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 | Rabia Shahbaz |
| Applicant email | rshahbaz@ggc.edu |
| Applicant position/title | Assistant Professor |
| Submitter name | Helen McDaniel |
| Submitter email | [hmcdanie@ggc.edu](mailto:hmcdanie@ggc.edu) |
| Submitter position/title | Project Coordinator, Office of Research and Sponsored Programs |

|  |  |  |
| --- | --- | --- |
| Team member | Name | Email address |
| Team member 1 | Rabia Shahbaz | rshahbaz@ggc.edu |
| Team member 2 | Ekaterina Nathanson | enathanson@ggc.edu |
| Team member 3 | Jamye Curry Savage | jcurrysavage@ggc.edu |
| Team member 4 | Angi Lively | alively@ggc.edu |
| Team member 5 | Sarah Park | spark3@ggc.edu |
| Team member 6 |  |  |

**PROJECT TITLE:** Precalculus: An Active Learning Approach

# Project Information

|  |  |
| --- | --- |
| Requested information | Answer |
| Priority Category / Categories  *Projects in these categories will receive three extra points in the final score for fitting a priority of these particular rounds of Transformation Grants. The type of funding for the project is determined by the funding categories criteria above. As of Round 18, projects can be a part of more than one category. Note that the below categories only indicate priority, not which applications qualify for a grant. Select all that apply.* | *2 Priorities:*   * *Student Participation in Materials Evaluation and/or Development* * *Professional Support from staff* |
| Requested Total Amount of Funding  *$30,000 maximum total award per grant* | $30,000 |
| Final Semester of Project | *Spring 2023* |
| Using OpenStax Textbook?  *This is to indicate to OpenStax that they can provide additional support and resources to your team during the adoption process.* | *No* |

# Impact Data

## Course 1

|  |  |  |
| --- | --- | --- |
| Row # | Requested information | Answer |
| N/A | Course title and number | MATH 1113 Precalculus |
| N/A | Course instructors | Rabia Shahbaz, Ekaterina Nathanson, Jamye Curry Savage, Angi Lively, Sarah Park |
| 1 | Average number of students enrolled per section | 28 |
| 2 | Average number of affected course sections scheduled in a summer semester | 5 |
| 3 | Average number of affected course sections scheduled in a fall semester | 8 |
| 4 | Average number of affected course sections scheduled in a spring semester | 15 |
| 5 | Total number of course sections scheduled in an academic year  *Add up rows 2-4.* | 28 |
| 6 | Total number of student section enrollments per academic year  *Multiply row 1 and row 5.* | 784 |
| 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.* | Title: Algebra and Trigonometry – MyMathLab, 6th Ed. ISBN 13: 9780135902059  Author: Robert F. Blitzer  Cost: $99.99 New Print  URL: Please copy and paste URL  <https://ggc.bncollege.com/course-material-listing-page?bypassCustomerAdoptions=true>  \*Spring 2022  \*Department – MATH  \*Course #: 1113  \*Section: 01 |
| 8 | Original cost per student section enrollment  *Add up the cost of all materials in row 7.* | $99.99 |
| 9 | Average post-project cost per student section enrollment | $0 |
| 10 | Average post-project savings per student section enrollment  *Subtract row 9 from row 8.* | $99.99 |
| 11 | Projected total annual student savings per academic year  *Multiply row 10 and row 6.* | $78,392.16 |

**NARRATIVE SECTION**

## **1. PROJECT GOALS**

The overarching goal of this project is to increase students’ understanding and disposition towards precalculus while providing them a no-cost course option. The course material developed in this project will aim to transform the pedagogy of teaching and learning precalculus. Precalculus is a required math course for all STEM majors at Georgia Gwinnett College (GGC). GGC students have historically struggled in this course as indicated by an average DFW rate of about 40% in the last five years.

Nationwide, the number of students who take college precalculus is increasing and according to a report prepared by a cabinet-level agency for the Governor of State of Ohio, college algebra and precalculus courses have become gateway math courses that hinder students from continuing studies in their areas of interest. Li and Schoenfeld (2019) have mentioned how mathematics, in general, is often perceived as a difficult subject and as a result many students leave disciplines in science, technology, engineering, and mathematics (STEM), closing doors to careers in those fields. In addition, the increasing cost of textbooks in higher education is limiting students’ access to instructional resources, thereby causing them to fall behind. In response to these price trends, recently many educators have turned to open educational resources (Baraniuk and Burrus, 2008).

The ever-increasing failure rate in mathematics and cost of course materials in higher education drive this project, which has three main goals as follows:

1. Increase accessibility of the precalculus course by providing no cost materials thereby saving our current and future precalculus students hundreds of dollars.
2. Develop course materials to allow active learning in precalculus courses. A sample course will be developed that can be easily adapted and integrated by other instructors.
3. Increase students’ understanding of mathematical concepts, which will increase students’ success rate and retention in STEM majors.

## **2. STATEMENT OF TRANSFORMATION**

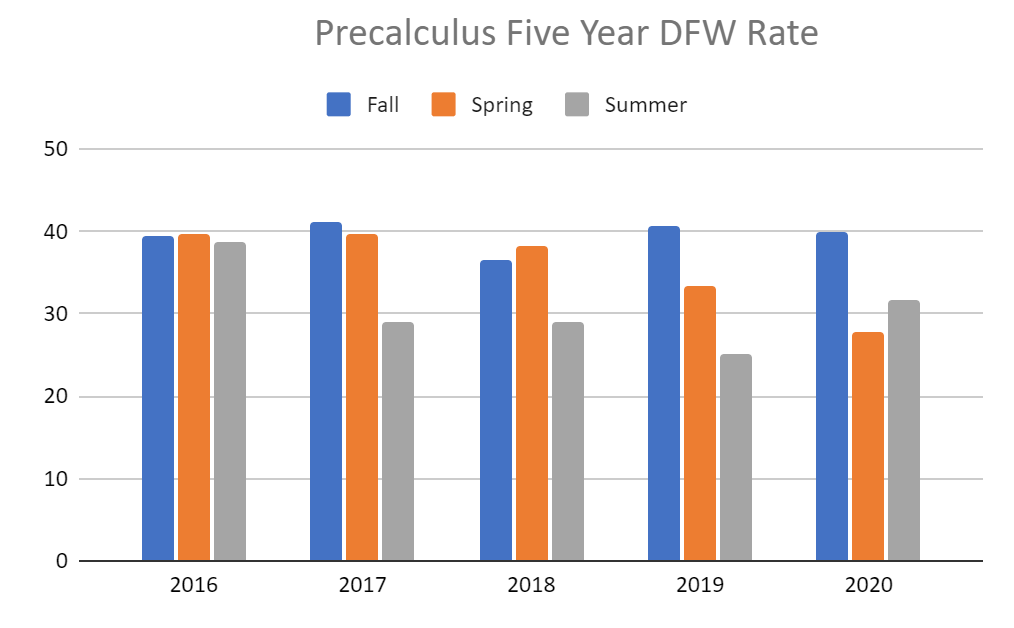
***A description of the current state of the course, department, and/or institution if relevant.***

Georgia Gwinnett College (GGC) is one of the most diverse four-year colleges of the University System of Georgia, serving many non-traditional students with various academic and socio-economic backgrounds. At GGC, STEM majors are required to take precalculus as one of their core courses. Based on the data provided by our Office of Institutional Research, about 700-800 students enroll in precalculus classes in each of the fall and spring semesters, and only 60% of them successfully complete the course. Table 1 and Figure 1 below show the five-year DFW rate of our precalculus course from 2016 through 2020. In 2016 & 2017, the DFW rate was on average 40% for all semester terms (Fall, Spring, and Summer). It is necessary to note that a significant number of transient students take the precalculus course during summer terms, which is a factor contributing to a decline in DFW rates during summer. Also, in Spring 2020, the COVID pandemic transferred all courses to online platforms, which impacted the DFW rate, causing it to drop to 28%. Despite the recent fluctuations in the DFW rates, the average DFW rate for all five years during the fall semesters when the majority of students take the course for the first time is 39.8%. This higher failure rate causes students to retake this course multiple times and some end up changing their majors to a non-stem majors.

**Table 1: Precalculus Five-Year DFW Rates**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **2016** | **2017** | **2018** | **2019** | **2020** |
| **Fall** | 40 | 41 | 37 | 41 | 40 |
| **Spring** | 40 | 40 | 38 | 33 | 28 |
| **Summer** | 39 | 29 | 29 | 25 | 32 |

**Figure 1: Precalculus Five-Year DFW Rates**



In a traditional precalculus course at GGC, students are required to purchase course materials such as an access code to the Pearson MyMathLab (MML) software/online homework management system and the corresponding ebook costing as much as $99.99. This high cost of materials causes almost all of our students to not purchase the hardcopy textbook and instead only purchase the required MML access code which includes the online access to the textbook. There are still many students that cannot afford to purchase the MML access code leaving them without access to any course materials or educational resources.

**Overall description of how the project will impact the course, department, and institution as described previously. Include references to scholarly literature to support the claims of your impact if possible.**

In response to these current issues of higher failure rate in mathematics and increased cost of instructional material (i.e. textbook and homework platform), this project aims to transform one of our largest multi section courses, precalculus, into an accessible active learning course. A large-scale evaluation of open educational resources (OER) has found positive effects of OER adoption on student grades (Colvard et al., 2018). Through this project we will not only create no-cost instructional resources for our students, but will also transform the pedagogy of this course. The ancillary materials and activities developed in this course will facilitate the implementation of active learning allowing students to engage in meaningful classroom experiences. The National Center for Education Statistics (2012) has reported that a major cause for our students’ low performance in mathematics courses is the lack in their ability to comprehend and apply mathematical concepts. Weiss and Pasley (2004) also studied the cause of the nation's current performance and achievement in mathematics and found a significant correlation between students’ learning experiences and performance. As a result of these and other similar findings, many researchers and agencies such as the National Council of Teachers of Mathematics (2009) encourage educators to place great emphasis on student-centered learning strategies.

The course materials developed in this project will include lecture videos with embedded guided notes. These pre-work assignments are designed to not only engage students outside the classroom but also develop a knowledge base that will assist them to actively participate in the in-class collaborative activities. These collaborative activities will allow students to develop a deeper understanding of the precalculus concepts and will help them in making connections between mathematics and the real world. We plan to adopt Myopenmath, which is a free and open educational resource, as an online homework platform for our students. The ancillary materials created through this project can be easily adapted by other instructors. The in-class activities can also be adapted in online settings and will help in making synchronous online teaching more interactive and engaging for students.

## **3. ACTION PLAN**

**A. Transformation Stages and Roles and Responsibilities of Each Team Member**

Our proposed transformation of the precalculus course is unique as it is not seeking to transform any specific already-existing textbook, but the entire teaching and learning experience for a USG required curriculum. Experienced educators have long been aware of the inefficacy associated with passive learning, and the effects of the recent pandemic have further illuminated this fact. Educators have had to respond to the needs of students by experimenting with modalities and techniques that were previously foreign to them. Our team is responding to those shifts with the creation of resources that allow active learning in the classroom, facilitated by a blended instructional approach to the transmission of the curriculum. All materials created will be accessible by all students. Although the team members will continue to implement and improve this course, the grant project will be completed in four distinct stages.

**Stage One (late spring 2022 and early summer 2022)-** **Material Curation and Creation:**

In depth review of several existing OER that have potential for implementation by either direct adoption or customizing materials to align with transformation goals. After the initial review, team members will create a list of topics for which ancillary materials and in-class activities will be designed. Each team member will be responsible for specific topics, but the entire team will review all of the course materials. The course materials will be developed for both inside and outside the classroom experience.

1. Pre(class)-work tools that facilitate a blended classroom environment by providing ground knowledge and exposure to the content.
2. Video Instruction – while all instruction will not be conducted by video, creating these short video instructional experiences will allow students the opportunity to be exposed to curricular topics prior to the scheduled class meeting times. Unlimited student access also provides the capability to revisit topics for which they feel less prepared by re-watching at their convenience.
3. Coordinated Guided Notes – these materials directly correspond to the video including theory behind the curricular skills as well as ample material exemplifying ways to use those skills. These notes act as scaffolds to the video materials, increasing mental connections and extending interaction with videos beyond “just” taking notes.
4. In-Class Active Learning Experiences:
5. When students arrive to class, having previously engaged in the video and note-taking process, they will have filled notes to refer to, an initial interaction with the curriculum, and the class time can be rich in terms of instructor-led activities and student-driven questions. Activities will be curated or created that go beyond worksheets and really require students to ***engage*** with and ***apply*** the material, with opportunities to collaborate with their peers and instructor.

C) Post-work (Homework)

iv) We will use Myopenmath, which is a free online course management system, for homework and creating assessments. The team will create a new precalculus course and will develop weekly homework assignments. Myopenmath has an extensive community of users who collaborate and share their courses and questions. The team will review the available questions and will adopt or create new for homework and assessments. Myopenmath can be easily integrated into our Learning Management System which will provide our students an easy access to all course materials.

**Stage Two (late summer 2022) - Beta Testing:**

Team members will field test the created materials in their summer precalculus classes while continuing to create new course materials. Interviews will be conducted to hire three math major student workers who will assist in the evaluation and modification of the course materials. These students will be recruited through our math and engineering club. The interested students will be required to submit an application along with their CVs and two recommendation letters from their past math professors. After reviewing the applications and interviewing the selected students, the team will hire three students as student workers for this project. These student workers will be hired for fall 2022 and spring 2023 semesters.

**Stage Three (fall 2022) - Pilot and Enhancements:**

In fall 2022 the team members will integrate materials fully within their course sections. The student workers will be given access to our course sections. These will work for 85 hours together in fall 2022 and spring 2023 semesters and will be paid at the rate of $10/hr. Student workers will attend our classes twice a week and participate in our newly created course activities as students. They will also complete surveys to provide us specific feedback about the content and the pedagogy of the activities. The team will host two focus groups at the end of fall 2022 and spring 2023 semesters to receive more qualitative and comprehensive feedback from the student workers regarding the quality and effectiveness of the content and delivery of the course materials. The feedback received from these student workers will help in improving the quality and delivery of our course materials. In addition to the student evaluators, the enrolled students in the courses will also be asked to complete their course evaluations. The course evaluation will be tailored to include questions pertaining to the effectiveness of and their satisfaction in using the course and ancillary materials.

**Stage Four (spring 2023) - Full Integration:**

Team members that are teaching precalculus in spring 2023 will integrate improved materials fully within their course sections. Materials will also be made available to any other faculty member at GGC desiring to use the instructional package.

The curriculum has been divided up between the team so that each member is responsible for fully developing three (3) content-rich topics within the curriculum and fully creating the support materials that are mentioned above. The topics are divided as follows:

* Rabia Shahbaz: Trig Functions of any Angle, Graphs of Trigonometric Functions, and Applications of Trig Functions
* Ekaterina Nathanson: Angles and Radian Measures, Right Triangle Trigonometry, and the Unit Circle
* Sarah Park: Exponential Functions, Inverse Trig Functions, and Solving Systems of Equations using Matrix Methods
* Jamye Curry Savage: Polynomial Functions, Rational Functions & Logarithmic Functions
* Angela Lively: Using Special Trig Formulas, Solving Trig Equations, and Solving Oblique Triangles

**B. Number of hours for each task**

It is estimated that the creation process for the materials for each topic designated to each team member will require between **100-150 hours of work**. Upon completion of the development of the materials, team members will all be involved in beta-testing **(5 hours/topic)** as well as field testing **(10 hours/topic)** of the materials, and finally, for fully implementing materials **(10 hours/topic)** and data collection and analysis **(2 hours/topic)** within the treatment sections.

There is a great deal of existing open, no-cost, and/or low-cost course materials for precalculus (college algebra + trigonometry) in the form of textbooks, but we have not found a complete package that transforms the entire learning process. We intend to run our pilots using MyOpenMath as a homework platform, but our materials are intended to be independent of any given text.

**C. Plan for providing access**

We intend to provide access to our materials by using the hosting provided by Affordable Learning Georgia OpenALG, as well as post all material locally within our institution’s learning management system (D2L). The team will also work with Ms. Chris Robinson (GGC Technical Writer) to make a final check on the uploaded materials to ensure that they are ADA compliant for our students who are hearing and/or visually impaired.

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

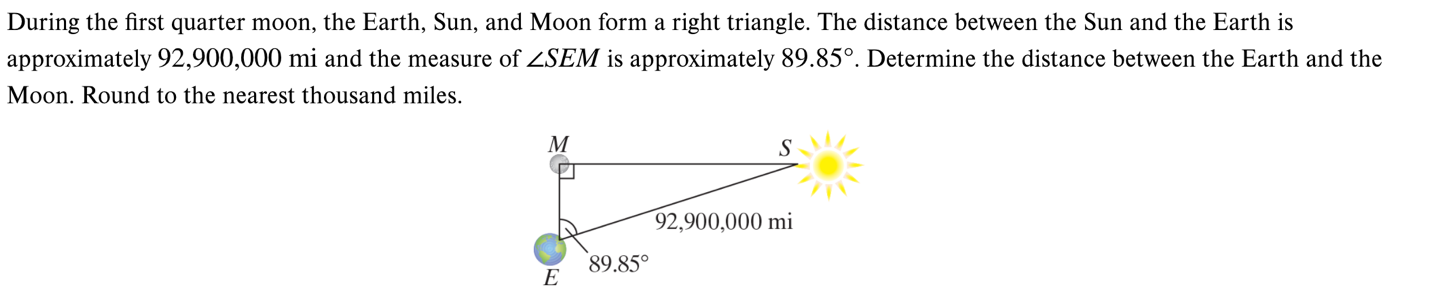
The team will combine both quantitative and qualitative data to measure the impact of the ancillary and no-cost resources (guided notes, pre-work, videos, active-learning in-class activities, MyOpenMath) on student satisfaction, student performance, and course-level retention through surveys, final grade distribution, and pre- and post-assessments.

Quantitative measures:

* We will collect demographic information (age, class year, major, ethnicity), and academic preparation data (GPA) will be obtained directly from the college.
* We will use end of semester course grade distribution, attendance rate, and DFW rates, for comparison between the control and treatment precalculus sections.
* Students will take pre and post-precalculus content assessments to assess student learning objectives.
* We will compare scores on students’ responses on the common final assessment questions between control and treatment Precalculus (Math 1113) sections. Examples of common final assessment questions are:

Sample Questions:

1. Given the function , find the amplitude, period, phase shift(s), maximum and minimum points. Graph the function for one period.
2. The population of Canada in 2010 was approximately 34 million with an annual growth rate of 0.804%. At this rate, the population (in millons) can be approximated by , where is the time in years since 2010 (source: [www.cia.gov](http://www.cia.gov)).
3. Is the graph of an increasing or decreasing exponential function?
4. Evaluate and interpret its meaning in the context of this problem.
5. Evaluate and interpret its meaning in the context of this problem. Round the population value to the nearest million.

3. During the first quarter moon, the Earth, Sun, and Moon form a right triangle. The distance between the Sun and the Earth is approximately 92,900,000 miles and the measure of is approximately . Set up an appropriate trig equation and determine the distance between the Earth and the Moon. Round to the nearest thousand miles.

* We will administer pre and post surveys using a Likert scale and multiple choice format to analyze information on: (1) students’ previous math background, (2) course satisfaction, (3) engagement with active learning tasks, (4) satisfaction of blended flipped-model, (5) satisfaction of collaborative learning, (6) attitudes of learning precalculus, (7) interactions with faculty and peers, (8) ease of using no-cost MyOpenMath platform for homework, and (9) perception of videos and pre-work.

Qualitative measures :

* As part of the survey at the midpoint and at the end of the semester, students will complete open-ended questions to have students reflect on and provide feedback on (1) satisfaction of the videos, pre-work, and guided notes (2) perceptions of in-class active learning activities (3) perceptions of flipped-learning (4) satisfaction of MyOpenMath as a low-cost homework option and (5) how this course helped their learning of precalculus.
* Focus-group interviews or surveys of hired students about quality and effectiveness of the course materials and learning activities.

Examples of Likert scale (Strongly Disagree to Strongly Agree) survey questions are:

1. I am satisfied with the videos.
2. I am satisfied with MyOpenMath.
3. The pre-work was beneficial to my learning.
4. The in-class activities encouraged collaboration with my classmates.
5. The materials were presented clearly and in an organized manner.

Examples of open-ended qualitative questions are:

1. Which aspects of this course did you find the most beneficial to your learning of pre-calculus?
2. In what ways did the in-class learning activities encourage collaboration with other students in the class?
3. What did you like about the organization and delivery of this course? Why?
4. If you could change one thing about the course, what would it be?
5. If you could keep one thing the same about this course, what would it be?

## **5. TIMELINE**

The following timeline will be utilized shortly after the kickoff on March 25, 2022:

**Spring 2022-** All team members will complete the asynchronous training modules followed by the synchronous kickoff meeting on March 25. In April and May, the Team will meet to develop the course pacing guide and a schedule that will allow active learning throughout the semester. Team will create a list of materials that need to be created for each topic. The IRB application will be submitted to use students’ grades in fall 2022 and spring 2023 for comparison and analysis purposes. The team will also review the existing OER resources for possible adoption/adaptation.

**Summer 2022-** Team will create pre-work lecture videos along with guided notes for students to complete before each class meeting. Team will also create in-class activities that will allow students to dig deeper into the concepts using active learning. During summer semesters our college offers limited sections of all courses and these sections are randomly assigned to faculty who are interested in teaching during summer. Any members of our team who are assigned to teach precalculus during summer 2022 will implement active learning using the new course materials. The course materials will be developed and piloted in both in-person and online settings.

**Fall 2022-** Each member of the team will request two sections of precalculus. In all 10 sections we will pilot our resources. The classes will be taught using blended instruction. Three GGC students who are currently taking higher mathematics courses will be hired through an interview process. These students will be added into three precalculus sections taught by our team members. The hired students will complete the pre-work and in-class assignments like regular students. Surveys and focus group interviews will be conducted to obtain feedback from these students regarding the quality and effectiveness of our resources. Survey questions will also ask students to rate the pedagogy and delivery of the experiential learning activities. The feedback received from student ALG materials evaluators and our regular students will help us in modifying and improving our resources.

**Spring 2023-** After piloting and modifying instructional resources using student evaluators and students’ feedback, we will fully implement our transformed course in spring 2023. Students’ grades will be compared from our historic DFW rate in the last 5 years. In addition, results from the pre and pos-perception surveys will be compared to analyze the impact of active learning on students’ perception and disposition towards mathematics. Final report of the project will be submitted.

## **6. BUDGET**

Type of Request: Transformation Grant

Request: $30,000

**A. Faculty Individual Awards - $25,000**

Each of the five Faculty members will receive a $5000 stipend for transforming the precalculus course by creating course materials that will allow and facilitate active learning. The stipend will cover the compensation as well as the fringe benefits (FICA/SS, FICA Med, Retirement (rate varies) for all members. All team faculty members will participate in the training modules and will create and review all course materials. Topics are further subdivided based on faculty’s interest and expertise.

* Rabia Shahbaz, Assistant Professor of Mathematics, will serve as the principal investigator and will lead and facilitate all team meetings. She will be responsible for accomplishing all benchmarks as determined by the team and for submitting the end report of the project. She will create the course materials for the following topics: Trig Functions of Any Angle, Graphing Trig Functions, and Applications of Trig Functions.

Pay: $3,922.80

Fringe Benefit: $1,077.20

Total Request: $5,000.00

* Ekaterina Nathanson, Associate Professor of Mathematics, will lead the effort of aligning and compiling existing open resource materials that can be adapted for active learning. She will be responsible for creating course materials for the following topics: Angles and Radian Measures, Right Triangle Trigonometry and Unit Circle.

Pay: $3,922.80

Fringe Benefit: $1,077.20

Total Request: $5,000.00

* Jamye Curry Savage, Associate Professor of Mathematics, will supervise the process of submitting an IRB application. She will be responsible for developing course materials for Polynomial, Rational and Logarithmic Functions.

Pay: $3,922.80

Fringe Benefit: $1,077.20

Total Request: $5,000.00

* Angela Lively, Instructor of Mathematics, will lead the hiring process for student interns. She will be responsible for developing course materials for Special Trig Formulas, Solving Trigonometric Equations and Using Trigonometry in Oblique Triangles.

Pay: $3,922.80

Fringe Benefit: $1,077.20

Total Request: $5,000.00

* Sarah Park, Instructor of Mathematics, will lead the development of evaluation instruments which includes pre and post surveys, reflection prompts, and interview questions for the focus group. She will be responsible for creating course materials for Exponential Functions, Inverse Trigonometric Functions and System of Equations.

Pay: $4,277.53

Fringe Benefit: $722.47

Total Request: $5,000.00

All team members have worked together in the past on several projects and have built a strong camaraderie amongst them. Rabia Shahbaz, Ekaterina Nathanson and Jamye Curry Savage have collaborated on multiple CURE (Course Embedded Undergraduate Research Experience) projects in Precalculus and Calculus I courses. Rabia Shahbaz, along with another colleague, has worked on a mini ALG grant in the past in which guided notes were developed for college algebra courses. She has also led a Faculty Learning community which was funded under the umbrella of a larger NSF grant at our college. Angela Lively and Sarah Park are doctorate students and are passionate about teaching and implementing research-based strategies and interventions into their courses.

All team members have recently participated in the mobile summer institute on scientific teaching (MOSI) funded by the NSF grant. Most team members have served as precalculus coordinators in the past. Rabia and Angi are current coordinators of precalculus and will ensure that the new of the team members are current coordinators of the precalculus course.

**B. Student ALG Course Materials Evaluators - $2,550**

Three students will be hired for fall 2022 and spring 2023, and each will be paid $850. These students are preferably math major students who are taking advanced math classes. These students will work as evaluators and will provide us with feedback on the course materials and the pedagogy. Each student worker will attend our classes twice a week and participate in the course activities. The feedback from the student workers will be collected through qualitative and quantitative surveys. Additionally, these student workers will participate in focus groups at the end of both fall 2022 and spring 2023 semesters. The feedback received from these students will help in improving the content and pedagogy of the activities.

Pay per student: $850 (85 hours X $10/hour)

In-class participation in fall 2022 and spring 2023 - 2.5 x 28= 70 hours

Surveys & Focus Group- 15 hours

**C. Supplies- $2,450**

* Wireless Drawing Table- $950

A wireless writing tablet will be purchased for each faculty member in the team to facilitate video instructions as well as active learning in the classroom @ $190 (includes tax and shipping) X 5 faculty.

LINK:<https://www.amazon.com/gp/product/B079NWPZTG/ref=ox_sc_act_title_1?smid=A1FVGXDO8NIMN0&th=1>

* Edpuzzle Subscription-$1500

Each faculty member of the team will receive a two year subscription for Edpuzzle. Edpuzzle will be used for creating and storing engaging videos for students as part of the blended instruction.

LINK: https://edpuzzle.com/pricing

## **TOTAL REQUEST: $30,000**

## **7. SUSTAINABILITY PLAN**

**The maintenance and updating of course materials**

The goal of this project is to transform the approach of teaching precalculus from a traditional lecture-based course to a student-centered active learning course. We will create a course shell for this transformed course and make it available to all full time and part time math faculty at our institute. We are using a free open resource Myopenmath as a homework (HW) platform but this course can easily be paired with any text and HW system that our discipline decides to adopt in the future. Through the Creative Common license, we will make this transformed course available to the public.

**The commitment of the department(s) or institution(s) to continue the use of affordable materials**

This course will remain available to all our GGC faculty as a sample Precalculus course. The team is committed to maintain and improve this course on an ongoing basis. Our team is committed to improve the quality of the course materials and add new activities. We will also continue to add more technology and innovative ideas into this course to make online teaching of this course more engaging for our students.

**Any possible expansion of the project to more course sections in the future**

We plan to help support the expansion of the ALG efforts and the use of our materials by publishing one or more articles and presenting this project at local (USG Teaching and Learning conference, Georgia Organization for Student Success etc.) and national conferences (Joint Math Meeting and International Conference on Technology in Collegiate Mathematics). We also plan to collaborate with our Center for Teaching and Learning department and host a workshop on active learning. Through these efforts, we aspire to disseminate the effectiveness of the project and encourage colleagues to develop open educational resources that will lower or remove the financial burden imposed on our students.

**References**

Baraniuk RG, Burrus CS. Global Warming toward Open Educational Resources. Communications of the ACM. 2008;51(9):30.

Colvard NB, Watson CE, Park H. The Impact of Open Educational Resources on Various Student Success Metrics. International Journal of Teaching and Learning in Higher Education. 2018;30(2):262–275.

Li, Y., Schoenfeld, A.H. Problematizing teaching and learning mathematics as “given” in STEM education. IJ STEM Ed 6, 44 (2019). <https://doi.org/10.1186/s40594-019-0197-9>

National Center for Education Statistics. (2012). Highlights from TIMSS 2011: Mathematics and

science achievement of U.S. fourth- and eighth-grade students in an international context

(NCES Publication No. 2013009). Retrieved from <http://nces.edu.gov/>

National Council of Teachers of Mathematics. (2009). Focus in high school mathematics:

Reasoning and sense making. Reston, VA: Author.

Weiss, I., & Pasley, J. (2004). What is high-quality instruction? Educational Leadership, 61(5),

24-28.

# Creative Commons Terms

*I understand that any new materials or revisions created with ALG funding will, by default, be made available to the public under a Creative Commons Attribution License (CC-BY), with exceptions for modifications of pre-existing resources with a more restrictive license.*

# Accessibility Terms

*I understand that any new materials or revisions created with Affordable Learning Georgia funding must be developed in compliance with the specific accessibility standards defined in the Request for Proposals.*

# Letter of Support

*The Department Chair from the corresponding project, or the Department Chair’s direct report such as the Dean or Provost, must provide a signed Letter of Support for the project. This letter should acknowledge the following:*

* *The department will provide support for fund disbursement in correspondence with the Grants/Business Office.*
* *The department approves of the work on the proposal by the applicant(s).*
* *The department acknowledges the sustainability of the use of these affordable resources after the grant work is complete.*

*In the case of multi-institutional affiliations, all participants’ institutions must provide a letter of support.*

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

|  |
| --- |
| Mohamed I. Jamaloodeen Ph.D. Chair of Faculty, Mathematics, School of Science and Technology Georgia Gwinnett College |

# 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.*

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