Affordable Materials Grants, Round 21:

Transformation Grants

(Spring 2022-Spring 2023)

Proposal Form and Narrative

# Applicant and Team Information

| Requested information | Answer |
| --- | --- |
| Institution(s) | Georgia Gwinnett College |
| Applicant name | Umar M. Khokhar |
| Applicant email  | ukhokhar@ggc.edu |
| Applicant position/title | Assistant Professor of Information Technology |
| Submitter name  | Helen McDaniel |
| Submitter email  | hmcdanie@ggc.edu |
| Submitter position/title | Project Coordinator, Office of Research and Sponsored Programs |

Please provide the first/last names and email addresses of all team members within the proposed project. Include the applicant (Project Lead) in this list. Do not include prefixes or suffixes such as Ms., Dr., Ph.D., etc.

| Team member | Name | Email address |
| --- | --- | --- |
| Team member 1 | Umar M. Khokhar | ukhokhar@ggc.edu |
| Team member 2 | Binh Tran | Btran5@ggc.edu  |
| Team member 3 |  |  |
| Team member 4 |  |  |
| Team member 5 |  |  |
| Team member 6 |  |  |

If you have any more team members to add, please enter their names and email addresses in the text box below.

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|  |

# **Project Title: Operating Systems Textbook Transformation**

# Project Information:

| Requested information | Answer |
| --- | --- |
| Priority Category /Categories | *Priority categories:* * *Student Participation in Materials Evaluation and/or Development*

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| Requested Total Amount of Funding*$30,000 maximum total award per grant* | *$10,240* |
| Final Semester of Project | *Spring 2023* |
| Using OpenStax Textbook? | *Yes* |

# Impact Data

## Course 1

| Row # | Requested information | Answer |
| --- | --- | --- |
| N/A | Course title and number | ITEC 3600 (Operating Systems) |
| N/A | Course instructors | Umar M. Khokhar and Weidong Mao |
| 1 | Average number of students enrolled per section | 24 |
| 2 | Average number of affected course sections scheduled in a summer semester | 1 |
| 3 | Average number of affected course sections scheduled in a fall semester | 2 |
| 4 | Average number of affected course sections scheduled in a spring semester | 2 |
| 5 | Total number of course sections scheduled in an academic year *Add up rows 2-4.* | 5 |
| 6 | Total number of student section enrollments per academic year | 120 |
| 7 | Original required commercial materials*Include each title, author, price for a new copy purchased from either your campus bookstore, the publisher, or Amazon, and a URL to the book showing the price.* | Operating System Concepts 10th Edition Authors: Abraham Silberschatz, Greg Gagne and Peter B. GalvinPrice: $298.99 (Paperback) At the time of submissionURL: https://www.amazon.com/Operating-System-Concepts-dp-1119439256/dp/1119439256/ref=mt\_other? \_encoding=UTF8&me=&qid=  |
| 8 | Original cost per student section enrollment | $298.99 |
| 9 | Average post-project cost per student section enrollment | $0 |
| 10 | Average post-project savings per student section enrollment | $298.99 |
| 11 | Projected total annual student savings per academic year | $34,798.8 |

# **NARRATIVE SECTION**

## **1. PROJECT GOALS**

**A. Materials creation: Create engaging, customized, and focused contents.**

The Operating System (OS) course (ITEC 3600) has seven (7) course objectives that mainly involve operating system design concepts, data structures & algorithms and systems programming basics which are considered highly technical concepts of the computer science field. In order to satisfy these course objectives, a customized book which breaks down the OS topics in a well-organized manner (based on the course goals) and simplifies the difficult theoretical concepts using real world examples would enhance the students’ interest in this theoretical-oriented course.

**B. Student Success: Improve student success rate through focused materials such as practical labs**

The Operating System course mainly involve theoretical contents and most of the concepts covered in this course are highly technical. The students always find it hard to grasp over the concepts if they are not engaged in the practical, hand-on projects where they can apply those theoretical concepts. In our proposed book, at the end of each chapter, we are planning to add some scenario-based hands on projects and labs which will help the students to improve their analytical and empirical skills. These projects and labs will also cover various advanced topics such as Dockers, Virtual Machines and Hyper threading. We hope this pedagogical transformation will fill the gap of textbook knowledge and real-world applications and in return improve student success rate. This customization will increase grades and reduce DWF rates.

**C. Cost Savings: Reduce student expenses in textbook purchases to $0**

This course is offered three times (Spring, Summer & Fall) in a year, and around 120 students take this course every year. The cost of the text book is $324.66 and using the no cost learning materials it will lower the cost of college education, a savings of nearly $39,000. Moreover, the availability of textbooks on the first day of class that are completely free and should help with decreased drop/fail/withdraw rates.

**D. Share the learning materials with other USG universities and colleges to benefit more students.**

## We will make the created learning materials available to GGC and as well as other USG faculty. They can be used as a trial and possible replacement to their current textbooks or supplement teaching materials.

## **2. STATEMENT OF TRANSFORMATION**

The operating system course covers the fundamental concepts of the operating system structure, software management schemes, memory architecture, resources constraints and security protection of the hardware from unauthorized access. These concepts serve as building blocks for many advanced courses in security and software engineering such as Internet Security, Ethical Hacking, Operating Systems Security, Software development and Software testing and Quality Assurance.

The operating system mainly acts as resource manager and provides a platform on which all the application software and other system software are installed. If any user or application wants to access any of the resources, then they must make system call which will be managed by the Kernel (OS). Usually, the hackers find the vulnerabilities of the operating systems and try to gain unauthorized access of the computational systems (the security analysts/pen-tester try to design a secure system to ensure that only legitimate people may have access to the system). Some of the recent vulnerabilities of Windows can be accessed by clicking on such links as CVE and Exploit-DB (See links in references). In order to avoid security attacks and to design a robust security system, a deep understanding of the operating systems is mandatory. (McGuffee, 2020; IES-NCES, n.d.) Without having a good understanding of operating systems, one cannot design application software since, each application software has its resources constraints and compatibility requirements. Moreover, without providing real-world exercises, learners are less likely to grasp the complex concepts that are involved in the operating system. The importance of project-based approach as a pedagogy (Pinto, et al., 2013) has been adopted for this project to ensure the success of our students, and this approach is made even more practical by the use of OER materials.

**Current State of the Course**

Currently, most of our ITEC students take this course before taking the 4000 level courses to gain knowledge of core concepts of operating systems. They have to purchase the book which is quite expensive ($324.66, but current website stated $298.99) and the “No cost book” will surely improve the students’ interest and the enrollment in this course. Additionally, we will write the book in a very simple academic language and will discuss the difficult concepts with real-world practical examples, which will surely improve the students’ success rate in this course.

**Impact on the Department and Institution**

In addition to increased enrollment in this major, the proposed course with hands-on practical labs strongly support GGC’s mission that… “emphasizes the innovative use of technology and active-learning environments to provide students enhanced learning experiences, practical opportunities to apply knowledge...” The team hopes that the project and the idea of no-cost textbook will inspire more successful course transformation in other areas and disciplines at GGC and USG at large.

## **3. ACTION PLAN**

ITEC 3600 has seven (7) learning outcomes:

1) Describe the structures and components of an operating system

2) Explain basic operating system concepts and functions, advantages and issues associated with virtualization

3) Implement short and long-term CPU scheduling to control multitask programs

4) Illustrate operations of UI and able to implement simple interrupt handling in a context of UI

5) Implement multi-process and concurrent process programs utilizing process synchronization

6) Describe how file systems are organized and how files are managed in OS

7) Describe memory management strategies and how those strategies are implemented in OS

The new course materials will be identified and gathered or created based on course objectives and student learning outcomes of the ITEC 3600 Operating systems course. The course syllabus will be modified for the transformation, such as the course material information, grade distribution, tentative course schedule, etc. The syllabus will be made available in D2L for this course by the PIs. Since the new course materials will be provided on D2L, each topic covered in the course will have a web link in D2L, which contains all the materials relevant to the topic. In addition, each course topic will be designed based on learning-by-doing approach to include many examples, tutorials, and hands-on features that allow students to practice and improve their own analytical skills. The organization of the transformed book, helpful contents and team members responsibilities are presented as follows:

**Suggested OER sources/references**:

* Introduction To Operating Systems

<https://www.oercommons.org/authoring/15170-introduction-to-operating-systems/view>

OER Commons

* Operating System

<https://www.oercommons.org/authoring/14878-operating-system/view>

OER Commons

* The Role of Operating Systems in Security

<https://study.com/academy/lesson/the-role-of-operating-systems-in-security.html>

Study.com

**Chapter 1**: Introduction to Operating Systems

Person responsible: Umar Khokhar

**Chapter 2**: Operating Systems Structures

Person responsible: Binh Tran

**Chapter 3**: Process Management

Person responsible: Binh Tran

**Chapter 4**: Thread Management

Person responsible: Umar Khokhar

**Chapter 5**: Deadlocks

Person responsible: Umar Khokhar

**Chapter 6**: File Management and Implementation

Person responsible: Binh Tran

**Chapter 7**: Memory Management

Person responsible: Umar Khokhar

**Chapter 8**: Virtualization Concepts

Person responsible: Binh Tran

The PIs have already reached out to Ms. Barbara Mann, Systems Librarian, to assist with identifying resources and OERs. They will cull the resources. The team plans to utilize Galileo, OpenStax, and Merlot to create the textbook and the ancillary materials.

**Sample Video lectures**

The PI will also create video lectures of the operating system course which will be provided to the students along with No-Cost materials. Some of the videos (created by the PI) can be accessed using the link below:

1. <https://youtu.be/6Ii9WxRQfDA>
2. <https://youtu.be/ALW64307Ux0>
3. <https://youtu.be/VPht1hwsl28>

**Sample Interactive Games for learning**

Team members have already created many Kahoot Games to involve the students and maximize Describe the current state of your class. For example, Because of the cost, students do not purchase books until later in class or never at all, which affects their class performance.

The learning of the theoretical contents of the course.

1. <https://create.kahoot.it/details/556bd839-3fac-4287-884c-982b151e7da4>
2. <https://create.kahoot.it/details/8238cf1b-f374-4ef1-94e4-8981c5431091>
3. <https://create.kahoot.it/details/daf9076c-e70c-4722-993c-4394d16c75e3>
4. <https://create.kahoot.it/details/4e008149-5d28-4961-958d-e3c77188837e>
5. <https://create.kahoot.it/details/4ea6885c-fd08-4419-9888-0a998214b037>
6. <https://create.kahoot.it/details/da3bf82b-f983-4c93-ab64-a06c980715f8>

**Team Members Role:**

**Umar Khokhar, Assistant Professor of Information Technology**: Dr. Khokhar has been teaching this course for three (3) years. During that time, he has created customized labs, customized handouts, assignments, and Kahoot Learning games. The project will allow him the much-needed time to organize his materials, thereby allowing him and future faculty to improve the teaching of the course. As a subject matter expert and instructional designer, he will identify and create new course materials and oversee the entire transformation process. For this project, he will select and determine study material for all quizzes, exams and homework assignments/projects, develop hands-on activities, lab activities, complete and analyze all grade/survey related data for the course. The new course materials will be identified and gathered/created based on course objectives and student learning outcomes of the ITEC 3600 Operating Systems course. Dr. Khokar will spend approximately 120 hours on his responsibilities.

**Binh Tran, Associate Professor of Information Technology**: Dr. Tran has been teaching a hardware and networking courses for ten years and has created customized materials that would prepare the students especially for the Microsoft Technology Associate certification. Approximately 90% of his students successfully pass the Microsoft Technology Associate certification. Dr. Tran focuses on hardware and software aspects of computing. In 2019, Dr. Tran received the Felton Jenkins Jr. Hall of Fame Faculty Award, the University System of Georgia’s highest faculty honor.

Dr. Tran’s expertise in cloud computing and virtualization is of particular benefit to the project since the project team plans to ensure that all materials will be accessible. As the other subject matter expert and instructional designer, he will create new course materials including developing lecture notes/course PPT slides, identifying online free complementary reading materials/tutorials/video clips for each course topic. He will also set up and maintain the D2L course material for this project. Dr. Tran will spend approximately 120 hours on his responsibilities.

Student Worker. This student worker will be a senior majoring in Systems and Security. The student would have previously used the current textbook, and therefore familiar with the operating system concepts and the practical labs. The student will be working on proof-reading, analysis of the lab exercises and numerical problems, and on clarity of concepts. We expect the student to work a total of 24 hours.

Since the course has various difficult and complex concepts, we will include real-world analogies to break down the concepts and enable the students to understand these operating systems models. Thus, students enrolled in the class will evaluate: (1) how comprehensible or easy to understand these concepts are and (2) how satisfied they are with the course materials and delivery. The student worker and student evaluations are critical to the improvement of the materials.

**The plan for providing open access to the new materials.**

The no-cost textbook and course materials will be hosted in Georgia Gwinnett College Brightspace (D2L) (https://ggc.view.usg.edu/d2l/home) and all students who take this course will have free access to the materials on the first day of class. This website will be used to post all the course materials, announcements, assignments, and for students to submit homework and take tests and quizzes. The “no-cost” textbook will not be “sold” in the GGC bookstore. The textbook will be FULLY accessible through links in D2L.

In addition, the materials will be accessible through the ALG repository.

The team will also work with the appropriate College’s unit to ensure that created materials that will be uploaded in the website will be accessible to students who may have hearing or reading disabilities.

## **4. QUANTITATIVE AND QUALITATIVE MEASURES**

The team will request for IRB approval prior to starting the grant. Dr. Khokhar will take the lead in ensuring that the evaluation plan is completed. Dr. Tran will assist with the development and refinement of the surveys.

**Goal 1: Creating customized and focused theoretical contents**

Quantitative Measures, Methods, and Tools:

The PI will assess the impact of the materials contents by ensuring that:

1. All of the deliverables are produced in a free digitalized format, including the textbook and ancillary materials.
2. All six-course objectives are included in the textbook to ensure that the required learning outcomes that the skills and knowledge that will prepare students for the next level IT course will be achieved.

Qualitative Measures, Methods, and Tools:

1. All students will be surveyed on their satisfaction with the course content of the transformed textbook. In addition, students will be surveyed on their assessment on ease of use, accessibility of OER materials, and effectiveness in helping students meet the learning outcomes.
2. We will also ask the students:
* What their challenges were with the materials?
* What they liked/did not like?
* What improvements or materials would help them further improve their skill?

**Goal 2: Improve student success rate through OER hands-on practical labs**

Quantitative Measures, Methods, and Tools:

The PIs will collect data from all students who take this course using the developed no-cost-to-student course materials. These data include but are not limited to:

1. Demographic data
2. Major area of study
3. Retention rate in the course
4. Passing and failing rate
5. Drop and withdraw rate
6. Percentage of students getting A’s, B’s, C’s, D’s, F’s, W’s
7. Percentage of students achieving student learning outcomes

The above data will be collected at the end of the semester and compared with the sections of the ITEC 3600 without using the proposed course materials. The comparison result will be used to evaluate the efficacy of the course materials in improving student success.

Qualitative Measures, Methods, and Tools:

The PIs will also survey our students using (SurveyMonkey) to understand their experience using the developed no-cost-to-student course material. For example, students will be asked to evaluate the following statement on a 1-5 scale from strongly disagree to strongly agree.

The project-based course materials are more engaging.

1. I like the class activities designed for this course.
2. I like the homework designed for this course.
3. I learned all the knowledge and skills needed to build my web site project.
4. Having a textbook free of charge affected my performance in the class.
5. Having a textbook available on the first day of class affected my performance in class.
6. Having online resources that are current and industry-focused impact my job/career preparedness.

The students will also be asked the following short answer questions:

1. What were the best aspects of using the No-cost-to-Students learning materials?
2. What were the challenges of using the No-cost-to-Students learning materials?
3. Other comments or suggestions about this course?

The survey will be conducted at the end of the semester and the data collected will help the PIs to modify and improve the learning materials to be used in the following semesters.

**Goal 3: Reduce student expenses in textbook purchases to $ 0**

Quantitative Measures, Methods, and Tools:

The PIs will:

* Track the amount of savings based on the number of students and current books’ prices.

Qualitative Measures, Methods, and Tools:

* Create open-ended questions in the student survey that will assess the impact of no cost versus hardcover textbooks on their finances and ability to keep up with class work. Sample question: How was your experience with e-contents vs traditional book-based contents?

**Goal 4: Share the learning materials with other USG universities and colleges to benefit more students.**

Quantitative Measures, Methods, and Tools:

The PI will:

* Track the number of presentations made to the academic community through conferences and during GGC TechTalk.
* Track the number of USG and non-USG faculty who have expressed interest on the materials.

Qualitative Measures, Methods, and Tools:

* Track the comments of colleagues who have utilized the materials.

## **5. TIMELINE**

Start will be in Spring 2022 and end in Spring 2023 semester.

We anticipate that it will take two semesters to complete the transformed textbook since this is a 3000-level course, which is a core course for majors. We will pilot in the spring 2023 and do the full implementation in Summer 2023.

**Spring and Summer 2022**

March 2022 – July 2022

* Start Literature Review, gathering of materials, start write-up of the textbook (First Four (4) Chapters) and four (4) Labs
* Submit ALG semester report

**Fall 2022**

August 2022 – December 2022

* Continue Write up (Last Four (4) Chapters) and Labs
* Peer Review and ready for pilot the Project for Spring
* Submit ALG semester report

**Spring 2023**

January 2023 – May 2023

* Pilot the project in one section, affecting ~25 students. Typically, we only offer two to sections in the spring
* Peer review, modifications
* Present findings at conference
* Submit final report

## **6. BUDGET**

A. Type of Grant: Standard-Scale Transformation

B. Budget request: $10,240

C. Budget Justification (Itemized):

**(1) Compensation for two faculty: $5,000 \*2 = $10,000**

Funds are requested to compensate for the investigators’ work and activities beyond normal teaching load in order to successfully complete the project. Each team member will receive $5,000 each. The requested amount will cover each team member’s pay and fringe benefits (FICA/SS, FICA Med, and Retirement) for Dr. Khokhar.

Pay: $3,922.80

Fringe Benefit: $1,077.20

Total Request: $5,000.00

Dr. Khokhar will be responsible for chapters 1, 4, 5, and 7 and the practical labs. He will take the lead on implementing the evaluation plan and preparing reports to ALG. Dr. Binh Tran who will be responsible for chapters 2, 3, 6 and 8 and the practical labs associated with the chapters. He will assist Dr. Khokhar on the evaluation.

Pay: $3,922.80

Fringe Benefit: $1,077.20

Total Request: $5,000.00

**(2) Compensation for 1 student worker: $240**

Student worker will assist with the proof reading, analysis of the lab exercises and numerical problems, and on the clarity of the concepts developed for the project. The student pay is $10/hour. Fringe is not applied on his or her pay.

Pay: $240

Fringe Benefit: $0

Total Request: $240

 **Total: $10,240**

## **7. SUSTAINABILITY PLAN**

The plan is to disseminate the information in order to publicize the benefits of transforming textbooks for courses, such as this course, and to encourage colleagues to consider utilizing our and other ALG-created materials already in the repository.

In the study entitled “Freeing the Textbook: Educational Resources in U.S. Higher Education, 2018”, Seaman and Seaman (2018) stated, “The study results show that there is little question that OER awareness and use will continue to grow.” In fact, the study indicated that faculty are preferring OER over print in the classroom for the first time. Yet, we noted that one of the findings is that less than one in five faculty are aware of any institutional or system-wide initiative. The project plans to assist the national and ALG initiative to utilize OER materials in the classroom through our dissemination and sustainability efforts. The project team understands that this project will greatly reduce students cost, better prepare and engage students, improve academic performance, and in turn improve retention and success rates in this course. As such, the project team will make every effort to disseminate information to other IT faculty. He will share the resources with the other full-time part-time faculty who teach the course so that they may adopt these resources. The adoption will result to an average of five sections taught by full-time and part-time faculty or the materials being adopted by GGC even after the grant is over.

For GGC faculty, all no-cost materials and resources will be made available in D2L and will be shared among all faculty teaching this course. For non-GGC faculty, the materials will be provided through the ALG textbook transformation repository. After the grant is over, the team plans to submit an ALG mini-grant to include other ancillary materials (e.g., Video lectures of the transformed textbook, PowerPoint (D2L), hands on labs, the OER search engines utilized by the project). The Succeeding updates will be based on the feedback received from the students and users, as well as emerging industry partners.

**REFERENCES**

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3. IES NCES National Center for Education Statistics. Publication 98. (n.d.) *Safeguarding your Technology.* Retrieved from: https://nces.ed.gov/pubs98/safetech/chapter4.asp

3. McGuffee, JW. (2020) *Why Teach Operating Systems?* Consortium for Computing Sciences in Colleges. Retrieved from: <https://dl.acm.org/doi/pdf/10.5555/3417682.3417687>

4. Pinto, Renê S., Pedro Nobile, Edwin Mamani, Lourenço P .Júnior, Helder J.F. Luz, Francisco J. Monaco. (2013) *Operating System from the Scratch: A Problem-based Learning Approach for the Emerging Demands on OS Development*. DOI: https://doi.org/10.1016/j.procs.2013.05.424

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5. Seaman, Julia E. and Jeff Seaman (2018). *Freeing the Textbook: Educational Resources in U.S. Higher Education 2018.* Babson Survey Research Group. Retrieved from: https://www.bayviewanalytics.com/reports/freeingthetextbook2018.pdf

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# Letter of Support

*Please provide the name and title of the department chair (or other administrator) who provided you with the Letter of Support.*

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| *Chavonda Mills, Dean of Science and Technology* |

# Grants or Business Office Acknowledgment Form

*Please provide the name and title of the grants or business office representative who provided you with the acknowledgement form.*

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| --- |
| *Marie Firestone, Associate Director, Office of Research and Sponsored Programs* |