Affordable Learning Georgia Affordable Materials Grants
Transformation Grants Final Report

(or Textbook Transformation Grants, if R17 or earlier)

Once you have completed this template, to submit your Final Report, go to the Final Report submission form.

The final report submission form allows you to submit the following:

- This completed narrative document (required)
- Syllabus or syllabi (required)
  If multiple files, compress into one .zip folder
- Qualitative/Quantitative Measures data files (optional, as needed)
  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: May 15, 2023

Grant Round: 21

Grant Number: 608

Institution Name(s): Georgia Southern University

Project Lead: Weitian Tong

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

- Weitian Tong, Assistant Professor, Computer Science, wtong@georgiasouthern.edu
- Yao Xu, Assistant Professor, Computer Science, yxu@georgiasouthern.edu
- Lixin Li, Professor, Computer Science, lli@georgiasouthern.edu

Course Name(s) and Course Numbers:

- CSCI 7130 Artificial Intelligence
- CSCI 7432 Algorithm Analysis and Data Structures
- CSCI 7090 Knowledge Process for GIS Data

Semester Project Began: Spring 2022

Final Semester of Implementation: Spring 2023

Total Number of Students Affected During Project:

Course	Number of sections	Enrollment
CSCI 7130	4	36
CSCI 7432	6	25
CSCI 7090	1	14
Total	11	75

1. Narrative

A. 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*

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

C. Describe any materials you created or revised/remixed that will be shared with the public. Include the open license your materials will be shared under—for most materials, this will be an Attribution 4.0 License (CC BY) as required in the Grants Request for Proposals.

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

Summary of your transformation experience, including challenges and accomplishments: Our project aims to transform three essential graduate computer science courses (i.e., CSCI 7090 Knowledge Process for GIS Data, CSCI 7130 Artificial Intelligence, and CSCI 7432 Algorithm Analysis and Data Structures). With the significant amount of time and effort committed by each investigator, the overall goal of our project has been successfully achieved. For each course, we redesigned the learning modules to better align with the course learning outcomes as well as our program outcomes. High-quality learning materials for each learning module were screened and identified. We organized these materials in an adaptive way to engage students in the learning process under different course delivery modalities. For example, we constructed a webpage for CSCI 7130 and CSCI 7432 to provide cost-free, up-to-date, and interactive learning materials. It is challenging to collect and organize the learning materials in the rapidly developing computer science field.

Transformative impacts on students: in each academic year, about 75 graduate students will be impacted by our efforts. The up-to-date learning materials will help students keep up

with the pace of the development of the related computer science field. Moreover, our up-to-date, interactive, and adaptive learning materials will make students more engaged and thus improve students learning experience. As the learning materials are organized to align with the student learning outcomes of our programs, students will achieve better success rates, which may result in better retention, progression, and graduation rates.

Our assessment data (refer to Tables 1-7) show that the developed no-cost learning materials achieve no worse effectiveness compared with traditional textbooks. In particular, better success rates were observed (refer to Table 6). In addition, most students showed a positive attitude towards our learning materials (refer to Table 1).

Transformative impacts on the institution: As students achieve better success rates using our learning materials, better retention, progression, and graduation rates can be expected. Our no-cost materials make our programs more affordable to students, which may increase enrollment in the department.

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

Lessons learned by Dr. Weitian Tong on CSCI 7130: AI is a booming computer science field. There are too many topics and hands-on examples. It is hard to select the most representative ones and introduce them in an easy-to-understand way to students. Besides, new topics come out every day and it is difficult to keep up with the most recent topics. Using course projects to promote students to explore cutting-edge topics is a promising approach to solving this problem.

Lessons learned by Dr. Yao Xu on CSCI 7432: Many algorithms require a strong mathematical background and can be difficult to comprehend. Utilizing more algorithm visualizations can facilitate learning. It would also be advantageous to create more practical assignments. Additionally, adding a new module on machine learning algorithms, a rapidly evolving and widely applicable topic, is also worth considering.

Lessons learned by Dr. Lixin Li on CSCI 7090: There are many interesting applications to use Geographic Information Systems (GIS) as a database management system for spatial and spatiotemporal data. More assignments and projects can be developed to motivate students to apply advanced techniques to GIS, including machine learning.

C: Describe any materials you created or revised/remixed that will be shared with the public. Include the open license your materials will be shared under—for most materials, this will be an Attribution 4.0 License (CC BY) as required in the Grants Request for Proposals.

High-quality learning materials for each learning module were screened and identified. We organized these materials in an adaptive way to engage students in the learning process under different course delivery modalities. For CSCI 7090, we designed hands-on assignments, labs, and projects. For CSCI 7130 and CSCI 7432, a webpage for each course

was created to provide cost-free, up-to-date, and interactive learning materials. All these materials are shared with the public through OpenALG and the GALILEO Open Learning Materials repository.

2. Quotes

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

The following comments are from the anonymous survey that we conducted during this project.

CSCI 7130:

- The timely updated course website is very helpful! I also learned a lot from the shared YouTube videos.
- These materials are up-to-date!
- I love how the materials are organized.
- It saves money

CSCI 7432:

- Good materials and well organization
- I like the idea of replacing traditional textbooks with free and up-to-date materials.
- These materials are helpful. I learned a lot.

CSCI 7090:

- N/A

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: _____75_____

- Positive: ___97____ % of ____33____ number of respondents
- Neutral: ___3____ % of ____33____ number of respondents
- Negative: ___0____ % of _____33___ number of respondents

Refer to Table 1 and Table 2 for more details.

Table 1. Students' response to the question "In general, the learning modules were organized" in our survey. Note: in the survey, students are asked to express their opinion on a list of question using a 10-point Likert scale where 1 is strongly disagree, 5 is neutral, and 10 is strongly agree.

1	2	3	4	5	6	7	8	9	10
0%	0%	0%	0%	3%	3%	3%	6%	18%	67%

Table 2. Students' Opinion on Cost-free Learning Material. Note: in the survey, students are asked to express their opinion on a list of question using a 10-point Likert scale where 1 is strongly disagree, 5 is neutral, and 10 is strongly agree.

Field	Min	Max	Mean	Standard Deviation	Variance	Responses	Sum
In general, the learning modules were organized	5.00	10.00	9.33	1.22	1.49	33	308.00
The content, links and other leaning module materials were sufficient to help me learn.	3.00	10.00	9.21	1.79	3.20	33	304.00
I liked not having to buy a textbook and instead used the materials that were provided and free.	8.00	10.00	9.85	0.43	0.19	33	325.00
I prefer using selected open source/free learning materials rather than a paid textbook for this course.	5.00	10.00	9.55	1.26	1.58	33	315.00
Overall, compared to a potential paid textbook, open resource learning materials provided the necessary assistance to learn the material.	4.00	10.00	9.55	1.23	1.52	33	315.00
I would take another course that uses open/free learning materials.	5.00	10.00	9.64	1.18	1.38	33	318.00

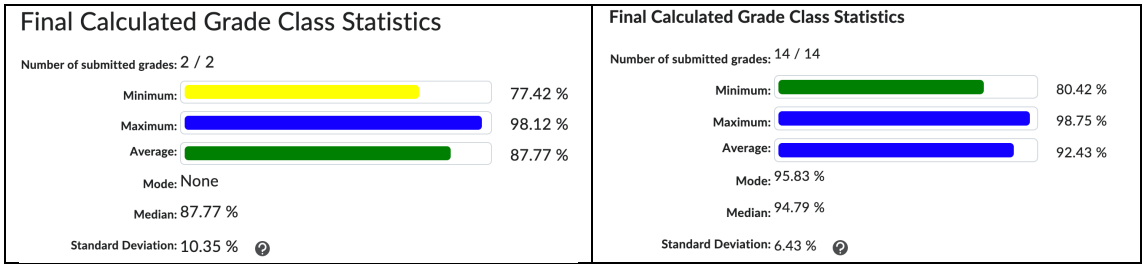
Student Learning Outcomes and Grades

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.

As shown in Tables 3-5, the overall comparative impact on student performance in terms of learning outcomes and grades in the semester(s) of implementation over previous semesters was **positive**.

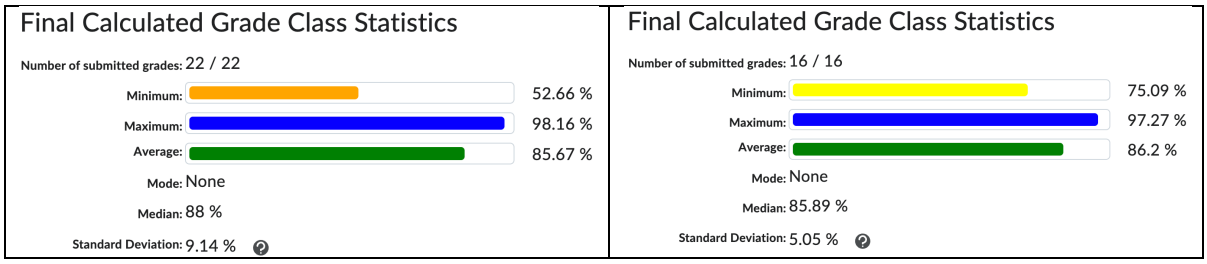
Table 3 CSCI 7090 Students' grades in Fall 2020 (left) and Spring 2023 (right)



Choose One:

- _x__ 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)

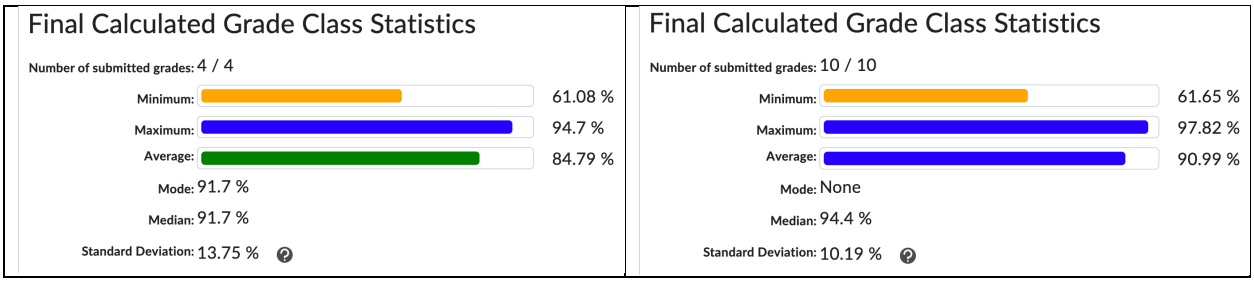
Table 4 CSCI 7130 Students' grades in Fall 2021 (left) and Fall 2022 (right)



Choose One:

- __x_ 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)

Table 5 CSCI 7432 Students' grades in Fall 2021 (left) and Fall 2022 (right)



Choose One:

- _x_ 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?

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

As shown in Table 6, the overall comparative impact on Drop/Fail/Withdraw (DFW) rates in the semester(s) of implementation over previous semesters was **positive**.

Choose One:

- __x_ Positive: This is a lower percentage of students with D/F/W than previous semester(s)
- ___ 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)

Table 6 Students' DFW rates

	Previous Semester	Current Semester
CSCI 7130	10% in Fall 2021	10% Fall 2022
CSCI 7432	33% in Fall 2021	17% in Fall 2022
CSCI 7090	33% in Fall 2020	22% Spring 2023

B. 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.*

Multiple types of data were collected to measure the effectiveness of our no-cost learning materials quantitatively and qualitatively.

	Measures
Quantitative	• Student's grades, obtained from Folio (our teaching system of Georgia Southern) [Refer to Tables 3, 4, and 5] • DFW rates, taken from student registration system. [Refer to Table 6] • Students' numerical feedback on learning materials, collected via anonymous surveys designed by investigators. [Refer to Tables 1 and 2] Note that a numeric reporting scale of 1-10 was applied to measure students' attitude towards the cost-free learning materials. • Students' success in learning objectives, assessed via the regular teaching evaluation. [Refer to Table 7] Note that every course needs to be evaluated every semester at Georgia Southern University. This evaluation form includes students' success in achieving the learning outcomes.
Qualitative	• Anonymous survey questionnaire was designed to allow students to share their learning experiences and discuss the effectiveness of the learning materials. The survey was conducted at the end of the semester. Qualitative comments and suggestions are collected. [Refer to Tables 1 and 2]

Survey results are provided in Tables 1 and 2. Based on the assessment data we collected, the cost-free learning materials offer the similar learning effectiveness as the textbook (in some case, even better). Students' performance outcomes (refer to Tables 3, 4, and 5) and DFW rates (Refer to Table 6) show improvement after applying our learning materials. Students' overall feedback to our teaching materials are positive as indicated in Table 7 and their comments.

There are two questions are specifically related to the course materials.

- Q13 The course material was well organized.
- Q14 The presentation of the course material was clear.

Table 7 Students' Teaching Evaluation

		Previous Semester	Current Semester
CSCI 7090	Q13	4.8	4.5
	Q14	4.6	4.5
CSCI 7130	Q13	4.3	4.5
	Q14	4.3	4.4
CSCI 7432	Q13	4.5	5.0
	Q14	4.0	5.0

Comment(s) from students regarding the course materials:

- CSCI 7090
  - N/A
- CSCI 7130:
  - Dr. Tong is VERY dedicated to making quality content and resources available to his students. The course website is always up to date and full of information for each topic we learned. Phenomenal effort.
- CSCI 7432:
  - I thought the lectures and course material was great! love how additional course textbooks were not needed and all information was supplied to us.
  - They've all been super useful especially the swift upload of every course material. They all really helped during the semester for the course.

4. Sustainability Plan

Describe how your project team or department will offer the materials in the course(s) in the future, including the maintenance and updating of course materials.

CSCI 7130 and CSCI 7432 are offered each semester, and CSCI 7090 is offered every academic year. These courses are usually assigned to our team members, and we promise to maintain and update the learning materials as needed. Further improvement will be made based on the feedback from the semesterly teaching evaluation.

5. Future Affordable Materials Plans

Describe any impacts or influences this project has had on your thinking about or selection of learning materials in this and other courses that you will teach in the future.

As a rapidly developing discipline, up-to-date, open-source, no-cost, and adaptive online resources are more advantageous compared with the traditional textbooks in Computer Science. Faculties in Computer Science department already completed an individual ALG project. Successful experience from this project will be shared with the other faculties. This will inspire more faculties in our department to get involved with developing cost-free learning material for more CS courses.

6. Future Scholarship Plans

Describe any planned or actual papers, presentations, publications, or other professional activities that you expect to produce that reflect your work on this project.

We plan to summarize the results from this textbook transformation project and share them through presentations at educational conferences (i.e., ACM Southeast Conference) and/or journal publications.

7. Description of Photograph (optional)

This is where a team can list the names of the people shown in this separately uploaded photograph, along with their roles, if applicable.