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Application Summary

Competition Details

Competition Title:	Textbook Transformation Grants, Round Fourteen (2019-2020)
Category:	University System of Georgia
Award Cycle:	Round 14
Submission Deadline:	04/09/2019 at 11:59 PM

Application Information

Submitted By:	Walidah Walker
Appplication ID:	3374
Application Title:	457
Date Submitted:	04/09/2019 at 8:24 AM

Personal Details

Institution Name(s):	Augusta University Research Institute, Inc.
Applicant First Name:	Thomas
Applicant Last Name:	Colbert
Applicant Email Address:	tcolbert@augusta.edu
Applicant Phone Number:	706-737-1458
Primary Appointment Title:	Professor of Physics/Assistant Chair of Chemistry and Physics/Director of Physics Program
Submitter First Name:	Walidah
Submitter Last Name:	Walker
Submitter Email Address:	wawalker@augusta.edu
Submitter Phone Number:	706-729-2403
Submitter Title:	Manager, Interdisciplinary Research

Application Details

Proposal Title

457

Final Semester of Project

Summer 2020

Requested Amount of Funding

15,800

Type of Grant

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

Course Title(s)
Introductory Physics I and Introductory Physics II

Course Number(s)
PHYS1111 and PHYS1112

Team Member 1 Name
Joseph Newton

Team Member 1 Email
jnewton3@augusta.edu

Team Member 2 Name
Josefa Guerrero-Millan

Team Member 2 Email
jguerreromillan@augusta.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
Diego Vazquez

Sponsor Title
Executive Director

Sponsor Department
Augusta University Research Institute, Inc.

Original Required Commercial Materials (title, author, price)
College Physics: A Strategic Approach Plus Mastering Physics with Pearson eText-Access Card Package 4th edition
Randall D. Knight, Brian Jones, Stuart Field ISBN 978-0-13-464149-2

http://www.mypearsonstore.com/bookstore/college-physics-a-strategic-approach-plus-mastering-0134641493.
Original Total Cost Per Student, $297.64

Average Number of Students per Course Section Affected by Project in One Academic Year
60

Average Number of Sections Affected by Project in One Academic Year
9

Total Number of Students Affected by Project in One Academic Year
503

Average Number of Students Affected per Summer Semester
80

Average Number of Students Affected per Fall Semester
200

Average Number of Students Affected per Spring Semester
223

Original Total Cost per Student
$297.64

Post-Project Cost per Student
$33.95

Post-Project Savings per Student
$263.69

Projected Total Annual Student Savings per Academic Year
$132,636.07 maximum

Using OpenStax Textbook?
Yes

Project Goals

The project is transforming the current traditional high cost textbook use for courses in Introductory Physics I and II (PHYS1111 and PHYS1112) at Augusta University to a low cost OpenStax text. The transformation will include development of free open educational resources matched to the format, symbol use, and outline of the OpenStax College Physics text. A lower cost online homework system (WebAssign) will be used by those instructors choosing to do so. The cost savings impact to students is expected at approximately $66,000 per year at our current enrollment rates of 503 students annually. Our current Fall enrollment expectations for 2019 allows classroom enrollment space for additional student enrollment growth of 25% over last Fall, further highlighting the significance of current growth trends and student savings at Augusta University. In addition to cost savings, the freely available OpenStax text will allow our students to have access to the book immediately upon the start of a course. One recent course survey on textbook use indicates that 31% of the students receiving financial aid would have access to an OpenStax text earlier than a traditional text. The financial aid process can be detrimental to course success for many students.

The rapid turnover of publisher materials has also been a problem for instructors. Such turnover hampers efforts to point students to quality problems and to use instructor created resources that point to specific text, pages, figures or exercises. The OpenStax publication maintains a much more stable instructor resource.

Primary goals of this proposal focus on:

1. Cost savings to students
2. Immediate access to the course text
3. Development of instructor ancillary course materials
4. A highly stable course development environment.

Each of these goals is expected to have a significant positive impact on the student experience in introductory physics courses. The transformation is being made for all sections of introductory physics at Augusta University, validating the “Large Scale Transformation” status.

Statement of Transformation

The current Introductory Physics courses (I and II----PHYS1111 and PHYS1112) are taught by instructors/professors as assigned within the Augusta University Department of Chemistry and Physics. The physics faculty have adopted the text published by Pearson, Randall Knight, College Physics. That text is well known and respected in the physics community and is in its 4th edition currently. The frequent publisher driven changes in each edition of the text are both expensive to students and hamper the effective course development efforts of faculty.

The project will implement a transformation to the OpenStax College Physics text in order to reduce costs to students. While the cost savings to students is significant, the impact on teaching effectiveness due to the development of course resources may be more significant. The project will implement a transformation to the OpenStax College Physics text in order to reduce costs to students. Team members will collaborate on joint syllabus materials, course topics, and calendar schedules for time spent on each topic. Each of the team members has been active in the production of Just in Time Teaching (JiTT) warmup physics exercises, homework assignments or quizzes. These materials will have a major developmental impact on the project. Content based warmup exercises have been developed using current texts. These require alignment with OpenStax text notation and order. In addition, references to specific OpenStax figures, equations, or other text-based material can be added once we make the shift to the OpenStax textbook in Fall 2019. Warmup exercises will also implement a set of learning objectives/goals so that students will know why they are doing this work. Faculty will continue to survey students for feedback regarding course materials development. JiTT was introduced to physics by G. Novak at Indiana University-Purdue University Indianapolis in 1996 and has been studied as a highly effective teaching/learning technique since that time[1] (being adopted in many other fields).

In addition to the cost savings to students, there are significant savings to the course instructors’ effort. With a long-term reliable textbook platform, instructors can redirect and invest greater time and effort towards the development and implementation of meaningful strategies in the course. Adoption of OpenStax eliminates the need for instructors to waste effort on unproductive publisher driven course resource updates; thereby, instructor effort can be spent more effectively.

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[1] Novak, GN, Patterson, ET, Gavrin, A, and Christian, W (1999), Just-in-Time Teaching: Blending active Learning and Web Technology, Saddle River, NJ: Prentice Hall. ISBN 0-13-085034-9

Transformation Action Plan

While all three team members will collaborate extensively on all aspects of course design and development, each has specific functions and roles.

- The OpenStax text will be implemented in Fall 2019 for all Introductory Physics sections.
- Dr. Colbert will offer oversight of developments in both PHYS1111 and PHYS1112.
- Dr. Newton will focus on warmup development and renovation for PHYS1111.
- Dr. Guerrero-Millan will focus on warmup development and renovation for PHYS1112.
- Dr. Colbert will recommend selected problems for WebAssign/OpenStax College Physics for both courses. In addition Dr. Colbert will recommend specific PHET and PHYSLET (both popular physics simulation packages) materials for possible use.

Each team member is an expert in these areas and has extensive teaching and curricular design experience.

Team members have implemented homework, warmups and quiz materials as examples of well-established best practices in physics education research. A single example of gains and benefits to students follows from a current analysis of Introductory Physics I taught by Dr. Colbert in Fall 2019. In preparation for a transformation in PHYS1111 Dr. Colbert has switched his pervious practices to implementing course warmups extensively. These warmups are graded worksheets. They are typically based on materials students have read prior to lectures. After exam 1 Dr. Colbert identified approximately 12 students at risk of not succeeding in the course (scores of less than 55). Of the “at risk” students, there appeared to be a direct correlation between gain (2nd exam compared to first) and performance on warmups. At present 14 warmup assignments have been completed by students. The data is plotted below as Gain vs. Average Warmup Score. The gain is a percentage of achievable increase in student score. For example a student earning 60 on Exam 1 can have a maximum improvement of 40 points. If that student earns a 90 on Exam 2 their gain is calculated as follows:

gain=100% x Actual improvement/Maximum improvement.

For this example, gain=100%x 30/40=75% gain. The trend in the data simply shows that students who have high levels of accomplishment on warmups tend to show greater improvement (gain) on their exams. Exams determine most of the course grade and success.

Both Drs. Guerrero-Millan and Newton demonstrate similar measurements of student performance in their courses. Longer-term tracking of general trends in relation to homework assignment scores and overall course grades is shown below and includes several years of data from Dr. Guerrero-Millan’s introductory physics courses. Similarly, Dr. Newton has extensively surveyed classes and observed a strong correlation between course grade and warmup performance.

Instructional redesign shall consist of each member developing/renovating warmup, quiz, and homework materials. Realignment with the OpenStax text shall be a critical part of the initiative and is best managed as part of the syllabus which the team will develop jointly.

Developed materials will be made available (OER) through Galileo. This will primarily consist of developed warmup materials, other homework assignments, suggested problems and solutions, or quizzes. Augusta University Reese Library faculty Melissa Johnson can assist with appropriate posting of materials.

Quantitative & Qualitative Measures

Student success in the course shall be measured and based upon rates of successful completion of the course relative to rates of D,W, F. Grades of D and F do not satisfy major requirements for most students, and course withdrawal is not successful completion. Both affordability and alignment of course material may impact the success rates in the Introductory Physics courses.

For each semester of the project success rates will be tracked in each of the courses for Introductory Physics.

Students will be surveyed regarding several factors impacting their attitude toward the courses and materials. Specific surveys will be developed assessing student input relating to:

- Cost of text and course materials
- Access to course materials
- Effectiveness of Instructor developed materials WarmupsQuizzesOther exercises or teaching techniques
- Effectiveness of OpenStax text.

Instructors will evaluate and compare course performance on homework, exams, quizzes and warmups.

- Student progress evaluation throughout project
- Comparison to pre-project performance

The use of student surveys, student feedback, and evaluation of performance on a variety of assessment tools is routinely performed by each of the investigators on this project.

We do not anticipate the need for IRB approval for normal course assessment activities.

Timeline

Summer 2019

- Develop syllabi appropriate to pace and material in OpenStax
- Develop warmups/quizzes
- Sample /Select WebAssign problems
- Participate May 20, 2019: Kickoff Meeting

Fall 2019

- Implement course materials
- Survey and assess during first semester
- Revise materials as indicated for spring 2020 implementations

Spring 2020

- Develop syllabi appropriate to pace and material in OpenStax
- Develop warmups/quizzes
- Sample /Select webassign
- Make OER materials available in Galileo

Summer 2020

- Gather data for assessment
- Write final report
- Present to Affordable Learning

Budget

- Three team members will use the budget for summer support and include the required project travel funding.
- Summer 2019 Dr. Joseph Newton $2500Dr. Josefa Guerrero-Millan $2500Dr. Tom Colbert $2500
- Summer 2020 Dr. Joseph Newton $2500Dr. Josefa Guerrero-Millan $2500Dr. Tom Colbert $2500

Travel/Dissemination Support $800

TOTAL $15,800

Sustainability Plan

- Maintaining Course materials The team members have a history of sharing and collaborating with developed course materials.Updated course materials will replace outdated materials in Galileo with assistance of library faculty (Melissa Johnson/Reese Library)Updates shall include new developments in traditional course materials as well as more current media based materials (videos or simulations).
- Expansion of project Course sections and enrollments are growing.An institution goal for enrollment growth envisions 16,000 students up from about 9000 currently.

o Additional growth may occur for a similar course (Calculus based physics) as publishers resort to revisions and high costs.

· Dissemination of Results

o All team members are active with professional communities and have ample opportunity to present significant findings or developments at local, state, regional, and national meetings.

Implementation of plans is expected to be significant and shared under a Creative Commons license.

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.

April 8, 2019

Attn: Review Committee
Affordable Learning Georgia
University System of Georgia
Textbook Transformation Grants

Re: Proposal entitled: "Transformation of Introductory Physics"

Augusta University Principal Investigator: Thomas Colbert, Ph.D

Dear Review Committee:

I am pleased to transmit for your consideration the enclosed proposal entitled "Transformation of Introductory Physics" on behalf of Dr. Thomas Colbert, PhD.

If this application is funded, the award should be made to the **Augusta University Research Institute, Inc.**, and directed to the attention of:

Diego R. Vazquez, MPA, CRA
Executive Director
Augusta University Research Institute, Inc.
1120 15th Street
Augusta, GA 30912-4810

The Augusta University Research Institute, Inc. (AURI) is a 501(c)(3) type tax-exempt organization with a mission to conduct research and is acting on behalf of Augusta University. For your information, the tax identification number of the Augusta University Research Institute, Inc. is 58-1418202 and the DUNS number is 96-666-8691.

These grant funds will be accepted and administered in conjunction with the purpose of the grant and the requirements of the institution. We will be happy to provide the facilities and other support necessary to carry out the proposed project. Please contact me if additional information is needed.

Sincerely,

Diego R. Vazquez, MPA, CRA
Executive Director, AURI
AUGUSTA UNIVERSITY RESEARCH INSTITUTE

Enclosures

Mailing Address:
1120 15th Street, CJ 3301
Augusta, Georgia 30912

T (706) 721-2592
F (706) 721-6478 (Pre-Award)
F (706) 721-4067 (Post-Award)

augusta.edu

AUGUSTA
UNIVERSITY

April 3, 2019

Dear Review Committee,

I enthusiastically support the application for an Affordable Learning Georgia Textbook Transformation Grant by physics faculty Drs. Tom Colbert, Joe Newton, and Josefa Guerrero Millan. These faculty are among the corps who teach PHYS 1111 and PHYS 1112 Introductory Physics at Augusta University (AU), and are heavily involved in curricular improvements in these courses. Enrollment in these courses normally exceeds 500 students each academic year who are completing any of a number of STEM degrees or preparing for future healthcare professional programs such as medicine, dentistry, pharmacy, and physical therapy.

To date the introductory physics curriculum has employed a traditional textbook published by Pearson. This traditional textbook represents a significant student expense and a potential for delayed access if the financial aid process does not run smoothly. Edition updates of the traditional textbook also place a burden on the instructor to ensure proper coordination of the course with each new edition of the textbook. Adoption of OpenStax as a more stable resource allows in-house development of high-value ancillary items that promote active learning, proper preparation for class, and student success.

While reduced student costs are important, the ability to better harness faculty efforts in a sustainable manner through a more stable textbook platform will result in improved instruction. The OpenStax text provides better stability because it does not update to a new edition frequently. Therefore faculty effort to develop instructional materials matched to OpenStax will enjoy increased longevity without the necessity of "reinventing the wheel" that accompanies new editions of textbooks. Instead the instructor materials can be improved and updated when desired based on data from instruction, rather than being forced by a publishing house.

While teaching responsibility for introductory physics is distributed among many faculty, the physics faculty on this proposal are well-suited for the desired transformation. Each of these faculty has been pro-active in developing and implementing best-practices in physics education.

- Dr. Colbert has been active in developing and reviewing physics materials for textbooks and standardized exams including Sapling Physics, MCAT, GRE, SAT, PRAXIS, GACE, Physics AP, and ETS Physics Major Field Test. He was also an editorial board member for Multimedia Educational Resources for Learning and Online Teaching (MERLOT) and author of the exploration worksheets that accompany Physlet Physics (compadre.org).
- Dr. Newton has earned teaching excellence awards at AU and has vast experience creating assignments including warmups and other active learning strategies for introductory physics, introductory astronomy, and nuclear science courses. He spearheaded the completion and first publication by any college or university of the gap analysis for alignment and compliance with

DEPARTMENT OF CHEMISTRY AND PHYSICS

Mailing Address:
1120 15th Street, SCI W3005
Augusta, Georgia 30912

Office Address:
2500 Walton Way, SCI W3005
Augusta, Georgia 30904

T (706) 737-1541
F (706) 667-4519

augusta.edu

the Nuclear Energy Institute's Nuclear Uniform Curriculum Program for training of chemistry technicians. This curriculum is utilized by nuclear power reactor facilities nationwide.

- Dr. Guerrero has taught both PHYS 1111 and 1112. She routinely employs a number of best practices in instruction such as ranking tasks, think-pair-share, drawing sketches of the problem and its solution, and purposeful demonstrations. She is skilled at embedding applications of concepts into the class to help students discover and appreciate implications while encouraging increased motivation for deep learning. She made significant contributions to the modernization of the physics II laboratory with embedding of microcontroller activities and developing project-based lab instruction.

Thank you for your consideration of this proposal to develop a no-cost resource of benefit to our students and to enable improved instruction and efficiency for faculty. The transformations enabled by this proposal will reap benefits to both groups for many years to come.

Sincerely,

Thomas D. Crute, Ph.D.
Professor and Chair

Textbook Transformation Grants, Round Fourteen (Summer 2019 –Summer 2020)

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 14 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)	Augusta University
Applicant Name	Thomas M. Colbert
Applicant Email	tcolbert@augusta.edu
Applicant Phone #	706-737-1458
Applicant Position/Title	Professor of Physics/Assistant Chair of Chemistry and Physics/Director of Physics Program
Submitter Name	Walidah Walker
Submitter Email	wawalker@augusta.edu
Submitter Phone #	706-729-2403
Submitter Position	Manager, Interdisciplinary Research

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	Joseph Newton	jnewton3@augusta.edu
Team Member 2	Josefa Guerrero-Millan	jguerreromillan@augusta.edu

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

Dr. Thomas Crute, Department Chair, Dept. of Chemistry and Physics, Augusta University

Project Information and Impact Data

Title of Grant Project	Transformation and Learning Materials for

	Introductory Physics
Type of Grant	Large Scale Transformation
Requested Amount of Funding	$15,800
Course Names and Course Numbers	Introductory Physics I and Introductory Physics II PHYS1111 and PHYS1112
Final Semester of Project	Summer 2020
Average Number of Students Per Course Section Affected by Project	Students are currently enrolled in section sizes of 60 students maximum. It is typical for fall and spring courses to fill
Average Number of Sections Affected by Project in One Academic Year	Nine sections per year
Total Number of Students Affected by Project in One Academic Year	Based on FA18, SU18, SP19 enrollments both courses total enrollment=503 students
Average Number of Students Affected per Summer Semester	Summer 2018 enrollment both courses 80
Average Number of Students Affected per Fall Semester	200 (based on Fall 2018)
Average Number of Students Affected per Spring Semester	223 (based on Spring 2019)
Title/Author of Original Required Materials	College Physics: A Strategic Approach Plus Mastering Physics with Pearson eText-Access Card Package 4th edition Randall D. Knight, Brian Jones, Stuart Field ISBN 978-0-13-464149-2 http://www.mypearsonstore.com/bookstore/college-physics-a-strategic-approach-plus-mastering-0134641493
Original Total Cost Per Student	$297.64
Post-Project Cost Per Student	WebAssign OpenStax College Physics access for Higher Ed Single Term **$33.95**
Post-Project Savings Per Student	$297.64-$33.95 = **$263.69**
Projected Total Annual Student Savings Per Academic Year	**Maximum savings** =503 students x $263.69=**$132,636.07** (but not all the students purchase new textbooks each semester) **Estimated actual savings** (the same textbook is used for both Introductory Physics I and II, repeat students and used book purchases) approximately half maximum **=$66,000**
Using OpenStax Textbook?	Yes –Transition to OpenStax Textbook.

Narrative Section

1. Project Goals

The project is transforming the current traditional high cost textbook use for courses in Introductory Physics I and II (PHYS1111 and PHYS1112) at Augusta University to a low cost OpenStax text. The transformation will include development of free open educational resources matched to the format, symbol use, and outline of the OpenStax College Physics text. A lower cost online homework system (WebAssign) will be used by those instructors choosing to do so. The cost savings impact to students is expected at approximately $66,000 per year at our current enrollment rates of 503 students annually. Our current Fall enrollment expectations for 2019 allows classroom enrollment space for additional student enrollment growth of 25% over last Fall, further highlighting the significance of current growth trends and student savings at Augusta University. In addition to cost savings, the freely available OpenStax text will allow our students to have access to the book immediately upon the start of a course. One recent course survey on textbook use indicates that 31% of the students receiving financial aid would have access to an OpenStax text earlier than a traditional text. The financial aid process can be detrimental to course success for many students.

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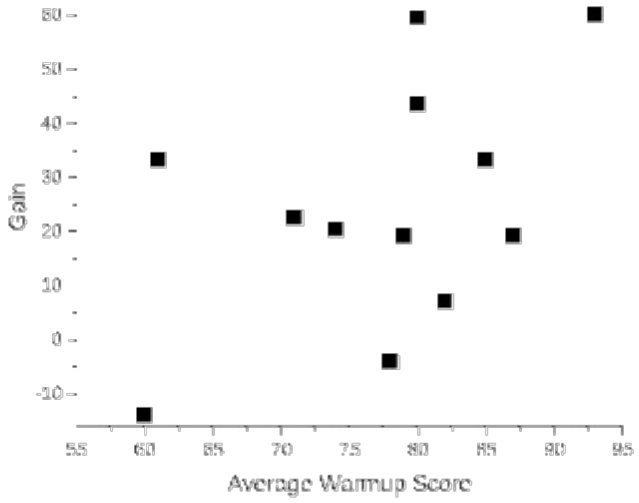

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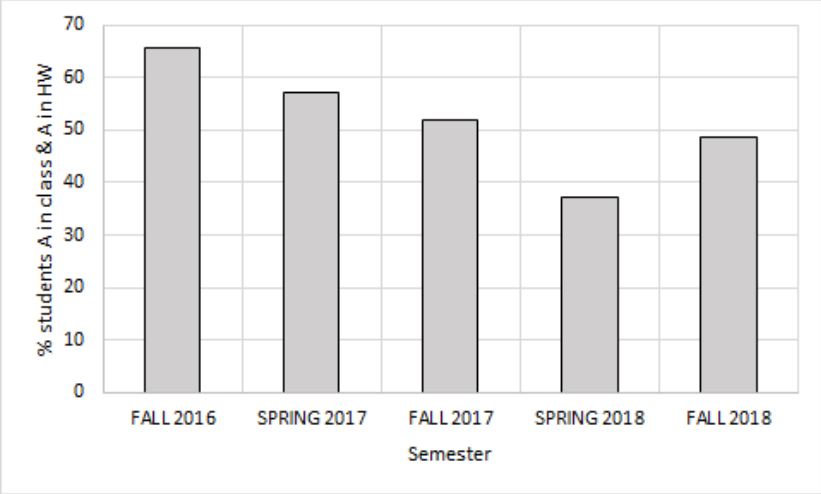

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For each semester of the project success rates will be tracked in each of the courses for Introductory Physics.

Students will be surveyed regarding several factors impacting their attitude toward the courses and materials. Specific surveys will be developed assessing student input relating to:

- Cost of text and course materials
- Access to course materials
- Effectiveness of Instructor developed materials
    - Warmups
    - Quizzes
    - Other exercises or teaching techniques
- Effectiveness of OpenStax text.

Instructors will evaluate and compare course performance on homework, exams, quizzes and warmups.

- Student progress evaluation throughout project

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Summer 2019

- Develop syllabi appropriate to pace and material in OpenStax
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- Develop syllabi appropriate to pace and material in OpenStax
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- Make OER materials available in Galileo

Summer 2020

- Gather data for assessment
- Write final report
- Present to Affordable Learning

6. Budget

- Three team members will use the using budget for summer support and also include required project travel funding.
- Summer 2019
    - Dr. Joseph Newton $2500
    - Dr. Josefa Guerrero-Millan $2500
    - Dr. Tom Colbert $2500
- Summer 2020
    - Dr. Joseph Newton $2500
    - Dr. Josefa Guerrero-Millan $2500
    - Dr. Tom Colbert $2500

Travel/Dissemination Support	$800
TOTAL	$15,800

7. Sustainability Plan

- Maintaining Course materials
  - The team members have a history of sharing and collaborating with developed course materials.
  - Updated course materials will replace outdated materials in Galileo with assistance of library faculty (Melissa Johnson/Reese Library)
  - Updates shall include new developments in traditional course materials as well as more current media based materials (videos or simulations).
- Expansion of project
  - Course sections and enrollments are growing.
  - An institution goal for enrollment growth envisions 16,000 students up from about 9000 currently.
  - Additional growth may occur for a similar course (Calculus based physics) as publishers resort to revisions and high costs.
- Dissemination of Results
  - All team members are active with professional communities and have ample opportunity to present significant findings or developments at local, state, regional, and national meetings.
  - Implementation of plans is expected to be significant and shared under a Creative Commons license.