Affordable Learning Georgia Textbook Transformation Grants

Final Report

To submit your Final Report, go to the [Final Report submission page](http://affordablelearninggeorgia.org/site/final_report_submission) on the ALG website: http://affordablelearninggeorgia.org/site/final\_report\_submission

The final report submission form allows up to five files:

* This completed narrative document (required)
* Syllabus or syllabi (required)

*If multiple files, compress into one .zip folder*

* Qualitative/Quantitative Measures data files (required)

*If multiple files, compress into one .zip folder*

* Photo of your team or a class of your students for future ALG promotions (optional)
* Invoice for the second half of the grant’s award amount (optional)

Follow the instructions on the webpage for uploading your documents. Based on receipt of this report, ALG will process the final payment for your grant. ALG will follow up in the future with post-project grantee surveys and may also request your participation in a publication, presentation, or other event.

# General Information

**Date: June 10, 2020**

**Grant Round: 13**

**Grant Number: 412**

**Institution Name(s): Columbus State University**

**Project Lead: Kimberly A Shaw**

**Team Members: Andrew Puckett, Associate Professor, Earth & Space Sciences, puckett\_andrew@columbusstate.edu**

**Course Name(s) and Course Numbers: Introductory Physics 1 (PHYS 1111) and Principles of Physics 1 (PHYS 2211)**

**Semester Project Began: Summer 2019**

**Final Semester of Implementation: Spring 2020**

**Total Number of Students Affected During Project: 83 during Spring 2020**

# Narrative

* 1. *Describe the key outcomes, whether positive, negative, or interesting, of your project. Include:*
* *Summary of your transformation experience, including challenges and accomplishments*
* *Transformative impacts on your instruction*
* *Transformative impacts on your students and their performance*

We found that the time it took to create videos to our professional satisfaction was often far greater than we expected, and we still feel that we could do better. However, students for the most part appreciated that the video flipped lectures were available, even if they did not use them to come to class prepared. We also found that we both value being able to prepare materials much closer to the date that we are planning to teach, and that even when materials are prepared in advance, that we still spend preparation time just before class adjusting materials. While this benefits our students (we think), it means that less time savings were gained by the two of us.

We also found that we both truly valued being able to spend more time interacting with students, and working problems with them, instead of allowing them to passively take notes. We feel that in a future semester that our students will feel a stronger benefit from this, when we are able to spend a larger portion of the semester interacting in this manner.

Because of the transition to remote learning halfway through the semester, we do not feel that we can make any strong conclusions about the impacts on student learning – although we suspect that this will at worst be neutral. We do, however, know that we are both more deeply committed to continuing to use OpenStax and ExpertTA resources, both for the cost to the students and the quality of the ExpertTA materials. By adding lectures and example problems as videos, we feel that we will be better able to leverage these materials in future.

The biggest challenge, of course, was determining how to navigate a shift to remote learning in a setting that none of our students had wanted, and that we both felt needed to provide asynchronous learning opportunities. Shaw adapted her activities to an optional synchronous session, which she recorded and posted for other students to view. Puckett saved synchronous sessions as times for questions/answers and his course used the flipped lectures with homework and quizzes as the primary activity.

* 1. *Describe lessons learned, including any things you would do differently next time.*

We have learned that rather than submitting all of our videos in a large batch to our Center of Online Learning for their captioning service, that instead we should have submitted these as they were completed. For several reasons, the captioning service was overwhelmed with requests this year, and some of our videos are still not captioned as of the date of this report.

# Quotes

·     I really appreciate how helpful you were throughout the semester and how you find a cheaper option for homework than other professors and you found us a free textbook! overall good semester, hate that we ended up online but it still went as smooth as possible thanks to you :)  [PHYS 1111]  
·     I thought that thee openstax textbook was incredible not just because it was free, but because it got straight to the point of each section without me feeling like I need to impatiently skim ahead. I like that you can read the chapters within an hour and very easily understand all the concepts without it being watered down. Expertta was also very helpful, although sometimes the questions are worded in ways that obfuscate the problem, but overall, it's a good resource. One small remark that I believe would be tremendous is if each problem in expertta could be mapped to the section in the book that covers it.  [PHYS 1111]  
·     I think overall this class was effective and made me feel comfortable solving physics problems and that is something many classes are not able to achieve. I felt like I had a good grasp of the concepts and I can carry them with me to future classes. Overall I think the flipped classroom is a good idea, but I would like to have seen more problems covered in class and more variety covered that way I was immersed in more problems. I feel like the OpenStax textbook was not very adequate when it came to looking for example problems. There would only be several examples in a section and none of the sections were variations of that same type of problem, just different types of problems. However, I feel like with the amount of online sources (videos) I was able to figure it out. [PHYS 2211]

# Quantitative and Qualitative Measures

## Uniform Measurements Questions

*The following are uniform questions asked to all grant teams. Please answer these to the best of your knowledge.*

**Student Opinion of Materials**

**Was the overall student opinion about the materials used in the course positive, neutral, or negative?**

Total number of students affected in this project: 83 in spring 2020\_

* Positive: \_\_65.7\_\_\_\_\_ % of \_\_\_\_70\_\_\_\_ number of respondents
* Neutral: \_\_\_18.6\_\_\_\_ % of \_\_\_\_70\_\_\_\_ number of respondents
* Negative: \_\_\_15.7\_\_\_\_ % of \_\_\_\_70\_\_\_\_ number of respondents
* helpfulness of the free textbook and low-cost homework:  98.6% yes, 1.4% no

**Student Learning Outcomes and Grades**

**Was the overall comparative impact on student performance in terms of learning outcomes and grades in the semester(s) of implementation over previous semesters positive, neutral, or negative?**

*Student outcomes should be described in detail in Section 3b.*

Choose One:

* \_\_\_ Positive: Higher performance outcomes measured over previous semester(s)
* \_\_x\_ Neutral: Same performance outcomes over previous semester(s)
* \_\_\_ Negative: Lower performance outcomes over previous semester(s)

Because of the shift to online only learning due to Covid-19 at mid-semester, we are assuming neutral outcomes for the Spring 2020 semester. Based on the data we were able to collect, we have insufficient evidence to support a conclusion of positive outcomes at this time.

**Student Drop/Fail/Withdraw (DFW) Rates**

**Was the overall comparative impact on Drop/Fail/Withdraw (DFW) rates in the semester(s) of implementation over previous semesters positive, neutral, or negative?**

**Drop/Fail/Withdraw Rate:**

*Depending on what you and your institution can measure, this may also be known as a drop/failure rate or a withdraw/failure rate.*

\_\_\_17.6\_\_\_\_% of students, out of a total \_\_\_83\_\_\_\_ students affected, dropped/failed/withdrew from the course in the final semester of implementation.

Choose One:

* \_\_\_ Positive: This is a lower percentage of students with D/F/W than previous semester(s)
* \_x\_\_ Neutral: This is the same percentage of students with D/F/W than previous semester(s)
* \_\_\_ Negative: This is a higher percentage of students with D/F/W than previous semester(s)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Term | Course | Instructor | ABC | DFW | I | Ave. Score | GPA |
| Spr. 2019 | PHYS 1111 | Puckett | 89.3% | 10.7% |  | 81% | 2.77 |
| Spr. 2019 | PHYS 2211 | Shaw | 57.5% | 42.5% |  | 73% | 2.02 |
| Sum. 2019 | PHYS 1111 | Shaw | 75.0% | 25.0% |  | 76% | 2.39 |
| Spr. 2020 | PHYS 1111 | Shaw | 71.4% | 28.6% |  | 73% | 1.97 |
| Spr. 2020 | PHYS 2211 | Puckett | 93.0% | 2.3% | 4.7% | 90% | 3.58 |

**See narrative. Because of the shift to remote learning, we feel that overall that this is a neutral, perhaps positive shift.**

## Measures Narrative

*In this section, summarize the supporting impact data that you are submitting, including all quantitative and qualitative measures of impact on student success and experience. Include all measures as described in your proposal, along with any measures developed after the proposal submission.*

*[When submitting your final report, as noted above, you will also need to provide the separate file (or .zip with multiple files) of supporting data on the impact of your Textbook Transformation, such as surveys, analyzed data collected, etc.]*

* *Include measures such as:*
  + *Drop, fail, withdraw (DFW) delta rates*
  + *Course retention and completion rates*
  + *Average GPA*
  + *Pre-and post-transformation DFW comparison*
  + *Student success in learning objectives*
  + *Surveys, interviews, and other qualitative measures*
* *Indicate any co-factors that might have influenced the outcomes.*

A total of 122 videos were produced for this project, of which 70% have been captioned as of this writing. Lecture-type videos make up 59% of the video archive, while worked example problems make up the remaining 41%. In the Spring 2020 term, 114 of these videos were used in PHYS 2211 (N=43); 71 were used in PHYS 1111 (N=40); and 63 were used in both courses.

In both courses, the fraction of students who viewed the assigned videos generally decreased as the semester progressed. In the pair of figures that follow, the vertical axis shows the fraction of students in the course who accessed each video file at least once, while the horizontal axis gives each video a sequential number in the order that it was assigned. Lecture and Example videos are indicated in blue and orange, respectively. Points shown in green correspond to lecture-type videos designed to prepare students for the laboratory-course topics of uncertainty, comparisons, graphing, and lines of best fit.

During Spring 2020, the COVID-19 crisis led all instruction to be moved online just after midterm exams and Spring Break. In the pair of graphs that follow, the first video assigned after this point is indicated by a vertical bar (#42 in PHYS 1111, and #75 in PHYS 2211).

In PHYS 1111, videos were grouped into folders by chapter as they were assigned throughout the semester. Example videos were indicated by inclusion of the word “example” near the end of each video title, but were not otherwise set off from the Lecture videos. This may explain why these two categories were accessed at similar rates at any given point during the semester. Before midterm exams, the viewing fraction mostly remains steady at 60-70%, with a few exceptions. Departing from that trend, videos #19-21 covered units, unit conversion, significant figures, and scientific notation, while #22-25 were in preparation for a laboratory course taught by a different instructor. Students may have seen these videos as remedial or tangential, and therefore lower priority. Video access steadily declined from ~55% to ~15% after the transition to online instruction, although there is some indication that the decline had begun shortly before midterm exams and Spring Break.

In PHYS 2211, video assignments were posted as weekly announcements on the course website, in the order that they were to be viewed. However, the video files themselves were organized into two large folders of Lectures and Examples, respectively. Lecture videos were indexed numerically, while example videos were presented in order but with purely descriptive titles prefixed by the word “Example:”. These two factors may help to explain why lecture videos were accessed by about twice as many students as example videos in this course. Video views got a temporary boost after the transition to online instruction, but Example videos were already undergoing a brief ramping-up period just prior to that point, in the run up to midterm exams and Spring Break.

The graph below shows the comparison of viewing fractions in PHYS 2211 vs PHYS 1111 for the set of 63 videos assigned in both courses. The PHYS 2211 students were both more likely to watch Lecture videos and less likely to watch Example videos than their PHYS 1111 counterparts. Within both categories, the most popular videos in one course also tended to be quite popular in the other – but these commonalities were also strongly correlated with time. For example, the top 4 lecture videos in both courses were on the early foundational topics of motion diagrams, coordinate systems, speed, velocity, and graphing position and velocity vs time, while the bottom 4 were on the later topics of circular motion, statics and torque.

The two graphs that follow show the correlation between Final Exam grades and the fraction of assigned videos accessed, where each data point represents one student. In PHYS 1111, the slope of 3.2 ± 7.8 is consistent with zero at 0.4-𝜎. The correlation is a bit stronger in PHYS 2211, where the slope of 6.5 ± 4.5 is consistent with zero at the 1.4-𝜎 level.

The next two graphs show the correlation with Overall Course grades. In PHYS 1111, the slope of 14.9 ± 7.4 is consistent with zero at just slightly more than 2.0-𝜎, indicating a much stronger correlation in that course than for Final Exam grades. But in PHYS 2211, the slope of 4.5 ± 3.4 remains consistent with zero at the 1.4-𝜎 level.

65.7% Positive – 8 Excellent; 17 Good; 21 Satisfactory

18.6% Neutral – 13 No Feelings

15.7% Negative – 7 Not As Useful; 2 Only Useful Occasionally; 2 Not Helpful At All.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | PHYS 1111 (Spr 2019) | PHYS 2211 (Spr 2019) | PHYS 1111 (Spr 2020) | PHYS 2211 (Spr 2020) |
| Students | 55 | 39 | 40 | 40 |
| Exam 1 | 67.5 ± 19.8% | 79.9 ± 13.5% | 76.5 ± 14.2% | 72.0 ± 15.7% |
| Exam 2 | 73.4± 15.5% | 69.1 ± 14.3% | 68.1 ± 16.1% | 73.6 ± 15.6% |
| Exam 3 | N/A | 56.2 ± 13.2% | 57.7 ± 17.1% | 86.1 ± 10.5% |
| Final Exam | 69.0 ± 22.0% | 62.5 ± 19.2% | 74.5 ± 13.7% | 87.9 ± 7.7% |
| Overall | 81.3 ± 12.3% | 72.8 ± 15.8% | 72.3 ± 15.0% | 90.3 ± 5.8% |

PHYS 2211 (Spr. 2019) and PHYS 1111 (Spr. 2020) were taught by Dr. Shaw with the same testing structure. Three exams were given on days 9, 17, and 24 of the 28-day term, followed by a comprehensive Final Exam. PHYS 1111 (Spr. 2019) was taught by Dr. Puckett with Exam 1 on day 9, Exam 2 on day 18, and the remainder of the term was covered by the comprehensive Final exam. PHYS 2211 (Spr. 2020) was also taught by Dr. Puckett, but with exams replaced by 6 quizzes which took place on days 5, 9, 14, 17, 23, and 28 of the term. Due to similar timing with the other courses, these quizzes have been combined in pairs for comparison purposes, e.g., Quizzes 1 and 2 combined are compared with Exam 1.

During Spring 2020, Exams 1-2 and their equivalents (Quizzes 1-4) were all held in a face-to-face format directly comparable to each other and to previous semesters. The remaining scores (Exam 3, Quizzes 5-6, and both Final Exams) were held online due to COVID-19. One result of this transition was that exam difficulty in PHYS 2211 did not correspond appropriately to the new open-book testing format, which explains the significant rise in exam scores in that course.

# Sustainability Plan

Both team members have fully developed materials for these courses, and have them archived in a shared drive. These will be used again with future course offerings for the foreseeable future.

These materials will also be shared with the other faculty member in our department who teaches these courses, and he will be encouraged to utilize them.

# Future Affordable Materials Plans

Both of us are pleased with the opportunities that this project has provided us to improve our student learning outcomes. We feel, in particular, that having flipped our lectures provided us a much stronger base on which to build when we shifted to emergency remote learning in March. Many of our students reported positive experiences with the increased opportunities for in class activities and problem solving, despite the reputation of group work among students. We were also pleased with the fact that a greater percentage of students had ExpertTA subscriptions early in the semester, and thus were better able to start work early and stay on track.

Both of us intend to continue to use these resources in future semesters in the PHYS 1111 and PHYS 2211 sequence.

# Future Scholarship Plans

We are considering analyzing further the differences in usage patterns between PHYS 1111 and PHYS 2211 at a later time for publication. However, with the sharp divide halfway through the semester after everyone suddenly was teaching remotely, we are wary of analyzing too much, and feel that this unique situation is a confound that may or may not produce any replicable work. However, we are both currently scheduled to teach the same courses again in Spring 2021, so it is possible that we could look at replicability at that point.

# Description of Photograph (optional)

*Not included*