**Grants Collection**
Kennesaw State University

UNIVERSITY SYSTEM OF GEORGIA

Rebecca Rutherfoord, Dawn Tatum, Susan VandeVen, Richard Halstead-Nussloch, James Rutherfoord, and Zhigang Li

# Hardware and Software

Affordable Learning Georgia

Georgia's Virtual Library GALILEO
An Initiative of the University System of Georgia

# Grants Collection

Affordable Learning Georgia Grants Collections are intended to provide faculty with the frameworks to quickly implement or revise the same materials as a Textbook Transformation Grants team, along with the aims and lessons learned from project teams during the implementation process.

Each collection contains the following materials:

- Linked Syllabus
  - The syllabus should provide the framework for both direct implementation of the grant team's selected and created materials and the adaptation/transformation of these materials.
- Initial Proposal
  - The initial proposal describes the grant project's aims in detail.
- Final Report
  - The final report describes the outcomes of the project and any lessons learned.

# Initial Proposal

## Application Details

## Manage Application: Textbook Transformation Grants: Round Eleven

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| **Award Cycle:** | Round 11 |
| **Internal Submission Deadline:** | Tuesday, January 23, 2018 |

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| **Application Title:** | 354 |
| **Application ID:** | 002074 |
| **Submitter First Name:** | Rebecca |
| **Submitter Last Name:** | Rutherfoord |
| **Submitter Title:** | Department Chair, Professor of IT |
| **Submitter Email Address:** | brutherf@kennesaw.edu |
| **Submitter Phone Number:** | 470-578-7399 |
| **Submitter Campus Role:** | Proposal Investigator (Primary or additional) |
| **Applicant First Name:** | Rebecca |
| **Applicant Last Name:** | Rutherfoord |
| **Applicant Email Address:** | brutherf@kennesaw.edu |
| **Applicant Phone Number:** | 470-578-7399 |
| **Primary Appointment Title:** | Department Chair, Professor of IT |
| **Institution Name(s):** | Kennesaw State University |
| **Co-Applicant(s):** | Dr. Richard Halstead-Nussloch, Prof. Dawn Tatum, Prof. Susan VandeVen, Prof. James Rutherfoord, Zhigang Li |
| **Submission Date:** | Tuesday, January 23, 2018 |

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| **Proposal Title:** | 354 |
| **Proposal Category:** | No-Cost-to-Students Learning Materials |
| **Final Semester of Instruction:** | Fall 2018 |
| **Are you using an OpenStax textbook?:** | No |

**Team Members (Name, Email Address):**

Dr. Becky Rutherfoord - brutherf@kennesaw.edu

Dr. Rich Halstead-Nussloch - rhalstea@kennesaw.edu

Prof. Dawn Tatum - dtatum7@kennesaw.edu

Prof. Susan VandeVen - svandev@kennesaw.edu

Prof. Jim Rutherfoord - jruther3@kennesaw.edu

Dr. Zhigang Li - zli8@kennesaw.edu

**Sponsor, (Name, Title, Department, Institution):**

Dr. Rebecca H. Rutherfoord

Interim Assistant Dean of the College of Computing & software Engineering, and Department Chair, Information Technology

Information Technology Department

Kennesaw State University

**Course Names, Course Numbers and Semesters Offered:**

IT 3123 - Hardware/Software Concepts- every semester - 3 fall, 3 spring, 2 summer

IT 3223 - Software Acquisition & Project Management- every semester - 3 fall, 3 spring, 2 summer

IT 4683 - Management of IT & Human Computer Interaction- every semester - 2 fall, 2 spring, 2 summer

IT 4723 - IT Policy and Law- every semester, every semester - 2 fall, 2 spring, 2 summer

CSE2300 - Discrete Structures- every semester - 4 fall, 4 spring, 2 summer

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|---|---|
| **List the original course materials for students (including title, whether optional or required, & cost for each item):** | 1. IT 3123, The Architecture of Computer Hardware, Systems Software, and Networking: An Information Technology Approach, Englander, 5th edition, John Wiley and Sons, 2014; ISBN-13:978-1-118-32263-5; required; cost: $150.00; yearly enrollment: 225; total cost: $33,750.2. IT 3223, a) Guide to Software Development, Springer Pub., ISBN 978-1-4471-2299-9; required; cost: $101.20; yearly enrollment 245; total cost: $24,794 b) Fundamentals of Project Management, 4th edition, AMACON; ISBN 978-0-8144-1748-5; required; cost: $18.75; yearly enrollment 245; total cost: $4593.75. Total for class cos: $29,387.75.3. IT 4683, Using MIS 2017, Kroenke, 10th edition, ISBN 978-0-1346-0699-6; required; cost $223.15; yearly enrollment 90; total cost: $20,083.50.4. IT 4723, The Legal Environment of Business and Online Commerce, 8th edition, Cheeseman, Prentice-Hall, ISBN: 978-013-397-3310; cost: $148.15; yearly enrollment 140; total cost: $20,741.5. CSE 2300, Discrete Mathematical Structures, 6th ed, Pearson, ISBN: 978-0-13-469644-7; cost: $94.97; yearly enrollment 425; total cost: $40,362.25All cost of books are prices for new books. |
| **Average Number of Students per Course Section:** | 29.6 |
| **Number of Course Sections Affected by Implementation in Academic Year:** | 38 |
| **Average Number of Students Per Summer Semester:** | 216 |
| **Average Number of Students Per Fall Semester:** | 420 |
| **Average Number of Students Per Spring Semester:** | 425 |

| | |
|---|---|
| **Total Number of Students Affected by Implementation in Academic Year:** | 1125 |
| **Requested Amount of Funding:** | 30,000 |
| **Original per Student Cost:** | $736.22 |
| **Post-Proposal Projected Student Cost:** | 0 |
| **Projected Per Student Savings:** | $736.22 |
| **Projected Total Annual Student Savings:** | $144,324.50 |

**Creation and Hosting Platforms Used ("n/a" if none):**

Kennesaw State University D2L Brightspace

**Project Goals:**

In this project, we propose to take a department-wide effort to transform five required undergraduate Information Technology major courses using no-cost-to-students learning material. This project not only aims to reduce the financial burden imposed by high cost of textbooks, but also strives to develop free and open-access learning materials that offer equivalent or better educational effectiveness than traditional textbooks. These courses will then be sent through the campus Quality Matters rubric to meet institutional standards of excellence as the Information Technology degree can be completed face-to-face or completely online.

Goals:

1. Transform five required undergraduate IT major courses using no-cost-to-students learning materials

2. Create Quality Matters “ready” courses to meet institutional standards of excellence for face-to-face and online courses.

**Statement of Transformation:**

Research According to Priceonomics (http://priceonomics.com/which-major-has-the-most-expensive-textbooks/), an average undergraduate student annually spends $1,200 on textbooks. In addition, out of 31 majors at the University of Virginia, Computer Science (and IT) comes in 8th for the most expensive books. On the other side, the University of Virginia reports that Computer Science (and IT) textbooks only have a 25% resale value based on the original price. The highest resale value for other majors is up to 70%. Previous ALG Grant Information

One Team members was part of the round two of an "Affordable Learning Textbook Transformation Grant" in 2015 (round two, award #119). They designed and evaluated the effectiveness of no-cost-to-students learning materials for database courses in the IT department, and saved students $110,419. The assessment results showed that the developed free material offered equivalent or better learning experience than the textbooks did. The preliminary results of the grant were published in the Proceedings of Southern Association for Information Systems Conference (SAIS 2016), the final results were published in the Proceedings of the ACM Special Interests Group in IT Education (SIGITE 2016), "Transforming IT Education with No-Cost Learning Materials". They also hosted a panel discussion on no-cost learning material in IT education, at SIGITE in October 2016. The panel attracted a lot of attention among computing faculty. Many colleagues from different states were impressed with the USG initiative and with course material developed by the team. Building on our past success and lessons learned from the prior ALG grant, we will continue our transformation efforts by developing no-cost learning material for five required undergraduate IT courses. The Stakeholders There are two primary sets of stakeholders for this proposal – the students taking the five required IT classes (both in-class and online students), and the faculty developing and teaching those courses. The high cost of textbooks puts a large financial burden on students and may become a road-block for students' ability to finish their education. Our team of investigators strives to make higher education more affordable to the students. The information technology required courses listed for this grant proposal have resources that are publicly accessible, free, or with an open license to use. These materials include open and free tutorials, books, videos, labs, software, and services. One of the major problems with using regular textbooks for IT courses is that information technology material is constantly changing. Textbook publishing cannot keep up with these fast changes in the technology field. In addition, tools and software packages that are part of a textbook also become obsolete. As soon as a new version of a tool or software package is released, the instructions in a textbook become obsolete. Therefore, we need to include the latest available tools to prepare hands-on labs. Digital delivery of the learning materials makes it easier to keep the content up-to-date. Developing and assembling a set of learning materials for major courses is a unique approach. It will allow us to better align the learning material not only with the outcomes of each course, but also with the outcomes of the Information Technology program. Compared to traditional textbooks, the open source software and web resources have many benefits: 1) the Web resources are generally free to use; 2) they are constantly being updated and always reflect the latest trends and industrial development; and, 3) the materials from the Web are also more dynamic and interactive. The pitfalls of Web resources are that they are often disorganized and may contain inaccurate information. However, members of our team of investigators are not only subject matter experts in the information security field, but also proficient educators who on average have more than 10 years teaching experience including online teaching. We will select, organize and integrate resources from the web and transform the information into instructionally sound learning materials for the proposed courses including content that the team members develop themselves. We strongly believe that the new learning materials will offer up-to-date,

equivalent or better learning effectiveness compared to the original textbooks. Digital delivery also allows us to add interactive elements into the learning materials. The interactive content will not only engage the students, but also improve their learning experience. It will help to enhance the learning outcomes and learning satisfaction. The Impact The impact of our transformation efforts will be profound. By our estimates, more than 1125 students will benefit from the no-cost learning material each year. Moreover, it will benefit more students in the Bachelor of Science in Cybersecurity (eMajor) approved by the Board of Regents. One of the required courses proposed for this grant is also part of the BS in Cybersecurity. Student numbers are not included for the cybersecurity degree in this grant, but the expectation is that there will be an additional 120 students for this course per year within two years. The goal of eMajor is to reduce the cost of education by using prior learning assessments, lower tuition and potentially no-cost learning materials (https://emajor.usg.edu). The proposed project is expected to save current students $144,324.50 in textbook costs each year (not counting the cybersecurity savings). 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 required IT courses adopting no-cost-to-student material not only offers better and more consistent learning experience to students, but also makes our nationally renowned IT programs more affordable. As a result, our IT programs could recruit more students and produce more qualified IT professionals that Georgia needs. Our experience gained in this transformation project could be useful to other programs or departments who want to lower the cost of education to their students in IT programs across Georgia. In summary, we believe the proposed project will have a positive impact in students' retention, progression, and graduation at program, department and institution levels. As shown in the following table, the textbooks used in the five required IT undergraduate major courses are expensive. In fact, most textbooks used in Information Technology are costly in general. In addition, due to the fast evolving nature of the technology field, the textbooks used in the proposed courses are updated frequently, which negatively impacts their resale value to the students. The goal of our transformation is to replace the textbook used in the proposed courses with no-cost-to-students learning materials that offer equal or higher educational effectiveness. Data Table 1: Enrollments and Projected 2018 Enrollments of 5 IT courses Course Spring 2017 Summer 2017 Fall 2017 Total Projected 2018 Enrollment Number of Sections Total Number of students IT3123 93 40 78 211 8 225 IT3223 112 39 84 235 8 245 IT4683 0 41 41 82 6 90 IT4723 50 38 47 135 6 140 CSE2300 170 58 170 398 10 425 Total 425 216 420 1061 38 1125 As shown in the following table, the textbooks used in the five required IT undergraduate major courses are expensive. In fact, most textbooks used in Information Technology are costly in general. In addition, due to the fast evolving nature of the technology field, the textbooks used in the proposed courses are updated frequently, which negatively impacts their resale value to the students. The goal of our transformation is to replace the textbook used in the proposed courses with no-cost-to-students learning materials that offer equal or higher educational effectiveness. Table 2: Costs of Current Textbooks for 5 IT Courses Course Textbook Used Cost per Student Projected Enrollment Projected Costs IT3123 IT 3123, The Architecture of Computer Hardware, Systems Software, and Networking: An Information Technology

Approach, Englander, 5th edition, John Wiley and Sons, 2014; ISBN-13:978-1-118-32263-5; required; $150.00 225 $33,750 IT3223 3223, a) Guide to Software Development, Springer Pub., ISBN 978-1-4471-2299-9; required; cost: $101.20; total cost: $32,384. b) Fundamentals of Project Management, 4th edition, AMACON; ISBN 978-0-8144-1748-5; required; cost: $18.75 $119.95 245 $29,387.75 IT4683 IT 4683, Using MIS 2017, Kroenke, 10th edition, ISBN 978-0-1346-0699-6; required; $223.15 90 $20,083.50 IT4723 IT 4723, The Legal Environment of Business and Online Commerce, 8th edition, Cheeseman, Prentice-Hall, ISBN: 978-013-397-3310; cost: $148.15; yearly enrollment 200; total cost: $29, 630. $148.15 140 $20,741 CSE2300 CSE 2300, Discrete Mathematical Structures, 6th ed, Pearson, ISBN: 978-0-13-469644-7; cost: $94.97 $94.97 425 $40,362.25 Total: $736.22 1125 $144,324.50

**Transformation Action Plan:**

With a coordinated effort, our team of investigators plan the following activities to transform 5 required Information Technology courses to completely use no-cost learning materials:

1. Research and identify no cost reading materials 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 licensed.

2. Research and identify no cost materials that can be shared across the courses.

3. Develop study guides and lecture notes for students' use to review course content and key learning points.

4. Adopt or develop content, assignments, exercises and lab materials that are no cost to students to replace the ones in the textbooks.

5. Develop test banks to replace the ones in the textbooks.

6. Adopt open source or no-cost-to-student lab ware for students to gain hands-on experience.

7. Update the syllabus to include major resources and no cost materials.

8. Re-develop the proposed courses in our learning management system, D2L Brightspace, following Quality MattersTM standards and get the course approved for online instruction.

The responsibilities of each investigator is described as follows.

Dr. Rebecca Rutherfoord, IT 3123, Project lead; Subject matter expert, course developer and instructor of record of IT 3123.

Prof. Susan VandeVen, IT 3223, subject matter expert, course developer and instructor of record for IT 3223.

Dr. Richard Halstead-Nussloch, IT 4683, subject matter expert, course developer and instructor of record for IT 4683.

Prof. Dawn Tatum, IT 4723, subject matter expert, course developer and instructor of record for IT 4723.

Prof. James Rutherfoord, CSE 2300, subject matter expert, course developer and instructor of record for CSE 2300.

Dr. Zhigang Li, Provide Instructional Design Support to all five proposed courses.

All course design with the no-cost materials will be provided through D2L Brightspace for our students and on the ALG website for the public access.

**Quantitative & Qualitative Measures:** The investigators plan to assess the effectiveness of our proposal in two ways. Qualitatively, we will design a survey and gather inputs from the students after they use the no-cost learning material. Quantitatively, we will compare students' performance data gathered from sections using traditional textbooks and sections using no-cost learning material. The investigators will collect student performance data such as pass rates from the five proposed courses taught with a textbook by team members for spring, summer and fall 2017. This data will be used as a baseline for comparison of student performance in courses with alternative no cost material. Our assessment plan can be summarized as follows. 1. Student performance measures. This data is from the overall class performance based on the grading of student works. Metrics include:* Class average, grades distribution, pass rate for each grading item.* Overall letter grades distribution, pass rate, withdraw rate, and fail rate.* Percentage of students meeting or exceeding learning outcomes2. Specific survey on no-cost learning materials. A web-based survey will be developed for all proposed courses and be distributed at the end of the semester to collect student feedback. * Student perception and attitude toward no cost materials including:ratings of the no cost materials used in this coursecomments and suggestions for course improvements3. Student evaluation of the instructor. Formal student evaluation of the instructor can also provide information about teaching effectiveness using no cost materials. This evaluation is based on standardized forms for every course.For each of the measurement, the investigators are going to conduct two levels of analysis: 1) comparing the achievement levels of the course learning outcomes - generally, 75% is the aimed passing rate in undergraduate courses, and, 2) comparing the achievement levels to those from past offerings where costly textbooks were used. The investigators will use the data from the sections taught in the past 2 years.In

addition, Kennesaw State University requires all online courses to be reviewed and approved following an internal review process using Quality Matters (QM) standards. This review will insure the no-cost learning materials used or developed for the 5 required IT courses are instructionally sound. The College of Computing and Software Engineering will also conduct subject matter expert reviews for all developed courses to ensure the quality of the learning materials.

**Timeline:**

Spring 2018

Collect baseline statistics on each course (course developers – those faculty who are in charge of the course for this study)
Course modules redesigned to use the no cost materials. These include all new content, readings, lecture notes, video clips, exercises, labs, and assignments. The changes are reflected in the learning module study guides. (completed by course developers)
Course level assessment and informational materials redesign. This includes quizzes, tests, and syllabus. (course developers and instructional designer)
Submit the developed courses for instructional design review through Quality Matters. (instructional designer and KSU Distance Learning Center office)
Submit the developed courses for subject matter expert review. (department Chair)

Summer 2018

Develop a survey on effectiveness of the no cost materials (all course developers and instructional designer)
Teach:
IT 3123 – hardware/Software, Dr. Rutherfoord
CSE 2300 – Discrete Structures, Prof. Rutherfoord
Survey two summer courses and give student course evaluation (course developers and instructional designer)

Fall 2018

Teach:
IT 3223 – Software Acquisition and Proj. Management, Prof. VandeVen
IT 4683 – Management Information Technology & HCI, Dr. Halstead-Nussloch
IT 4723 – IT Policy and Law, Prof. Tatum
Survey three fall courses and give student course evaluation (course developers and instructional designer)

Complete final assessment data analysis and prepare a final report (all course developers and instructional designer)

**Budget:**

The funding mainly compensates our team of investigator's work and activity beyond normal teaching load or other job responsibilities in order to successfully complete the project. For each proposed course, course developers approximately will spend at least 80 hours in developing the no-cost learning material and be the instructor of record, and, will spend 20 hours in course assessment. Instructional support will devote at a minimum 50 hours in assisting course developers. Thus, we request the budget of this project as follows.

Dr. Rebecca Rutherfoord, Project lead; course developer and instructor of record of IT 3123, $5,000

Prof. Susan VandeVen, course developer and instructor of record for IT3223, $5,000

Dr. Richard Halstead-Nussloch, course developer and instructor of record for IT 4683, $5,000

Prof. Dawn Tatum, course developer and instructor of record for IT 4723, $5,000

Prof. James Rutherfoord, subject matter expert, course developer and instructor of record for CSE 2300, $5000

Dr. Zhigang Li, Provide Instructional Design Support to all five proposed courses, $1500

Travel: $3500, for project team members to attend the ALG kickoff and subsequent meetings to bring back information to the team members. Our project team is also planning to submit a paper to reputable IT education conference such as ACM SIGITE 2018 (Special Interest Group in IT Education). Travel money will be used to attend conferences to present findings from the grant.

Total Budget: $30,000

Only open source software or free software will be used in this project thus there is no additional spending on software or equipment purchasing.

**Sustainability Plan:**

The IT department implemented a course coordinator/developer system for all courses. A course coordinator/developer updates course content based on research, publications and feedback from faculty, students, alumni and our Industrial Advisory Board. Each of the investigators, except the instructional designer, is a course coordinator/developer for their corresponding course. A course coordinator/developer creates and maintains the course

materials and teaching plans. He/she also teaches the course at least once a year to make sure all resources are valid and makes necessary changes and updates. This makes sure all no-cost materials and resources are highly sustainable in the future offerings of this course. The coordinator/developer also brings major/minor course changes to the annual assessment retreat for all IT faculty.

**Final Semester of Instruction:** Spring 2017

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KENNESAW STATE UNIVERSITY
College of Computing and Software Engineering
Information Technology

January 19, 2018

ALG Grant Committee
University System of GA

Dear Colleagues:

This letter is in support of the Proposal "Staying Current in Information Technology- Transforming Required Undergraduate IT Courses" submitted from Kennesaw State University, Information Technology department faculty. As Department Chair for Information Technology, I clearly see the need for bringing down costs 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.

Several faculty in the Information Technology Department at Kennesaw State University have successfully carried out ALG grants for several of our undergraduate Information Technology courses. The current proposal addresses five of our required undergraduate courses in the IT curriculum. The savings already realized from the previous ALG grants encouraged our faculty to develop this new ALG grant proposal to help our students save even more money.

I strongly support this proposal. This is a very sustainable proposal as we have two Information Technology undergraduate degree programs. Many of our students take courses online as well as in-class. Creating the no-cost for textbook version of our five required undergraduate IT courses will allow students for many years to realize savings from not buying textbooks. As Information Technology material is constantly changing, the concept of not relying on just textbooks for courses is extremely important to our field.

This is a very solid proposal. All faculty participating in the previous ALG grants completed their courses and offered them successfully. Papers for several conferences, and workshops about the previous grants have been created and presented. This concept has been well received in the information technology academic community. I believe that this new ALG proposal will have the same student satisfaction and success that the previous ALG grants did. This new proposal will have a unique impact as it addresses HIT courses. Thank you for your consideration for this proposal.

Sincerely,

Rebecca H. Rutherfoord

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Phone: 470-578-3803 • www.kennesaw.edu

Rebecca H. Rutherfoord, Ed.D.
Interim Assistant Dean of the College of Computing & Software Engineering, Department Chair for Information Technology, Professor of Information Technology
brutherf@kennesaw.edu

KENNESAW STATE UNIVERSITY
College of Computing and Software Engineering

January 19, 2018

Dear Affordable Learning Georgia (ALG) Grant Reviewers,

It is my pleasure to write this letter in support of the proposal titled "Staying Current in Information Technology-Transforming Required IT Courses" submitted by Drs. Rutherfoord, Halstead-Nussloch, Li, and Ms. Tatum, Ms. VandeVen, and Mr. Rutherfoord from our Information Technology (IT) Department at Kennesaw State University.

In this project, the primary investigators will work as a team to replace existing, costly textbooks in five undergraduate information technology courses with no-cost-to-students learning materials. Their efforts will significantly lower the cost of education for students, saving over $144k per year and impacting over 1000 students per year at KSU. Additionally, this will 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 IT field, having digital materials available to students will improve the ability to keep them updated with the latest advances in the field of information technology.

The proposers have past experience with a successful ALG projects, thus the quality and success of this project is highly likely. The investigators in this project are also designated course architects who are responsible for the development and the maintenance of the to-be-transformed courses.

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

Sincerely,

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

**Affordable Learning Georgia Textbook Transformation Grants**
**Rounds Ten and Eleven**
**For Implementations beginning Spring Semester 2018**
**Running Through Fall Semester 2018**

## Proposal Form and Narrative

| | |
|---|---|
| **Submitter Name** | Rebecca H. Rutherfoord |
| **Submitter Title** | Department Chair, Professor of Information Technology |
| **Submitter Email** | brutherf@kennesaw.edu |
| **Submitter Phone Number** | 470-578-7399 |
| **Submitter Campus Role** | *Proposal Investigator (Primary)* |
| **Applicant Name** | *Rebecca Rutherfoord* |
| **Applicant Email** | brutherf@kennesaw.edu |
| **Applicant Phone Number** | 470-578-7399 |
| **Primary Appointment Title** | *Department Chair, Professor of Information Technology* |
| **Institution Name(s)** | Kennesaw State University |
| **Team Members** | Dr. Becky Rutherfoord - brutherf@kennesaw.edu<br>Dr. Rich Halstead-Nussloch - rhalstea@kennesaw.edu<br>Prof. Dawn Tatum - dtatum7@kennesaw.edu<br>Prof. Susan VandeVen - svandev@kennesaw.edu<br>Prof. Jim Rutherfoord - jruther3@kennesaw.edu<br>Dr. Zhigang Li - zli8@kennesaw.edu |

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|---|---|---|---|---|---|
| **Sponsor, Title, Department, Institution** | Dr. Rebecca H. Rutherfoord<br><br>Interim Assistant Dean of the College of Computing & software Engineering, and Department Chair, Information Technology<br><br>Information Technology Department<br><br>Kennesaw State University | | | | |
| **Proposal Title** | Staying Current in Information Technology-Transforming Required Undergraduate IT Courses | | | | |
| **Course Names, Course Numbers and Semesters Offered** | IT 3123 - Hardware/Software Concepts- every semester - 3 fall, 3 spring, 2 summer<br><br>IT 3223 - Software Acquisition & Project Management- every semester - 3 fall, 3 spring, 2 summer<br><br>IT 4683 - Management of IT & Human Computer Interaction- every semester - 2 fall, 2 spring, 2 summer<br><br>IT 4723 - IT Policy and Law- every semester, every semester - 2 fall, 2 spring, 2 summer<br><br>CSE2300 - Discrete Structures- every semester - 4 fall, 4 spring, 2 summer | | | | |
| **Final Semester of Instruction** | *Fall 2018* | | | | |
| **Average Number of Students Per Course Section** | 29.6 | **Number of Course Sections Affected by Implementation in Academic Year** | **38** | **Total Number of Students Affected by Implementation in Academic Year** | 1125 |
| **Average Number of Students Per Summer Semester** | *216* | | | | |

| | |
|---|---|
| **Average Number of Students Per Fall Semester** | *420* |
| **Average Number of Students Per Spring Semester** | *425* |
| **Award Category (pick one)** | ☒ No-or-Low-Cost-to-Students Learning Materials<br>☐ Specific Core Curriculum Courses |
| **Are you planning on using an OpenStax textbook?** | ☐ Yes<br>☒ No |

| | |
|---|---|
| **List the original course materials for students (including title, whether optional or required, & cost for each item)** | |

| Course | Textbook Used | Cost per Student |
|---|---|---|
| IT3123 | IT 3123, The Architecture of Computer Hardware, Systems Software, and Networking: An Information Technology Approach, Englander, 5th edition, John Wiley and Sons, 2014; ISBN-13:978-1-118-32263-5; required; | $150.00 |
| IT3223 | IT 3223, a) Guide to Software Development, Springer Pub., ISBN 978-1-4471-2299-9; required; cost: $101.20; total cost: $32,384. b) Fundamentals of Project Management, 4th edition, AMACON; ISBN 978-0-8144-1748-5; required; cost: $18.75 | $119.95 |
| IT4683 | IT 4683, Using MIS 2017, Kroenke, 10th edition, ISBN 978-0-1346-0699-6; required; | $223.15 |
| IT4723 | IT 4723, The Legal Environment of Business and Online Commerce, 8th edition, Cheeseman, Prentice-Hall, ISBN: 978-013-397-3310; cost: $148.15; yearly enrollment 200; total cost: $29, 630. | $148.15 |
| CSE2300 | CSE 2300, Discrete Mathematical Structures, 6th ed, Pearson, ISBN: 978-0-13-469644-7; cost: $94.97 | $94.97 |
| | Total: | $736.22 |

*[Material Title, optional or required]*

| | |
|---|---|
| **Requested Amount of Funding** | $30,000 |
| **Original Per Student Cost** | $736.22 |

| | |
|---|---|
| **Post-Proposal Projected Per Student Cost** | $0 |
| **Projected Per Student Savings** | $736.22 |
| **Projected Total Annual Student Savings** | *$144,324.50* |

## NARRATIVE

## 1.1 PROJECT GOALS

In this project, we propose to take a department-wide effort to transform five required undergraduate Information Technology major courses using no-cost-to-students learning material. This project not only aims to reduce the financial burden imposed by high cost of textbooks, but also strives to develop free and open-access learning materials that offer equivalent or better educational effectiveness than traditional textbooks. These courses will then be sent through the KSU online course review process using the Quality Matters rubric to meet institutional standards of excellence as the Information Technology degree can be completed face-to-face or completely online.

Goals:

1. Transform five required undergraduate IT major courses using no-cost-to-students learning materials.
2. Create Quality Matters “ready” courses to meet institutional standards of excellence for face-to-face and online courses.

## 1.2 STATEMENT OF TRANSFORMATION

**Research**

According to Priceonomics (http://priceonomics.com/which-major-has-the-most-expensive-textbooks/), an average undergraduate student annually spends $1,200 on textbooks. In addition, out of 31 majors at the University of Virginia, Computer Science (and IT) comes in 8th for the most expensive books. On the other side, the University of Virginia reports that Computer Science (and IT) textbooks only have a 25% resale value based on the original price. The highest resale value for other majors is up to 70%.

**Previous ALG Grant Information**

One team member was part of the round two of an "Affordable Learning Textbook Transformation Grant" in 2015 (round two, award #119). They designed and evaluated the effectiveness of no-cost-to-students learning materials for database courses in the IT department, and saved students $110,419. The assessment results showed that the developed free material offered equivalent or better learning experience than the textbooks did. The preliminary results of the grant were published in the Proceedings of Southern Association for Information Systems Conference (SAIS 2016), the final results were published in the Proceedings of the ACM Special Interests Group in IT Education (SIGITE 2016), "Transforming IT Education with No-Cost Learning Materials". They also hosted a panel discussion on no-cost learning material in IT education, at SIGITE in October 2016. The panel attracted a lot of attention among computing faculty. Many colleagues from different states were impressed with the USG initiative and with course material developed by the team. Building on our past success and lessons learned from the prior ALG grant, we will continue our transformation efforts by developing no-cost learning material for five required undergraduate IT courses.

**The Stakeholders**

There are two primary sets of stakeholders for this proposal – the students taking the five required IT classes (both in-class and online students), and the faculty developing and teaching those courses. The high cost of textbooks puts a large financial burden on students and may become a road-block for students' ability to finish their education. Our team of investigators strives to make higher education more affordable to the students. The information technology required courses listed for this grant proposal have resources that are publicly accessible, free, or with an open license to use. These materials include open and free tutorials, books, videos, labs, software, and services. One of the major problems with using regular textbooks for IT courses is that information technology material is constantly changing. Textbook publishing cannot keep up with these fast changes in the technology field. In addition, tools and software packages that are part of a textbook also become obsolete. As soon as a new version of a tool or software package is released, the instructions in a textbook become obsolete. Therefore, we need to include the latest available tools to prepare hands-on labs. Digital delivery of the learning materials makes it easier to keep the content up-to-date. Developing and assembling a set of learning materials for major courses is a unique approach. It will allow us to better align the learning material not only

with the outcomes of each course, but also with the outcomes of the Information Technology program.

Compared to traditional textbooks, the open source software and web resources have many benefits: 1) the Web resources are generally free to use; 2) they are constantly being updated and always reflect the latest trends and industrial development; and, 3) the materials from the Web are also more dynamic and interactive. The pitfalls of Web resources are that they are often disorganized and may contain inaccurate information. However, members of our team of investigators are not only subject matter experts in the information security field, but also proficient educators who on average have more than 10 years teaching experience including online teaching. We will select, organize and integrate resources from the web and transform the information into instructionally sound learning materials for the proposed courses including content that the team members develop themselves. We strongly believe that the new learning materials will offer up-to-date, equivalent or better learning effectiveness compared to the original textbooks. Digital delivery also allows us to add interactive elements into the learning materials. The interactive content will not only engage the students, but also improve their learning experience. It will help to enhance the learning outcomes and learning satisfaction.

**The Impact**

The impact of our transformation efforts will be profound. By our estimates, more than 1125 students will benefit from the no-cost learning material each year. Moreover, it will benefit more students in the Bachelor of Science in Cybersecurity (eMajor) approved by the Board of Regents. One of the required courses proposed for this grant is also part of the BS in Cybersecurity. Student numbers are not included for the cybersecurity degree in this grant, but the expectation is that there will be an additional 120 students for this course per year within two years. The goal of eMajor is to reduce the cost of education by using prior learning assessments, lower tuition and potentially no-cost learning materials (https://emajor.usg.edu). The proposed project is expected to save current students $144,324.50 in textbook costs each year (not counting the cybersecurity savings).

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 required IT courses adopting no-cost-to-student material not only offers better and more consistent learning experience to students, but also makes our nationally renowned IT programs more affordable. As a result, our IT programs could recruit more students and produce more qualified IT professionals that Georgia needs. Our experience gained in this transformation project could be useful to other programs or departments who want to lower the cost of education to their students in IT programs across Georgia. In summary, we believe the proposed project will have a positive impact in students' retention, progression, and graduation at program, department and institution levels.

As shown in the following table, the textbooks used in the five required IT undergraduate major courses are expensive. In fact, most textbooks used in Information Technology are costly in general. In addition, due to the fast evolving nature of the technology field, the textbooks used in the proposed courses are updated frequently, which negatively impacts their resale value to the

students. The goal of our transformation is to replace the textbook used in the proposed courses with no-cost-to-students learning materials that offer equal or higher educational effectiveness.

## Data

**Table 1: Enrollments and Projected 2018 Enrollments of 5 IT courses**

| Course | Spring 2017 | Summer 2017 | Fall 2017 | Total | Projected 2018 Enrollment | |
|---|---|---|---|---|---|---|
| | | | | | Number of Sections | Total Number of students |
| IT3123 | 93 | 40 | 78 | 211 | 8 | 225 |
| IT3223 | 112 | 39 | 84 | 235 | 8 | 245 |
| IT4683 | 0 | 41 | 41 | 82 | 6 | 90 |
| IT4723 | 50 | 38 | 47 | 135 | 6 | 140 |
| CSE2300 | 170 | 58 | 170 | 398 | 10 | 425 |
| **Total** | **425** | **216** | **420** | **1061** | **38** | **1125** |

As shown in the following table, the textbooks used in the five required IT undergraduate major courses are expensive. In fact, most textbooks used in Information Technology are costly in general. In addition, due to the fast evolving nature of the technology field, the textbooks used in the proposed courses are updated frequently, which negatively impacts their resale value to the students. The goal of our transformation is to replace the textbook used in the proposed courses with no-cost-to-students learning materials that offer equal or higher educational effectiveness.

**Table 2: Costs of Current Textbooks for 5 IT Courses**

| Course | Textbook Used | Cost per Student | Projected Enrollment | Projected Costs |
|---|---|---|---|---|
| IT3123 | IT 3123, The Architecture of Computer Hardware, Systems Software, and Networking: An Information Technology Approach, Englander, 5th edition, John Wiley and Sons, 2014; ISBN-13:978-1-118-32263-5; required; | $150.00 | 225 | $33,750 |
| IT3223 | IT 3223, a) Guide to Software Development, Springer Pub., ISBN 978-1-4471-2299-9; required; cost: $101.20; total cost: $32,384. b) Fundamentals of Project Management, 4th edition, AMACON; ISBN 978-0-8144-1748-5; required; cost: $18.75 | $119.95 | 245 | $29,387.75 |
| IT4683 | IT 4683, Using MIS 2017, Kroenke, 10th edition, ISBN 978-0-1346-0699-6; required; | $223.15 | 90 | $20,083.50 |
| IT4723 | IT 4723, The Legal Environment of Business and Online Commerce, 8th edition, Cheeseman, Prentice-Hall, ISBN: 978-013-397-3310; cost: $148.15; yearly enrollment 200; total cost: $29, 630. | $148.15 | 140 | $20,741 |
| CSE2300 | CSE 2300, Discrete Mathematical Structures, 6th ed, Pearson, ISBN: 978-0-13-469644-7; cost: $94.97 | $94.97 | 425 | $40,362.25 |
| | Total: | $736.22 | 1125 | $144,324.50 |

## 1.3 TRANSFORMATION ACTION PLAN

With a coordinated effort, our team of investigators plan the following activities to transform 5 required Information Technology courses to completely use no-cost learning materials:

- Research and identify no cost reading materials 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 licensed.
- Research and identify no cost materials that can be shared across the courses.
- Develop study guides and lecture notes for students' use to review course content and key learning points.
- Adopt or develop content, assignments, exercises and lab materials that are no cost to students to replace the ones in the textbooks.
- Develop test banks to replace the ones in the textbooks.
- Adopt open source or no-cost-to-student lab ware for students to gain hands-on experience.
- Update the syllabus to include major resources and no cost materials.
- Re-develop the proposed courses in our learning management system, D2L Brightspace, following Quality Matters™ standards and get the course approved for online instruction.

The responsibilities of each investigator is described as follows.

Dr. Rebecca Rutherfoord, IT 3123, Project lead; Subject matter expert, course developer and instructor of record of IT 3123.

Prof. Susan VandeVen, IT 3223, subject matter expert, course developer and instructor of record for IT 3223.

Dr. Richard Halstead-Nussloch, IT 4683, subject matter expert, course developer and instructor of record for IT 4683.

Prof. Dawn Tatum, IT 4723, subject matter expert, course developer and instructor of record for IT 4723.

Prof. James Rutherfoord, CSE 2300, subject matter expert, course developer and instructor of record for CSE 2300.

Dr. Zhigang Li, Provide Instructional Design Support to all five proposed courses.

All course design with the no-cost materials will be provided through D2L Brightspace for our students and on the ALG website for the public access.

## 1.4 QUANTITATIVE AND QUALITATIVE MEASURES

The investigators plan to assess the effectiveness of our proposal in two ways. Qualitatively, we will design a survey and gather inputs from the students after they use the no-cost learning material. Quantitatively, we will compare students' performance data gathered from sections using traditional textbooks and sections using no-cost learning material.

The investigators will collect student performance data such as pass rates from the five proposed courses taught with a textbook by team members for spring, summer and fall 2017. This data will be used as a baseline for comparison of student performance in courses with alternative no cost material. Our assessment plan can be summarized as follows.

1. Student performance measures. This data is from the overall class performance based on the grading of student works. Metrics include:

* Class average, grades distribution, pass rate for each grading item.

* Overall letter grades distribution, pass rate, withdraw rate, and fail rate.

* Percentage of students meeting or exceeding learning outcomes

2. Specific survey on no-cost learning materials. A web-based survey will be developed for all proposed courses and be distributed at the end of the semester to collect student feedback.

* Student perception and attitude toward no cost materials including:

  - ratings of the no cost materials used in this course

  - comments and suggestions for course improvements

3. Student evaluation of the instructor. Formal student evaluation of the instructor can also provide information about teaching effectiveness using no cost materials. This evaluation is based on standardized forms for every course.

For each of the measurement, the investigators are going to conduct two levels of analysis: 1) comparing the achievement levels of the course learning outcomes - generally, 75% is the aimed passing rate in undergraduate courses, and, 2) comparing the achievement levels to those from past offerings where costly textbooks were used. The investigators will use the data from the sections taught in the past 2 years.

In addition, Kennesaw State University requires all online courses to be reviewed and approved following an internal review process using Quality Matters (QM) standards. This review will insure the no-cost learning materials used or developed for the 5 required IT courses are instructionally sound. The College of Computing and Software Engineering will also conduct subject matter expert reviews for all developed courses to ensure the quality of the learning materials.

## 1.5 TIMELINE

Spring 2018

- Collect baseline statistics on each course (course developers – those faculty who are in charge of the course for this study)
- Course modules redesigned to use the no cost materials. These include all new content, readings, lecture notes, video clips, exercises, labs, and assignments. The changes are reflected in the learning module study guides. (completed by course developers)
- Course level assessment and informational materials redesign. This includes quizzes, tests, and syllabus. (course developers and instructional designer)
- Submit the developed courses for instructional design review through Quality Matters. (instructional designer and KSU Distance Learning Center office)
- Submit the developed courses for subject matter expert review. (department Chair)

Summer 2018

- Develop a survey on effectiveness of the no cost materials (all course developers and instructional designer)
- Teach:
    - IT 3123 – hardware/Software, Dr. Rutherfoord
    - CSE 2300 – Discrete Structures, Prof. Rutherfoord
- Survey two summer courses and give student course evaluation (course developers and instructional designer)

Fall 2018

- Teach:
    - IT 3223 – Software Acquisition and Proj. Management, Prof. VandeVen
    - IT 4683 – Management Information Technology & HCI, Dr. Halstead-Nussloch
    - IT 4723 – IT Policy and Law, Prof. Tatum
- Survey three fall courses and give student course evaluation (course developers and instructional designer)

- Complete final assessment data analysis and prepare a final report (all course developers and instructional designer)

## 1.6 BUDGET

The funding mainly compensates our team of investigator's work and activity beyond normal teaching load or other job responsibilities in order to successfully complete the project. For each proposed course, course developers approximately will spend at least 80 hours in developing the no-cost learning material and be the instructor of record, and, will spend 20 hours in course assessment. Instructional support will devote at a minimum 50 hours in assisting course developers. Thus, we request the budget of this project as follows.

Dr. Rebecca Rutherfoord, Project lead; course developer and instructor of record of IT 3123, $5,000

Prof. Susan VandeVen, course developer and instructor of record for IT3223, $5,000

Dr. Richard Halstead-Nussloch, course developer and instructor of record for IT 4683, $5,000

Prof. Dawn Tatum, course developer and instructor of record for IT 4723, $5,000

Prof. James Rutherfoord, subject matter expert, course developer and instructor of record for CSE 2300, $5000

Dr. Zhigang Li, Provide Instructional Design Support to all five proposed courses, $1,500

Travel: $3,500, for project team members to attend the ALG kickoff and subsequent meetings to bring back information to the team members. Our project team is also planning to submit a paper to reputable IT education conference such as ACM SIGITE 2018 (Special Interest Group in IT Education). Travel money will be used to attend conferences to present findings from the grant.

Total Budget: $30,000

Only open source software or free software will be used in this project thus there is no additional spending on software or equipment purchasing.

## 1.7 SUSTAINABILITY PLAN

The IT department implemented a course coordinator/developer system for all courses. A course coordinator/developer updates course content based on research, publications and feedback from faculty, students, alumni and our Industrial Advisory Board. Each of the investigators, except the instructional designer, is a course coordinator/developer for their corresponding course. A course coordinator/developer creates and maintains the course materials and teaching plans. He/she also teaches the course at least once a year to make sure all resources are valid and makes necessary changes and updates. This makes sure all no-cost materials and resources are highly sustainable in the future offerings of this course. The coordinator/developer also brings major/minor course changes to the annual assessment retreat for all IT faculty.

## 1.8 REFERENCES & ATTACHMENTS

*A letter of support must be provided from the sponsoring area (unit, office, department, school, library, campus office of the Vice President for Academic Affairs, etc.) that will be responsible for receipt and distribution of funding. Letters must reference sustainability. In the case of multi-institutional affiliations, all participants' institutions/departments must provide a letter of support.*

# Syllabus

IT 3123 Hardware and Software
Developed by Dr. Rebecca Ruthefoord

Course Syllabus

Module 0:
Link to free textbook: https://www.pdfdrive.net/the-architecture-of-computer-hardware-and-system-software-e20630163.html

Vannebar Bush's Memex Link: https://en.wikipedia.org/wiki/Memex
Link – The Internet: http://en.wikipedia.org/wiki/Internet
Link – Von Neumann Architecture: https://www.computerscience.gcse.guru/theory/von-neumann-architecture
Link – Von Newmann Architecture Def: https://en.wikipedia.org/wiki/Von_Neumann_architecture
Link – History of Computing: https://en.wikipedia.org/wiki/History_of_computing

Link – Computer Systems Architecture: https://www.techopedia.com/definition/26757/computer-architecture
Link – Computer Systems Architecture Lecture: http://www.cs.utexas.edu/users/mckinley/352/lectures/01.pdf

Module 1:
Link – Number Systems: http://en.wikipedia.org/wiki/Numeral_system
Link – Binary Numbers: https://www.mathsisfun.com/binary-number-system.html
Link – Binary Numbers: https://en.wikipedia.org/wiki/Binary_number
Link – Hexidecimal Numbers: https://www.electronics-tutorials.ws/binary/bin_3.html
Link – Converting Decimal to Binary: https://www.electronics-tutorials.ws/binary/bin_2.html

Link – Data formats: https://en.wikipedia.org/wiki/Data_format
Link – Set theory: https://byjus.com/maths/set-theory-symbols/
Link – What is Unicode: http://unicode.org/standard/WhatIsUnicode.html
Link – Encoding information: http://kunststube.net/encoding/
Link – more on Unicode: https://en.wikipedia.org/wiki/Unicode

Link – Floating Point numbers: http://www.cs.utah.edu/~zachary/isp/applets/FP/FP.html
Link – more on number systems: https://code.tutsplus.com/articles/number-systems-an-introduction-to-binary-hexadecimal-and-more--active-10848
Link – twos complement integer: https://en.wikipedia.org/wiki/Two%27s_complement

Module 2:
Link – Digital logic book chapter: http://users.ece.utexas.edu/~valvano/Volume1/E-Book/C4_DigitalLogic.htm
Link – Digital logic: https://learn.sparkfun.com/tutorials/digital-logic/all
Link – Boolean Function: https://en.wikipedia.org/wiki/Boolean_function

Link – Computer Registers: https://en.wikipedia.org/wiki/Processor_register
Link – Arithmetic Logic Unit: https://en.wikipedia.org/wiki/Arithmetic_logic_unit
Link – Control Unit: https://en.wikipedia.org/wiki/Arithmetic_logic_unit
Link- Data Bus: https://en.wikipedia.org/wiki/Bus_(computing)
Link – Instruction Set Architecture: https://en.wikipedia.org/wiki/Instruction_set_architecture
Link – CPU: https://en.wikipedia.org/wiki/Central_processing_unit
Link – Types of Buses: https://turbofuture.com/computers/buses
Link – Computer Memory: https://en.wikipedia.org/wiki/Computer_memory

Link – Computer Organization: https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

Link – How pipelined computers work:  http://en.wikipedia.org/wiki/Computer_architecture

Module 3:
Link – Computer Interface:  https://en.wikipedia.org/wiki/Interface_(computing)
Link – Input-output:  https://en.wikipedia.org/wiki/Input/output
Link – Interrupt drive I-O:  http://inputoutput5822.weebly.com/interrupt-driven-io.html
Link – direct memory access:  https://en.wikipedia.org/wiki/Direct_memory_access
Link – computer interrupts:  https://en.wikipedia.org/wiki/Interrupt

Link – disk storage:  https://en.wikipedia.org/wiki/Disk_storage
Link – RAID storage:  https://en.wikipedia.org/wiki/RAID
Link – network storage:  https://en.wikipedia.org/wiki/Network-attached_storage
Link – computer peripherals:  https://study.com/academy/lesson/what-are-peripheral-devices-of-a-computer-definition-examples-types.html
Link – computer peripherals 2:  https://www.britannica.com/technology/input-output-device

Link – computer network:  https://www.techopedia.com/definition/25597/computer-network
Link – networks:  https://en.wikipedia.org/wiki/Computer_network
Link – communication channel:  https://en.wikipedia.org/wiki/Communication_channel
Link – network message passing:  https://en.wikipedia.org/wiki/Message_passing
Link – network packet:  https://en.wikipedia.org/wiki/Network_packet
Link – local area network:  https://en.wikipedia.org/wiki/Local_area_network
Link – wide area network:  https://en.wikipedia.org/wiki/Wide_area_network
Link – network topologies:  http://fcit.usf.edu/network/chap5/chap5.htm

Link – Ethernet:  https://en.wikipedia.org/wiki/Ethernet
Link – TCP-IP:  https://en.wikipedia.org/wiki/Internet_protocol_suite

Link – bandwidth:  https://en.wikipedia.org/wiki/Bandwidth_(computing)
Link – network transmission models:  http://www.informit.com/articles/article.aspx?p=683070
Link – transmission media:  https://turbofuture.com/misc/Data-Communication

Module 4:
Link – operating system:  https://en.wikipedia.org/wiki/Operating_system
Link – active directory:  https://en.wikipedia.org/wiki/Active_Directory
Link – data files:  https://en.wikipedia.org/wiki/Data_file
Link – computer data storage:  https://en.wikipedia.org/wiki/Computer_data_storage
Link – file management system:  https://www.globodox.com/globodox-articles/file-management-system/

Link – operating systems:  https://en.wikipedia.org/wiki/Operating_system
Link – virtual memory:  https://en.wikipedia.org/wiki/Virtual_memory
Link – virtualization:  https://en.wikipedia.org/wiki/Virtualization

Link – Microsoft windows:  https://en.wikipedia.org/wiki/Microsoft_Windows
Link – Unix:  https://en.wikipedia.org/wiki/Unix
Link – Linux:  https://en.wikipedia.org/wiki/Linux

Link – programming languages:  https://en.wikipedia.org/wiki/Programming_language
Link – list of programming languages:  https://en.wikipedia.org/wiki/List_of_programming_languages

Link – computer security:  https://en.wikipedia.org/wiki/Computer_security
Link – cryptography:  https://en.wikipedia.org/wiki/Cryptography

Link – cryptosystem:  https://en.wikipedia.org/wiki/Cryptosystem
Link – PGP:  https://en.wikipedia.org/wiki/Pretty_Good_Privacy
Link – computer security software:  https://en.wikipedia.org/wiki/Computer_security_software

Discussions:

Discussion 1:
In chapter 3 - we studied number systems.  Do you agree or disagree that we should study number systems in computing?  Why are Binary and Hexadecimal so important in computing?

Discussion 2:
Why is it important to understand the basic ways in which pictures and video are stored in the computer?

Discussion 3:
Name at least one new advancement in networks over the last 5 years, and discuss why you think this has been an important addition to networks.

Discussion 4:
How has wi-fi changed the landscape of channel technology?

Discussion 5:
Do you think operating systems have changed much in the last 5 years?  If so - how have they changed

Discussion 6:
Why is it important to know the different types of file organizations, and how they are stored and accessed?

## Kennesaw State University
## Information Technology Department
## IT 3123 Hardware/Software

**Instructor:** Dr. Becky Rutherfoord

*Office:* Atrium Building J393

*Email:* brutherf@kennesaw.edu

*Office Hours:* by appointment (usually in my office unless in meetings)

**Meeting Times:** Tues 11:00Am – 1:45 pm in room J-262

**Required Textbook:  NONE**

**Online Free Textbook**: Englander, Irv The Architecture of Computer Hardware, Systems Software, and Networking: An Information Technology Approach, Fourth Edition.  You will find a link to the online textbook in Module 0 – Start Here.

**Credit Hours:** 3 class hours; 0 lab hours; 3 credit hours.

**Prerequisite:** (IT 1324 or CSE 1302 or CS 1302) AND Corequisite: MATH 2345 or CSE 2300)

This course examines various hardware and software components and how they work together in a modern computing environment. Topics include an overview of computer organization and architecture, machine language and modern languages

**Course outcomes:**

Students will be able to:

1. Identify, use and convert binary, decimal, and hexadecimal number systems, describe common digital data formats, and describe fundamental digital logic circuits and their relationship to binary numbers.
2. Explain the relationship between digital logic and computation, describe the parts of a computer instruction, and explain the fetch-decode-execute instruction cycle.
3. Describe and use the components of a CPU, input/output hardware, peripherals, and digital communications and how they work. Apply the hierarchy of storage to explain how storage, data, and computation are related.
4. Describe the functions of an operating system and be able to compare various types of operating systems, including file management, cache and virtual memory, memory management, and security.
5. Use and differentiate between high-level, low-level and machine computer languages.

**Course Information:**

The free textbook, D2L content, links and other supplemental material will be the basis for all test taking and quizzes. You will have 8 quizzes, 6 discussions, 1 midterm and 1 final.

**Course Schedule**

Please take a look at the course schedule listed in D2L (*LivingScheduleSum18IT3123_Dr_R*). This will be our road map for the course and will show what topics will be covered and when. It will also list important dates such as: quiz due dates, exam dates, and scheduled university closures.

**Exams**

There will be 1 midterm and 1 final examination. Examinations will come from the questions from the quizzes – the midterm from quizzes 1-4, and the final from quizzes 5-8. You must take the exams on the dates in the syllabus unless you have made arrangements with me well in advance of the exam. Makeup examinations will not be given unless you make *prior* arrangements with me. In general, makeup examinations will only be allowed in cases of genuine emergency or exigent circumstances, such as serious illness. Requests for makeup exams for the convenience of the student will generally not be allowed.

**Quizzes**

Quizzes for this course will be administered using Desire2Learn and will be available approximately three days before the due date. They are open-book and open-notes, but *not* "open Internet." Why not? Well, there's a lot of misinformation and incomplete information on the web, and I don't want to put any into your heads through the quizzes. In any case, quizzes are timed, so you will not have much research time available.

**Discussions**

There will be 6 discussions in the course. You can earn up to 4 points total for each discussion. You receive points as follows:

4 points – you give your initial response to the question, then respond to 3 other classmates
3 points – you give your initial response to the question, then respond to 2 other class-mates

2 points – you give your initial response to the question, then respond to 1 other class-mate
1 point – you give your initial response only
0 points – you don't participate in the discussion

Discussions have due dates! Please check the calendar.

**Due Dates**

All work for this course will be submitted using Desire2Learn.

All discussions, quizzes and tests are due *at 11:59 PM* on the date shown in the syllabus or course calendar. Late assignments will be accepted for 48 hours after the due date for a penalty of 25%. Late exams will not be accepted and will be recorded as zeros. As university students, I expect you will manage your time well enough to be able to complete your assignments on time in spite of both usual and unanticipated events.

**Grading Policy**

Your final grade will be based on the number of points you earn during the semester.

| | | |
|---|---|---|
| 8 Quizzes: | 400 points | 60% of grade |
| 2 Exams: | 200 points | 30% of grade |
| 6 discussions: | 24 points | 10% of grade |
| Total: | 624 points | |

Your grading scale will be as follows:

561-624 points - "A"
499-560 points - "B"
437-498 points - "C"
374-436 points - "D"
0-373 points - "F"

**Attendance & Participation policy:**

Participation is expected. You are responsible for all material and announcements in the news tool and D2L email.

**Electronic Communications**

I will only respond to emails in D2L. Please don't send emails to my regular email account about the course. Other general emails, of course, can be sent to my regular email.

The University provides all KSU students with an "official" email account with the address "students.kennesaw.edu." As a result of federal laws protecting educational information and other data, **this is the sole email account you should use to communicate with your instructor or other University officials for questions NOT pertaining to this course. For the course communication – you may use the provided D2L email for our course**

**General Expectations for Coursework in CCSE IT Programs**

This course syllabus *is a general "plan" for the course and not a contract* - please know that the course instructor is permitted to make updates to it. If you have questions regarding this, please contact the Chair of the IT Department.

1. *Intellectual Property Issues*. You may not misappropriate the intellectual property of a member of the Faculty, another student, an online resource or other source even if you paid for them to do your work. Ideas, and course content are the intellectual property of the author irrespective of whether they are written in a book, course online content, course lectures or a paper. Kennesaw State University prohibits the misappropriation of intellectual property (which is a form of theft), which can result in discipline for a student, up to and including dismissal from the University. If the student is also a member of a profession with an applied code of ethics, it may additionally result in professional discipline, as well as subjecting the student to any civil legal remedies protecting intellectual property.

1. *Copyright Law.* It is the responsibility of KSU faculty and students to respect the rights of copyright holders and comply with copyright law. Students, faculty, and staff must comply with limited exclusive rights of copyright holders as set forth in 17 U.S.C. § 106, the application of the four fair use factors in 17 U.S.C. § 107, and other copyright exceptions.

1. *Electronic Recording.* You may not record or disseminate any electronically recorded class discussion unless given explicit permission by the instructor in writing. If a student needs to electronically record a course as a result of a recognized disability or other exceptionality, the student should contact the University's DisAbled Student Support Services to develop an appropriate reasonable accommodation. http://www.kennesaw.edu/stu_dev/dsss/prospect.shtml

***How to Succeed in this Class:*** Here are five things you can do that will greatly improve your chances of making a satisfactory grade in this class:

- **Read the syllabus:** It is *a lot of trouble* to prepare so detailed a syllabus. You should assume I had a reason for it. You should read *every word* in the syllabus before the second class. I will not be sympathetic to complaints that you didn't understand something about the course if it's written down in the syllabus.
- **Read the textbook:** You will get a lot more out of this class, and so be able to give back more on the assignments and examinations, if you read the assigned parts of the textbook *before* class. In my experience, students who don't complete the reading before class either never complete it or try to cram it all in just before the exams. That doesn't work.
- **Participate in the discussions:** Participation forms a part of your course grade. When you participate in the discussions, you learn and also help others learn. The printable slides are an integral part of the course. If you ignore them, you will learn less and probably earn a lower grade.

***What I expect of You***

- You will prepare for each session by having done the assigned reading.
- You will do your own work. There are severe penalties for cheating.
- You will complete your work on time.

***What You May Expect of Me***

- I will listen respectfully to your opinions.
- I will answer your questions promptly and carefully; if I do not know an answer, I'll find out.
- I will help you succeed.

**COURSE WITHDRAWAL**
Please refer to the KSU Catalog **http://www.kennesaw.edu/registrar/policies/withdrawl.php**

**ACADEMIC INTEGRITY**
Every KSU student is responsible for upholding all provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. The Code of Conduct includes the following:

- Section II of the Student Code of Conduct addresses the University's policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to University materials, misrepresentation/falsification of University records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the University Judiciary Program, which includes either an "informal" resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct's minimum one semester suspension requirement.
- Students involved in off-campus activities shall not act in a disorderly or disruptive fashion, nor shall they conduct any dangerous activity.
- Students involved in off-campus activities shall not take, damage or destroy or attempt to take, damage or destroy property of another.
- **Collaboration with your classmates in studying and understanding the material is part of the collegiate experience, and is strongly encouraged. Collaboration on written assignments is permitted and encouraged, BUT each student must turn in their own original work written in his or her own words. Copying and submitting another's work will be considered cheating; all students involved will receive a grade of zero for the first offense. For a second offense, you will be given a grade of 'F' for the course.**
- **If you submit work obtained from a subscription service, you will receive a grade of 0 for the assignment and be docked a letter grade on your final grade for the first offense; a second offense will result in a grade of 'F' for the course. Unless you are specifically advised otherwise by the instructor, any work submitted for credit, including homework and lab assignments, must be completely the work of the individual student.**
- **Collaboration or cheating on examinations will result in a grade of zero for the exam and a reduction in the course grade. If this is not the first misconduct offense, you will be given a grade of 'F' for of the course and may be dismissed from the University.**

**Reasonable Accommodations**
Students with qualifying disabilities under the Americans with Disabilities Act (ADA) and/or Section 504 of the Rehabilitation Act who require "reasonable accommodation(s)" to complete the course may request those from Office of Student Disability Services. Students requiring such accommodations are required to work with the University's Office of Student Disability Services not individual faculty members or academic departments. A student anticipating a need for accommodation, must submit documentation requesting an accommodation in a timely fashion to permit time for a determination prior to submitting assignments or taking course quizzes or exams. Students may not request retroactive accommodation. Students should contact the office as soon as possible in the term for which they are seeking accommodations. Student Disability Services is located in the Carmichael Student Center in Suite 267. For more information, please call 470-578-2666 or visit the Student Disabilities Services websites at
www.kennesaw.edu/stu_dev/sds_
http://www.kennesaw.edu/stu_dev/dsss/dsss.html

**Student Privacy (FERPA)**
Students have certain rights to privacy. http://registrar.kennesaw.edu/resources/ferpa.php

The University's online learning system and email system are designed to prevent unauthorized individuals from gaining access to sensitive information or information protected by federal or state law. We will communicate regarding course matters through the University's designated technology learning system or Kennesaw state email system.

**KSU Sexual Misconduct Policy & Ethics Statement**

KSU will not tolerate sexual misconduct or sexually exploitative or harassing behavior of any kind. https://policy.kennesaw.edu/content/sexual-misconduct-policy.

You are expected to respect religious, cultural, and gender differences.

**Netiquette: Communication Courtesy**

All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats. Inappropriate communication will not be tolerated and will be reported to the Chair and Dean. It may result in dismissal from the course. Be respectful of your classmates.

**KSU Student Resources**

For issues with technical difficulties, please contact the **Student Helpdesk**:

- Email: studenthelpdesk@kennesaw.edu
- Call: 470-578-3555

* Additional Technology Resources
  - Student Service Desk and Help Center
  - Browser Checker
  - USG Desire2Learn Help Center
  - ITS Documentation Center
  - Check Service Outages
  - Maintenance Schedule

* Academic Resources
  - Academic Tutoring Services
  - Disability Resources
  - ESL Study and Tutorial Center
  - Library
  - The Writing Center

* Student Support and Wellness Resources
  - Career Services Center
  - Counseling and Psychological Services
  - Center for Health, Promotion and Wellness Student Health Clinic

**Grade Appeals and Student Complaints**

KSU desires to resolve student grievances, complaints and concerns in an expeditious, fair and amicable manner. For complaints regarding this course, please contact the professor. If the issue is not resolved, contact the department chair.

# Final Report

**Affordable Learning Georgia Textbook Transformation Grants**

**Final Report**

**Grant #354**

*To submit your Final Report, go to the Final Report submission page on the ALG website: http://affordablelearninggeorgia.org/site/final_report_submission*

*Final report submission requires four files:*

- *This completed narrative document*
- *Syllabus or syllabi*
  - *(if multiple files, compress into one .zip folder)*
- *Qualitative/Quantitative Measures data files*
  - *(if multiple files, compress into one .zip folder)*
- *Photo of your team or a class of your students w/ at least one team member, minimum resolution 800x600px*
  - *(nearly all smartphones take photos larger than this size by default)*

*Follow the instructions on the webpage for uploading your documents. Based on receipt of this report, ALG will process the final payment for your grant. ALG will follow up in the future with post-project grantee surveys and may also request your participation in a publication, presentation, or other event.*

## General Information

**Date: 12/21/2018**

**Grant Round: 11**

**Grant Number: #354**

**Institution Name(s): Kennesaw State University**

**Project Lead: Rebecca Rutherfoord**

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


- Rebecca Rutherfoord, Interim Assistant Dean, College of Computing and Software Engineering, Department Chair for Information Technology, and Professor of Information Technology, brutherf@kennesaw.edu.
- Dawn Tatum, Senior Lecturer, College of Computing & Software Engineering, Information Technology Department, dtatum7@kennesaw.edu
- Susan VandeVen, Senior Lecturer, College of Computing & Software Enginieering, Information Technology Department, svandeve@kennesaw.edu

- Richard Halstead-Nussloch, Professor of Information Technology, College of Computing & Software Engineering, Information Technology Department, rhalstea@kennesaw.edu
- James Rutherfoord, Senior Lecturer, College of Computing & Software Engineering, Software Engineering & Game Design Department, jruther3@kennesaw.edu
- Zhigang Li, Assistant Professor of Information Technology, College of Computing & Software Engineering, Information Technology Department, zli8@kennesaw.edu


**Course Name(s) and Course Numbers:**

- IT 3123 Hardware/Software: Rebecca Rutherfoord
- IT 4723 IT Policy & Law: Dawn Tatum
- IT 4683 Management of IT: Richard Halstead-Nussloch
- IT 3223 Software Acquisition & Project Management: Susan VandeVen
- CSE 2300 Discrete Structures: James Rutherfoord

**Semester Project Began: Spring 2018**

**Final Semester of Implementation: Fall 2018**

**Total Number of Students Affected During Project:**

| Course | Enrollment |
|---|---|
| IT 3123 | 112 |
| IT 4723 | 15 |
| IT 4683 | 92 |
| IT 3223 | 78 |
| CSE 2300 | 238 |
| Total | 535 |

## 1. Narrative

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

- Summary of your transformation experience, including challenges and accomplishments
- Transformative impacts on your instruction
- Transformative impacts on your students and their performance

Our transformation effort is a great success. We have developed and implemented no-cost-to-student learning material for the five proposed courses. The URLs of the learning material are

listed in table one. 126 students have been impacted by our efforts. As shown in table two, students' opinions on Learning material we created are overwhelmingly positive. Our assessment data shows that, the no-cost learning material we developed are as effectively as the textbooks used in the corresponding classes.

**Table 1. URL of No-Cost Learning Material**

| Course | URL of No-Cost Learning Material | Developer |
|---|---|---|
| IT 3123 Hardware/Software | http://ksuweb.kennesaw.edu/~lli13/ALG364/IT3123 | Dr. Rebecca Rutherfoord |
| IT 4723 IT Policy & Law | http://ksuweb.kennesaw.edu/~lli13/ALG364/IT4723/IT4723.htm | Prof. Dawn Tatum |
| IT 4683 Management of IT | http://ksuweb.kennesaw.edu/~rhalstea/ALG/IT4683/index.html | Dr. Richard Halstead-Nussloch |
| IT 3223 Software Acq & Proj Mgt | | Prof. Susan VandeVen |
| CSE 2300 Discrete Structures | http://ksuweb.kennesaw.edu/~lli13/ALG364/CSE2300.html | Prof. James Rutherfoord |

**Table 2. Students' Opinion on No-Cost Learning Material**

| Statements | Score |
|---|---|
| In general, the learning modules were organized | 4.13 |
| The content, links and other leaning module materials were sufficient to help me learn. | 4.22 |
| I liked not having to buy a textbook and instead used the materials that were provided and free. | 4.45 |
| I prefer using selected open source/free learning materials rather than a paid textbook for this course. | 4.47 |
| Overall, compared to a potential paid textbook, open resource learning materials provided the necessary assistance to learn the material. | 4.62 |
| I would take another course that uses open/free learning materials. | 4.74 |

Note: in the survey, students are asked to express their opinion on a list of question using a 5-points scale where 1 is mostly disagree, 3 is neutral, and 5 is mostly agree.

Our plan is to get many of our undergraduate Information Technology courses completed without a textbook. The volatile area of Information Technology makes a no-textbook course ideal! Our faculty are completely onboard with the no-cost course development that the ALG grants provide.

From the instructors' perspectives, collecting and organizing the learning material ourselves not only enable us to better respond to dynamic nature of the information technology field, but also give us the flexibility to customize the course content to better serve our students. On the other hand, the transformation activities require significant efforts and time commitment from the faculty to collect, organize, create, and maintain no-cost learning material that offers equivalent learning experience as the textbooks. Our transformative efforts in replacing textbooks in the proposed courses will not happen without the strong supports from the ALG grant.

With our sustainability plan, the no-cost learning material will be continually used and hundreds and thousands of students from the Information Technology undergraduate degree Kennesaw State University will enjoy the cost savings and enhanced learning experience in the future.

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

IT3123

What worked well: The newly designed instructor created content, along with an online free textbook assisted the students in learning the material. All of the links and videos were also important for up-to-date material for the course.

What needs to be done still: New labs will need to be added to the course when the newly created Information Technology lab goes into effect fall 2019.

IT 4683

What worked well: taking our the ISACA materials and replacing them with online links and videos for the course outcomes.

IT 4723

What worked well: creating new content for the course, updating links and videos and creating new labs for the course allowed the students to have several types of ways to learn the material.

IT 3223

What worked well: Being able to replace two books for this course saved the students quite a lot of money. Since this course looks at two major areas – software acquisition & software life cycle, and then project management, the instructor was able to find up-to-date material for both major areas of the course. Creating new course content, providing links and videos has given the students current material to meet the course outcomes.

## 2. Quotes

- Provide three quotes from students evaluating their experience with the no-cost learning materials.
  "The IT3123 course has changed quite a bit from the previous version. I really liked having everything online (including a free textbook), and felt that all of the modules contained enough material for me to learn the outcomes of each module. I liked not having to buy a textbook." – an IT 3123 student

  "I had heard from previous students that we had to buy two books for this course, so I was surprised when we didn't have to buy any books. This really saved me money and I still felt I could learn everything I needed to from the materials provided." – an IT 3223 student

  "The IT 4683 course seemed fine without having a textbook. I didn't have any trouble learning the material for the course." – an IT 4683 student

## 3. Quantitative and Qualitative Measures

### 3a. Uniform Measurements Questions

*The following are uniform questions asked to all grant teams. Please answer these to the best of your knowledge.*

**Student Opinion of Materials**

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

Total number of students affected in this project: ___535_____

1. Positive: __91.1_____ % of ___102_____ number of respondents
2. Neutral: __6.45_____ % of ____102____ number of respondents
3. Negative: __2.45_____ % of ___102_____ 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.*

| | | Student average GPA | |
|---|---|---|---|
| **Course** | **Enrollment** | **Semester with no-cost material** | **Semester with textbooks** |
| IT 3123 | 112 | 2.89 | 2.23 |
| IT 4723 | 15 | 2.98 | 2.96 |
| IT 4683 | 92 | 3.73 | 3.70 |
| IT 3223 | 78 | 3.03 | 3.2 |
| IT 2300 | 238 | 3.72 | 3.68 |

Choose One:

- __X_ Positive: Higher performance outcomes measured over previous semester(s)
- ___ Neutral: Same performance outcomes over previous semester(s)
- ___ Negative: Lower performance outcomes over previous semester(s)

**Student Drop/Fail/Withdraw (DFW) Rates**

**Was the overall comparative impact on Drop/Fail/Withdraw (DFW) rates in the semester(s) of implementation over previous semesters positive, neutral, or negative?**

**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.*

| | | Drop/Fail/Withdraw Rate Comparison | |
|---|---|---|---|
| **Course** | **Enrollment** | **Current semester** | **Previous semester** |
| IT 3123 | 112 | 5% | 15% |
| IT 4723 | 15 | 8% | 8% |
| IT 4683 | 92 | 5% | 0% |
| IT 3223 | 78 | 12% | 11% |
| CSE 2300 | 238 | 5% | 8% |

___35____% of students, out of a total ___535____ students affected, dropped/failed/withdrew from the course in the summer and fall semesters of implementation.

Choose One:

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

### 3b. 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.*

For this ALG proposal, we proposed to use multiple data collection methods to measure the success of our creating our no-cost courses. We looked at both quantitative and qualitative measures.

Quantitatively, we compared students' DFW rates, grades, and success in course learning outcomes. The DFW rates are taken from student registration system. The student grades and success in course learning outcomes are assessed Faculty Course Assessment Report (FCAR). Faculty in IT department at Kennesaw State University are required to create a FCAR for every course they teach for each semester. The FCAR includes students' grade and success in achieving the course learning outcomes.

Qualitatively, we developed a survey to collect students' opinion on the learning material used in the courses. Students rated their experience using a 5 points scale. Students also give the opportunities to enter comments they may have. Based on the assessment data we collected, the learning material we created offer the same level of the learning effectiveness as the textbook. Some no-cost percentages were higher than textbook courses, and some were lower. Students' performance outcomes and DFW in generally stay the same pre-implementation and post-implementation.

## 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 IT department at KSU has an individual course architect architect for all courses. A course architect develops, updates and maintains course content based on research, publications and feedback from students and alumni. He/she also teaches the course at least once a year to make sure all resources are valid and make necessary changes. This makes sure all no-cost materials and resources are highly sustainable in the future offerings of this course.

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

Information technology is dynamic field where existing technology frequently get updated and new technology constantly comes out. Due to this reason, the no-cost learning material model naturally fits better for IT curriculum than the traditional textbook models. The faculty in the IT department already completed several individual and transform-at-scale grants. The positive feedback from the students and our own development and implementation process inspire more faculty in the IT to get involved with developing no cost learning material for their courses.

A panel was presented at SIGITE 2018 on developing No-cost Materials for STEM fields by all of the ALG participants. Dr. Rebecca Rutherfoord and Prof. James Rutherfoord also presented a paper at the EDSIG 2018 conference on Creating No-Cost Materials for STEM Courses.

## 6. Description of Photograph

- *On the Final Report Submission page, you will be submitting a photo. In this document, list the names of the people shown in this separately uploaded photograph, along with their roles.*

From Left:  Dr. Richard Halstead-Nussloch, Dr. Rebecca Rutherfoord, Prof. Datn Tatum, Professor Susan VandeVen