

Application Details

Manage Application: Textbook Transformation Grant

Award Cycle: Round 3

**Internal Submission
Deadline:** Sunday, May 31, 2015

Application Title: 140

Submitter First Name: Tatiana

Submitter Last Name: Krivosheev

Submitter Title: Professor of Physics

Submitter Email Address: tatianakrivosheev@clayton.edu

Submitter Phone Number: 678-466-4783

Submitter Campus Role: Proposal Investigator (Primary or additional)

Applicant First Name: Tatiana

Applicant Last Name: Krivosheev

Co-Applicant Name(s): Bram Boroson, Caroline Sheppard, Patricia
Todebush, Justin Mays

Applicant Email Address: tatianakrivosheev@clayton.edu

Applicant Phone Number: 678-466-4783

Primary Appointment Title: Professor of Physics

Institution Name(s): Clayton State University

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

Bram Boroson, Assistant Professor of Physics, Department of Natural Sciences,
bramboroson@clayton.edu

Tatiana Krivosheev, Professor of Physics, Department of Natural Sciences,
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Caroline Sheppard, Professor of Chemistry, Department of Natural Sciences,
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Patricia Todebush, Professor of Chemistry, Department of Natural Sciences,
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Justin Mays, Director, Distance Learning, Center for Instructional Development,
JustinMays@clayton.edu

Sponsor (Name, Title, Department, Institution):

Division of Chemistry and Physics, Department of Natural Sciences, Clayton State University

Proposal Title: 140

Course Names, Course Numbers and Semesters Offered:

Principles of Physics Laboratory I, PHYS 2211L, Fall 2015, Spring 2016, Fall 2016.

Principles of Physics Laboratory II, PHYS 2212L, Fall 2015, Spring 2016, Fall 2016.

Introductory Physics Laboratory I, PHYS 1111L, Summer 2015, Fall 2015, Spring 2016, Summer 2016, Fall 2016.

Introductory Physics Laboratory II, PHYS 1112L, Summer 2015, Fall 2015, Spring 2016, Summer 2016, Fall 2016.

Principles of Chemistry Laboratory I, CHEM 1211L, Summer 2015, Fall 2015, Spring 2016, Summer 2016, Fall 2016.

Principles of Chemistry Laboratory II, CHEM 1212L, Summer 2015, Fall 2015, Spring 2016, Summer 2016, Fall 2016.

Organic Chemistry Laboratory I, CHEM 2411L, Summer 2015, Fall 2015, Spring 2016, Summer 2016, Fall 2016.

Organic Chemistry Laboratory II, CHEM 2412L, Summer 2015, Fall 2015, Spring 2016, Summer 2016, Fall 2016.

Final Semester of Instruction: Fall 2016

Average Number of Students per Course Section: 24

Number of Course Sections Affected by Implementation in Academic Year: 25

Total Number of Students Affected by Implementation in Academic Year: 600

List the original course materials for students (including title, whether optional or required, & cost for each item): PHYS 1111L, 1112L, PHYS 2211L, PHYS 2212L Lab Manuals printouts (\$12-\$15), Required.
Chemistry 1211L, 1212L Lab Manuals (\$20), Required.
Hayden McNeil Student Lab Notebook, (\$28) Required.

Proposal Categories: Specific Top 50 Lower Division Courses

Requested Amount of Funding: \$30,000.00

Original per Student Cost: \$12 - \$28; \$17.7 (average for three disciplines)

Post-Proposal Projected Student Cost: \$0

Projected Per Student Savings: \$12 - \$28; \$17.7 (average for three disciplines)

Plan for Hosting Materials: Other

Project Goals:

Convert the existing laboratory manuals for eight (8) Physics and Chemistry courses: Principles of Physics Laboratory I and II, Introductory Physics Laboratory I and II, Principles of Chemistry Laboratory I and II, and Organic Chemistry Laboratory I and II into the integrated IPython notebooks - a web-based interactive computational environment that combines code execution, text, mathematics, plots and rich media into a single document. Because of the steadily increasing cost of course materials, many of Clayton State students elect to forgo purchasing/printing laboratory manuals in order to conserve funds. This is of great concern for our full-time, first-year students who are required to live on campus and incur additional housing expenses with a finite amount of financial resources. For instance, 92% of our first-year students received federal and/or state financial aid during Fall Semester 2014. Since IPython is an open access software that can be downloaded free of charge, it will translate into a projected cost savings of \$10,620 per year for students in twenty five (25) sections of chemistry and physics.

Statement of Transformation:

Students using the existing laboratory manuals for eight (8) courses: Principles of Physics Laboratory I and II, Introductory Physics Laboratory I and II, Principles of Chemistry Laboratory I and II, and Organic Chemistry Laboratory I and II must spend \$10,620 per year for the required laboratory manuals and notebooks. Although our students come from a variety of cultural and economic backgrounds, the cost of the materials can be prohibitive for who have limited financial resources.

Undergraduate students majoring in science (chemistry or biology), computer science, mathematics, pre-pharmacy, and pre-engineering are the main stakeholders enrolled in these courses. Using the IPython notebooks throughout all introductory Physics and Chemistry courses will re-enforce the interdisciplinary nature of science, stress the similarities in scientific methods and techniques, and make the transition from one course to the other more responsive to student needs. Overall access to these no cost learning materials will greatly enhance the science-laboratory experience for the students. In particular:

1. Students will be able to complete the laboratory reports inside an electronic file and submit it to their instructors electronically;
2. Students will be exposed to a new technology (seen in many industries and graduate schools);
3. Students will be able to access and implement computational laboratories and simulations more efficiently using the built-in Python language;
4. Students will gain a better understanding of the relationship between laboratory experiments that they are required to implement throughout the semester;
5. Students will be able to maintain all course materials in a central, single-source location for ease of reference and access;
6. Students will gain valuable undergraduate laboratory experience closer to what they will experience in employment and professional schools via the transformation to IPython.

Additionally, the transformation from textbooks to open access learning materials will allow faculty stakeholders, full-time professors in the Department of Natural Sciences who teach the courses, to share materials without difficulty, since notebooks can be copied and shared; and, retain copies of student notebooks for assessment purposes.

By the end of AY2016, all introductory Physics, Chemistry, and Organic Chemistry laboratories within the department will use the integrated IPython notebooks. Starting in AY2017, the upper-level Chemistry and Physics laboratories will transition to the integrated IPython notebook method of teaching and learning.

Transformation Action Plan:

Several electronic laboratory notebooks were considered to replace the paper laboratory manuals before the IPython platform was chosen. The benefits of IPython notebooks include major cost savings, ease of use and the built-in Python language feature that allows the implementation of numerical simulations in the calculus-based Physics laboratories.

Existing laboratory manuals (including procedures, pre-lab and post-lab assignments, and sample Excel files) will be converted to the IPython notebook format. In Physics, students are currently required to organize and process the experimental data in Microsoft Excel, and complete the laboratory report in Microsoft Word. With the IPython electronic notebook single-source data management will be achieved, students will complete the required data processing and laboratory reports in IPython.

Several of the Physics laboratories will include a new content: numerical simulations of the phenomena investigated in the laboratory exercise.

Currently Chemistry students record data in a physical laboratory notebook, and complete the laboratory report in Microsoft Word. After the changeover, students will input all laboratory observations and raw data and pictures of laboratory equipment, and analyze the data, calculate results and graph in the IPython system. Questions will be answered in the notebook to ensure qualitative understanding of the laboratory materials. Students will still be required to complete a formal written report and a laboratory practical final exam, at the end of the semester.

The following faculty members will be responsible for the transformation:

- Dr. Boroson: subject matter expert facilitating the transformation and instructor of record for PHYS 2211L, PHYS 1111L;
- Dr. Krivosheev: subject matter expert facilitating the transformation and instructor of record for PHYS 2212L, PHYS 1112L;
- Dr. Todebush: subject matter expert facilitating the transformation and instructor of record for CHEM 1211L, CHEM 1212L;
- Dr. Sheppard: subject matter expert facilitating the transformation and instructor of record for CHEM 2411L, CHEM 2412L;
- Mr. Mays: instructional designer in charge of development and administration of the assessment, distribution of the course materials.

All developed IPython notebooks will be easily accessible from the instructor's website, the Natural Sciences Department website, and GitHub public repository.

Quantitative & Qualitative Measures: The following tools will be used to assess the effectiveness of the project on student success and experience:
Student feedback surveys will be used to qualitatively assess student attitudes and experience;
Lawson's Classroom Test of Scientific Reasoning (LCTSR) will be administered in all courses before and after the implementation of the project to quantitatively assess the effectiveness of transformation;
Student grades (overall and for selected laboratory exercises) will serve as a quantitative measure of achieving course outcomes. The student overall grades in each of the affected courses will be compared to the overall grades from the previous 3 semesters to measure the success of the transformation. The average student grades for selected laboratory exercises before and after the transformation will serve as a quantitative measure of achieving course outcomes. The analysis of the DWF rates for these laboratory courses are not particularly meaningful since these rates are principally due to the co-requisite physics and chemistry courses.

Timeline:

- Summer 2015: Student feedback surveys are developed. Sampler notebooks (one laboratory activity per course affected by the transformation) are developed.
- Fall 2015: All laboratory activities are transformed into IPython format, new computational content in Physics is introduced and integrated.

Notebooks are posted on the instructors' webpages and uploaded to the GitHub repository. LCTSR and student feedback surveys are administered to students in all Physics and Chemistry classes affected by the project implementation.

- Spring 2016: Notebooks are used in CHEM 1211L, CHEM 2411L, PHYS 2211L, and PHYS 2212L for the first time. Quantitative measures are collected and analyzed. Surveys are administered and analyzed. Notebooks are fine-tuned, if needed.
- Summer 2016: Notebooks are developed for the Introductory Physics I and II laboratories.
- Fall 2016: Notebooks are implemented in all sections of Introductory Physics I and II Laboratories, Principles of Physics I and II Laboratories, Principles of Chemistry I and II Laboratories, and Organic Chemistry Laboratory I and II.

Budget:

Justin Mays, Instructional Designer @ \$5000

Salary differential for release time to support development

\$5,000.00

Tatiana Krivosheev, Physics subject matter expert @ \$5000

Bram Boroson, Physics subject matter expert @ \$5000

Caroline Sheppard, Chemistry subject matter expert @ \$5000

Patricia Todebush, Chemistry subject matter expert @ \$5000

Salary differential for release time to support development

\$20,000.00

3 Undergraduate student assistants @ \$1,400 x 3

Assist subject matter experts Summer 2015, Fall 2015, Spring 2016

\$4,200.00

Project Expenses: Travel

Kickoff event attendance

\$800.00

Total

\$30,000.00

Sustainability Plan:

Once implemented, all laboratory courses (CHEM 1211L, CHEM 1212L, CHEM 2411L, CHEM 2412L, PHYS 1111L, PHYS 1112L, PHYS 2211L, and PHYS 2212L) affected by the transformation, the new learning materials will be offered for the indefinite future. Once the materials are posted on the faculty web pages, Department of Natural Sciences webpage and online public repository, minimal to no maintenance is required. The team members responsible for the development and initial teaching with the iPython notebooks will present the notebooks, tutorials on their development and usage, and lessons learned in the process of their development to the other faculty of Natural Sciences Department and larger teaching community (through the conference presentations and workshops). Course materials may be updated as necessary by the members of Chemistry and Physics division to incorporate additional experiments or technologies, and shared with all faculty teaching the courses through the online public repository.



May 20, 2015

Dr. Tatiana Krivosheev
Professor of Physics,
Department of Natural Sciences
2000 Clayton State Blvd.
Morrow, GA 20360

Reference: – Support for the Affordable Learning Georgia Textbook Transformation Grant Proposal

Dear Dr. Krivosheev:

I am pleased to support you and your team's efforts to submit a proposal to offer Clayton State students no cost learning materials as part of the University System of Georgia's initiative, Affordable Learning Georgia Textbook Transformation, to eliminate a substantial and growing part of what's driving up the cost of higher education: the often prohibitive expense of class materials. Lowering the price of textbooks has long been something reformers see as a way to help students burdened by rising tuition. The cost of new printed textbooks continue to rise—up more than 7 percent last year alone, according to the Bureau of Labor Statistics, and 82 percent between 2002 and 2012, as calculated by the Government Accountability Office, the non-partisan research arm of Congress (<http://www.gao.gov/assets/660/655066.pdf>). This project will replace approximately 25 Physics and Chemistry Laboratory I and II courses in the spring 2016 to fall 2016 with the preliminary work to be completed in the Summer/Fall 2015, resulting in savings of more than \$10, 620 per year for 600 students.

The Physics and Chemistry Department-wide plan is to continue using these materials into the indefinitely Faculty may contribute to the continued development of the materials (by suggesting revisions or contributing to the pool of homework problems, for example) to enhance their long-term utility and sustainability. Continuous evaluation of effectiveness will inform revisions for future semesters.

The department-wide scope of work outlined in the proposal supports our core institutional value of community engagement, as well as our strategic plan to “create an outstanding educational experience that stimulates intellectual curiosity, critical thinking, and innovation”. Additionally, the proposed partnership represents a depth of efficient and beneficial resource sharing and collaboration that is vital to serving our students in the best possible way. Your team has a long standing relationship for working together to develop 21st century instructional models that use a combination of proven and innovative teaching and learning models to prepare both educators and students to meet the challenges of living and working in a global society. Therefore, I am confident that this partnership is fully capable of implementing and managing the project successfully.

Sincerely,


Nasser Momayezi
Dean of the College of Arts and Sciences