete review of the materials. Modules, images, fonts, typos will be checked.

2. Create videos, interactive homework questions, self-assessment test.

3. Images of each module will be reviewed.

4. PI meets with collaborators to review and compare each other's materials to ensure consistency.

5. Order any materials needed for activities.

SUMMER 2019

1. Work to expand the supplemental electronic textbook to release it as a full Chemistry textbook.

FALL 2019

1. Use selective modules of the digital textbook across the campus.

2. Administer student skill survey, attitude survey in the first week of classes.

3. At midpoint, administer student perception of course survey.

4. At midpoint, contact the Office of Institutional Research to discuss data fields to be collected.

5. At the end of the semester, administer student skill survey, attitude survey, and student perception of course survey.

6. Work toward the completion of the Chemistry textbook.

7. Send completed materials to the Chemistry Curriculum Committee for review. The review of the materials may extend into spring 2020.

SPRING 2020

1. Complete final report in January, 2020.

2. Review students' feedback and make changes as appropriate.

3. Collect comments from Curriculum committee and make changes as appropriate.

Budget

PERSONNEL:

Each of the project personnel will receive $1,450 in additional compensation plus 33% fringe benefits ($478.50) totaling $1,928.50 for completing the work on this project. 3 faculty X $1,928.50 = $5,785.50.

TOTAL PERSONNEL = $5,785.50

TRAVEL:

Travel funds in the amount of $800 are utilized for the project personnel to attend the Kick-Off meeting on October 29, 2018 at the Middle Georgia State University Hatcher Conference Center.

TOTAL TRAVEL = $800.00

SUPPLIES:

Axon (Tophat) access codes. This digital textbook is considered as premium content on Tophat so there is a fee for the text. There is an on-going TopHat subscription fee each semester a student uses the classroom engagement tools in their course. This subscription fee is for support and allowing access to the chemical software program (CHEM AXON). The plan is to release the content free for a term to the students to evaluate the effectiveness. Funds are requested for 629 Axon access codes at $5/each for faculty and students enrolled in the course. 629 X $5 = $3,145.00

Technology is required to create the video and audio clips of the content. Chemical simulation programs (Camtasia for capturing video & audio clips) and a microphone are needed to create the video and audio content. Camtasia = $249.00; Microphone = $49.00

Registrations. Funds are requested for conference registration fees for the 3 faculty members to attend and present results at the Georgia Academy of Science Spring 2019 meeting at $145 per faculty member. 3 faculty X $145 = $435.00.

Miscellaneous Supplies. Funds are requested for miscellaneous supplies to create ancillary materials = $336.50

TOTAL SUPPLIES = $4,214.50

TOTAL REQUEST = $10,800

Sustainability Plan

Though this proposal is presented as a supplemental book for a non-science major course, the ultimate goal is to give it the shape of a full textbook, making it interactive, explanatory and with collaborative learning activities. Following developing strategies will be incorporated in developing full text.

1) Questions and responses: Questions and responses are the most fundamental and important activities in education, and a great way to grasp the understanding level of each student on specific learning contents. This digital textbook, therefore, would have the facility to support them, in particular instructor's questions and students' reaction, and to collect and manage the data relative to questions and answers on further steps.

2) Monitoring students based on learning data: To grasp students' understanding and to provide feedback, instructors should monitor student learning activity data. Learning data is a highly meaningful resource to observe and document learning behaviors.

3) Assessment: Another factor of digital textbooks is the facility to support assessment. There are many alternatives to traditional assessment types that can be used to broaden the scope of the teacher's classroom assessment activities. The typical techniques of the alternatives are self, portfolio, and peer assessment. The next generation of digital textbooks should support alternatives as well as traditional types of assessment.

4) Experimental learning and learning by doing: Involving students with in-class activities is a pedagogical method intended to promote active learning. This digital text-book should support the creation of various activity-based objects for experimental learning or learning by doing. This is the facility that paperback books can never provide. Digital books should incorporate a variety of learning activities and cloud-based resources such as immersive simulation environments for practice, collaborative/individual homework, and adaptive testing and assessments.

5) Including some functionalities of learning management system (LMS) and course management system (CrMS): This digital textbook will not be restricted to duplication of the printed page on a digital device, and will be able to provide more types of learning contents and digital tools. It will include many functionalities of icollege at our current institution.

The course is offered every semester. The modular nature of the materials will facilitate the maintenance and updating of the course materials. Dr. Dutta will assume that responsibility as a service to the college.

In the future, more course sections will be included if improvement in student success is demonstrated by the use of the digital textbook. Future plans are to expand this supplementary textbook into a full textbook and use it college-wide for free.

Discussion sessions will be held with peer faculty members to reflect on the improvement and suggestions of this ebook. Their valuable suggestions will be incorporated to improve the quality of the textbook.

The materials and results of this project will be presented at the Georgia Academy of Science Spring 2019 Meeting and the 2019 ACS National Meeting.

Dr. Glenn Nomura, Chair of Physical Science, Dunwoody and Dr. Mike Nelson chair of Chemistry Curriculum Committee have given their assurances that the college will support this initiative.

References

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Acknowledgment

Grant Acceptance

[Acknowledged] I understand and acknowledge that acceptance of Affordable Learning Georgia grant funding constitutes a commitment to comply with the required activities listed in the RFP and that my submitted proposal will serve as the statement of work that must be completed by my project team. I further understand and acknowledge that failure to complete the deliverables in the statement of work may result in termination of the agreement and funding.

August 27, 2018

Affordable Learning Georgia
2500 Daniels Bridge Road
Building 300
Athens, Georgia 30606

Dear Affordable Learning Georgia Grant Committee,

As the Associate Dean of Sciences at Georgia State University-Perimeter College, I am writing this letter in full support of Dr. Antara Dutta's Textbook Transformation proposal for Chemistry 1151.

Drs. Antara Dutta, Maher Atteya and Jerry Poteat are proposing to write a chemistry E-book for non-chemistry majors. As we all know, the cost of textbooks have become unaffordable to most of our students at Perimeter College. In many situations, only part of a textbook may be needed for the course. Some textbooks that students buy may not be the best for our student learning. To circumvent these issues, this office has encouraged faculty members to write their own E-textbooks for their courses that they teach.

Several years ago, this office encouraged Dr. Jim Guinn, Physics/Astronomy Professor, to develop E-textbook for his physics courses. He is currently using his own E-textbook for PHYS 1111/1112. He has been able to edit his textbook as needed. The current physics textbook on market cost $200-300. Students in Dr. Guinn's class do not have to spend any money on physics textbook. This is a significant financial help to our students.

This office would like to encourage faculty members in the other disciplines to develop E-textbooks for our students. I am glad that Dr. Dutta and her colleagues are proposing to write an E-textbook that best serve our students. I strongly support their efforts and would like to see the conclusion of the E-textbook in the very near future.

Sincerely,

Paulos Yohannes

Paulos Yohannes
Associate Dean of Sciences
GSU-Perimeter College

Textbook Transformation Grants, Round Twelve (Fall 2018-2019)

Proposal Form and Narrative

Notes

- The proposal form and narrative .docx file is for offline drafting and review. Submitters must use the InfoReady Review online form for proposal submission.
- The only way to submit the official proposal is through the online form in Georgia Tech's InfoReady Review. The link to the online application is on the Round 12 RFP Page.
- The italic text we provide is meant for clarifications and can be deleted.

Applicant, Team, and Sponsor Information

The **applicant** is the proposed Project Lead for the grant project. The **submitter** is the person submitting the application (which may be a Grants Officer or Administrator). The submitter will often be the applicant – if so, leave the submitter fields blank.

Institution(s)	Perimeter College Georgia State University
Applicant Name	Antara Dutta
Applicant Email	adutta@gsu.edu
Applicant Phone #	770-274-5066
Applicant Position/Title	Associate Professor of Chemistry
Submitter Name	Glenn Pfeifer
Submitter Email	gpfeifer@gsu.edu
Submitter Phone #	678-891-2528
Submitter Position	Director, Grants Development and Administration, Georgia State University-Perimeter College

Please provide the first/last names and email addresses of all team members within the proposed project. Include the applicant (Project Lead) in this list. Do not include prefixes or suffixes such as Ms., Dr., Ph.D., etc.

	Name	Email Address
Team Member 1	Jerry Poteat	jpoteat@gsu.edu
Team Member 2	Maher Atteya	matteya@gsu.edu

If you have any more team members to add, please enter their names and email addresses in the text box below.

Please provide the sponsor's name, title, department, and institution. The sponsor is the provider of your Letter of Support.

Dr. Paulos Yohannes (Associate Dean), Perimeter College, GSU

Project Information and Impact Data

Title of Grant Project	Digital Textbook for Survey of Chemistry I Course
Type of Grant	"No-or-Low-Cost-to-Students Learning Materials"
Requested Amount of Funding	$10,800.00
Course Names and Course Numbers	Survey of Chemistry I, CHEM 1151
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1. PROJECT GOALS

OVERREACHING GOAL:

Develop a supplementary digital textbook for students taking Survey of Chemistry I course which supports the tenets recommended by Vision and Change to integrate core concepts and competencies throughout the curriculum, focus on student-centered learning for all students and employ relevant, interactive, effective, collaborative, outcome-oriented, engaging learning materials.

SPECIFIC GOALS:

1. Identify student learning outcomes from each chapter content, keep students engaged through different learning activities (active learning).
2. Assign homework questions based on the learning objectives, encourage collaborative work through group questions and various different types.
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9. Provide the entire content online so students can download the materials on their mobile devices.
10. Provide self-paced and self-controlled learner oriented, personalized space so that students can make decisions regarding their learning.
11. Disseminate the resources and results of this project at a state-wide meeting (Georgia Academy of Science Spring 2019) and national meeting (ACS National Meeting).
12. Publish the materials as completely free Open resource materials for Survey of Chemistry I students.

2. STATEMENT OF TRANSFORMATION

VISION AND CHANGE IN UNDERGRADUATE EDUCATION:

The student population at access institutions is drastically changing year after year. The current generation of students prefers to get information on the go, not at the designated time and any specific part of the day. In their busy multitasking life, students need knowledge in a different format, in terms of imagination, visualization, practice and mastery. Unfortunately, change is not easy and although change is occurring, it is occurring slowly and in isolated pockets. In a traditionally taught classroom, students are encouraged to follow the textbook but sometimes they get frustrated when a new edition is published. Students can't sell back their book anymore but the new editions are still missing the crucial linkage between materials. Coming from a non-science background, it is difficult for the students to grasp content materials if the concept is incomplete, presented in a complex way and if the flow of the material is disconnected.

Another big obstacle for student success is the modern expensive higher education system. Tuition costs aren't the only thing driving up the cost of higher education. Textbook prices have skyrocketed in recent years. Since 2006, the cost of a college textbook has increased by 73 percent or more than four times the rate of inflation — according to a new report from the non-profit Student PIRGs (Public Interest Research Groups). It's not uncommon for an individual book to cost more than $200, and some have price tags that go as high as $400, the report said. At access institutions many students cannot afford to have a textbook and therefore they fall behind in class due to lack of a standard reference to understand the concept and gain the mastery of the content materials.

Today we find that institutions are gradually shifting from publisher-produced printed or electronic format materials to creating and adopting Open Educational Resources (OERs). OERs are materials that are openly licensed, giving users the legal permission to retain, reuse, revise, remix, and redistribute the material (Wiley, 2017). OERs range from comprehensive materials such as curriculum and textbooks to individual videos, syllabi, lecture notes, and tests. Emerging research finds that students using OERs are no worse in course performance than those using costly printed materials (Lane Fischer, 2015). In a non-experimental case study, Hilton and Laman (Feldstein, 2012) compared the performance of 690 students using an open textbook in an introductory psychology class to the performance of 370 students who used a traditional textbook in a previous semester. They concluded that students who used the open textbook achieved better grades in the course, had a lower withdrawal rate, and scored better on the final examination.

The objective of this project is to prepare an open source free resource for the non-science major students who are taking college level Survey of Chemistry Course I. The students registering for this course come from a non-science background and often get overwhelmed with college-level textbook materials, impeding their critical thinking and problem solving skills. The goal of the digital course content developed in this project is to prepare structured course material with all needed benefits of the regular textbook to assist students in being able to read and understand the material and build up their foundational knowledge. The digital course content will provide them with a supplementary resource to help in improving their performance. The content will also include engaging learning activities tied to visual diagrams and interactive quizzes that would exemplify core concepts, and introduce and reinforce competencies (Junco, 2015). Since the students enrolled in this course are primarily from non-science backgrounds, a high level of visual content of the concept with real life examples will be implemented in concept building. The final outcome of this project is to develop a full OER textbook and make it available as open source free materials to the students.

STAKEHOLDERS

Students are the central stakeholders in this endeavor. While not a prerequisite for biology, students are encouraged to complete the Survey of Chemistry I prior to enrolling in biology. Having the foundational chemical knowledge of living organisms before taking biology can increase the likelihood that a student is successful. It is essential to engage students in relevant curriculum, ensure the development of foundational skills and grow scientific literacy.

Faculty teaching the course are also stakeholders as is the institution offering the course. Faculty outside the discipline are also stakeholders. Since the broadly based skills acquired in these foundational, general educational courses are needed by students to complete upper level courses in other non-science major courses.

Georgia and society in general, are stakeholders in the success of students in this course and their solid understanding of science. These students may not become chemists or teachers but need a foundational understanding of science to be productive, knowledgeable and contributing members of society.

IMPACT ON STAKEHOLDERS AND COURSE SUCCESS

Impact on Students:

1. Financial: Standard textbooks are very expensive and unaffordable to many students. Typically, college bookstores do not buy the used access codes for online resources that often accompany the standard textbook. As a result, students do not receive very much money for their used textbooks. This supplementary textbook will be free during the implementation semester and will be available to students in subsequent semesters for $5.00.
2. Skill Development: Foundational skills (graphing, critical thinking, cognitive knowledge, effective comprehension) that will be introduced and developed in this course will not only serve the students throughout their time in higher education but throughout their careers, as these skills are frequently cited as important to employers.

3. Science literacy/relevance: The importance of science and technology in today's world is indisputable. Students will have a better understanding of science and technology at the completion of this course.

Impact on Faculty:

1. Faculty will be able to use the materials as they are or customize the materials to suit their own learning objectives of the course.
2. Faculty will be provided with access to the 24/7 helpdesk by Tophat to resolve any technical issue.
3. Implementation of this digital textbook may encourage faculty to implement these practices in other chemistry courses.

Impact on the Institution:

1. Successful implementation should lead to increased student success and higher retention in the course.
2. A positive experience in the course may lead some students to select a STEM pathway. Successful implementation of the digital textbook would potentially increase the number of students in the STEM pathway.
3. The proposed digital textbook would align the college's curriculum with the current expectations.

Impact on the State:

1. Georgia would have a more Science(Chemistry) literate citizenry
2. Graduates will have stronger workforce-required skills.

IMPACT ON THE COURSE, PROGRAM, DEPARTMENT, INSTITUTIONS, ACCESS INSTITUTION, AND/OR MULTIPLE COURSES:

The potential impact of this digital textbook as envisioned could be significant. At the course level, this digital textbook could increase engagement, student success and retention. The Survey of Chemistry I course serves as a general education science requirement for a large number of students. These students may decide to matriculate in science major if they enjoy and are successful in this course. The department and institution will benefit from increased retention and student success. Although all students benefit from active learning strategies, students with academic deficits exhibit the greatest academic gains when these strategies are introduced into the curriculum. The skills acquired in this course will lay the foundation for future courses. Students will learn how to be better students and move from novice learners to intermediate learners which will benefit faculty teaching these students in other courses.

3. TRANSFORMATION ACTION PLAN

THE IDENTIFICATION, SELECTION, ADOPTION/ADAPTION/CREATION, AND REVIEWS OF THE NEW COURSE MATERIALS:

Currently there is no complete introductory chemistry textbook for non-science majors available through open access venue. In recent conversations with representatives of Tophat, it appears that there is some interest in this project because there is currently nothing in development that would assist students taking this course. Preliminary library research of open commons and other royalty free materials found significant listings of activities for the K-12 educational sector while little materials are available for the higher education sector.

As the costs of textbooks continue to rise, students are avoiding buying a book more than before and looking for more free online resources. This project will endeavor to create modules that are fully online and free of cost.

The PI of this project. Dr. Antara Dutta serves as the Principal Investigator of this project and brings a wealth of prior experience in writing course materials. In 2013-2016 she was the Principle Investigator of an initiative on learning methods and strategies for non-science major students that was funded by a USG grant.

I. Topic Identification and Selection:

Topics for Survey of Chemistry I (CHEM 1151) are fairly standard. However, the pedagogical approach can vary widely. The textbook was created after consulting with the following:

A) Topic Review of major standard textbooks
B) Topic Review from campuses within Institution taught
C) Syllabus solicitation from colleagues

II. Design:

Concepts are discussed in QA based format for students to focus on the key materials. All the numerical problems and additional questions are solved following the current textbook (Timberlake) used in this course. For homework and self-assessment tests, a reference textbook (Smith) is used. A variety of other visual contents and questions are developed or collected from standard available web resources.

1. Typical Topics

A) Matter, Measurement & Energy
B) Atoms and Periodic Table
C) Chemical Bonding
D) Chemical reactions and Quantities
E) Gases
F) Solutions
G) Chemical Kinetics and Equilibrium
H) Acids and Bases
I) Nuclear Chemistry

2. Module Structure

Module: Matter, Measurement & Energy

A) Key terms
B) Sample questions and answers to the main important topics with homework questions
C) Worked out solutions to the problems from currently existing textbook
D) Self-Assessment Quiz

III. Delivery:

The design of the syllabus will be still at the discretion of the instructor.

As a broad, general science course, Survey of Chemistry I (CHEM 1151) has been taught chapter by chapter starting with a brief history and definition of Chemistry and the scientific method. Often chemistry has been taught in chunks and it has been left up to the students to connect the chunks. Unfortunately, those connections are not always obvious to the students. Faculty, as expert learners, frequently are unaware that their novice learner students are not "getting it". Without those connections that build on previous knowledge, true learning doesn't occur. Learning is easier when the connection is evident and students can build a cognitive knowledge map. Some form of repetition in which concepts are introduced one week and then reinforced in activities during a succeeding week can be beneficial. Learning requires repetition and repeated exposure to a concept. As a part of the project, team members will explore ways to connect the modules conceptually and repeat the exercises. Different pedagogical approaches to optimize the active learning and integrative conceptual cognitive mapping will be observed.

Review: Materials would be circulated within the Chemistry Curriculum Committee for review and comment. Their comments will be used for appropriate revisions considered.

THE ACTIVITIES EXPECTED FROM EACH TEAM MEMBER AND THEIR ROLE(S):

All three faculty members of this project teach this course on a regular basis either face to face or online.

Credentials of Dr. Antara Dutta:

Chemistry Professor with 10 years of experience teaching at the college level. Dr. Dutta is committed to helping college students develop their full potential in their studies. Dr. Dutta has a strong philosophy of teaching in which she frequently applies modern technologies in her instruction to motivate and engage students to improve their performance in their courses. Dr. Dutta is constantly engaged in science educational research to improve learning methods and strategies. She is dedicated to University service programs and professional society outreach events in promoting learning and supporting the community. Dr. Dutta completed her Ph.D. in Theoretical Computational Chemistry and has published work in reputed international journals such as the Journal of Physical Chemistry, Theochem, etc. Dr. Dutta presented her research work on Chemical Education at the National ACS meeting in 2016. She was the recipient of the Governor's Teaching Fellow Award in 2016.

Credentials of Dr. Maher Atteya:

Dr. Atteya has been teaching for more than twenty years at Perimeter College. Dr. Atteya completed his Ph.D. in Applied Chemistry at the University of Colorado and has received

numerous honors and recognitions throughout his career. He has developed flipped classroom models for the Survey of Chemistry I lecture. To his credit he has developed an online laboratory for CHEM 1151 course as well as a hybrid model of lab. He is the co-advisor of the Perimeter College Science and Pre-Professional Chemistry clubs. He is the recipient of the 2017 Outstanding Senior Faculty Award, and the 2018 NISOD Award for Excellence in Teaching.

Credentials of Dr. Jerry Poteat:

Dr. Poteat has been teaching at Perimeter College since August 2000 and attained the rank of professor in August 2015. He completed a Ph.D. in Polymer Chemistry at Texas A & M University. Working with Dr. Atteya and other colleagues, Dr. Poteat led the development of the first viable model for a hybrid chemistry lab course for non-majors science students at Perimeter College. The results from this project were presented at the 2013 Southeast Regional Meeting of the American Chemical Society. Additionally, he has taught chemistry courses at various levels and in varying formats including GOB, general chemistry and organic chemistry, face-to-face, online, and hybrid. In 2013, Dr. Poteat received the Phi Theta Kappa International Honor Society Award for Teaching Excellence. In addition, Dr. Poteat was selected as one of twenty-six faculty nationwide to participate in the Cengage Project Tomorrow Research Study which was an initiative to determine the effectiveness of online homework software. Dr. Poteat also chaired the Chemistry Curriculum Committee for two years, overseeing the management and selections of course materials for all twelve chemistry courses offered at Perimeter College.

Dr. Atteya and Dr. Poteat will divide the topics equally. Each of them will be responsible for developing a part of the content (videos, quizzes, homework questions, self-assessment test). They will also develop concept maps and similar devices for linking module concepts and recommend assessment strategies.

Dr. Dutta will create the course framework and serve as the primary editor for the materials. This digital textbook will be continuously updated. She will serve as the PI with regard to communication with the other two faculty partners of this project. Dr. Dutta has credentials in institutional research and she will oversee implementation efforts.

Materials will be provided to the faculty through access to Tophat platform, a resource for open source course materials. Faculty can choose the availability period of any module when the students have free access to them. Faculty will be able to select homework questions and assessment tests from within the various modules based on the time allotted per module. Tophat representatives will assist the faculty in order to control this process.

4. QUANTITATIVE AND QUALITATIVE MEASURES

QUALITATIVE MEASURES:

1. Student's attitudes toward Chemistry: Students will be surveyed at the beginning and at the end of the semester using iCollege Survey tool.
2. Student Focus group: Students will be asked at mid-point and at the end of the semester to respond to a set of questions regarding their perceptions on the efficacy of the course approach and offer constructive criticism.

3. Discussion sessions will be held with peer faculty members to reflect on the improvement and suggestions of this ebook.

QUANTITATIVE MEASURES:

1. Student success data will be gathered through institutional research. ABCD and WF rates will be calculated and compared to previous semesters. The college-wide success rate (students earning an A, B, C, D) for students in the Survey of Chemistry I course is 72.3% in recent years. Approximately 27.3% of the students enrolled in this course earn a D, W or F grade. Although this DFW rate is not exceptionally high for an introductory non-science major chemistry course at an access institution, improving the pass rate profoundly affects the student's chances of making academic progress and remaining in college. Additionally, a significant focus of this digital textbook is to improve student's understanding and literacy in Chemistry with minimum cost. Although the gains in retention and success is expected, gains in learning are the major goal.
2. To assess the effectiveness of the book, student usage data (number of login attempts and amount of time spent) will be collected from the publishers group for certain assignments. An engagement index is planned to be created based on this data. Student success rates will be compared with this engagement index.
3. Knowledge development: College-wide nationally standardized final exam average raw scores will be compared with engagement index to evaluate the effectiveness of this ebook.

5. TIMELINE

FALL 2018

1. Attend the Kick-Off meeting.
2. Create course framework.
3. Divide and assign topic content development.

SPRING 2019

1. Complete review of the materials. Modules, images, fonts, typos will be checked.
2. Create videos, interactive homework questions, self-assessment test.
3. Images of each module will be reviewed.
4. PI meets with collaborators to review and compare each other's materials to ensure consistency.
5. Order any materials needed for activities.

SUMMER 2019

1. Work to expand the supplemental electronic textbook to release it as a full Chemistry textbook.

FALL 2019

1. Use selective modules of the digital textbook across the campus.
2. Administer student skill survey, attitude survey in the first week of classes.

3. At midpoint, administer student perception of course survey.
4. At midpoint, contact the Office of Institutional Research to discuss data fields to be collected.
5. At the end of the semester, administer student skill survey, attitude survey, and student perception of course survey.
6. Work toward the completion of the Chemistry textbook.
7. Send completed materials to the Chemistry Curriculum Committee for review. The review of the materials may extend into spring 2020.

SPRING 2020

1. Complete final report in January, 2020.
2. Review students' feedback and make changes as appropriate.
3. Collect comments from Curriculum committee and make changes as appropriate.

6. BUDGET

PERSONNEL:

Each of the project personnel will receive $1,450 in additional compensation plus 33% fringe benefits ($478.50) totaling $1,928.50 for completing the work on this project. 3 faculty X $1,928.50 = $5,785.50.

TOTAL PERSONNEL = $5,785.50

TRAVEL:

Travel funds in the amount of $800 are utilized for the project personnel to attend the Kick-Off meeting on October 29, 2018 at the Middle Georgia State University Hatcher Conference Center.

TOTAL TRAVEL = $800.00

SUPPLIES:

Chem Axon (Tophat) access codes. This digital textbook is considered as premium content on Tophat so there is a fee for the text. There is an on-going TopHat subscription fee each semester a student uses the classroom engagement tools in their course. This subscription fee is for support and allowing access to the chemical software program (CHEM AXON). The plan is to release the content free for a term to the students to evaluate the effectiveness. Funds are requested for 629 Chem Axon access codes at $5/each for faculty and students enrolled in the course. 629 X $5 = $3,145.00

Technology is required to create the video and audio clips of the content. Chemical simulation programs (Camtasia for capturing video & audio clips) and a microphone are needed to create the video and audio content. Camtasia = $249.00; Microphone = $49.00

Conference Registrations. Funds are requested for conference registration fees for the 3 faculty members to attend and present results at the Georgia Academy of Science Spring 2019 meeting at $145 per faculty member. 3 faculty X $145 = $435.00.

Miscellaneous Supplies. Funds are requested for miscellaneous supplies to create ancillary materials = $336.50

TOTAL SUPPLIES = $4,214.50

TOTAL REQUEST = $10,800

8. SUSTAINABILITY PLAN

Though this proposal is presented as a supplemental book for a non-science major course, the ultimate goal is to give it the shape of a full textbook, making it interactive, explanatory and with collaborative learning activities. Following developing strategies will be incorporated in developing full text.

1) **Questions and responses:** Questions and responses are the most fundamental and important activities in education, and a great way to grasp the understanding level of each student on specific learning contents. This digital textbook, therefore, would have the facility to support them, in particular instructor's questions and students' reaction, and to collect and manage the data relative to questions and answers on further steps.

2) **Monitoring students based on learning data:** To grasp students' understanding and to provide feedback, instructors should monitor student learning activity data. Learning data is a highly meaningful resource to observe and document learning behaviors.

3) **Assessment:** Another factor of digital textbooks is the facility to support assessment. There are many alternatives to traditional assessment types that can be used to broaden the scope of the teacher's classroom assessment activities. The typical techniques of the alternatives are self, portfolio, and peer assessment. The next generation of digital textbooks should support alternatives as well as traditional types of assessment.

4) **Experimental learning and learning by doing:** Involving students with in-class activities is a pedagogical method intended to promote active learning. This digital text-book should support the creation of various activity-based objects for experimental learning or learning by doing. This is the facility that paperback books can never provide. Digital books should incorporate a variety of learning activities and cloud-based resources such as immersive simulation environments for practice, collaborative/individual homework, and adaptive testing and assessments.

5) **Including some functionalities of learning management system (LMS) and course management system (CrMS):** This digital textbook will not be restricted to duplication of the printed page on a digital device, and will be able to provide more types of learning contents and digital tools. It will include many functionalities of icollege at our current institution.

The course is offered every semester. The modular nature of the materials will facilitate the maintenance and updating of the course materials. Dr. Dutta will assume that responsibility as a service to the college.

In the future, more course sections will be included if improvement in student success is demonstrated by the use of the digital textbook. Future plans are to expand this supplementary textbook into a full textbook and use it college-wide for free.

Discussion sessions will be held with peer faculty members to reflect on the improvement and suggestions of this ebook. Their valuable suggestions will be incorporated to improve the quality of the textbook.

The materials and results of this project will be presented at the Georgia Academy of Science Spring 2019 Meeting and the 2019 ACS National Meeting.

Dr. Glenn Nomura, Chair of Physical Science, Dunwoody and Dr. Mike Nelson chair of Chemistry Curriculum Committee have given their assurances that the college will support this initiative.

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