Application Details

Manage Application: Textbook Transformation Grants: Round Ten

Award Cycle:	Round 10
Internal Submission Deadline:	Friday, September 29, 2017

Application Title:	336
Application ID:	001882
Submitter First Name:	William
Submitter Last Name:	Baird
Submitter Title:	Professor of Physics
Submitter Email Address:	william.baird@armstrong.edu
Submitter Phone Number:	912-344-2708
Submitter Campus Role:	Proposal Investigator (Primary or additional)
Applicant First Name:	William
Applicant Last Name:	Baird
Co-Applicant Name(s):	Jeffery Secrest
Applicant Email Address:	william.baird@armstrong.edu
Applicant Phone Number:	912-344-2708
Primary Appointment Title:	Professor of Physics
Institution Name(s):	Armstrong State University
Submission Date:	Monday, October 2, 2017

Proposal Title:	336
Proposal Category:	No-Cost-to-Students Learning Materials
Are you using an OpenStax textbook?:	Yes
Final Semester of Instruction:	Spring 2018

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

William Baird, Professor of Physics, and Jeffery Secrest, Associate Professor of Physics, Department of Chemistry & Physics, Armstrong State University

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

Will Lynch, Department Head, Chemistry and Physics, Armstrong State University

Course Names, Course Numbers and Semesters Offered:

PHYS 2211K Principles of Physics I, offered Sp, Su, Fall

List the original course materials for students (including title, whether optional or required, & cost for each item):	WebAssign homework (including eBook) – one semester - $90.70 Not available without eBook. Paperback copy (optional): Vol. 1 of 9th edition Halliday, Resnick & Walker Fundamentals of Physics - $74 at Amazon.com
Average Number of Students per Course Section:	25
Number of Course Sections Affected by Implementation in Academic Year:	3

Average Number of Course Sections Per Semester:

Currently 1.5 average per semester, but see transformative impact

Total Number of Students Affected by Implementation in Academic Year:	77* (please see transformative impact)
Requested Amount of Funding:	$10,800
Original per Student Cost:	$90.70 to $164.70
Post-Proposal Projected Student Cost:	$32.50 (Paper copy of OpenStax text adds $40)
Projected Per Student Savings:	$58.20 to $92.20
Projected Total Annual Student Savings:	$4,480 to $7,100 based on 2016 enrollment and ignoring Summer.

Project Goals:

We propose to significantly enhance student success and engagement while reducing the financial burden associated with purchasing modern textbooks. We will adopt the OpenStax University Physics book and move from WebAssign online homework to ExpertTA. We will record video homework solutions to ensure students are able to solve all of the assigned problems by the time a test is given. We will also create computerized demonstrations using

VPython (a free, multi-platform high-level computer language designed for physics modeling and instruction) to aid in the explanation of difficult concepts. Finally, we will develop at least two laboratory exercises in which students will actually program in VPython. We expect to see increased learning gains, a reduction in the DFW (grade of D, F, or W/WF) rate for the course, greater student retention from 2211K to 2212K, and a higher level of student satisfaction.

Statement of Transformation:

We have recently piloted the use of open-source materials in our algebra-based physics courses and in selected upper-level courses for majors. This grant would make it possible to extend this process to our first-semester calculus-based course.

The materials to be created will allow a significant recapture of course time that would otherwise be spent on solving homework questions. By recording video solutions, students can watch (and re-watch) how to solve the “hard” problems without having to sit through explanations of solutions to problems they worked easily. Based on Dr. Baird’s experience with this method, 10-15% of course time was previously devoted to demonstrating homework solutions and would now be available for other uses.

According to the Armstrong State University 2016-2017 Common Data Set , the yearly “Books and Supplies” line item is estimated to be larger than the “Required Fees” and exceeds the cost of 9 credit hours of in-state tuition. Academic stakeholders would be students, who will get enhanced and more individualized instruction; faculty, who will reduce the monotony inherent in repeatedly solving the same homework problems over and over; and the department as a whole, since greater student success means fewer students repeating a course and ultimately necessitating larger/more sections to be staffed. Financial stakeholders would include anyone responsible for payment of educational expenses (i.e., students, parents, taxpayers, etc.).

Transformative Impact - We believe that removing the financial impediment to buying a book will improve student learning as well as reduce the total cost of college for the students in our courses. The decrease in total cost as compared to other local or regional institutions may lead to slightly higher enrollments for our courses. Positive results in student outcomes would suggest that we expand this idea to other courses, providing benefits for other students of physics.

In concert with this change, we will move our online homework system from WebAssign ($90.70 per semester including mandatory eBook rental) to ExpertTA ($32.50 per semester) to provide additional savings to students. ExpertTA neither requires nor offers extra-cost eBooks. We would point out that it has long been our practice to not use the latest textbook in our 2211K/2212K sequence; we are usually one or more editions behind the latest since we have seen no substantive benefits and few differences between editions, except for a large jump in price. We only move to a more recent version when the bookstore finds it impossible to gather a sufficient quantity of “old” books. Our amount saved would increase significantly if we compared the latest version of a physics text to our proposal (e.g., the 10th edition of the book we use currently is available at Amazon for just over $250!) .

The amount saved based on the 2016 spring and fall enrollments in 2211K would have been between $4,480 and $7,100. We note, though, that PHYS 2211K has been taught once per

summer session for at least the past twelve years. Including those students changes the savings to between $5,587 and $8,850.

While we have not claimed it in the calculations above, the coming merger between Armstrong and Georgia Southern is expected to dramatically increase enrollment in the calculus-based physics sequence. While questions about consolidation so far outnumber answers, at least a few things are known at this point: 1) we can expect more engineering students on the Armstrong campus, all of whom must take the PHYS 2211/2212 sequence 2) Chemistry majors, who have traditionally had the option to take either calculus-based or algebra-based physics, depending on their chosen degree, will now all take PHYS 2211/2212. The total number of Chemistry and Biochemistry majors (per the 2016 Fact Book) is over 200; the vast majority of them currently take the algebra-based sequence. 3) Cell/Molecular track Biology students as well as pre-professional Biology students (between 1/3-1/2 of the total number of Biology majors, of which there are 380 according to the 2016 Fact Book) will also move to PHYS 2211/2212.

This will amplify the impact of the transformation described herein and will require the addition of multiple sections of PHYS 2211/2212. While we hope to eventually add faculty to deal with the increased enrollment, we expect the students will arrive first. This will lead to a problem we had years ago, where repeating students fill up PHYS 2211K and keep out new (so later-registering) students. Helping students to be successful on the first try (without lowering standards, of course) will ease the staffing tension for students, faculty, and administration alike.

It has been pointed out to us that it is common for students to use the same book in both 2211K and 2212K, and that changing the book for only one course does not result in a savings. We disagree. Some students choose not to purchase the book for financial reasons. Surely it would be better for them to at least have a book in 2211 and perhaps understand the value of it when deciding whether to purchase the book for 2212. Also, as the book is available (e.g., Amazon.com) in two separate volumes, the students can still save money even if PHYS 2212K is never converted to open source materials. Of course, if the 2211K trial goes well, the next logical step would be to implement it in 2212K. A wholesale change of the entire sequence may or may not be desirable; we do not believe it is necessary, however. We have chosen to start with 2211K since it has a significantly higher DFW rate than 2212K. For the 2016 calendar year, 10 % of the students taking 2212 K failed to earn a C or better, while the DFW rate for 2211K was a troubling 39.6%. Clearly, students in the first semester of physics are in greater need of help.

Transformation Action Plan:

Drs. Baird and Secrest will jointly identify appropriate homework problems from the collection available through ExpertTA. Dr. Baird will record video solutions to all problems to be posted after the due date for each homework. Since Summer 2016, Dr. Baird has recorded over 500 videos solving homework problems (about 175 per course) and has found the time spent doing so is repaid in recovered class time.

Drs. Baird and Secrest will also discuss suitable demonstrations of physical concepts using

VPython, which Dr. Secrest will then create. They will also collaborate on the development of laboratory exercises in which the students themselves will program in VPython. This free software is an add-on for the popular and powerful Python computing language. It was created to make simulation of physical concepts easier. The software includes a sample file where the motion of a binary star system is realistically modeled in about 15 lines of easily understandable code. Students taking the calculus-based physics sequence are quite likely to need to do some programming eventually, and this is a gentle introduction to a tool they could use many times in the future. The extra time gained by the use of video homework solutions will provide more than enough time to add these programming exercises.

The demonstrations will be available online through each instructor's web page and the laboratory exercises and video solutions will be shared with any other instructor who contacts us. We have debated making the solutions available on the web at all times rather than only posting them after the homework deadline, since students would still need to watch the videos for problems they were unable to solve.

Quantitative & Qualitative Measures:	The materials will be used for PHYS 2211K in Spring 2018. We have for years employed a standard assessment instrument known as the Force Concept Inventory (FCI), a widely-used 30-question test of concepts discussed in first-semester physics courses. We have (and will) administer this as a pre- and post-test. The normalized gain, defined as (post-pre)/(30-pre), where pre and post are the FCI scores at the beginning and end of the semester, will be calculated. This is the number commonly reported in the Physics Educational literature, since it takes into account the student's prior familiarity with the subject. We will compare this gain with existing FCI results gathered at ASU for the past several semesters. Drs. Baird and Secrest both offer extra-credit incentives to students based on their performance on the final FCI to ensure that students try to do well on it. Students will be given a survey about the text (attached) and their use of it, and their answers will be compared with data gathered during the previous semester. This will allow us to record student attitudes and opinions about the course materials, as well as providing them the opportunity to mention other resources they believe would have been helpful. We will investigate any student proposals for these added resources, and adjust our focus on existing materials in response to the multiple-choice questions. Finally, DFW rates will be compared to historical averages.

Timeline:

Late October 2017 – As soon as notification is received, the PIs will begin the process of selecting homework problems and identifying potential VPython demonstrations.

November 2017 – Dr. Baird will begin recording video homework solutions. Previous experience suggests that this process can be completed by or before the end of 2017. Dr. Secrest will begin coding VPython demonstrations and will have an initial library of 15 of these finished by the end of 2017.

December 2017 – The PIs will outline potential laboratory exercises, with a target of producing two finished labs by the end of January 2018.

January 8, 2018 – First day of Spring 2018 semester. Dr. Baird will administer the FCI.

Spring Semester 2018 – The PIs will meet weekly to discuss the progress of the course and to plan additional VPython demonstrations and possible laboratory exercises.

April 27, 2018 – Last day of classes for Spring 2018. Dr. Baird will again administer the FCI as well as the Student Survey of Course Resources (SSCR).

Summer 2018 – Assessment data (FCI, SSCR, DFW rate) will be assembled for final report.
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Budget:

We request $5,000 salary for each PI. We also request $800 for registration, mileage, and hotel expenses for travel to events such as the required kick-off meeting and/or conferences where the results of this work may find an audience (e.g., SACS-AAPT, etc.).

Salary – Dr. Baird $5,000
Salary – Dr. Secrest $5,000
Travel $800

==========

Total $10,800

Sustainability Plan:

If, as expected, the assessment outcomes from this experiment are encouraging, we will continue to use the resources developed in future offerings of this course. The no-cost nature of the materials will allow future modifications to them as needed, and we will make these available to our ASU colleagues and future GSU colleagues as well as the general public as outlined earlier. The initial effort to create video solutions and VPython demos and labs is significant; once that has been done, however, using what we have produced beyond 2018 is the easy part.

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

September 28, 2017

Dear Review Committee,

I am pleased to write with enthusiastic support for the Affordable Learning Georgia Textbook Transformation grant proposal submitted by Dr. William Baird and Dr. Jeffery Secrest of Armstrong's Department of Chemistry and Physics. Their proposal, entitled "Composite Physics Resource (CPR)," intends to compile and enhance a group of existing free-ware materials for use in Principles of Physics I (PHYS 2211K), an introductory calculus-based physics course. The course is fundamental for science, mathematics and engineering majors. Professors Baird and Secrest plan to use the OpenStax University Physics digital textbook as the basic course material and will supplement that e-book with video recordings and computer demonstrations to facilitate homework assignments as well as design e-laboratories where students will learn to program in VPython.

Professors Baird and Secrest are familiar with the open source materials available and have piloted the use of open-source materials in teaching our algebra-based sequence courses. They bring considerable experience and knowledge to their project, and I expect that it will provide a high-quality, rigorous course experience for our students. The grant requests funding to support the creative portion of the project, which is the time and cost heavy part. Once created, however, the materials will be easy to revise and maintain so that it will be a sustainable resource for several academic cycles.

It is important to recognize that commercially published General Physics textbooks are generally quite expensive, as are most science texts. Further, due to the very high cost, students often feel that they cannot afford to purchase the text and hence, do not do so. Thus, assembling such a no-cost alternative to a traditional textbook will have a significant impact on both students' cost for taking PHYS 2211K, as well as their performance, by making high-quality free materials readily available.

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 to assist student learning in this challenging area. I am pleased to support this project wholeheartedly.

Sincerely,

Christopher M. Curtis, Ph.D.
Interim Provost and Vice President for Academic Affairs

Affordable Learning Georgia Textbook Transformation Grants

Round Nine

For Implementations beginning Summer Semester 2017

Running Through Spring Semester 2018

Proposal Form and Narrative

Submitter Name	William Baird
Submitter Title	Professor of Physics
Submitter Email	william.baird@armstrong.edu
Submitter Phone Number	912-344-2708
Submitter Campus Role	Proposal Primary Investigator
Applicant Name	William Baird
Applicant Email	william.baird@armstrong.edu
Applicant Phone Number	912-344-2708
Primary Appointment Title	Professor of Physics
Institution Name(s)	Armstrong State University
Team Members	William Baird, Professor of Physics, and Jeffery Secrest, Associate Professor of Physics, Department of Chemistry & Physics, Armstrong State University

Sponsor, Title, Department, Institution	Will Lynch, Department Head, Chemistry and Physics, Armstrong State University				
Proposal Title	Composite Physics Resource (CPR)				
Course Names, Course Numbers and Semesters Offered	PHYS 2211K Principles of Physics I, offered Sp, Su, Fall				
Final Semester of Instruction	Spring 2018				
Average Number of Students Per Course Section	25	**Number of Course Sections Affected by Implementation in Academic Year**	3	**Total Number of Students Affected by Implementation in Academic Year**	77* (See transf. impact)
Average Number of Course Sections Per Semester	Currently 1.5 average per semester, but see transformative impact				
Award Category (pick one)	☒ No-or-Low-Cost-to-Students Learning Materials ☐ Specific Core Curriculum Courses				
Are you planning on using an OpenStax textbook?	☒ Yes ☐ No				
List the original course materials for students	WebAssign homework (including eBook) – one semester - $90.70 Not available without eBook. Paperback copy: Vol. 1 of 9th edition Halliday, Resnick & Walker Fundamentals of Physics				

(including title, whether optional or required, & cost for each item)	- $74 at Amazon.com
Requested Amount of Funding	$10,800
Original Per Student Cost	$90.70 - $164.70
Post-Proposal Projected Per Student Cost	$32.50 for ExpertTA (homework system) Paper copy of OpenStax text - $40 (PDF copy is free)
Projected Per Student Savings	$58.20 - $92.20
Projected Total Annual Student Savings	Between $4,480 and $7,100 based on 2016 enrollment and ignoring Summer.

NARRATIVE

1.1 PROJECT GOALS

We propose to significantly enhance student success and engagement while reducing the financial burden associated with purchasing modern textbooks. We will adopt the OpenStax University Physics book and move from WebAssign online homework to ExpertTA. We will record video homework solutions to ensure students are able to solve all of the assigned problems by the time a test is given. We will also create computerized demonstrations using VPython (a free, multi-platform high-level computer language designed for physics modeling and instruction) to aid in the explanation of difficult concepts. Finally, we will develop at least two laboratory exercises in which students will actually program in VPython. We expect to see increased learning gains, a reduction in the DFW (grade of D, F, or W/WF) rate for the course, greater student retention from 2211K to 2212K, and a higher level of student satisfaction.

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1 https://www.armstrong.edu/images/uploads/institutional-research/CDS_2016-2017.pdf

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1.3 TRANSFORMATION ACTION PLAN

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1.4 QUANTITATIVE AND QUALITATIVE MEASURES

The materials will be used for PHYS 2211K in Spring 2018. We have for years employed a standard assessment instrument known as the Force Concept Inventory (FCI), a widely-used 30-question test of concepts discussed in first-semester physics courses. We have (and will) administer this as a pre- and post-test. The normalized gain, defined as (*post-pre*)/(30-pre), where *pre* and *post* are the FCI scores at the beginning and end of the semester, will be calculated. This is the number commonly reported in the Physics Educational literature, since it takes into account the student's prior familiarity with the subject. We will compare this gain with existing FCI results gathered at ASU for the past several semesters. Drs. Baird and Secrest both offer extra-credit incentives to students based on their performance on the final FCI to ensure that students try to do well on it.

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1.5 TIMELINE

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1.6 BUDGET

We request $5,000 salary for each PI. We also request $800 for registration, mileage, and hotel expenses for travel to events such as the required kick-off meeting and/or conferences where the results of this work may find an audience (e.g., SACS-AAPT, etc.).

Salary – Dr. Baird	$5,000
Salary – Dr. Secrest	$5,000
Travel	$800
Total	$10,800

1.7 SUSTAINABILITY PLAN

If, as expected, the assessment outcomes from this experiment are encouraging, we will continue to use the resources developed in future offerings of this course. The no-cost nature of the materials will allow future modifications to them as needed, and we will make these available to our ASU colleagues and future GSU colleagues as well as the general public as outlined earlier. The initial effort to create video solutions and VPython demos and labs is significant; once that has been done, however, using what we have produced beyond 2018 is the easy part.

1.8 REFERENCES & ATTACHMENTS

Student Survey of Course Resources (SSCR)
Letter of support – VPAA/Provost

Student Survey of Course Resources

I identify as Male Female Other Prefer not to answer

Major_____

My current status is

<30 credit hours (Fr) 30-59 cr hrs (Soph) 60-89 cr hrs (Jr) >90 cr hrs (Sr)

Buying a textbook would have been a significant financial strain

Strongly Agree Agree Disagree Strongly Disagree

Hours/week I used the OpenStax book: <3 3-5.9 6-8.9 9-11.9 >12

If the cost for each were the same, I would prefer a paper book to a PDF or an e-book

Strongly Agree Agree Disagree Strongly Disagree

Please rank the following resources in order of their importance to your success in this course (5 = very useful, 4 = somewhat useful, 3 = not very useful 2= not at all useful, 1 = did not try to use)

Textbook _____ Lectures in class_____ Online class notes_____

Work w/fellow students_____ ExpertTA_____ Non-ExpertTA problems_____

Video Homework Solutions_____ Video lectures provided by instructor_____

Online resources not listed here_____ Tutoring Center_____ Other books_____

Other_____ (please describe below)

_____

What are your thoughts about the required text for this course? _____

_____

_____

For the items above you listed as most/least useful, can you explain why?

_____
___

_____
_____

_____
_____

What do you think **<u>could</u>** have been useful to you for this course?
_____
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_____
_____

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_____