

Affordable Learning Georgia Textbook Transformation Grants

Final Report

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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)

General Information

Date: 08/14/2020

Grant Round: 14th

Grant Number: 457

Institution Name(s): Augusta University

Project Lead: Thomas M. Colbert

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

- Thomas M. Colbert, Professor of Physics/Assistant Chair of Chemistry and Physics/Director of Physics Program, tcolbert@augusta.edu;
- Joseph Newton, Assistant Professor of Physics, Department of Chemistry and Physics, jnewton3@augusta.edu
- Josefa Guerrero-Millan, Assistant Professor of Physics, Department of Chemistry and Physics, jguerreromillan@augusta.edu

Course Name(s) and Course Numbers: Introductory Physics I (PHYS 1111), Introductory Physics II (PHYS 1112)

Semester Project Began: Summer 2019

Final Semester of Implementation: Summer 2020

Total Number of Students Affected During Project: 578

- (578 is total enrollment listed by all instructors for Fall 2019, spring 2020, su2020 ---for PHYS1111 and PHYS1112—not including labs). These students used openstax text.

1. Narrative

A. *Describe the key outcomes, whether positive, negative, or interesting, of your project.*

Include:

The main outcome of this project is transitioning the current traditional high cost textbook used in Introductory Physics I and II (PHYS1111 and PHYS1112) at Augusta University to a no cost OpenStax text (College Physics). As a consequence:

- Students had access to the book the first day of class (they can download it for free, or access the book electronically).
- “Warm-up” sheets have been developed for every day of class, similarly to the “Just in time” activities. In addition to the activities/questions, we added reading objectives to help guiding the reading and clarify what the main take-away ideas are.
- We have developed a stable course environment, independent of the frequent changes on the edition of the textbooks. This allow us to use figures and equation numbers on our warm-ups sheets to guide the reading process.

The early access to the textbook and the use of daily “warm-up” activities/exercises increased the student engagement in the class, as they are “forced” to practice daily. The warmup exercises and answers are used during the regular class time.

This grant has a high impact at our institution as about 250 student/semester take Introductory Physics courses. Our courses, Introductory Physics I and II (PHYS1111 and PHYS1112), are listed as no/low cost in the university catalog.

Students’ performance. Due to COVID-19, we had to move all our courses online in March 2020. While instructors continued to use the openstax textbook, and continued to use warmups, the course environment has changed dramatically. Since the survey mechanism is fundamentally different during an online experience, and most of instructional effort had to go towards development of online course resources, no new surveys were conducted in the Covid-19 related online environments. Thus, data collection by survey was implemented during one full semester (2019). We may continue student surveys and analysis in the future to more accurately measure the impact of the no cost materials adoption, and the use of our particular warmup exercises. We note again that the unique factor included in our warmup exercises is the preliminary learning objectives. Students know why they are answering the questions in the exercise. More semesters would be needed to actually measure the impact our project has in students’ performance.

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

- *Our daily warm-ups are done “old school” (students write their answers on the write-up sheet we supplied). Returning this to the students once graded in the next class takes a considerable amount of time if you don’t organize this effectively keeping in mind FERPA regulations.*
- *Adding “cool-down” exercises to more warm-ups will be under consideration for further editions of our materials. Cool-down exercises are an application of the*

material seen in class, opposite to the warm-up that are exercises related to materials we have not seen in class yet.

2. Quotes

Quote 1: "Putting in the work on daily worksheets actually helps when it comes to test days and getting familiar with the problems for that chapter."

Quote 2: "I would give the normal advice I guess, just do the homework and warm-ups every day and come to class every day."

Quote 3: "Take advantage of the worksheets! They are the difference between a good and bad grade"

3. Quantitative and Qualitative Measures

A. 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: ____578____

- Positive: ____75.5%__ of ____104__ number of respondents
- Neutral: ____16.55 %__ of ____104____ number of respondents
- Negative: ____8.05% of ____104____ number of respondents

The results come from students remaining in courses of the investigators—surveyed at the end of Fall 2019 semester. The “Positives” are a combination of results from survey questions 4 and 5 regarding use of warmup exercises. Analysis and survey instrument attached below.

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)
- ☐ Neutral: Same performance outcomes over previous semester(s)
- ☐ Negative: Lower performance outcomes over previous semester(s)

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.

20.6 % of students, out of a total 578 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) **(Compared to 25% D/W/F in Fall 2018)**
- ☐ 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)

B. Measures Narrative

Affordable Learning Grant: Quantitative Measures

Five hundred and seventy eight students have taken either PHYS1111 or PHYS1112 at Augusta University during the Fall 2019, Spring 2020, and Summer 2020. All of the students have used the no-cost textbook by OpenStax-College Physics. At a cost of approximately ~\$300 for a new book, plus the costs of online HW systems picked up by some instructors---the total savings for students may be as much as approximately \$170,000.

During our transition to no-cost materials we have developed warmup exercises for students. These warm-ups follow a Just in Time teaching style in our courses. The warm-ups are unique in their inclusion of targeted learning objectives stated up front for each warm-up.

The results of our implementations, in addition to the savings to students, show a modest change in the DFW rate as compared to the fall 2018 semester data. The DFW rate

changed from 25% to 20.6%. This is a gain ($4.2\%/25\%$) of 17.6%, which is significant. We have seen both a cost savings and a decrease in the DFW rates

The completion rate in the course is unchanged from Fall 2018 to Fall 2019---both indicated at 92%, already a high course completion rate.

The charts included below indicate results of survey data collection from students. The data indicates a clear value to both the transition to no-cost materials, and also to the use of warmups with learning outcomes included.

Tables included below compare warm-up performance with class grades. There seems to be a correlation between performance on warmup exercises and course grades. While this may or may not be causal, the correlation is useful. Warm-ups indicate that students study material, and that those who do study appear to do well in the classes.

As with much of academia this past six months, the Covid-19 pandemic has forced our pedagogical attention to the immediate development of resources specifically for use in online learning environments. This has interrupted the normal plan for continuing analysis and survey data acquisition regarding the use of warm-ups with learning objectives. While the results of our course transformation seem both positive and clear, several semesters of data would provide a more precise determination of the impact these changes have had on student learning. We expect this investigation to continue as the impact of Covid-19 diminishes.

Supporting data to include:

- Textbook questionnaire (fall 2019). Attached below.
- Survey question results below
- Grade correlation data below
- Warmup exercises ---attached with grant submission documents
 - 88 warmup exercises created attached and submitted for available access in Galileo

Students' perspective on the new book and warm-ups

During fall 2019 (first semester of the grant) we developed a questionnaire to survey about two main topics: (i) the use of the new textbook, and (ii) the warm-ups.

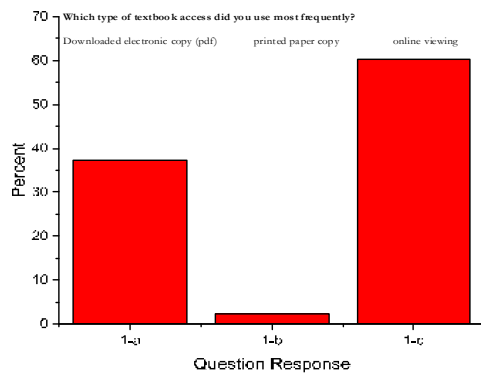


Figure 1. Question 1 responses indicate that students are able to view the free text as either pdf or online.

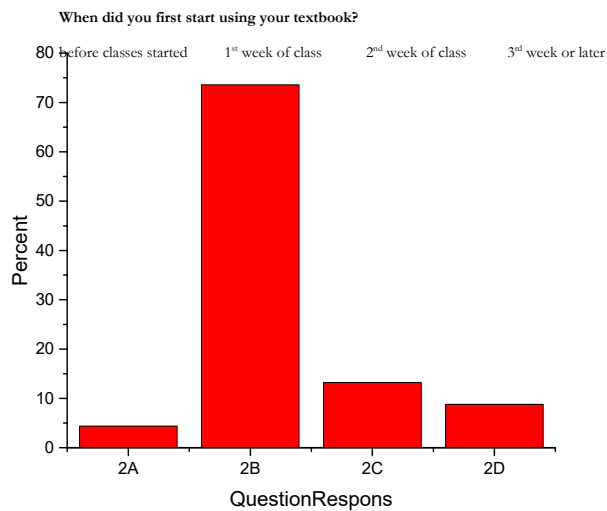


Figure 2. Students have indicated a very high level of use rate of the OpenStax College Physics textbook. The book has no cost. Faculty note that this is very high compared to previous anecdotal experience.

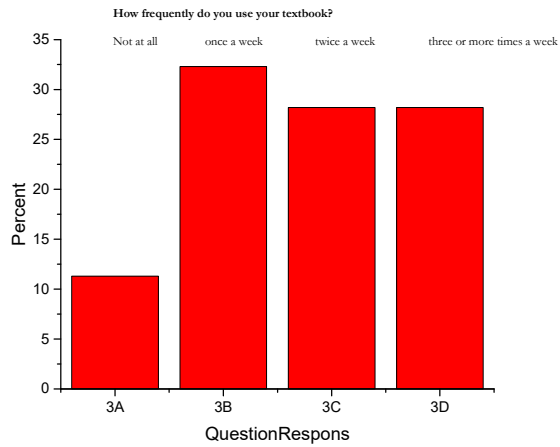


Figure 3. (Class meets two or three times a week)
From these questions we can say the ability to access a free textbook electronically has improved the used of the textbook.

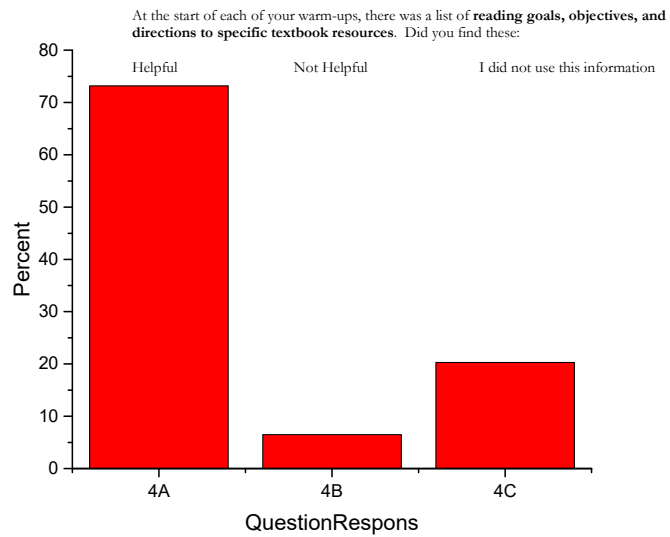


Figure 4. Students find warm-ups with learning objectives useful.

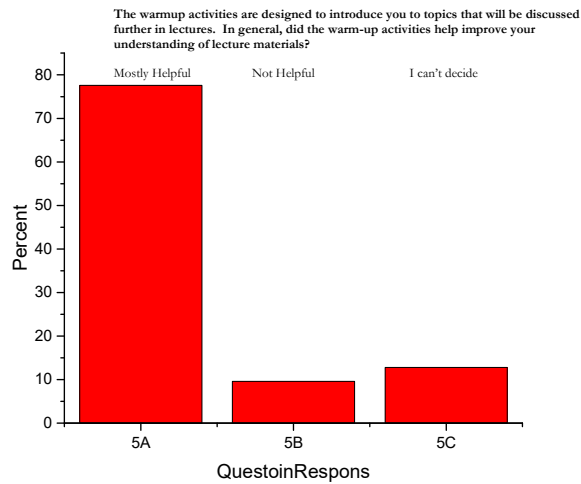


Figure 5. About the warm-ups: Most of the students find the reading objectives very useful and the activities described there helped them to improve their understanding of the material covered in the course.

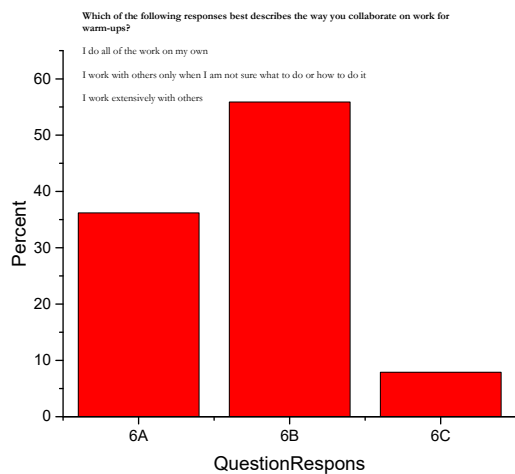


Figure 6. Student self-assessment of work.

Due to COVID-19, we could not collect data during spring 2020.

Fall 19

N = 57

| WU Grade | Course grade | A | B | C | D | F | Totals |
|-------------|-----------------|----|----|---|---|---|--------|
| A | | 18 | 15 | 6 | 1 | 1 | 41 |
| B | | 2 | 2 | 1 | 2 | 1 | 8 |
| C | | | | 1 | 2 | | 3 |
| D | | | | | 1 | | 1 |
| F | | | | 1 | 1 | 2 | 4 |
| | totals | 20 | 17 | 9 | 7 | 4 | |

| F18 | N=67 | 67 | | | | | |
|---|--------|--------|--------|--------|--------|--------------------------|----|
| WU /Course | A | B | C | D | F | total with this WU grade | |
| A | 17 | 9 | 8 | 0 | 0 | | 34 |
| B | 3 | 5 | 5 | 0 | 1 | | 14 |
| C | 0 | 2 | 3 | 2 | 1 | | 8 |
| D | 0 | 3 | 1 | 1 | 0 | | 5 |
| F | 0 | 0 | 0 | 2 | 4 | | 6 |
| course grade received as a percentage of total with given warm up grade | | | | | | | |
| WU /Course | A | B | C | D | F | | |
| A | 50.00% | 26.47% | 23.53% | 0.00% | 0.00% | | |
| B | 21.43% | 35.71% | 35.71% | 0.00% | 7.14% | | |
| C | 0.00% | 25.00% | 37.50% | 25.00% | 12.50% | | |
| D | 0.00% | 60.00% | 20.00% | 20.00% | 0.00% | | |
| F | 0.00% | 0.00% | 0.00% | 40.00% | 80.00% | | |

| SP18 | N=50 | 50 | | | | | |
|---|--------|--------|--------|--------|--------|--------------------------|----|
| WU /Course | A | B | C | D | F | total with this WU grade | |
| A | 13 | 4 | 0 | 0 | 0 | | 17 |
| B | 1 | 3 | 2 | 2 | 1 | | 9 |
| C | 0 | 1 | 5 | 2 | 0 | | 8 |
| D | 0 | 2 | 1 | 2 | 0 | | 5 |
| F | 0 | 2 | 4 | 1 | 4 | | 11 |
| course grade received as a percentage of total with given warm up grade | | | | | | | |
| WU /Course | A | B | C | D | F | | |
| A | 76.47% | 23.53% | 0.00% | 0.00% | 0.00% | | |
| B | 11.11% | 33.33% | 22.22% | 22.22% | 11.11% | | |
| C | 0.00% | 12.50% | 62.50% | 25.00% | 0.00% | | |
| D | 0.00% | 40.00% | 20.00% | 40.00% | 0.00% | | |
| F | 0.00% | 18.18% | 36.36% | 9.09% | 36.36% | | |

The data indicates a correlations between daily warm up performance and final course grade. The takeaways are consistent here. Students who put in the time to do well on the warm-ups, also do well in the course. Instructors have observed that with the addition of learning objectives to the warmups, a much higher percentage of students complete the warm-ups on a regular basis In Fall 19, 72% (41 out of 57) of students had a WU average of 90% or better and 86% (49 out of 57) of students had a WU average of 80% or better. While in Fall18, only 51% of students scored a 90% or better on WUs and only 72% of students scored an 80% or better. In Sp18 the scores were 34% of students scored a 90% or better on WUs and only 52% scored and 80% or better on WarmUps. This means that the addition of the reading objectives, have overwhelmingly changed the value of the WarmUps to our students. The final grade distribution, however, does not seem significantly altered, although once again a correlation is noted.

Introductory Physics II

| WU grade | COURSE GRADE | | | | | TOTAL |
|----------|--------------|----|---|---|---|-------|
| | A | B | C | D | F | |
| A | 9 | 10 | 4 | 7 | | 30 |
| B | 3 | 2 | 2 | | 2 | 9 |
| C | | 1 | | | | 1 |
| D | | | 1 | | 1 | 2 |
| F | | | | | 1 | 1 |
| TOTAL | 12 | 13 | 7 | 7 | 4 | |

Total number of students = 43

As in PHYS 1111, students with good grades in warm-ups have mostly good grades on the course.

| GRADE | FALL 2018 (HW) [%] | SPRING 2019 (HW) [%] | FALL 2019 (warm-up) [%] |
|-------|--------------------|----------------------|-------------------------|
| A | 33.33 | 21.28 | 26.67 |
| B | 18.33 | 17.02 | 28.89 |
| C | 25.00 | 31.91 | 15.56 |
| D | 10.00 | 8.51 | 15.56 |
| F | 8.33 | 14.89 | 8.89 |

In this table you can see the comparison between using warm-ups and old school homework (a set of problems at the end of each chapter of the book). There is a small increase in the AB grades, but we need more semesters to draw a conclusion.

Textbook Questionnaire

Please circle your answers below.

1. Which type of textbook access did you use most frequently?

Downloaded electronic copy (pdf)
viewing

printed paper copy

online

2. When did you first start using your textbook?

before classes started

1st week of class

2nd week of class

3rd week or later

3. How frequently do you use your textbook?

Not at all once a week

twice a week

three or more times a week

4. At the start of each of your warm-ups, there was a list of **reading goals, objectives, and directions to specific textbook resources. Did you find these:**

Helpful

Not Helpful

I did not use this information

5. The warmup activities are designed to introduce you to topics that will be discussed further in lectures. In general, did the warm-up activities help improve your understanding of lecture materials?

Mostly Helpful

Not Helpful

I can't decide

6. Which of the following responses best describes the way you collaborate on work for warm-ups?

I do all of the work on my own

I work with others only when I am not sure what to do or how to do it

I work extensively with others

4. Sustainability Plan

During the semester, students access these materials through our learning management system (Brightspace Desire to Learn D2L, or other online access). These materials are revised each semester.

- 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.
 - 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.
 - Additional course conversions may include future adoption of OpenStax textbook for use with PHYS2211 and PHYS2212 (Calculus based physics courses).
 - An institution goal for enrollment growth envisions 16,000 students up from about 9000 currently.

5. Future Affordable Materials Plans

Additional growth may occur for a similar course (Calculus based physics) as publishers resort to revisions and high costs. A new Cyber Science engineering degree is expected to increase the number of students in Principle of Physics I and II (calculus based introductory physics).

6. Future Scholarship Plans

Investigators are considering presentation of materials at regional or national meetings such as AAPT (American Association of Physics Teachers), or other comparable meetings. Emphasis will focus on the use of warm-up materials and the inclusion of goals and learning objectives.