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 | Zengjun Chen |
| Applicant email  | zchen1@ggc.edu |
| Applicant position/title | Associate Professor |
| Submitter name  | Helen McDaniel |
| Submitter email  | hmcdanie@ggc.edu |
| Submitter position/title | Coordinator |

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 | Zengjun Chen | zchen1@ggc.edu |
| Team member 2 | Qing Shao | qshao@ggc.edu |
| Team member 3 | Sherita Moses | smoses2@ggc.edu |
| Team member 4 | Lijun Pang | lpang@ggc.edu |

# **Project Title:** Adoption and improvement of the Existing OER (OpenStax College Physics) of Introductory Physics II at GGC

# **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.* | *Collaborative Projects with Professional Support* |
| Requested Total Amount of Funding*$30,000 maximum total award per grant* | *$21,987*  |
| 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.* | *Yes* |

# **Impact Data**

## Course 1

| Row # | Requested information | Answer |
| --- | --- | --- |
| N/A | Course title and number | Introductory Physics II with lab (PHYS1112K) |
| N/A | Course instructors | Zengjun Chen, Qing Shao, Sherita Moses, Lijun Pang |
| 1 | Average number of students enrolled per section | 24 |
| 2 | Average number of affected course sections scheduled in a summer semester | 2 |
| 3 | Average number of affected course sections scheduled in a fall semester | 5 |
| 4 | Average number of affected course sections scheduled in a spring semester | 7 |
| 5 | Total number of course sections scheduled in an academic year *Add up rows 2-4.* | 14 |
| 6 | Total number of student section enrollments per academic year*Multiply row 1 and row 5.* | 336 |
| 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: College Physics: A strategic approach (4th edition) Author: Randy KnightCost: $233.49 (new)<https://www.amazon.com/College-Physics-Strategic-Approach-4th/dp/0134609034> |
| 8 | Original cost per student section enrollment*Add up the cost of all materials in row 7.* | $233.49 |
| 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.* | $233.49 |
| 11 | Projected total annual student savings per academic year*Multiply row 10 and row 6.* | $78,452.64 |

# **NARRATIVE SECTION**

## **1. PROJECT GOALS**

This project aims to:

1. Adopt OpenStax College Physics at no cost to students in our introductory physics II (PHYS1112K).
2. Create tailored materials (lecture videos, lab videos, homework problems, and tests) for the course.
3. Assess the impact of the adoption on students’ satisfaction and retention in the proposed course.

## **2. STATEMENT OF TRANSFORMATION**

**Current state of the course, department, and/or institution**

PHYS1112K at GGC is an algebra-based physics course that is required for most STEM-degree-seeking students. It covers the materials of electricity, magnetism, and optics. Upon completion of this course, students will:

1. Demonstrate a conceptual and mathematical knowledge of electrostatic force, field, potential energy, and potential;
2. Demonstrate a conceptual and mathematical knowledge of DC circuits containing batteries, resistors, and capacitors;
3. Demonstrate a conceptual and mathematical knowledge of magnetic forces and fields and induction;
4. Demonstrate a conceptual and mathematical knowledge of ray and wave optics;
5. Effectively collect and present scientific data gathered through experiment;
6. Use computational and estimation skills to analyze data, construct and interpret charts, graphs, and tables, and compose scientific explanations.

Each year, there are around 14 sections of PHYS1112K offered to the GGC students by the physics discipline and more than 250 students are served. Most students are majoring in chemistry, biology, and exercise science. In the fall of 2021, the performance of students in PHYS1112K can be seen in the following table.

**Table 1: Distribution of final grades in all PHYS1112K sections in Fall 2021**

|  |  |  |
| --- | --- | --- |
| **Grade** | **Number of students** | **Percentage** |
| A | 31 | 34% |
| B | 22 | 24% |
| C | 13 | 14% |
| D | 2 | 2.2% |
| F/FN/WF | 10 | 11.0% |
| W | 13 | 14.3% |

College textbooks become more expensive. [1] Several popular textbooks in the market for the introductory physics course and their prices are listed in the following table.

**TABLE 2: Sample Introductory Physics II Textbooks**

**Sold at Amazon.Com**

|  |  |  |
| --- | --- | --- |
| **Title** | **Publisher** | **Price** |
| College Physics: A strategic approach (4th edition) by Randy Knight | Pearson | $233.49 |
| College Physics (3rd edition) by Roger Freedman | Macmillan | $297.47 |
| College Physics (11th edition) by Raymond Serway | Cengage | $142.95 |

Because of the high prices, it was observed by the PI and Co-PIs that a significant percent of PHYS1112K students did not have the required textbook until weeks or even months after the class began. Some of them did not possess a textbook at all in the whole semester. The observation is consistent with the findings of a survey conducted by the U.S. PIRG Education Fund. [2] This has resulted in a series of problems such as delay of assignment submissions, low quiz and test scores, withdrawal of students from the course (shown in table 1), and even delay of college enrollment for many high-school graduates. [3] Therefore, providing affordable (low or no cost) and equally well-written physics materials not only reduces students’ financial burdens but also helps the retention rate and improves college enrollment.

**Overall description of the project**

This project will first adopt OpenStax College Physics, which can be accessed freely by the public. As a supplement, it is proposed that the PI and Co-PIs create short videos to help students in the course. Short videos have received good ratings when it comes to getting students engaged [4-6]. Since PHYS1112K at GGC is a lecture and lab combined course, lab activities with lab videos and instruction will also be created. The proposed short videos, online homework, and all the resources related to the lab activities will be free and open access. Not only do they provide a good supplement to OpenStax College Physics, but they can also be watched by students to review concepts or prepare for tests. Additionally, students’ opinions about the OER will be collected through surveys. The PI and Co-PIs will be planning to improve the materials based on their responses.

**Project Impact**

*Impact on course.*

Upon the implementation of the proposed plan, over 70% of PHYS1112K sections will offer a no-cost textbook (OpenStax College Physics) and additional tailored materials to their students. It is expected to decrease the number of students who drop or withdraw due to the high price of textbooks. It is also highly expected to improve the satisfaction of students on the course due to the newly designed course materials such as the lecture and lab videos. Over time, the enrollment of this course is expected to increase. The PI and Co-PI will put the designed materials on D2L and other open access websites so that all USG institutions will be able to access them in their Introductory Physics courses.

During the project period, there would be at least 21 sections of PHYS1112K that Drs. Chen, Shao, Moses, and Pang will instruct. Each section can accommodate up to 24 students and these sections are usually filled up quickly. We can easily calculate the total cost saving for the students in the project period, as shown in Figure 1, between $72,046.80 and $149,924.88, depending on which textbook in the above table had been previously used. More savings could be made considering that the same materials would be utilized after the project is completed.



**Fig.1: Comparison of expenses of different textbook (and online materials) adoption in the introductory physics II course between Spring 2022 and Spring 2023.**

*Impact on the department.*

Currently, Dr. Chen is the only instructor in the discipline who adopts OpenStax College Physics textbook in PHYS1112K. Most of other sections are still requiring students to purchase the traditional textbooks. Because more college students like open educational resources, [7] this project would encourage more colleagues to turn to the innovative teaching materials, which is aligned with the GGC vision in regard of being “a model for innovative approaches to education.” It is expected that this project would improve the enrollment in PHYS1112K. If more physics instructors are adopting no-cost textbooks or creating their own digital textbooks, the overall increasing enrollment of students in the discipline would eventually help us start the physics major program. In addition, as the most ancient STEM subject, physics has played an indispensable role in the School of Science and Technology (SST) and Georgia Gwinnett College (GGC), yet the physics discipline has not received a single ALG transformation award on a pure physics course. Therefore, if successful, it would be a breakthrough for the discipline.

*Impact on the institution.*

As of spring 2021, GGC has received a total of 31 ALG grants. If funded, GGC will continue its driving momentum of digitalizing textbooks. This project will significantly reduce the cost of students at GGC, as shown in Fig.1. Since the SST is the largest school at GGC, the cost reduction would attract much more students to join GGC.

## **3. ACTION PLAN**

**Review of existing open, no-cost, and/or low-cost course materials for the course(s)**

There are several textbooks for PHYS1112K in the market. As mentioned in the previous section, most of them are published by for-profit companies. Therefore, most textbooks for this course are expensive. But open and no-cost materials are also available. OpenStax College Physics has been widely adopted by many instructors in their Introductory Physics courses. This textbook is genuinely free to all users. The PI has used this textbook for years. Not only does it cost zero to students, but its content is also updated frequently. This is a robust textbook that a student will always get its latest edition for free. According to its website, “the text is grounded in real-world examples to help students grasp fundamental physics concepts.” Because many contributing authors are physicists who work in the frontier research areas, their expertise adds many up-to-date applications of the covered topics. Students are not only studying the physics principles that have been developed decades or centuries ago but also being exposed to the new fields that they could have a career in.

**Plan for** **the** **selection, adoption, adaptation, and/or creation of new course materials**

In this project, the PI will be working with several other colleagues in the department (serving Co-PIs) to adopt OpenStax College Physics in more sections of PHYS1112K. In addition, the PI and Co-PIs are planning to create tailored materials for students based on OpenStax College Physics. These materials will also be no-cost and open access.

As shown in Fig. 2, the adopted open education resource (OER), OpenStax College Physics, is the parent to all other materials which include two levels. The inner ring is level one that is composed of the proposed lecture topics, and the outer ring is level two which has the proposed lab topics. It is important to have each lecture topic be the parent to at least one lab topic for students to be exposed to related hands-on activities.



**Fig.2: Proposed lecture and lab topics based on OpenStax College Physics**

Each lecture topic is covered in one chapter. The PI and Co-PIs will create materials in each chapter to help students with a better learning experience. The following table has the information of all chapters, the planned materials to be created, and the person who is in charge of the chapter.

**Table 3: Proposed Course Chapters, materials to be created, and involved personnel**

|  |  |  |
| --- | --- | --- |
| **Proposed chapters** | **Planned materials** | **Involved personnel** |
| #1: Electric charges and field | Lecture videosLab videosHomeworkQuiz | Chen |
| #2: Electric potential | Lecture videosLab videosHomeworkQuiz | Chen |
| #3: Electric current and resistance | Lecture videosLab videosHomeworkQuiz | Chen |
| #4: Electric circuits | Lecture videosLab videosHomeworkQuiz | Shao |
| #5: Magnetism | Lecture videosLab videosHomeworkQuiz | Shao |
| #6: Electromagnetic Induction and AC circuits | Lecture videosLab videosHomeworkQuiz | Shao |
| #7: Property of waves | Lecture videosLab videosHomeworkQuiz | Moses |
| #8: Electromagnetic waves | Lecture videosLab videosHomeworkQuiz | Moses |
| #9: Wave optics | Lecture videosLab videosHomeworkQuiz | Pang |
| #10: Geometric optics | Lecture videosLab videosHomeworkQuiz | Pang |

**Plan for redesigning** **your course**

With the adoption of OpenStax College Physics and creation of additional materials, the PI and Co-PIs are planning to spend more class time in solving problems, group discussions, and hands-on activities. Students will have more flexibility, not just rely on the class time, to learn new concepts.

**Detailed Task Description**

We propose completing the following tasks:

1. Create lecture videos for all 10 chapters covered in PHYS1112K. As suggested by the references, the length of each video will be up to 20-min. All videos will provide captions. This task will need an estimate of 150 hours.
2. Create the lab videos that cover topics: Electric charges and Coulomb’s law, Electric field, Capacitors in connection, Equivalent resistance, RC circuits, Magnetic field, Magnetic force on current, Electric transformers, Standing waves, Wave nature of light, and Image formation with convex lenses. The length of lab videos will be up to 20-min. The lab instruction for each lab video will also be developed. This task will need an estimate of 100 hours.
3. Prepare a list of free online simulations (phet.colorado.edu) that may be performed by students in class. This task will need an estimate of 70 hours.
4. Create context-rich problems to supplement the homework questions from OpenStax College Physics for all covered chapters and provide corresponding solutions. This task will need an estimate of 100 hours.
5. Create an online homework/test bank in D2L with randomly assigned numbers for each student and an auto-grading function to replace the current online homework system (mastering physics). This task will need an estimate of 100 hours.
6. Review previous course sections and analyze the students’ performance. Improve the lecture and lab videos with more focus on challenging topics. This task will need an estimate of 50 hours.

**Role of Each Team Member**

Dr. Zengjun Chen is an associate professor of physics at GGC. His research interests include condensed matter physics and physics education research. He will manage the creation of the adaptive materials with the help of the Co-PIs. Specifically, he will discuss with the Co-PIs about detailed content of each lecture and lab video. Dr. Chen will oversee purchasing the proposed equipment for video recording and editing. He will teach a total of six sections of PHYS1112K in spring 2022, summer 2022, fall 2022, and spring 2023. During and after the project period, Dr. Chen will adopt OpenStax College Physics and use the created materials in his sections. Dr. Chen will work for about 120 hours on this project.

Dr. Qing Shao is an associate professor of physics at GGC. Her research focuses on biophysics. In this project, she will help create lecture and lab videos as well as online homework/ tests and assessments. In addition, she will design the lab instructions for the proposed course. Dr. Shao will teach a total of five sections of PHYS 1112K in spring 2022, fall 2022, and spring 2023. During and after the project period, Dr. Shao will adopt OpenStax College Physics and use the created materials in her sections. Dr. Shao will work for about 150 hours on this project.

Dr. Sherita Moses is an assistant professor of physics at GGC. Her concentration is in optics and her research focuses on nanophysics and biophysics. In this project, she will help create lecture and lab videos as well as tests and assessments which focus on waves and optics. In addition, she will design the lab instructions for the proposed course. Dr. Moses will teach a total of five sections of PHYS 1112K in summer 2022, fall 2022, and spring 2023. During and after the project period, Dr. Moses will adopt OpenStax College Physics and use the created materials in her sections. Dr. Moses will work for about 150 hours on this project.

Dr. Lijun Pang is an assistant professor of physics at GGC. Her research focuses on the simulation physics. In this project, she will help create lecture and lab videos as well as tests and assessments. In addition, she will design the lab instructions for the proposed course. Dr. Pang will teach a total of five sections of PHYS 1112K in Spring 2022, fall 2022, and spring 2023. During and after the project period, Dr. Pang will adopt OpenStax College Physics and use the created materials in her sections. Dr. Pang will work for about 150 hours on this project.

**Plan for providing** **open access to the new materials**

The PI and Co-PIs will upload all materials (videos, quiz, homework, test, etc.) on D2L so that all students taking PHYS1112K will be able to access them. Meanwhile, all materials will be uploaded on OpenALG and the GALILEO Open Learning Materials repository. Dr. Chen will be working with Ms. Chris Robinson, the technical trainer of GGC, to do a final check of the 508 compliance for the accessibility of all students. In the following table, the links to several sample lecture videos and lab videos are provided to show how they will be accessed by students.

**Table 3. Sample video links for lectures and labs in PHYS1112K.**

|  |  |
| --- | --- |
| **Lecture topics** | **Video links** |
| Ampere’s law | [Kaltura-1](https://cdnapisec.kaltura.com/p/2022371/sp/202237100/embedIframeJs/uiconf_id/40989281/partner_id/2022371?iframeembed=true&playerId=kaltura_player&entry_id=1_ruw6sb04&flashvars%5bstreamerType%5d=auto&amp;flashvars%5blocalizationCode%5d=en&amp;flashvars%5bleadWithHTML5%5d=true&amp;flashvars%5bsideBarContainer.plugin%5d=true&amp;flashvars%5bsideBarContainer.position%5d=left&amp;flashvars%5bsideBarContainer.clickToClose%5d=true&amp;flashvars%5bchapters.plugin%5d=true&amp;flashvars%5bchapters.layout%5d=vertical&amp;flashvars%5bchapters.thumbnailRotator%5d=false&amp;flashvars%5bstreamSelector.plugin%5d=true&amp;flashvars%5bEmbedPlayer.SpinnerTarget%5d=videoHolder&amp;flashvars%5bdualScreen.plugin%5d=true&amp;flashvars%5bhotspots.plugin%5d=1&amp;flashvars%5bKaltura.addCrossoriginToIframe%5d=true&amp;&wid=1_db0gtx21) |
| RC circuits | [Kaltura-2](https://cdnapisec.kaltura.com/p/2022371/sp/202237100/embedIframeJs/uiconf_id/40989281/partner_id/2022371?iframeembed=true&playerId=kaltura_player&entry_id=1_vh3ze4gh&flashvars%5bstreamerType%5d=auto&amp;flashvars%5blocalizationCode%5d=en&amp;flashvars%5bleadWithHTML5%5d=true&amp;flashvars%5bsideBarContainer.plugin%5d=true&amp;flashvars%5bsideBarContainer.position%5d=left&amp;flashvars%5bsideBarContainer.clickToClose%5d=true&amp;flashvars%5bchapters.plugin%5d=true&amp;flashvars%5bchapters.layout%5d=vertical&amp;flashvars%5bchapters.thumbnailRotator%5d=false&amp;flashvars%5bstreamSelector.plugin%5d=true&amp;flashvars%5bEmbedPlayer.SpinnerTarget%5d=videoHolder&amp;flashvars%5bdualScreen.plugin%5d=true&amp;flashvars%5bhotspots.plugin%5d=1&amp;flashvars%5bKaltura.addCrossoriginToIframe%5d=true&amp;&wid=1_z9me1fir) |
| **Lab topics** | **Video Links** |
| Coulomb’s law | [Kaltura-3](https://cdnapisec.kaltura.com/p/2022371/sp/202237100/embedIframeJs/uiconf_id/40989281/partner_id/2022371?iframeembed=true&playerId=kaltura_player&entry_id=1_wwhu18c8&flashvars%5bstreamerType%5d=auto&amp;flashvars%5blocalizationCode%5d=en&amp;flashvars%5bleadWithHTML5%5d=true&amp;flashvars%5bsideBarContainer.plugin%5d=true&amp;flashvars%5bsideBarContainer.position%5d=left&amp;flashvars%5bsideBarContainer.clickToClose%5d=true&amp;flashvars%5bchapters.plugin%5d=true&amp;flashvars%5bchapters.layout%5d=vertical&amp;flashvars%5bchapters.thumbnailRotator%5d=false&amp;flashvars%5bstreamSelector.plugin%5d=true&amp;flashvars%5bEmbedPlayer.SpinnerTarget%5d=videoHolder&amp;flashvars%5bdualScreen.plugin%5d=true&amp;flashvars%5bhotspots.plugin%5d=1&amp;flashvars%5bKaltura.addCrossoriginToIframe%5d=true&amp;&wid=1_e3xzukbf) |
| RC circuits | [Kaltura-4](https://cdnapisec.kaltura.com/p/2022371/sp/202237100/embedIframeJs/uiconf_id/40989281/partner_id/2022371?iframeembed=true&playerId=kaltura_player&entry_id=1_p7ojm6qj&flashvars%5bstreamerType%5d=auto&amp;flashvars%5blocalizationCode%5d=en&amp;flashvars%5bleadWithHTML5%5d=true&amp;flashvars%5bsideBarContainer.plugin%5d=true&amp;flashvars%5bsideBarContainer.position%5d=left&amp;flashvars%5bsideBarContainer.clickToClose%5d=true&amp;flashvars%5bchapters.plugin%5d=true&amp;flashvars%5bchapters.layout%5d=vertical&amp;flashvars%5bchapters.thumbnailRotator%5d=false&amp;flashvars%5bstreamSelector.plugin%5d=true&amp;flashvars%5bEmbedPlayer.SpinnerTarget%5d=videoHolder&amp;flashvars%5bdualScreen.plugin%5d=true&amp;flashvars%5bhotspots.plugin%5d=1&amp;flashvars%5bKaltura.addCrossoriginToIframe%5d=true&amp;&wid=1_goqkno7u) |

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

**Goal 1:** Adoption of OpenStax College Physics helps reduce the financial burdens of the students

Qualitative opinions will be collected by using a specifically designed survey with open-ended questions, such as:

1. Does the used textbook (OpenStax College Physics) help you save money?
2. How important is the price of the textbook to you when registering for the course?

Quantitative results for this goal can be obtained by giving students some survey questions, such as:

1. How much did you expect the textbook to cost without knowing that OpenStax College Physics would be used? Options include <$50, $50 - $100, $100 - $150, $150 - $200, and above $200.
2. How much do you prefer to spend on the textbook if you know that OpenStax College Physics is available to use for free? Options include <$50, $50 - $100, $100 - $150, $150 - $200, and above $200.

 **Goal 2:** Creation of additional materials based on OpenStax College Physics helps motivate students and improve their learning effectiveness

A survey with open-ended questions will also be handed out to collect students’ qualitative feedback on this goal. Some questions are:

1. Do the lecture videos help you better understand the covered topics?
2. Do the lab videos help you better understand the experiment procedure?
3. Does the online homework help you better understand the covered topics?
4. Do the lecture and lab videos help you finish the assignments (homework and lab reports)?
5. Do you feel more confident about taking exams after watching the lecture and lab videos?
6. Were you satisfied with the information and resources presented by OpenStax?
7. What would you like to see added to the OpenStax content offerings?

Quantitative opinions for this goal can be collected by using a quiz with questions, such as:

1. How much do the recorded videos help you in this course? Options are on a scale of 1 – 5, with 1 being not at all, 2 a little bit, 3 some, 4 significantly, 5 extremely necessary.
2. Analyzing assessment data from exams completed during the semester.
3. Use Kaltura analytics tools to analyze students' video-viewing activities such as (how many times they played the video, percentage of video viewed, what dates they watched, etc.)

**Goal 3:** The project helps improve students’ satisfaction and retention in this course.

Qualitative:

At the end of each semester, a survey with open-ended questions will be given to students for their feeling on this course. Some questions are:

1. How satisfied are you with the course adopting OpenStax College Physics?
2. How satisfied are you with the lecture videos and lab videos?
3. Would you recommend other students to take this course?
4. Have you thought about withdrawing from this course? If yes, what changed your mind?
5. Please identify the specific resources that made learning easier by using OpenStax.

A quiz will be given to students at the end of each semester for their feedback in a quantitative manner. Questions are:

1. How satisfied are you with this course overall? Options are on a scale of 1 – 5, with 1 being extremely disappointed, 2, a little disappointed, 3 just okay, 4 satisfied, 5 very satisfied.
2. Would you recommend others to take this course? Options are on a scale of 1- 5, with 1 being no, 2 maybe, 3 yes.

We will compare the DFW rate before and after using the free and open access textbook and class resources. The statistical analysis method such as the correlation model will be used to have a holistic understanding of students’ feedback. The project team will submit a request for IRB approval once the project starts.

## **5. TIMELINE**

**Kickoff: March 25, 2022**

**Spring 2022:**

Mar/22 – May/22: PI and Co-PIs will start to confirm topics for lecture and lab videos, purchase video recording equipment, design survey questions, and create homework problems and solutions.

Milestones: Some lecture and lab videos (topics include Electrostatics, Electric field and force, Electric Potential and Potential energy) will be recorded for the course sections in the spring semester.

**Summer 2022:**

May/22 – July/22: PI and Co-PI (Dr. Moses) will utilize the recorded lecture and lab videos in their course sections. Response to survey questions will be collected. Meanwhile, Homework and solutions will also be used in the corresponding sections.

Milestones: More lecture and lab videos will be recorded (topics include: Electric current, resistance, and circuit, Magnetic force and field, Electromagnetic induction). Homework and solutions will also be completed by July of May 2022.

**Fall 2022:**

Aug/22 – Dec/22: PI and Co-PI will continue to teach the course and apply all materials in the section. Both PI and Co-PI will record more lecture and lab videos. Homework and solutions will be finalized. A survey about students’ satisfaction will be conducted.

Milestones: All lecture and lab videos will be finished (Additional topics include: AC circuits, Ray optics, and Wave optics). Students’ responses about the OER will be collected for analysis.

**Spring 2023:**

Jan/23 – May/23: PI and Co-PI will formally apply all created materials (lecture and lab videos, homework, quiz, test/exams) to the spring semester sections.

Milestones: All materials will be posted on D2L, a YouTube channel, and Affordable learning Georgia website. PI/Co-PIs will collect opinions from students on the materials.

## **6. BUDGET**

Amount Requested: $21,987.00

Justification: Stipend and equipment needed for the creation of ancillaries for the existing OER course and associated travel to professional conferences.

**A. INDIVIDUAL AWARD (Max allowed per person is $5,000): $20,000**

**1. Dr. Zengjun Chen, Associate Professor of Physics,** will serve as a PI. He is the subject matter expert and instructional designer for PHYS1112K. He will serve as project manager and share the design, creation, evaluation, and hosting roles of ancillary materials. He will design materials for topics related to electricity, magnetism, and optics. In addition, he will take the lead in accomplishing the project’s evaluation plan. The individual award will include compensation and fringe benefits. In addition, Dr. Chen requests to cover registration fees of $149 to participate in the AAPT physics education 2022 winter meeting during the project period for sharing the OER course, encouraging more instructors to digitalize their textbooks, and learning new pedagogic strategies.

**Compensation: $4,851**

**Conference registration: $149**

**2. Dr. Qing Shao, Associate Professor of Physics,** will serve as co-PI. Dr. Shao is the subject matter expert and instructional designer for the PHYS1112K course. She will share the design, creation, evaluation, and hosting roles of ancillary materials. Content-wise, she will also help design materials for chapters on electricity, magnetism, and optics. The individual award will include compensation and fringe benefits. In addition, Dr. Shao requests $149 to cover registration fees to participate in the AAPT physics education 2022 winter meeting during the project period for sharing the OER course, encouraging more instructors to digitalize their textbooks, and learning new pedagogic strategies.

**Compensation: $4,851**

**Conference registration: $149**

**3. Dr. Sherita Moses, Assistant Professor of Physics,** will serve as co-PI. Dr. Moses is the subject matter expert and instructional designer for the PHYS1112K course. She will share the design, creation, evaluation, and hosting roles of ancillary materials. Content-wise, she will also help design materials for chapters on electricity, magnetism, and optics. The individual award will include compensation and fringe benefits. In addition, Dr. Moses requests $149 to cover registration fees to participate in the AAPT physics education 2022 winter meeting during the project period for sharing the OER course, encouraging more instructors to digitalize their textbooks, and learning new pedagogic strategies.

**Compensation: $4,851**

**Conference registration: $149**

**4. Dr. Lijun Pang, Assistant Professor of Physics,** will serve as co-PI. Dr. Pang is the subject matter expert and instructional designer for the PHYS1112K course. She will share the design, creation, evaluation, and hosting roles of ancillary materials. Content-wise, she will also help design materials for chapters on electricity, magnetism, and optics. The individual award will include compensation and fringe benefits. In addition, Dr. Pang requests $149 to cover registration fees to participate in the AAPT physics education 2022 winter meeting during the project period for sharing the OER course, encouraging more instructors to digitalize their textbooks, and learning new pedagogic strategies.

**Compensation: $4,851**

**Conference registration: $149**

**B. Equipment:** The following items will be requested for creating ancillary materials for the OER course

* GoPro Hero 10 Black: $349.98 (<https://gopro.com/en/us/shop/cameras/hero10-black/CHDHX-101-master.html?option-id=CHDHX-101-master>). This item is necessary for the PI and Co-PIs to record lecture and lab videos. It is portable and provides high-resolution videos that will help students catch more details in an experiment.
* Ring light: $38.99 ([https://www.amazon.com/Extendable-Sensyne-YouTube-Compatible-Phones/dp/B08B3X7NXC/ref=sr\_1\_1?crid=3GFA3OYQX4Z6A&keywords=%E2%80%A2+Ring+light&qid=1644004778&sprefix=ring+light%2Caps%2C102&sr=8-1](https://www.amazon.com/Extendable-Sensyne-YouTube-Compatible-Phones/dp/B08B3X7NXC/ref%3Dsr_1_1?crid=3GFA3OYQX4Z6A&keywords=%E2%80%A2+Ring+light&qid=1644004778&sprefix=ring+light%2Caps%2C102&sr=8-1)) This item will be used to provide sufficient light for recording experiments carried out on a stable surface.
* 2 iPads Pro: $799.00 each, $1598.00 total (<https://www.apple.com/shop/buy-ipad/ipad-10-2>) The items will be needed for PI and Co-PIs to create additional lecture videos.

**Total:** $1,987 (rounded off)

**C. Total Budget Requested $ 21,987**

## **7. SUSTAINABILITY PLAN**

After the end of the project, the PI and Co-PIs will perform the following tasks:

**Plan to maintain and update course materials**

All created materials (Lecture and lab videos, Quiz and test problems, Homework solutions, Practice problems, etc.) will be stored on D2L, the OpenALG website, and the GALILEO Open Learning Materials repository. The PI and Co-PIs will continue to correct any errors in the materials, improve the effectiveness of the materials, update with more contemporary content, and collect students’ opinions on the materials,

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

As the dean of the School of Science and Technology (SST) says in her support letter, the school will “support their endeavors by providing the necessary resources to develop the proposed no- or low-cost learning materials.” The PI and Co-PIs will continue utilizing the OER and the created materials in their PHYS1112K sections.

**Plans to possibly expand the project to more course sections in the future**

The PI and Co-PIs will present this project at the GGC symposium to encourage more instructors (inside and outside of the department) to use the materials in their courses. An additional expansion of the project to more course sections in our discipline to include 1111K, 2211K, 2212K, and courses offered in the physics minor.

**Plans for sharing this work with others through presentations, articles, or other scholarly activities**

The PI and Co-PIs will publish the outcomes (students’ satisfaction survey, retention rates, enrollment, etc.) in peer-reviewed journals and/or present the results in relevant conferences to encourage more colleagues to adopt or create the digital textbooks.

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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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| --- |
| Dr. Chavonda J. Mills, Dean of School of Science and Technology, GGC |

# 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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| Dr. Marie Firestone, Associate Director, Office of Research & Sponsored Programs |