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Application Summary

Competition Details

Competition Title:	Textbook Transformation Grants, Round Sixteen (Spring 2020 - Spring 2021)
Category:	University System of Georgia
Award Cycle:	Round 16
Submission Deadline:	01/13/2020 at 11:59 PM

Application Information

Submitted By:	Sarah North
Application ID:	3948
Application Title:	502
Date Submitted:	01/14/2020 at 8:12 AM

Personal Details

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Submitter Phone Number:	470-578-7774
Submitter Title:	Senior Lecturer of Computer Science

Application Details

Proposal Title

502

Requested Amount of Funding

\$30,000

Priority Category (if applicable)

Upper-Level Courses (3000+)

Final Semester:

Spring 2021

Course Title(s)

Introduction to Database Systems, Undergraduate Core Course; Big Data Analytics, Undergraduate, New CS Track Core Course; Computer Graphics & Multimedia, Undergraduate, Major Elective

Course Number(s)

CS3410, CS4265, CS4722

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Sponsor Name

Coskun Cetinkaya and Jon Preston

Sponsor Title

Chair of Department of Computer Science and Dean of College of Computing and Software Engineering at Kennesaw State University

Sponsor Department

Computer Science

Total Number of Student Section Enrollments Affected by Project in One Academic Year

623

Average Number of Student Section Enrollments Affected per Summer Semester

82

Average Number of Student Section Enrollments Affected per Fall Semester

218

Average Number of Student Section Enrollments Affected per Spring Semester

323

Original Required Commercial Materials (title, author, price, and bookstore or retailer URL showing price)

1. **CS 3410** - Database Processing: Fundamentals, Design, and Implementation. By David M. Kroenke and David Auer, Prentice Hall, 15th Edition, ISBN-13: 978-0134802749, **\$267**, [Pearson Publisher Company](#),
2. **CS 4265** - Big Data Analytics: Advanced Analytics with Spark Patterns for Learning from Data at Scale, by Sandy Ryza, Uri Laserson, Sean Owen, Josh Wills, 2017 Edition, ISBN: 9781491972908, **\$41**, [O'Reilly Media](#)
3. **CS 4722** - Interactive Computer Graphics: A Top-Down Approach with WebGL, 7th Edition, by Edward Angel, University of New Mexico, Dave Shreiner, ARM, Inc. ISBN-13: 978-0262035613, **\$153**, [Pearson Publisher Company](#)

Original Total Cost per Student

\$461 - Total Cost Per Student; (For Two BSCS Core Courses - CS 3410 @ \$267 & CS 4265 @ \$41 = Total Cost \$308; For BSCS take one Major Elective's is: CS 4722 @ \$153 = \$153)

Post-Project Cost per Student

\$0

Post-Project Savings per Student

\$461

Projected Total Annual Student Savings per Academic Year

\$118,069

Using OpenStax Textbook?

Yes

Project Goals

The goal for this proposed Textbook Transformation Grant is to continue our department-wide effort to replace the textbook used in three more BSCS courses (two core and one major elective) with no-cost-to-student learning materials. The aim is to go beyond just cost savings. Include goals for student savings, student success, materials creation, and pedagogical transformation. The Bachelor of Science in Computer Science is one of the largest programs in Kennesaw State University, and it is continuing to grow at a rate of 18% per year. The Department of Computer Science currently has over 40 faculty and 1600 students in various programs, including the Bachelor of Science in Computer Science (BSCS), Bachelor of Arts in Applied Computer Science (BAACS), Minor in Computer Science, Master of Science in Computer Science (MSCS), Graduate Certificate in Computer Science Foundations and Certificate in High Performance Cluster Computing, and Ph.D. in Analytics and Data Science. In this project, we propose to make a department-wide effort to replace the textbooks used in three CS courses (two BSCS core and one CS major elective; the courses are also required by other majors such as Software Engineering, Game Design, and Mechatronic majors—This is the College wide transformation) in the area of science and technology in Introduction to Database Systems, Big Data Analytics (new CS Undergraduate track), and Computer Graphics & Multimedia with no-cost-to-students learning materials to greatly reduce student cost and improve student success rates.

We expect this textbook transformation project to have a profound impact. The graduates from CS have become a major workforce for the local community in the state of Georgia as well as nationwide. Programs from our department also advocate and promote student diversity and multiculturalism. In the past 7 years, more than 1,533 students have graduated from our undergraduate programs. For example, of the students currently enrolled in the BSCS program, 55% are minority students. Over the years, we are continuously improving the quality of our programs while constantly seeking ways to make our programs more affordable so that more good-quality, underrepresented, and career-changing students will be encouraged to apply for and enter our programs.

Many thanks to the prior support of Affordable Learning Georgia in prior grants supporting 6 out of 15 required courses and six out of 22 elective courses in BSCS/MSCS curriculum, with no-cost-to-student learning materials, and the responses from students have been overwhelmingly positive. In this project, we are proposing to continue our department-wide effort to replace the textbooks used in three BSCS courses (two core and one major elective) with no-cost-to-students learning materials. We believe the impact of the proposed project will be significant given the importance of the targeted courses to the BSCS program, and given the fact that this work will further the current department-wide efforts to replace the textbooks used in various courses as CS department grows continuously 18% annually, and given the fact that CS is one of the largest departments in the College of Computing and Software Engineering. The broader goals of this Textbook Transformation project go beyond the important cost savings for students, and they include making improvements to student success, materials creation, and pedagogical transformation.

Notes:

- 1) Summer, Fall 2020, and Spring 2021 enrollment numbers are projected numbers based on preceding enrollment of our programs in 2019-2020 cited from the school enrollment system, owlexpress.kennesaw.edu.
- 2) If there are multiple sections in a semester, we put a total number of students followed by a parenthesis that includes the section id and enrollment number of each section.

Table 1. 2020-2021 Projected Student Enrollment Data

1. CS 3410 - Introduction to Database Systems (Sarah & Xiaohua);

Offering Each Semester;

- **Summer 2020** -- 38 Students (Section W01(38));
- **Fall 2020** – 153 Students (Sections 01 (38); 02(37); 03(38); W01(40))
- **Spring 2021** – 152 Students (Sections 01(39); 02(35); W01(38); W02(40))
- **Total Sections to be offered is: 9**
- **Total Number of Enrollment: 343**

2. CS 4265 - Big Data Analytics (Undergraduate New CS Track) (Dan & Yong);

Offering Each Semester;

- **Summer 2020** -- 24 Students (Section 01(24));
- **Fall 2020** – 65 Students (Sections 01 (30); 02(35))

- **Spring 2021** – 57 Students (Sections 01(24); 02(33))
- **Total Sections to be offered is: 6**
- **Total Number of Enrollment: 146**

3. **CS 4722 - Computer Graphics & Multimedia** (Alan);

Offering 2 Times per year;

- **Summer 2020** -- 20 Students (Section 01(20));
- **Fall 2020** – No offering
- **Spring 2021** – 114 Students (Sections 01(39); 02(37); 03(38))
- **Total Sections to be offered is: 4**
- **Total Number of Enrollment: 134**

Sections to be offered is: 19 Sections

Total Projected Number of Enrollments: 623 (Summer 2020 (82); Fall 2020 (218); Spring 2021 (323)).

Table 2. Summary of Savings with No-Cost Learning Material

Courses; Textbook Used (complete textbook information including title, authors, ISBN, etc); Cost per Student (textbook price); Projected Enrollment Per Section (from Table 1); Projected Costs

1. **CS 3410** - Database Processing: Fundamentals, Design, and Implementation. By David M. Kroenke and David Auer, Prentice Hall, 14th Edition, ISBN-13: 978-0134802749, **\$267**, Pearson Publisher Company

- Cost per students (textbook price): \$264
- Projected Enrollment Per Section from Table 1): **343**
- **Projected Costs: \$91,581**

2. **CS 4265** - Big Data Analytics: Advanced Analytics with Spark Patterns for Learning from Data at Scale, by Sandy Ryza, Uri Laserson, Sean Owen, Josh Wills, 2017 Edition, ISBN: 9781491972908, \$41, O'Reilly Media

- Cost per students (textbook price): **\$41**
- Projected Enrollment Per Section from Table 1):**146**
- **Projected Costs: \$5,986**

3. **CS 4722** - Interactive Computer Graphics: A Top-Down Approach with WebGL, 7th Edition, by Edward Angel, University of New Mexico, Dave Shreiner, ARM, Inc. ISBN-13: 978-0262035613, \$153, Pearson Publisher Company.

- Cost per students (textbook price): **\$153**
- Projected Enrollment Per Section from Table 1):**134**
- **Projected Costs: \$20,502**

Total Projected Enrollment Per Section from Table 1 is: 623

Total Costs Saving is: \$118,069

In Summary, the objectives of the proposed ALG project are as follows:

- Create the BSCS programs more affordable by eliminating the textbooks used in three CS courses (two core courses and one major elective). By doing so, the BSCS programs can better support the lowering of costs for students at CCSE/KSU.

- Develop free, up-to-date, and well-designed learning material for the three significant core and elective proposed BSCS courses. By doing so, the BSCS program can better support the career-changing students and future boost female and minority participation.
- Teach the proposed courses using the developed learning material and validate those material offers equal, interactive, and/or better learning effectiveness that textbooks offers.
- Develop a sustainability plan to ensure the no-cost learning material will be continuously maintained and used in future course offerings.
- The Strategic Plan for the Computer Science Department is to have our complete BSCS programs completely no-cost or low-cost for all courses.

Statement of Transformation

Statement of Problem

Teaching with high expectation has been the goal of the BSCS curriculum of the Computer Science (CS) program since inception. Given the dynamic and ever-increasing pace of innovation in Computer Science and Technology, it is imperative for us to update the curriculum of CS programs frequently. Therefore, we need to constantly update our courses or create new courses to stay in the cutting edge of technology and competition.

Unfortunately, traditional textbooks used in the core and major elective courses mentioned above are not only expensive, but also insufficient to convey adequate and up-to-date knowledge to students. Furthermore, instructors who teach the core courses have to constantly add new materials to their courses in addition to what's covered in the textbook to keep up with ever-changing state of the fields involved. Consequently, the no-cost-learning-material model fits much better for the CS courses.

In the CS 3410 Intro to Database Systems, we will focus on fundamental programming concepts of database design, development, and implementation which covers algorithms and tools that are needed to create databases and their applications. Unlike typical database curriculum which covers how to use databases, we also target the data modeling and architectural principles involved in building databases to better educate students in the design, development, and implementation of database applications.

In the CS 4265 Big Data Analytics (a required core course for a new CS concentration), unlike existing free learning sources, we will cover the practical aspect of each data analytics algorithm with a real world dataset. Each of the learning module to be developed will be designed in a self-contained package with prior knowledge included. This pedagogical model will increase the effectiveness of the learning modules being adopted and integrated easily and seamlessly elsewhere.

For the CS 4722, Computer Graphics and Multimedia, we will cover the design and implementation of state-of-art computer graphics rendering methods for modern visual multimedia systems. It is imperative to provide wide variety of programming projects and materials and to fulfill the required curricular and to provide students with active learning opportunities that will aid in their being successful.

The total cost of the proposed textbooks for these courses is about \$460, even though one single textbook for each course is not going to cover all of the materials that are needed for the students to be successful or to fulfill all of the curricular goals and student learning outcomes.

Therefore, in order to reduce the high cost of the textbook for students, at the end of the Fall 2019 semester we conducted a survey among students to assess their usage of the textbook, their satisfaction with the textbook, and any improvements to be made that they could suggest.

- Among the 146 students who took the courses, 134 completed the survey and the response rate was 94%. Results of the survey indicated the respondents would very much appreciate it if the textbook was free.
- However, when asked how they currently use resources from their textbook, about 30% of them never used the resources. For those who did use the resources, only about 50% found them very useful or useful at all.
- When asked what could be done to improve the textbook, their responses reveal the following major issues they wish could be addressed:
 - 1) Some course topics in the textbook could be too rambling and lengthy;
 - 2) Some book chapters are comprised predominantly of text and plain graphs, which are neither easy to absorb nor engaging;
 - 3) There are not sufficient relevant examples explaining the course concepts;
 - 4) There are not sufficient practice questions at the end of each book chapter;
 - 5) The book covers too much redundant information and using it as it is does not exactly align with the learning objectives of the class;
 - 6) The questions from the test bank that comes with the textbook do not accurately assess the learning outcomes of the course;
 - 7) There are discrepancies between book chapters and lecture slides provided due to a lack of discussion or complete omission of critical information in the slides.

Statement of Transformation

During the past two years, the Department of Computer Science has been a big advocate of no-cost-learning material since ALG was introduced to us. The faculty of the CS department has transformed over a dozen CS courses at both undergraduate and graduate level with the support of ALG. A few of our ALG awards, e.g., round 12 award #2582-375 and round 14 award #3366-440, are coordinated at the department level. Moreover, the responses for those renovated with no-cost-learning-material courses have been overwhelmingly positive from the students.

The massive positive responses from the students, our past ALG grant accomplishments, and the nature of the CS discipline allow us to aim to continue transforming more CS courses using no-cost learning material. This project aims to replace the textbooks used in the three proposed BSCS courses with no-cost-to-students learning materials that offer equal or higher educational effectiveness benefits.

Textbook Transformation Grants are awarded to teams focused on creating meaningful changes. This section allows teams to describe why the ALG project is important to award to the particular set of courses that are being proposed.

First and foremost, Database Systems, Big Data Analytics (which became a new CS Track) and Computer Graphics and Multimedia are all important branches of the CS curriculum, and they will effect over 600 students and save about \$460 on textbook for each student each year.

Secondly, it is important to note that in the field of Computer Science in the modern day, there are numerous learning materials essential to the content of the proposed BSCS courses that are widely and readily available as open-source and free of charge materials. For example, in CS 3410, Database Processing, we use tools and open source resources such as Amazon Aurora, which is a MySQL and PostgreSQL-compatible relational database built for the cloud [8] that combines the performance and availability of traditional enterprise databases with the simplicity and cost-effectiveness of open source databases for free. Furthermore, many faculty members already have to use web-based contents as supplemental materials to the textbook.

Our third point is that because of the innovative nature of Computer Science, critical knowledge areas are continuously changing and quickly being updated, and free resources available online are more advantageous than traditional textbooks in keeping up with this fast pace of change. In fact, our instructors have already been researching and identifying appropriate and related no-cost web content to be used in the BSCS and MSCS courses involved in this project. For example, in CS 4265, Big Data Analytics, the course already uses good quality free online textbooks such as "Big Data, Data Science" by Brendan Martin, MIT Press, 2016, and books in data science from other websites (e.g., [1], [3]).

Our fourth point is that resources from the Web are generally more interactive. This not only allows the subject matter and content to be more engaging for our students, but it also improves their learning experience. As instructors, we play an important role in selecting, organizing and delivering educational content from the vast amount of information available from the web and open source resources in an attempt to match it with the classroom learner's background knowledge (e.g., [2]). In particular, we seek to develop hands-on labs and assignments with various tools and methods in order to help students become well prepared for what they will experience in the job market, and to advance their higher education and career goals. For example, there are books and manuals available on how to become a [5, 6] Big Data Analysis Practitioner or Developer (CS4265), but they may not directly apply to undergraduate students who are in need of effective hands-on learning.

Our fifth point is that by designing our own lecture notes, study guides, PowerPoint presentations, instructional/tutorials content videos, online and offline reading materials, assignments and exercises, and assessment tools, we gain the ability to dynamically adjust our courses so that they will always be consistent with the outcomes of our BSCS programs. For example, we use state-of-the-art technologies involving computer graphics rendering and visual multimedia systems in CS 4722, Computer Graphics and Multimedia, in order to implement 3-dimensional graphical applications and interactive multimedia applications. And in that course, we make use of free [e.g., 7] lecture notes by MIT Press [e.g., 4] in computer graphics to provide students with hands-on lab and assignments that use tools and methods that prepared them well for the job market and for pursuing more advanced courses.

Finally, our last point is that our project team is well prepared for the proposed transformation to the courses since the majority of our team members have more than 12 years of teaching experience, and we are all experts in searching through the unorganized mass of data on the Internet for our courses to find material that makes use of state-of-the-art content and techniques.

All CS courses are assessed every year as part of the continuous improvement process. In addition, the project leader, Dr. Sarah North, successfully completed the ALG Round Twelve grants. As part of a department-wide effort, we have together proposed to transform three CS courses using no-cost-to-student learning materials. Building on our previous successful experience, we are well positioned to continue the transformation efforts and further increase the cost saving benefits to the students in BSCS programs.

Impact of the Transformation:

The impact of our transformation efforts will be profound. By our estimates, around 623 students will benefit from the no-cost learning material each year. The proposed project is expected to save students \$118,069 in textbook cost each year and over three years, the textbook cost saving for undergraduate courses with no-cost-to student learning materials will be over \$300K. Because of the cost savings from not having to buy textbooks, students may be able to take a few more courses each year and graduate sooner. Having a series of CS required elective courses adopting no-cost-to-student material not only offers better and more up-to-date learning experience for students, but also makes our nationally renowned CS programs more affordable.

As a result of this, we could recruit more students, and produce more qualified CS professionals. Developing no-cost-to-student materials can help us better align course content with its learning outcomes and outcomes of our program, which will create positive impact in terms of curriculum development. Moreover, the learning materials developed in this proposal will be made available to the public and can be easily adopted by other programs or institutions who want to lower the cost of education to their students. Furthermore, we believe that the experience we gain in this transformation project could be beneficial to the academic community. We presented our previous ALG grant experience in the conference – IEEE Southeast 2020, etc. And we submitted a proposal to host a panel discussion to discuss the no-cost-to student learning materials in the Annual Open Education Conference (OpenEd' 2020).

References

[1] Barlow, M., Migrating Big Data Analytics into the Cloud, (2018), by O'Reilly.

<https://www.oreilly.com/data/free/>

[2] Taylor, L., and Purtova, N., (2019), What is responsible and Sustainable Data Science,

<https://journals.sagepub.com/> :: Big Data & Society.

[3] Spangler, S., Event Mining, Networking for Big Data (2015), <https://www.kdnuggets.com/tag/book>

[4] Matusik, W., Durand, F., Computer Graphics Lecture Notes by MIT Press, (2018).

[5] Raspberry Pi Projects, <https://opensource.com/article/16/12/yearbook-top-open-source-creative-tools-2016>

[6] How is big Data Analyzed, <https://opensource.com/resources/big-data>

[7] Multimedia codecs, containers, and splitters,

[https://en.wikipedia.org/wiki/Category:Free multimedia codecs, containers, and splitters](https://en.wikipedia.org/wiki/Category:Free_multimedia_codecs,_containers,_and_splitters)

[8] Database management systems, <https://en.wikipedia.org/wiki/Category:MySQL>

Transformation Action Plan

Textbook Transformation Grant projects can be work-intensive and require project management in order to be successful. This section allows teams to describe how the team will fulfill the goals of the project. The activities expected from each team member and their role(s): subject matter experts, instructional designer, instructor of record, et al.

Build on our preceding experience of developing no-cost to student learning materials and with a coordinated effort, our team of investigators plan to carry out the following activities to transform the three proposed BSCS two core CS and one major elective courses to completely develop the no-cost learning materials. We will plan our textbook transformation process in three stages:

Phase 1: Initial Preparation

- Analyze and complete the modification of course syllabi and no-cost materials
- Revising the content to make it better aligned with the course learning objectives and BSCS program outcomes;
- Integrating interactive multimedia learning materials to better engage students and facilitate their learning;
- Developing assessment to help students reinforce their learning and achieve the intended learning outcomes.
- Research and identify no cost readings for each of the learning modules in each course. The reading list includes both required readings and optional readings. All of these readings will be publicly accessible, free to use, or openly sourced.

Phase 2: Implementation

- Map and design no-cost-to-students learning materials to learning modules of each course
- Include materials that are required for our program, which not a single existing textbook will cover all information needed to succeed in the course.
- Review pre-requisite knowledge to improve student learning experience.
- Establish link concepts to real world applications with hands-on exercise.
- Design PowerPoints and video recordings for all learning modules of each course using no-cost-to-students learning materials
- Develop test banks, study guides, and lecture notes for students' use to review course content and key learning points with no-cost-to-students learning materials.
- Design assignments, labs and projects using no-cost-to-students learning materials
- Reconstruct the proposed three BSCS courses on the KSU official D2L Brightspace site
- The responsibilities of each investigator is described in Table 3. Here is a table that shows the responsibilities of each investigator involved in this project:

Phase 3: Evaluation and promotion

- Evaluate and measure our textbook transformation project using student surveys, official course evaluations and student performance data of Summer, Fall 2020 and Spring 2021 semesters in compare the results with those from 2019;
- Continuously update course learning modules using no-cost-to-students materials based on evaluation and feedback
- Evaluate the change of retention rate compared to previous academic year of 2019
- Present our work to a wide range of audiences through conference and workshop presentations
- Plan for providing open access to the new materials using OpenStax CNX, recommended by ALG program directors.

Table 3. PIs' Roles and Responsibilities

Primary Investigators, Courses, and their Responsibilities (Hosting Site: OpenStax CNX)

- Dr. Sarah North, Project Lead, Subject Matter Expert, and developer; instructor of record; for CS 3410: Introduction to Database Systems;
- Dr. Xiaohua Xu, Subject Matter Expert, and developer; instructor of record; for CS 3410: Introduction to Database Systems;
- Dr. Dan Lo, Subject Matter Expert and developer; instructor of record; for CS 4265: Big Data Analytics, Mobile Computing;
- Dr. Yong Shi, Subject Matter Expert and developer; instructor of record; for CS 4265: Big Data Analytics, Mobile Computing;
- Dr. Alan Shaw, Subject Matter Expert and developer; instructor of record; for CS 4722: Graphics & Multimedia, Mobile.

Quantitative & Qualitative Measures

Our plan is to assess the effectiveness of our project both quantitatively and qualitatively, including comparisons of students' performance before (student performance data from the academic year of 2019 will be collected) and after the adoption of no-cost-to-students learning materials, surveys, comparison of course-level retention, etc.

We intend to use aggregated data in the analysis and final report. The performance data will be collected after the no-cost learning material is implemented for a proposed course, which is referred as the current performance data. For each of the measurement, we plan to conduct two levels of analysis.

- We will measure the impact of the project by collecting data on students' usage of the textbook and learning materials, students' satisfaction with them, students' performance, and course-level retention.
- Compare the current performance data to a preset goal. For example, 80 % is the aimed passing rate as the courses involved are graduate courses. A letter grade of B or better will be considered as a passing grade.
- Compare the current performance data to those from past offerings where the textbooks were used. The student performance data from the sections last taught using the textbooks will be used as the baseline.
- All proposed courses will use the same survey, and the survey will be distributed at the end of implementation semester for a proposed course. The proposed survey consists of a mixture of quantitative and qualitative measures including:
 - 1) Student perception and attitude toward no-cost materials.
 - 2) Quantitative ratings of the no cost materials used in this course.
 - 3) Qualitative measures such as open-ended questions for comments and suggestions.
 - 4) Official student course evaluation from the university. The student course evaluation can also provide some insights on the effectiveness of no-cost learning material used in the proposed BSCS courses.

Table 4. Quantitative and Qualitative Measures

1. Source - Action Plan: Comparison of student performance before and after using no-cost-to-students learning materials (Quantitative Measures)

- **Description:** We use the grades to analyze the change of student performance in the following categories:
 - Homework grades
 - Project grades
 - Presentation grades
 - Lab grades
 - Individual questions in midterm and final exams

2. Source - Action Plan: Midterm student survey on no-cost-to-students learning materials (Qualitative Measures)

- **Description:**
 - We will conduct a survey of students' opinions on using the no-cost-to-students learning material in the middle of each semester. This is to gather students' feedback so we can dynamically adjust our course content according to students' suggestions and recommendations. The questions involved in this survey will include but not be limited to:
 - What do you think of the new no-cost-to-students learning material we used so far for this course?
 - Do you prefer the new way of using no-cost-to-students learning material or the traditional way of using hardcopy textbooks?
 - What improvements would you suggest we can make regarding our no-cost-to-students learning material delivery?
 - Do you think you will learn more or less knowledge using no-cost-to-students learning materials?

- Do you think your grade will be improved using no-cost-to-students learning materials?

3. Source - Action Plan: Official student evaluation (Quantitative and Qualitative Measures)

- **Description:**

- The official student evaluation provided by KSU will also be used to gather information of students' opinions on using no-cost-to-students learning materials as well as the way instructors are teaching no-cost-to-students learning materials. Qualitative measures such as open-ended questions for comments and suggestions.

4. Source - Action Plan: Retention (Quantitative Measures)

- **Description:** We will compare the drop rate, fail rate, and withdrawal rate before and after using no-cost-to-students learning materials to see how the new method impacts course retention.

5. Source - Action Plan: End-of-term student survey on no-cost-to-students learning materials (Qualitative Measures).

- **Description:**

- We will also conduct a survey of students' opinions on using the no-cost-to-students learning material again by the end of each semester. Feedback gathered in this survey will be used to adjust the course content and arrangement of no-cost-to-students learning material for the following semester. The questions involved in this survey will include but not be limited to:
 - What changes of no-cost-to-students learning material would you suggest if this course is offered again?
 - What is your expected grade for this course?
 - Would you prefer we redesign more courses in BSCS (MSCS) using no-cost-to-students learning materials? What would you say the impact to the program will be if we do so?

Timeline

The table below shows the detail step-by-step progress of this project including a list of major milestones **Aligned with the Transformation Action Plan.**

Table 5. Timelines and Milestones

Milestone dates: 02/24/2020 - Spring 2020

- Designing and developing visuals for the content
- Redesigning course presentation slides
- Developing an online test bank

Milestones are as follow:

1. Attend the Kickoff Meeting in Middle Georgia State University Hatcher Conference Center (2/24);
2. Complete the modification of course syllabi, analyze the consistency between no-cost-to-students learning materials, course learning outcomes, and BSCS program outcomes;
3. 1st) Progress report 1

03/01/2020

1. Map and design no-cost-to-students learning materials to learning modules of each course, design assignments, labs and projects using no-cost-to-students learning materials, redesign exams that are consistent with no-cost-to-students learning materials;
2. 2nd) Progress report 2

04/01/2020

1. Complete the update of course learning modules, assignments, labs, projects, PowerPoints, etc. on the official KSU D2L Brightspace;
2. Complete the design of midterm and end of term survey for students' feedback;
3. 3rd) Progress report 3

Milestone dates: 06/24/2020 - Summer 2020

- Verifying content from the OpenStax textbook and other resources that align with the course objectives

Milestone are as follow:

1. Conduct the midterm survey for Summer 2020, gather students' feedback;
2. Adjust the course content with no-cost-to-students learning materials based on the midterm survey;
3. Attend Conference and present our research work (tentative);
4. 4th)Progress report 4

07/24/2020

1. Conduct the end of term survey for Summer 2020, gather students' feedback;
2. Compare student performance before (spring 2019) and after using no-cost-to-students learning materials;
3. Adjust the course content with no-cost-to-students learning materials based on 1st) 2nd) and 3rd).

Milestone dates: 09/24/2020 - Fall 2020

- Designing and developing interactive multimedia supplementary materials.
- Designing and developing a web site to present the learning materials.

Milestone are as follow:

1. Conduct the end of term survey for Fall 2020, gather students' feedback;
2. Conduct the official student evaluation for Fall 2020;
3. Compare student performance before and after using no-cost-to-students learning materials;
4. Adjust the course content with no-cost-to-students learning materials based on 1st) 2nd) and 3rd);
5. Progress report 6

10/24/2020

1. Conduct the midterm survey for Fall 2020, gather students' feedback;
2. Adjust the course content with no-cost-to-students learning materials based on the midterm survey;
3. Attend Conference 2020 and present our research work (tentative);
4. Progress report 7

12/10/2020

1. Conduct the end of term survey for fall 2020, gather students' feedback
2. Conduct the official student evaluation for Fall 2020;
3. Compare student performance before (fall 2019) and after using no-cost-to-students learning materials;
4. Adjust the course content with no-cost-to-students learning materials based on 1st) 2nd) and 3rd);
5. Complete and submit research work to education conferences.

Milestone dates: 03/05/2021 - Spring 2021

- Offering proposed courses with the improved textbook, the newly-developed learning materials, and the test bank.
- Collecting data on student usage, student satisfaction, and student performance.

Milestone are as follow:

1. Conduct the final survey for Spring 2021, gather students' feedback;
2. Adjust the course content with no-cost-to-students learning materials based on the midterm survey;
3. Attend IEEE Southeast Conference and present our research work (tentative);
4. Adjust the course content with no-cost-to-students learning materials based on 1st) 2nd) and 3rd);
5. Complete and submit research work to education conferences.

05/10/2021

- Compile and Submit the final project report.

Budget

The budget and justification table 6, lists the responsibility and compensation for each investigator in our team. We estimate that each investigator (the coordinator of corresponding course(s)) will spend more than 100 hours in designing the no-cost-to-students learning materials, designing mid-term and end-of-term student surveys, updating and maintaining course curricula using no-cost-to-students learning materials, assessing course outcomes, and coordinating the work progress of instructors teaching different sections of the same course using the new no-cost-to-students learning materials.

Table 6. Budget and Justification

Team Members; Role and Responsibilities; Investigator's Compensations

Dr. Sarah North, Project Lead, Developer and instructor of record for CS 3410, \$5000 for Summer Salary.

Dr. Xiaohua Xu, Developer and instructor of record for CS 3410, \$5000 for Summer Salary.

Dr. Dan Lo, Developer and instructor of record for CS 4265, \$5000 for Summer Salary.

Dr. Yong Shi, Developer and instructor of record for CS 4265, \$5000 for Summer Salary.

Dr. Alan Shaw, Developer and instructor of record for CS 4722, \$5000 for Summer Salary.

Budget for Investigators Compensation :

1. Total investigators compensation will be $\$5000 * 5 = \mathbf{\$25,000}$.
2. Travel & Other Expense will be **\$2,500**, of which \$800 is the expense for two team members to attend the Kickoff Meeting at Middle Georgia State University Hatcher Conference Center on February 24, 2020, and the remaining \$1,700 is budgeted for attending another conference related to the course development involved in this project such as IEEE Southeast 2020 and related conferences.
3. Equipment (computers, tablets, or related Technologies): **\$2,500**, of which \$2000 will be used for purchase of computers, webcams and microphones for the team to build and test no-cost-to-students learning materials
4. **Total Budget: \$30,000.**

Sustainability Plan

The CS Department at Kennesaw State University continues to grow each year by over 18%, and its sustainability plan aligns with our College-wide and Department-wide efforts to continuously improve the quality of teaching. For each course taught in the Department of Computer Science at KSU, a coordinator/designer is assigned who is responsible for the course content maintenance and updates, course teaching, and coordinating instructors teaching different sections of the same course in a semester in ways that have department-wide impact. This means we will not only design and develop the no-cost-to-students learning materials and be the first ones to teach the course(s), but we will also monitor the course teaching for following semesters to make sure the course teaching is consistent. Each of us will write a course related tutorial which describes the arrangement of course content using no-cost-to-students learning materials for future instructors. All course related materials will be available at the official KSU D2L Brightspace site as well as the department depository to make sure that any future instructor for a course has access to the no-cost-to-students learning materials.

Moreover, the developed course content will not only be available on our learning management system, D2L, but it will also be archived on our CS Department's server. It is also our department policy that there are at least two faculty who regularly teach a course. This further ensures the developed learning material will be continuously used and updated even if there is personnel turnover. In addition to the course designer arrangement and course related no-cost-to-students learning materials availability within the Department of Computer Science, each semester, our department also organizes a day-long event for course assessment. The purpose of this assessment is to evaluate the student learning outcomes of each course and update course content using no-cost-to-students learning materials according to the evaluation. This process allows us to continuously improve our courses using no-cost-to-students learning materials. At the end of each semester, we also invite industry experts to our student project presentation meetings, and we ask them to evaluate the student projects and presentations from the courses using no-cost-to-students learning materials.

We will use the comparison of student performance data before and after using no-cost-to-students materials, student feedback, and evaluation from the industry experts to continuously improve the no-cost-to-students learning materials in our BSCS courses. As the first textbook transformation project in the Department of Computer Science, we hope this project will serve as a pioneer and that the success of this project will encourage many more future textbook transformation projects in the Department of Computer Science at KSU. We also plan to submit research work based on our textbook transformation project to education conferences such as SIGCSE and IEEE Southeast and present our work to a wide range of audiences.

We will assess the effectiveness of the textbook and the learning materials on student learning. We will develop a workshop for faculty at KSU to share our experiences with the design and development of the open educational resources (OER). We will also submit a proposal to a national or international conference to share our experiences with the OER community.

Our textbook transformation project is also supported by our department chair and the dean of our colleges as shown in their support letters to further ensure the sustainability of our transformation plan.

Note: Letter of Support

Attach are two letters of support. One is from the Chair of the Department of Computer Science and Dean of the College of Computing and Software Engineering.

Acknowledgment

Grant Acceptance

[Acknowledged] I understand and acknowledge that acceptance of Affordable Learning Georgia grant funding constitutes a commitment to comply with the required activities listed in the RFP and that my submitted proposal will serve as the statement of work that must be completed by my project team. I further understand and acknowledge that failure to complete the deliverables in the statement of work may result in termination of the agreement and funding.



College of Computing and
Software Engineering
Department of Computer Science

College of Computing and Software Engineering
Computer Science Department

December 12, 2019

Dear ALG Grant Committee and Reviewers,

It is my great pleasure to write a letter of support for the ALG grant proposal entitled "Developing More Large—Scale Transformation of No-Cost-to-Student Learning Materials for Required Core Courses in Undergraduate Computer Science Programs (BSCS) - Department-Wide Transformation." submitted from Kennesaw State University, Department of Computer Science (CS), by Dr. Sarah North, et al. As Department Chair, I clearly see the need for lower costs of textbooks for our students. The ALG grants assist faculty to prepare no-cost courses that allow students to take courses without the monetary burden of expensive textbooks. This proposed grant will develop free online textbooks for two core required courses and one major elective, which impacts over 623 students and over \$118,069 students saving on textbooks annually.

Past two years, several Computer Science faculty at the College of Computing and Software Engineering (CCSE) have successfully carried out an ALG Round Twelve grant for modern computing systems courses and Round Fourteen, developing No-Cost-to-Student Learning Materials for Core Computer Science courses in the Bachelor of Science in Computer Science (BSCS) Program. The savings already are enormous and we have been encouraged by the prior ALG grant success to develop this new ALG grant proposal to help our students save money on their textbooks with no cost to them.

I strongly support this proposal. This is a very sustainable proposal as CS Department is one of the largest department at KSU with about 1,600 students. We offer multiple sections for particular courses, e.g., CS 3410 Introduction to Database Systems, which covers development and implementation using multiple software that require multiple textbooks. In order to reduce textbook costs and to cover all topics, it is inevitable to create one that suits our curriculum and our students. I am eager to see the outcomes and impacts of this project. Furthermore, I confirm that project's suitability plan (detailed in the Section 7 of the proposal) aligns with the department's continues curriculum improving plan. I believe this new ALG proposal will achieve the same level of students' satisfaction and success as the previous ALG grants accomplished. Lastly, on behalf of Computer Science Department, I fully support this project. Thanks for your consideration of this proposal.

Should you have any questions, please do not hesitate to contact me.

Sincerely;
Coskun Cetinkaya, Ph.D.
Chair and Professor

1100 South Marietta Parkway • Marietta, GA 30060

Email: [cctinka@kennesaw.edu](mailto:cetinka@kennesaw.edu) Phone: 470-578-7606 • cse.kennesaw.edu/cs



College of Computing and
Software Engineering

December 11, 2019

Dear Affordable Learning Georgia (ALG) Grant Reviewers,

It is my pleasure to write this letter in support of the proposal titled “Developing More Affordable No-Cost-To-Student Learning Materials For Required Core Courses in Undergraduate Computer Science Programs (BSCS) – Department-Wide Transformation” submitted by Drs. North, Xu, Lo, Shi, and Shaw from our Computer Science (CS) Department at Kennesaw State University.

In this project, the primary investigators will work as a team to replace existing, costly textbooks in three undergraduate courses with no-cost-to-students learning materials. Their efforts will significantly lower the cost of education for students, saving over \$287k and impacting over 600 students across three years at KSU. This will also generate a positive impact on the retention, progression, and graduation for the College of Computing and Software Engineering. Additionally, given the rapid change of the CS field, having digital materials available to students will improve the ability to keep them updated with the latest advances in the field of computing.

As the proposal mentions, the course materials to be developed support fundamental course within Computer Science – the upper-level database, big data and analytics, and graphics/multimedia courses. These are important courses that are required by CS programs throughout Georgia and the world, so in developing material for this course, the USG will be broadening access for students at other institutions beyond KSU.

In conclusion, I wholeheartedly support this effort to improve access to our CS program. This proposal has the full support of the College of Computing and Software Engineering.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jon A. Preston', written in a cursive style.

Dr. Jon A. Preston
Dean
College of Computing and Software Engineering
Kennesaw State University



**Textbook Transformation Grants, Round Sixteen
(Spring 2020 – Spring 2021)
Proposal Form and Narrative**

Applicant, Team, and Sponsor Information

- The **applicant** is the proposed Project Lead for the grant project.
- The **submitter** is the person submitting the application (which may be a Grants Officer or Administrator).
- The **submitter** will often be the applicant – if so, leave the submitter fields blank.

Institution(s)	Kennesaw State University
Applicant Name	Sarah North, Primary investigator
Applicant Email	snorth@kennesaw.edu
Applicant Phone #	470-578-7774
Applicant Position/Title	Senior Lecturer of Computer Science
Submitter Name	Sarah North
Submitter Email	snorth@kennesaw.edu
Submitter Phone #	470-578-7774
Submitter Position	Senior Lecturer of Computer Science

Application Details

*Proposal Title	Developing More Affordable No-Cost-To-Student Learning Materials For Required Core Courses in Undergraduate Computer Science Programs (BSCS) – Department-Wide Transformation.
*Requested Amount of Funding:	\$30,000
Priority Category (if applicable):	Upper-Level Courses (3000+)
Final Semester	Spring 2021
Course Title(s):	- Introduction to Database Systems, Undergraduate Core Course; - Big Data Analytics, Undergraduate, New CS Track Core Course; - Computer Graphics & Multimedia, Undergraduate, Major Elective
Course number(s):	CS3410, CS4265, and CS4722

	Name	Email Address
Team Member 1	Sarah North	snorth@kennesaw.edu
Team Member 2	Xiaohua Xu	xxu6@kennesaw.edu
Team Member 3	Dan Lo	dlo2@kennesaw.edu
Team Member 4	Yong Shi	yshi5@kennesaw.edu
Team Member 5	Alan Shaw	ashaw8@kennesaw.edu

Additional Team Members (Name and email address for each):

Sponsor Name	Coskun Cetinkaya and Jon Preston
Sponsor Title	Chair of Department of Computer Science and Dean of College of Computing and Software Engineering at Kennesaw State University
Sponsor Department	Computer Science

*Total Number of Student section Enrollments Affected by Project in One Academic Year	623 (See details in Table 1)
*Average Number of Students Section Enrollments Affected per <u>Summer</u> Semester	82 per course section (See details in Table 1)
Average Number of Students Section Enrollments Affected per <u>Fall</u> Semester	218 per course section (See details in Table 1)
Average Number of Students Section Enrollments Affected per <u>Spring</u> Semester	323 per course section (See details in Table 1)
*Original Required Commercial Materials (title, author, price, and bookstore or retailer URL showing price):	<p>CS 3410 - Database Processing: Fundamentals, Design, and Implementation. By David M. Kroenke and David Auer, Prentice Hall, 15th Edition, ISBN-13: 978-0134802749, \$267, Pearson Publisher Company,</p> <p>CS 4265 – Big Data Analytics: Advanced Analytics with Spark Patterns for Learning from Data at Scale, by Sandy Ryza, Uri Laserson, Sean Owen, Josh Wills, 2017 Edition, ISBN: 9781491972908, \$41, O'Reilly Media</p> <p>CS 4722 - Interactive Computer Graphics: A Top-Down Approach with WebGL, 7th Edition, by Edward Angel, University of New Mexico, Dave Shreiner, ARM, Inc. ISBN-13: 978-0262035613, \$153, Pearson Publisher Company</p>

Original Total Cost Per Student	For BSCS core courses (CS 3410 @ \$267 and CS 4265 @ \$41). Total cost per student for core courses will be $267+41=\$308$. For BSCS take one Major Elective's (CS 4722 @ \$153). Total cost per student for major elective will be \$153 . Original total cost per student taken two core courses and one major electives course will be \$461 .
Post-Project Cost Per Student	\$0
Post-Project Savings Per Student	\$461
Projected Total Annual Student Savings Per Academic Year	\$118,069
Using OpenStax Textbook?	Yes

1. Narrative Section

Project Goals

The goal for this proposed Textbook Transformation Grant is to continue our department-wide effort to replace the textbook used in three more BSCS courses (two core and one major elective) with no-cost-to-student learning materials. The aim is to go beyond just cost savings. Include goals for student savings, student success, materials creation, and pedagogical transformation. The Bachelor of Science in Computer Science is one of the largest programs in Kennesaw State University, and it is continuing to grow at a rate of 18% per year. The Department of Computer Science currently has over 40 faculty and 1600 students in various programs, including the Bachelor of Science in Computer Science (BSCS), Bachelor of Arts in Applied Computer Science (BAACS), Minor in Computer Science, Master of Science in Computer Science (MSCS), Graduate Certificate in Computer Science Foundations and Certificate in High Performance Cluster Computing, and Ph.D. in Analytics and Data Science. In this project, we propose to make a department-wide effort to replace the textbooks used in three CS courses (two BSCS core and one CS major elective; the courses are also required by other majors such as Software Engineering, Game Design, and Mechatronic majors—This is the College wide transformation) in the area of science and technology in Introduction to Database Systems, Big Data Analytics (new CS Undergraduate track), and Computer Graphics & Multimedia with no-cost-to-students learning materials to greatly reduce student cost and improve student success rates.

We expect this textbook transformation project to have a profound impact. The graduates from CS have become a major workforce for the local community in the state of Georgia as well as nationwide. Programs from our department also advocate and promote student diversity and multiculturalism. In the past 7 years, more than 1,533 students have graduated from our undergraduate programs. For example, of the students currently enrolled in the BSCS program, 55% are minority students. Over the years, we are continuously improving the quality of our programs while constantly seeking ways to make our programs more affordable so that more good-quality, underrepresented, and career-changing students will be encouraged to apply for and enter our programs.

Many thanks to the prior support of Affordable Learning Georgia in prior grants supporting 6 out of 15 required courses and six out of 22 elective courses in BSCS/MSCS curriculum, with no-cost-to-student learning materials, and the responses from students have been overwhelmingly positive. In this project, we are proposing to continue our department-wide effort to replace the textbooks used in three BSCS courses (two core and one major elective) with no-cost-to-students learning materials. We believe the impact of the proposed project will be significant given the importance of the targeted courses to the BSCS program, and given the fact that this work will further the current department-wide efforts to replace the textbooks used in various courses as CS department grows continuously 18% annually, and given the fact that CS is one of the largest departments in the College of Computing and Software Engineering. The broader goals of this Textbook Transformation project go beyond the important cost savings for students, and they include making improvements to student success, materials creation, and pedagogical transformation.

Notes:

1) Summer, Fall 2020, and Spring 2021 enrollment numbers are projected numbers based on preceding enrollment of our programs in 2019-2020 cited from the school enrollment system, owlpress.kennesaw.edu.

2) If there are multiple sections in a semester, we put a total number of students followed by a parenthesis that includes the section id and enrollment number of each section.

Table 1. 2020-2021 Projected Student Enrollment Data

Course	Course Offering	Summer 2020	Fall 2020	Spring 2021	Sections to be Offered	Total Number of Enrollment
CS 3410 Introduction to Database Systems Sarah & Xiaohua	Each semester	38 Section W01(38)	153 Section 01(38) Section 02(37) Section 03(38) Section W01(40)	152 Section 01(39) Section 02(35) Section W01(38) Section W02(40)	9	343
CS 4265 Big Data Analytics (Undergraduate New CS Track) Dan & Yong	Each semester	24 Section 01(24)	65 Section 01(30) Section 02(35)	57 Section 01(24) Section 02(33)	6	146
CS 4722 Computer Graphics & Multimedia Alan	2 Times per year	20 Section 01(20)	0 No offering	114 Section 01(39) Section 02(37) Section 03(38)	4	134
TOTAL		82	218	323	19	623

Table 2. Summary of Savings with No-Cost Learning Material

Courses	Textbook Used (complete textbook information including title, authors, ISBN, etc.)	Cost per Student (textbook price)	Projected Enrollment Per section (from table 1)	Projected Costs
CS 3410	Database Processing: Fundamentals, Design, and Implementation. By David M. Kroenke and David Auer, Prentice Hall, 14th Edition, ISBN-13: 978-0134802749, \$267, Pearson Publisher Company	\$267	343	\$91,581
CS 4265	Big Data Analytics: Advanced Analytics with Spark Patterns for Learning from Data at Scale, by Sandy Ryza, Uri Laserson, Sean Owen, Josh Wills, 2017 Edition, ISBN: 9781491972908, \$41, O'Reilly Media	\$41	146	\$5,986
CS 4722	Interactive Computer Graphics: A Top-Down Approach with WebGL, 7th Edition, by Edward Angel, University of New Mexico, Dave Shreiner, ARM, Inc. ISBN-13: 978-0262035613, \$153, Pearson Publisher Company .	\$153	134	\$20,502
Total			623	\$118,069

Note: The prices of the textbooks are referenced from authors' websites.

In Summary, the objectives of the proposed ALG project are as follows:

- Create the BSCS programs more affordable by eliminating the textbooks used in three CS courses (two core courses and one major elective). By doing so, the BSCS programs can better support the lowering of costs for students at CCSE/KSU.
- Develop free, up-to-date, and well-designed learning material for the three significant core and elective proposed BSCS courses. By doing so, the BSCS program can better support the career-changing students and future boost female and minority participation.
- Teach the proposed courses using the developed learning material and validate those material offers equal, interactive, and/or better learning effectiveness that textbooks offers.
- Develop a sustainability plan to ensure the no-cost learning material will be continuously maintained and used in future course offerings.
- The Strategic Plan for the Computer Science Department is to have our complete BSCS programs completely no-cost or low-cost for all courses.

2. Statement of Transformation

Statement of Problem

Teaching with high expectation has been the goal of the BSCS curriculum of the Computer Science (CS) program since inception. Given the dynamic and ever-increasing pace of innovation in Computer Science

and Technology, it is imperative for us to update the curriculum of CS programs frequently. Therefore, we need to constantly update our courses or create new courses to stay in the cutting edge of technology and competition.

Unfortunately, traditional textbooks used in the core and major elective courses mentioned above are not only expensive, but also insufficient to convey adequate and up-to-date knowledge to students. Furthermore, instructors who teach the core courses have to constantly add new materials to their courses in addition to what's covered in the textbook to keep up with ever-changing state of the fields involved. Consequently, the no-cost-learning-material model fits much better for the CS courses.

In the CS 3410 Intro to Database Systems, we will focus on fundamental programming concepts of database design, development, and implementation which covers algorithms and tools that are needed to create databases and their applications. Unlike typical database curriculum which covers how to use databases, we also target the data modeling and architectural principles involved in building databases to better educate students in the design, development, and implementation of database applications.

In the CS 4265 Big Data Analytics (a required core course for a new CS concentration), unlike existing free learning sources, we will cover the practical aspect of each data analytics algorithm with a real world dataset. Each of the learning module to be developed will be designed in a self-contained package with prior knowledge included. This pedagogical model will increase the effectiveness of the learning modules being adopted and integrated easily and seamlessly elsewhere.

For the CS 4722, Computer Graphics and Multimedia, we will cover the design and implementation of state-of-art computer graphics rendering methods for modern visual multimedia systems. It is imperative to provide wide variety of programming projects and materials and to fulfill the required curricular and to provide students with active learning opportunities that will aid in their being successful.

The total cost of the proposed textbooks for these courses is about \$460, even though one single textbook for each course is not going to cover all of the materials that are needed for the students to be successful or to fulfill all of the curricular goals and student learning outcomes.

Therefore, in order to reduce the high cost of the textbook for students, at the end of the Fall 2019 semester we conducted a survey among students to assess their usage of the textbook, their satisfaction with the textbook, and any improvements to be made that they could suggest.

- Among the 146 students who took the courses, 134 completed the survey and the response rate was 94%. Results of the survey indicated the respondents would very much appreciate it if the textbook was free.
- However, when asked how they currently use resources from their textbook, about 30% of them never used the resources. For those who did use the resources, only about 50% found them very useful or useful at all.
- When asked what could be done to improve the textbook, their responses reveal the following major issues they wish could be addressed:
 1. Some course topics in the textbook could be too rambling and lengthy;
 2. Some book chapters are comprised predominantly of text and plain graphs, which are neither easy to absorb nor engaging;
 3. There are not sufficient relevant examples explaining the course concepts;
 4. There are not sufficient practice questions at the end of each book chapter.
 5. The book covers too much redundant information and using it as it is does not exactly align with the learning objectives of the class;
 6. The questions from the test bank that comes with the textbook do not accurately assess the learning outcomes of the course;

7. There are discrepancies between book chapters and lecture slides provided due to a lack of discussion or complete omission of critical information in the slides.

Statement of Transformation

During the past two years, the Department of Computer Science has been a big advocate of no-cost-learning material since ALG was introduced to us. The faculty of the CS department has transformed over a dozen CS courses at both undergraduate and graduate level with the support of ALG. A few of our ALG awards, e.g., round 12 award #2582-375 and round 14 award #3366-440, are coordinated at the department level. Moreover, the responses for those renovated with no-cost-learning-material courses have been overwhelmingly positive from the students.

The massive positive responses from the students, our past ALG grant accomplishments, and the nature of the CS discipline allow us to aim to continue transforming more CS courses using no-cost learning material. This project aims to replace the textbooks used in the three proposed BSCS courses with no-cost-to-students learning materials that offer equal or higher educational effectiveness benefits.

Textbook Transformation Grants are awarded to teams focused on creating meaningful changes. This section allows teams to describe why the ALG project is important to award to the particular set of courses that are being proposed.

First and foremost, Database Systems, Big Data Analytics (which became a new CS Track) and Computer Graphics and Multimedia are all important branches of the CS curriculum, and they will effect over 600 students and save about \$460 on textbook for each student each year.

Secondly, it is important to note that in the field of Computer Science in the modern day, there are numerous learning materials essential to the content of the proposed BSCS courses that are widely and readily available as open-source and free of charge materials. For example, in CS 3410, Database Processing, we use tools and open source resources such as Amazon Aurora, which is a MySQL and PostgreSQL-compatible relational database built for the cloud [8] that combines the performance and availability of traditional enterprise databases with the simplicity and cost-effectiveness of open source databases for free. Furthermore, many faculty members already have to use web-based contents as supplemental materials to the textbook.

Our third point is that because of the innovative nature of Computer Science, critical knowledge areas are continuously changing and quickly being updated, and free resources available online are more advantageous than traditional textbooks in keeping up with this fast pace of change. In fact, our instructors have already been researching and identifying appropriate and related no-cost web content to be used in the BSCS and MSCS courses involved in this project. For example, in CS 4265, Big Data Analytics, the course already uses good quality free online textbooks such as "Big Data, Data Science" by Brendan Martin, MIT Press, 2016, and books in data science from other websites (e.g., [1], [3]).

Our fourth point is that resources from the Web are generally more interactive. This not only allows the subject matter and content to be more engaging for our students, but it also improves their learning experience. As instructors, we play an important role in selecting, organizing and delivering educational content from the vast amount of information available from the web and open source resources in an attempt to match it with the classroom learner's background knowledge (e.g, [2]). In particular, we seek to develop hands-on labs and assignments with various tools and methods in order to help students become well prepared for what they will experience in the job market, and to advance their higher education and career goals. For example, there are books and manuals available on how to become a [5, 6] Big Data Analysis Practitioner or Developer (CS4265), but they may not directly apply to undergraduate students who are in need of effective hands-on learning.

Our fifth point is that by designing our own lecture notes, study guides, PowerPoint presentations, instructional/tutorials content videos, online and offline reading materials, assignments and exercises, and assessment tools, we gain the ability to dynamically adjust our courses so that they will always be consistent with the outcomes of our BSCS programs. For example, we use state-of-the-art technologies involving computer graphics rendering and visual multimedia systems in CS 4722, Computer Graphics and Multimedia, in order to implement 3-dimensional graphical applications and interactive multimedia applications. And in that course, we make use of free [e.g.,7] lecture notes by MIT Press [e.g., 4] in computer graphics to provide students with hands-on lab and assignments that use tools and methods that prepared them well for the job market and for pursuing more advanced courses.

Finally, our last point is that our project team is well prepared for the proposed transformation to the courses since the majority of our team members have more than 12 years of teaching experience, and we are all experts in searching through the unorganized mass of data on the Internet for our courses to find material that makes use of state-of-the-art content and techniques.

All CS courses are assessed every year as part of the continuous improvement process. In addition, the project leader, Dr. Sarah North, successfully completed the ALG Round Twelve grants. As part of a department-wide effort, we have together proposed to transform three CS courses using no-cost-to-student learning materials. Building on our previous successful experience, we are well positioned to continue the transformation efforts and further increase the cost saving benefits to the students in BSCS programs.

Impact of the Transformation:

The impact of our transformation efforts will be profound. By our estimates, around 623 students will benefit from the no-cost learning material each year. The proposed project is expected to save students \$118,069 in textbook cost each year and over three years, the textbook cost saving for undergraduate courses with no-cost-to student learning materials will be over \$300K. Because of the cost savings from not having to buy textbooks, students may be able to take a few more courses each year and graduate sooner. Having a series of CS required elective courses adopting no-cost-to-student material not only offers better and more up-to-date learning experience for students, but also makes our nationally renowned CS programs more affordable.

As a result of this, we could recruit more students, and produce more qualified CS professionals. Developing no-cost-to-student materials can help us better align course content with its learning outcomes and outcomes of our program, which will create positive impact in terms of curriculum development. Moreover, the learning materials developed in this proposal will be made available to the public and can be easily adopted by other programs or institutions who want to lower the cost of education to their students. Furthermore, we believe that the experience we gain in this transformation project could be beneficial to the academic community. We presented our previous ALG grant experience in the conference – IEEE Southeast 2020, etc. And we submitted a proposal to host a panel discussion to discuss the no-cost-to student learning materials in the Annual Open Education Conference (OpenEd’ 2020).

References

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3. Transformation Action Plan

Textbook Transformation Grant projects can be work-intensive and require project management in order to be successful. This section allows teams to describe how the team will fulfill the goals of the project. The activities expected from each team member and their role(s): subject matter experts, instructional designer, instructor of record, et al.

Build on our preceding experience of developing no-cost to student learning materials and with a coordinated effort, our team of investigators plan to carry out the following activities to transform the three proposed BSCS two core CS and one major elective courses to completely develop the no-cost learning materials. We will plan our textbook transformation process in three stages:

Phase 1: Initial Preparation

- Analyze and complete the modification of course syllabi and no-cost materials
- Revising the content to make it better aligned with the course learning objectives and BSCS program outcomes;
- Integrating interactive multimedia learning materials to better engage students and facilitate their learning;
- Developing assessment to help students reinforce their learning and achieve the intended learning outcomes.
- Research and identify no cost readings for each of the learning modules in each course. The reading list includes both required readings and optional readings. All of these readings will be publicly accessible, free to use, or openly sourced.

Phase 2: Implementation

- Map and design no-cost-to-students learning materials to learning modules of each course
- Include materials that are required for our program, which not a single existing textbook will cover all information needed to succeed in the course.
- Review pre-requisite knowledge to improve student learning experience.
- Establish link concepts to real world applications with hands-on exercise.
- Design PowerPoints and video recordings for all learning modules of each course using no-cost-to-students learning materials
- Develop test banks, study guides, and lecture notes for students' use to review course content and key learning points with no-cost-to-students learning materials.
- Design assignments, labs and projects using no-cost-to-students learning materials
- Reconstruct the proposed three BSCS courses on the KSU official D2L Brightspace site
- The responsibilities of each investigator is described in Table 3. Here is a table that shows the responsibilities of each investigator involved in this project:

Phase 3: Evaluation and promotion

- Evaluate and measure our textbook transformation project using student surveys, official course evaluations and student performance data of Summer, Fall 2020 and Spring 2021 semesters in compare the results with those from 2019;
- Continuously update course learning modules using no-cost-to-students materials based on evaluation and feedback
- Evaluate the change of retention rate compared to previous academic year of 2019
- Present our work to a wide range of audiences through conference and workshop presentations
- Plan for providing open access to the new materials using OpenStax CNX, recommended by ALG program directors.

Table 3. PIs' Roles and Responsibilities

Primary Investigators	Courses	Responsibilities	Hosting Site
Dr. Sarah North and Dr. Xiaohua Xu	CS 3410 (Introduction to Database Systems)	Project Lead, Subject Matter Expert, and developer; instructor of record; Introduction to Database Systems.	OpenStax CNX
Dr. Dan Lo and Dr. Yong Shi	CS 4265 (Big Data Analytics)	Subject Matter Expert and developer; instructor of record; Big Data Analytics, Mobile Computing	OpenStax CNX
Dr. Alan Shaw	CS 4722 (Computer Graphics & Multimedia)	Subject Matter Expert and developer; instructor of record; Graphics & Multimedia, Mobile Computing, and Game Design.	OpenStax CNX

4. Quantitative and Qualitative Measures

Our plan is to assess the effectiveness of our project both quantitatively and qualitatively, including comparisons of students' performance before (student performance data from the academic year of 2019 will be collected) and after the adoption of no-cost-to-students learning materials, surveys, comparison of course-level retention, etc.

We intend to use aggregated data in the analysis and final report. The performance data will be collected after the no-cost learning material is implemented for a proposed course, which is referred as the current performance data. For each of the measurement, we plan to conduct two levels of analysis.

- We will measure the impact of the project by collecting data on students' usage of the textbook and learning materials, students' satisfaction with them, students' performance, and course-level retention.
- Compare the current performance data to a preset goal. For example, 80 % is the aimed passing rate as the courses involved are graduate courses. A letter grade of B or better will be considered as a passing grade.
- Compare the current performance data to those from past offerings where the textbooks were used. The student performance data from the sections last taught using the textbooks will be used as the baseline.

- All proposed courses will use the same survey, and the survey will be distributed at the end of implementation semester for a proposed course. The proposed survey consists of a mixture of quantitative and qualitative measures including:
 - Student perception and attitude toward no-cost materials.
 - Quantitative ratings of the no cost materials used in this course.
 - Qualitative measures such as open-ended questions for comments and suggestions.
 - Official student course evaluation from the university. The student course evaluation can also provide some insights on the effectiveness of no-cost learning material used in the proposed BSCS courses.

Table 4. Quantitative and Qualitative Measures

	Source –Action Plan	Description
1.	Comparison of student performance before and after using no-cost-to-students learning materials (Quantitative Measures)	We use the grades to analyze the change of student performance in the following categories: <ul style="list-style-type: none"> • Homework grades • Project grades • Presentation grades • Lab grades • Individual questions in midterm and final exams
2.	Midterm student survey on no-cost-to-students learning materials (Qualitative Measures)	We will conduct a survey of students’ opinions on using the no-cost-to-students learning material in the middle of each semester. This is to gather students’ feedback so we can dynamically adjust our course content according to students’ suggestions and recommendations. The questions involved in this survey will include but not be limited to: <ol style="list-style-type: none"> 1. What do you think of the new no-cost-to-students learning material we used so far for this course? 2. Do you prefer the new way of using no-cost-to-students learning material or the traditional way of using hardcopy textbooks? 3. What improvements would you suggest we can make regarding our no-cost-to-students learning material delivery? 4. Do you think you will learn more or less knowledge using no-cost-to-students learning materials? 5. Do you think your grade will be improved using no-cost-to-students learning materials?
3.	Official student evaluation (Quantitative and Qualitative Measures)	The official student evaluation provided by KSU will also be used to gather information of students’ opinions on using no-cost-to-students learning materials as well as the way instructors are teaching no-cost-to-students learning materials. Qualitative measures such as open-ended questions for comments and suggestions.
4.	Retention (Quantitative Measures)	We will compare the drop rate, fail rate, and withdrawal rate before and after using no-cost-to-students learning materials to see how the new method impacts course retention.

5.	End-of-term student survey on no-cost-to-students learning materials (Qualitative Measures)	<p>We will also conduct a survey of students' opinions on using the no-cost-to-students learning material again by the end of each semester. Feedback gathered in this survey will be used to adjust the course content and arrangement of no-cost-to-students learning material for the following semester. The questions involved in this survey will include but not be limited to:</p> <ol style="list-style-type: none"> 1. What changes of no-cost-to-students learning material would you suggest if this course is offered again? 2. What is your expected grade for this course? 3. Would you prefer we redesign more courses in BSCS (MSCS) using no-cost-to-students learning material? What would you say the impact to the program will be if we do so?
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5. Timeline

The table below shows the detail step-by-step progress of this project including a list of major milestones Aligned with the Transformation Action Plan.

Table 5. Timelines and Milestones

Milestone dates	Milestone
02/24/2020 Spring 2020 <ul style="list-style-type: none"> • Designing and developing visuals for the content • Redesigning course presentation slides • Developing an online test bank 	<ol style="list-style-type: none"> 1. Attend the Kickoff Meeting in Middle Georgia State University Hatcher Conference Center (2/24); 2. Complete the modification of course syllabi, analyze the consistency between no-cost-to-students learning materials, course learning outcomes, and BSCS program outcomes; 3. 1st) Progress report 1
03/01/2020	<ol style="list-style-type: none"> 1. Map and design no-cost-to-students learning materials to learning modules of each course, design assignments, labs and projects using no-cost-to-students learning materials, redesign exams that are consistent with no-cost-to-students learning materials; 2. 2nd) Progress report 2
04/01/2020	<ol style="list-style-type: none"> 1. Complete the update of course learning modules, assignments, labs, projects, PowerPoints, etc. on the official KSU D2L Brightspace; 2. Complete the design of midterm and end of term survey for students' feedback; 3. 3rd) Progress report 3
06/24/2020 Summer 2020 <ul style="list-style-type: none"> • Verifying content from the OpenStax textbook and other resources that align with the course objectives 	<ol style="list-style-type: none"> 1. Conduct the midterm survey for Summer 2020, gather students' feedback; 2. Adjust the course content with no-cost-to-students learning materials based on the midterm survey; 3. Attend Conference and present our research work (tentative); 4. 4th)Progress report 4
07/24/2020	<ol style="list-style-type: none"> 1. Conduct the end of term survey for Summer 2020, gather students' feedback; 2. Compare student performance before (spring 2019) and after using no-cost-to-students learning materials; 3. Adjust the course content with no-cost-to-students learning materials based on 1st) 2nd) and 3rd).
09/24/2020	<ol style="list-style-type: none"> 1. Conduct the end of term survey for Fall 2020, gather students' feedback 2. Conduct the official student evaluation for Fall 2020

Fall 2020 <ul style="list-style-type: none"> • Designing and developing interactive multimedia supplementary materials. • Designing and developing a web site to present the learning materials 	<ol style="list-style-type: none"> 3. Compare student performance before and after using no-cost-to-students learning materials; 4. Adjust the course content with no-cost-to-students learning materials based on 1st) 2nd) and 3rd); 5. Progress report 6
10/24/2020	<ol style="list-style-type: none"> 1. Conduct the midterm survey for Fall 2020, gather students' feedback; 2. Adjust the course content with no-cost-to-students learning materials based on the midterm survey; 3. Attend Conference 2020 and present our research work (tentative) 4. Progress report 7
12/10/2020	<ol style="list-style-type: none"> 1. Conduct the end of term survey for fall 2020, gather students' feedback; 2. Conduct the official student evaluation for Fall 2020; 3. Compare student performance before (fall 2019) and after using no-cost-to-students learning materials; 4. Adjust the course content with no-cost-to-students learning materials based on 1st) 2nd) and 3rd); 5. Complete and submit research work to education conferences.
03/05/2021 Spring 2021 <ul style="list-style-type: none"> • Offering proposed courses with the improved textbook, the newly-developed learning. materials, and the test bank • Collecting data on student usage, student satisfaction, and student performance 	<ol style="list-style-type: none"> 1. Conduct the final survey for Spring 2021, gather students' feedback; 2. Adjust the course content with no-cost-to-students learning materials based on the midterm survey; 3. Attend IEEE Southeast Conference and present our research work (tentative); 4. Adjust the course content with no-cost-to-students learning materials based on 1st) 2nd) and 3rd); 5. Complete and submit research work to education conferences.
05/10/2021	Compile and Submit the final project report

6. Budget

The budget and justification table 6, lists the responsibility and compensation for each investigator in our team. We estimate that each investigator (the coordinator of corresponding course(s)) will spend more than 100 hours in designing the no-cost-to-students learning materials, designing mid-term and end-of-term student surveys, updating and maintaining course curricula using no-cost-to-students learning materials, assessing course outcomes, and coordinating the work progress of instructors teaching different sections of the same course using the new no-cost-to-students learning materials.

Table 6. Budget and Justification

Team Members	Role and Responsibilities	Investigator's Compensations
Dr. Sarah North	Project Lead, Developer and instructor of record for CS 3410	\$5000 for Summer Salary
Dr. Xiaohua Xu	Developer and instructor of record for CS 3410	\$5000 for Summer Salary
Dr. Dan Lo	Developer and instructor of record for CS 4265	\$5000 for Summer Salary
Dr. Yong Shi	Developer and instructor of record for CS 4265	\$5000 for Summer Salary
Dr. Alan Shaw	Developer and instructor of record for CS 4722	\$5000 for Summer Salary

Budget for Investigators Compensation

1. Total investigators compensation will be $\$5000 * 5 = \mathbf{\$25,000}$.
2. Travel & Other Expense will be **\\$2,500**, of which \$800 is the expense for two team members to attend the Kickoff Meeting at Middle Georgia State University Hatcher Conference Center on February 24, 2020, and the remaining \$1,700 is budgeted for attending another conference related to the course development involved in this project such as IEEE Southeast 2020 and related conferences.
3. Equipment (computers, tablets, or related Technologies): **\\$2,500**, of which \$2000 will be used for purchase of computers, webcams and microphones for the team to build and test no-cost-to-students learning materials
4. **Total Budget: \$30,000.**

7. Sustainability Plan

The CS Department at Kennesaw State University continues to grow each year by over 18%, and its sustainability plan aligns with our College-wide and Department-wide efforts to continuously improve the quality of teaching. For each course taught in the Department of Computer Science at KSU, a coordinator/designer is assigned who is responsible for the course content maintenance and updates, course teaching, and coordinating instructors teaching different sections of the same course in a semester in ways that have department-wide impact. This means we will not only design and develop the no-cost-to-students learning materials and be the first ones to teach the course(s), but we will also monitor the course teaching for following semesters to make sure the course teaching is consistent. Each of us will write a course related tutorial which describes the arrangement of course content using no-cost-to-students learning materials for future instructors. All course related materials will be available at the official KSU D2L Brightspace site as well as the department depository to make sure that any future instructor for a course has access to the no-cost-to-students learning materials.

Moreover, the developed course content will not only be available on our learning management system, D2L, but it will also be archived on our CS Department's server. It is also our department policy that there are at least two faculty who regularly teach a course. This further ensures the developed learning material will be continuously used and updated even if there is personnel turnover. In addition to the course designer arrangement and course related no-cost-to-students learning materials availability within the Department of Computer Science, each semester, our department also organizes a day-long event for course assessment. The purpose of this assessment is to evaluate the student learning outcomes of each course and update course content using no-cost-to-students learning materials according to the evaluation. This process allows us to continuously improve our courses using no-cost-to-students learning materials. At the end of each semester, we also invite industry experts to our student project presentation meetings, and we ask them to evaluate the student projects and presentations from the courses using no-cost-to-students learning materials.

We will use the comparison of student performance data before and after using no-cost-to-students materials, student feedback, and evaluation from the industry experts to continuously improve the no-cost-to-students learning materials in our BSCS courses. As the first textbook transformation project in the Department of Computer Science, we hope this project will serve as a pioneer and that the success of this project will encourage many more future textbook transformation projects in the Department of Computer Science at KSU. We also plan to submit research work based on our textbook transformation project to education conferences such as SIGCSE and IEEE Southeast and present our work to a wide range of audiences.

We will assess the effectiveness of the textbook and the learning materials on student learning. We will develop a workshop for faculty at KSU to share our experiences with the design and development of the open educational resources (OER). We will also submit a proposal to a national or international conference to share our experiences with the OER community.

Our textbook transformation project is also supported by our department chair and the dean of our colleges as shown in their support letters to further ensure the sustainability of our transformation plan.

Note: Letter of Support

Attach are two letters of support. One is from the Chair of the Department of Computer Science and Dean of the College of Computing and Software Engineering.

I understand and acknowledge that acceptance of Affordable Learning Georgia grant funding constitutes a commitment to comply with the required activities listed in the RFP and that my submitted proposal will serve as the statement of work that must be completed by my project team. I further understand and acknowledge that failure to complete the deliverables in the statement of work may result in termination of the agreement and funding.