Affordable Learning Georgia Textbook Transformation Grants
Final Report

Table of Contents

1. General Information

Date: Thursday, October 8, 2020
Grant Round: R14
Grant Number: 464
Institution Name(s): University of Georgia
Project Lead:

- Dr. Michael E. Cotterell, Lecturer, University of Georgia, mepcott@uga.edu

Team Members:

- Dr. Michael E. Cotterell, Lecturer, University of Georgia, mepcott@uga.edu
- Dr. Bradley J. Barnes, Senior Lecturer, University of Georgia, bjb211@uga.edu

Course Name(s) and Course Numbers:

- CSCI 1302 Software Development

Semester Project Began:

- Spring/Summer 2019

Final Semester of Implementation:

- Ongoing (sustained); however, the official project itself ended in Summer 2020.

Total Number of Students Affected During Project:

- 573+ (does not include Fall 2020)
- See CSCI 1302 in this document provided by the UGA Center for Teaching & Learning: https://ctl.uga.edu/_resources/documents/OER-Cost-Savings-by-Course.pdf

2. Narrative

Through this project, Dr. Cotterell and Dr. Barnes developed a guided reading-based textbook replacement for CSCI 1302 Software Development at the University of Georgia. CSCI 1302 is UGA's Computer Science II course in the set of USG Core Curriculum courses. Instead of reading a textbook, the students work through instructor-authored interactive tutorials to fully engage with new concepts. These tutorials are free for the students, licensed under a Creative Commons license, and consists of hands-on, relevant examples on each topic in the course. They provide the necessary background information and explain the importance of each topic. The tutorials guide the students through the topics using hands-on activities where they can implement, create, and test their implementations of new computer science topics. In other words, they are practicing the skill of computer programming while they are learning the concept. The full, active-learning, tutorial-based implementation of Software Development (CSCI 1302) began in Spring 2019. Below is an outline of the currently published editions comprising of over 300 pages of written material (conservatively estimated at ~50 lines per page), excluding supplemental programming/code examples. All of these materials are currently and actively being updated and added to this semester for a Fall 2020 edition.

1. Michael E. Cotterell and Bradley J. Barnes. 2019. **CSCI 1302 Code Style Guide.** CC BY-NC-ND 4.0 W. GitHub. Zenodo. Department of Computer Science, University of Georgia, Athens, GA, USA, (August 18, 2019), **761 lines of text ≈ 16 pages** (~50 lines per page). https://doi.org/10.5281/zenodo.3370471; https://github.com/cs1302uga/cs1302-styleguide
    A. Edition: 2019fa; http://dx.doi.org/10.5281/zenodo.3579521
    B. Edition: 2019su; http://dx.doi.org/10.5281/zenodo.3370472

2. Michael E. Cotterell and Bradley J. Barnes. 2019. **CSCI 1302 Tutorials.** CC BY-NC-ND 4.0 W. GitHub. Zenodo. Department of Computer Science, University of Georgia, Athens, GA, USA, (August 3, 2019), **7785 lines of text ≈ 156 pages** (~50 lines per page), not including supplemental full code examples. https://doi.org/10.5281/zenodo.3359638; https://github.com/cs1302uga/cs1302-tutorials/tree/v2019su
    A. Edition: 2019fa; http://dx.doi.org/10.5281/zenodo.3579499
    B. Edition: 2019su; http://dx.doi.org/10.5281/zenodo.3359639

3. Michael E. Cotterell and Bradley J. Barnes. 2019. **CSCI 1302 Class Exercises.** CC BY-NC-ND 4.0 W. GitHub. Zenodo. Department of Computer Science, University of Georgia, Athens, GA, USA, (April 26, 2019), **6737 lines of text ≈ 135 pages** (~50 lines per page), not including supplemental full code examples. https://doi.org/10.5281/zenodo.2652509; https://github.com/cs1302uga/cs1302-exercises/tree/v2019sp
    A. Edition: 2019fa; http://dx.doi.org/10.5281/zenodo.3579498
    B. Edition: 2019sp; http://dx.doi.org/10.5281/zenodo.2652510

The textbook transformation process was successful; however, it was not without its challenges. Dr. Cotterell and Dr. Barnes met on an almost daily basis in Spring 2020 to review the learning outcomes for coming days and draft and write material for both the **CSCI 1302 Tutorials** (required readings) and the **CSCI 1302 Class Exercises** (in-class exercises). This kind of schedule was difficult to maintain at times, but the benefits to instruction were clear:

- the reading material assigned to students clearly aligned with course learning outcomes;

- the exercises that students worked on also aligned with course learning outcomes; and
- adjustments to the material were possible based on instructor observations.

As Computer Science course enrollments continue to increase, the total savings for our students grows. In Fall 2019 and Spring 2020, a total of 573 students took CSCI 1302 which saved our students $79,452.18 over the course of the academic year (based on the current textbook price of $138.66). We also estimate the Fall 2020 savings to be somewhere between $26,688 and $37,391. Once the OERs are further refined, the hope is that they will be adopted by other institutions of higher education, making the impact even larger.

Lessons Learned: For future endeavors, we would strongly encourage authors who author the material live (as we did during Spring 2020) to ensure they have more than a week between the completion of a final OER draft and when the OER is used in the course. This allows for more review, content adjustments, and, if needed, corrections, before the material is consumed by students.

3. Quotes

Provide three quotes from students evaluating their experience with the no-cost learning materials.

1) This was a great class. The flipped structure is supported by the great learning resources, but I would recommend continuing to develop these (ie continue making videos and refine readings, some are still unclear).

2) I also enjoyed that we didn't have a textbook, but rather online tutorials. It was a lot easier to read.

3) The readings are super helpful and very easy to read (if you keep up from the beginning).

4) Video tutorials are helpful than the written tutorials.

4. Quantitative and Qualitative Measures

A. Uniform Measurements Questions

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: 182

- Positive: 89.0% of 182 number of respondents
- Neutral: 0% of 182 number of respondents
- Negative: 11.0 % of 182 number of respondents

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?

- **Neutral: Same performance outcomes over previous semester(s) -** *Explained in Section 3b.*

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:

35% of students, out of a total 253 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) -** *Explained in Section 3b.*

B. Measures Narrative

Anonymized versions of the supporting datasets are not yet available; however, a summary of the data ascertained from non-anonymized is provided below. The

Student Opinion of Materials: The "**overall student opinion**" measures provided in Section 3a were ascertained via the following exit survey question asked in Fall 2019 (after adoption): "Q89: Given the option, would you rather interact with instructor-authored reading materials, in-class exercises/handouts, tutorials, and videos (open educational resources) or read a propriety textbook?"

Q89	Count	Percent of Data	Confidence Interval (Percent of Data)
Open Educational Resources	162	89.0%	83.6% to 92.8%
Textbook	20	11.0%	7.2% to 16.4%

We also asked the following exit survey question in Fall 2019 (after adoption): "Q90: Having access to the open educational resources (readings, tutorials, exercises/handouts and videos) provided by my instructors reduced my anxiety."

Count			Percent	
	Q90			Q90
Strongly Agree	91		Strongly Agree	50.0%
Somewhat agree	53		Somewhat agree	29.1%
Neither agree nor disagree	26		Neither agree nor disagree	14.3%
Somewhat disagree	7		Somewhat disagree	3.8%
Strongly disagree	5		Strongly disagree	2.7%

Student Learning Outcomes and Grades: The average final course grade from Spring 2018 – Fall 2018 (prior to adoption) was 80.23% and the average final course grade from

Spring 2019 – Fall 2019 (after adoption) was 81.23%. The average final course grade from Spring 2019 – Spring 2020 was 82.21%. While these numbers do show a slight increase in average final course grades, they likely have overlapping confidence intervals, which is why we reported the **comparative impact as Neutral** in Section 3a.

Student Drop/Fail/Withdraw (DFW) Rates: The DFW rate for Fall 2018 (prior to adoption) was 43.02% and the DFW rate for Fall 2019 (after adoption) was 35.97%. The DFW rate for Spring 2020 was 31.56%. These numbers suggest a general decrease in the DFW rate for the affected course, which is why we reported the **comparative impact as Positive** in Section 3a. It should be noted that the Spring 2019 DFW was larger at 50.5%; however, that semester was the first time the materials were used and the first time the course was taught using a flipped, active learning pedagogical approach.

Possible Co-Factors: The initial adoption of the OERs in Spring 2019 coincided with the first time the course was taught using a flipped, active learning pedagogical approach. This was a sharp culture change for many students. We have since then worked out some of the kinks with the approach. The Spring 2020 semester was also impacted by the COVID-19 pandemic, which is why it's included separately in many of the post-adoption statistics provided above.

5. Sustainability Plan

The department is committed to utilizing and updating the OER materials for CSCI 1302 each semester as part of the university's Affordable Course Materials initiative. Saving students money and having the course designated as "low cost" or "no cost" is seen as an incentive for sustaining the works.

6. Future Affordable Materials Plans

This project has prompted both myself and others to seek out materials through the library before considering proprietary textbook offerings. In cases where collaboration is possible, the creation of instructor authored OERs, like the ones created through this project, is a strong possibility.

7. Scholarship

The following scholarly works were produced in conjunction with this project.

1. Michael E. Cotterell, Delaram Yazdansepas, Bradley J. Barnes. "Improving Student Sentiment of Active Learning in CS" Extended Abstract: Poster. In Proceedings of the 2020 ACM Conference on Computing Education Research (ICER'20). Virtual Event, Dunedin, New Zealand, August 12 - 13, 2020. pp. 308 - 308. ACM. https://doi.org/10.1145/3372782.3408120

2. Michael E. Cotterell, Delaram Yazdansepas, Bradley J. Barnes. "Active Learning in CS2 and Discrete Mathematics" Extended Abstract: Poster. In Proceedings of the 51st ACM Technical Symposium on Computer Science Education (SIGCSE'20). Portland, OR, USA, March 11 - 14, 2020. pp. 1318 - 1318. ACM. https://doi.org/10.1145/3328778.3372618