# Affordable Learning Georgia Textbook Transformation Grants

## Interim Final Report

## General Information

Date: Tue 11-Aug-20 05:31 PM

Grant Round: 14

Grant Number: 471

Institution Name(s): Georgia Gwinnett College

Project Lead: Mohamed Jamaloodeen, Kathy Pinzon

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

Mohamed Jamaloodeen Associate Professor and Chair of Faculty Mathematics, Mathematics, Georgia Gwinnett College

Kathy Pinzon Associate Professor, Mathematics, Georgia Gwinnett College

Joshua Roberts, Assistant Professor, Mathematics, Georgia Gwinnett College

Daniel Pragel Assistant Professor, Mathematics, Georgia Gwinnett College

Course Name(s) and Course Numbers: Math 2300 Discrete Mathematics

Semester Project Began: Summer 2019

Final Semester of Implementation: Summer 2021

Total Number of Students Affected During Project: 300

## 1. Narrative

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

A no text transformation of the GGC Math 2300 Discrete Math course was completed.

Using Asciidoc, online materials were developed and are made available for all sections of the course including the following Sections:

1) Introducing Discrete Math (online notes, 2 PowerPoints 3 videos and 2 online exercises)
2) Introduction to Python (online notes and PythonTutor Code examples)
3) Logic (online notes and PythonTutor code examples, 3 PowerPoints, 13 videos and 73 online exercises)

4) Set Theory (online notes and PythonTutor code examples, 1 PowerPoint, 5 videos and 102 online exercises)
5) Functions (online notes, 2 PowerPoints, 12 videos, 45 online exercises)
6) Growth of functions (online notes, 1 PowerPoint, 5 videos, 33 online exercises)
7) Algorithms (online notes, PythonTutor code examples, 2 PowerPoints (Python/pseudocode + Algorithms), 12 videos (3 Python videos and 9 algorithms videos), 24 online exercises)
8) Counting (online notes, PythonTutor code examples, 2 PowerPoints, 27 videos, 48 online exercises)
9) Number Theory (online notes, PythonTutor Code examples, 1 PowerPoint 12 videos, 38 online exercises)
10) Mathematical Induction (online notes, 1 PowerPoint, 12 videos, 23 online exercises)
11) Graph Theory (online notes, 1 PowerPoint, 3 videos, 62 online exercises)
12) Appendix 1: Library of functions (online notes)
13) Appendix 2: Python Syntax (online notes, PythonTutor)

The online notes and materials currently run to almost 300 pages.

As in the grant proposal, coding, through the use of Python, was integrated completely in the text, mostly by way of PythonTutor code, executable through the online text.

Coding while a challenging section, proved to be very useful and appreciated by the students (see comments). This proved to be the most challenging aspect of the project, mostly through instructor level of comfort with coding in Python, versus pseudocode. Since PythonTutor code examples were presented in the online text for many sections, a major challenge was when to introduce Python code. Most of the team felt it should be the very first topic introduced after a broad introduction to the course, and major topics.

The team also recognizes that in terms of adoption of these online materials, a hurdle for other institutions may be the integral use of Python code in the materials developed.

The team is working on developing a version of the materials that is program language independent (using mainly pseudocode), and that remains an ongoing task. Other remaining tasks include 1) a thorough proofing of the materials, 2) additional PythonTutor Code and examples for additional sections including graph theory, mathematical induction, 3) A students solution manual and an instructors solution manual for all of the online exercises, 4) Editing and improvement of the video qualities.

The project involved steep learning for many components (typsetting using the Asciidoc platform, PythonTutor for the coded Python Examples, video recording tools and platforms and exercise generation tools like Mathematica, and the WolframDemonstrations project). Now that the team has acquired these skills, refining and improving the materials should prove more welcoming tasks moving forward, including porting all the online materials from Asciidoc to the more professional American Institute for Mathematics Pretext platform.

In terms of transformative impact on instruction, the project helped considerably with the transition to online teaching in the spring of 2020 during the Covid-19 pandemic. The move to online teaching accelerated the development of supplementary materials like powerpoints, and videos, and the videos

proved really useful to students and now can be repurposed to support students in a variety of lesson delivery options (full online, hybrid, flipped etc.)

In terms of the transformative impact on the students, we present some data below, but for which care has to be taken in the interpretation of the results due to several confounding factors. Prior to transitioning to full online teaching due to the COVID-19 pandemic in the spring of 2020, Math 2300 instructors used a combination of lecture, group problem solving, board work, practice problems and python tutor to convey the material. Weekly turn-in problem sets, along with regular quizzes ensured students both understood the definitions and worked to gain a deeper understanding of the concepts. The incorporation of python examples and algorithms helps relate the material better to their ITEC majors and makes it more applicable to them.

In the Fall of 2019, 4 sections of Math 2300 were offered using selected chapters of the ALG materials which had been developed by then. These chapters were also not completely developed and were initial versions only.

In the spring of 2020, 5 sections of Math 2300, using many selected chapters of the ALG materials which had been developed by then. While several were revised chapter versions, some were also initial versions only. Also by far the most important confounding factor to account for was the move in March to fully online teaching from face to face teaching due to the COVID-19 pandemic.  Moreover we preface all data reporting here with an emphasis that this data corresponds to preliminary /interim reporting and a more formal data report will be provided in the final report.

Fall 2019 Grades in Math 2300

| Grade | A | B | C | D | F | |
|---|---|---|---|---|---|---|
| SECTION 1 | 12 | 3 | 5 | 2 | 4 | 26 |
| SECTION2 | 7 | 7 | 0 | 2 | 0 | 16 |
| SECTION 3 | 3 | 7 | 4 | 3 | 6 | 23 |
| SECTION 4 | 5 | 7 | 7 | 1 | 6 | 26 |
| SECTION 5 | 4 | 13 | 6 | 0 | 2 | 25 |
| SECTION 6 | 12 | 10 | 3 | 2 | 1 | 28 |
| Total | 43 | 47 | 25 | 10 | 19 | 144 |
| Percentage | 0.298611 | 0.326389 | 0.173611 | 0.069444 | 0.131944 | |

Spring 2020 Grades in Math 2300

| Grade | A | B | C | D | F | |
|---|---|---|---|---|---|---|
| SECTION 1 | 6 | 9 | 8 | 2 | 0 | 25 |
| SECTION2 | 9 | 11 | 4 | 0 | 3 | 27 |
| SECTION 3 | 5 | 5 | 2 | 6 | 8 | 26 |
| SECTION 4 | 6 | 6 | 8 | 1 | 5 | 26 |
| Total | 26 | 31 | 22 | 9 | 16 | 104 |
| Percentage | 0.25 | 0.298077 | 0.211538 | 0.086538 | 0.153846 | |

With most sections around 26-28 students the W rate is negligible for both semesters.

The D/F rates for fall 2019 and spring 2020 are respectively  20% and 24% and with the provisos mentioned above compare very well with the 42% DFWI rate the team mention in the ALG Round 14 grant proposal

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

Providing all of these materials also proved very challenging and perhaps was too ambitious in the grant proposal. That is integrating Python, developing online notes, and supplementary materials (powerpoints, videos, and solution manuals) while all accomplished in the project could do with another iteration of quality assurance and improvement.  These additional iterations of quality assurance for the project should also bring a more coherent and consistent feel to the materials, as sections and topics developed by different individuals are systematically edited, collated and curated.  Also different would be have more planning, designing and requirements specifications by the team on the project before development of the materials.  It would have made for a more structured and cohesive project, and the workflow and work designation would have been easier to delegate.

## 2. Quotes

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

What I found most valuable about this course was:  learning Python along with math subjects.

What I found most valuable about this course was: Recursions and using Python to understand how algorithms work.

While I appreciate the attempt to save students money, the textbook is incomplete and needs more work.

## 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**

We provide informal survey data, with the preface that this is data for an interim report. More formal data will be furnished as part of a formal data collection study for the final reports

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

Total number of students affected in this project: __70_____

- Positive: ___60____ % of __70_____ number of respondents
- Neutral: __30_____ % of ____70____ number of respondents
- Negative: __10_____ % of ____70____ 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?**

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

Choose One:
- <mark>See 3b</mark> Positive: Higher performance outcomes measured over previous semester(s)
- <mark>See 3b</mark> Neutral: Same performance outcomes over previous semester(s)
- <mark>See 3b</mark> 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?**

This was a slightly positive impact but see 3b for a description of the conditions.

**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.*

___15____% of students, out of a total __104_____ students affected, dropped/failed/withdrew from the course in the final semester of implementation.

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)

## 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.*

As mentioned in the first narrative, the fall 2019 implementation of materials for the project was minimal based on selected chapters only and so no assessment data of student learning outcomes was gathered to measure the project effectiveness on student learning outcomes. Moreover, while 4 sections were more formally studied in the spring of 2020, with more complete development of the Affordable Learning materials, the measurement of student outcomes had to be suspended as a result of the transition to online teaching in the middle of the semester in March/April 2020. Moreover, across all math courses assessment data collection measuring student outcomes and grades was suspended due to these developments. That being the case, more formal studies regarding the effectiveness of the textbook transformation project for Math 2300, Discrete Math will be conducted between now and when the final report is due in 2021.  However, even that data will need to be prefaced by the lingering effect of the COVID-19 on all sections of Math 2300 at Georgia Gwinnett College for the fall of 2020 as every section has transitioned online and asynchronously for the fall.  We anticipate studying face-to-face sections also for the spring and possibly summer of 2021 should face-to-face sections run during these semesters.

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## 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.***

The team will continue to utilize the materials in the courses we stated during the no-cost extension period, which will end on April 20, 2021. Updated findings on the objectives will be reported in the final report.

The team is looking for a way to house the online textbook and is hoping to work with the ALG team to host using the manifold app demonstrated at a kickoff meeting.

## 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.***

This project has helped incentivize the adoption of Affordable learning materials throughout all our math courses. It has inspired several faculty groups in mathematics at Georgia Gwinnett College to apply for ALG grants and to systemically adopt affordable learning materials.

For example, 2020-2021. No Text Transformation of MATH 1111 and MATH 1113. Affordable Learning Georgia Textbook Transformation Grants, Round Seventeen was awarded to a group at Georgia Gwinnett College.

The mathematics discipline at GGC is also beginning a discussion on moving towards low-cost/no-cost options for many courses in the Area A general education curriculum.  We hope to release the materials to a wider audience, outside of GGC, after the second round of testing during this fall semester.

## 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.***

The team plans to present its findings and ongoing research at the 2020 Open Education Conference to be held online in November 2020. Parts of the project were presented at several events this past academic year including

- Pinzon, K., Roberts, J.; Python and Open Source Materials in a Discrete Mathematics Course. ICTCM – March 2020 (Oral)
- NSF/AIM Scholarship to attend American Institute of Mathematics Workshop Dec 9—13, 2019, San Jose, Interactive assessments in open source textbooks
    - Jamaloodeen, M. I, Presentation at American Institute of Mathematics (AIM) "Round 14 Affordable Learning Georgia: Discrete Math Textbook Transformation—Status update."

## 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.***

See separate document.