Application Details

Manage Application: Textbook Transformation Grants: Round Eleven

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

Application Title:	351
Application ID:	002064
Submitter First Name:	Glenn
Submitter Last Name:	Pfeifer
Submitter Title:	Director, Grants Development and Administration
Submitter Email Address:	gpfeifer@gsu.edu
Submitter Phone Number:	678-891-2528
Submitter Campus Role:	Sponsored Programs Office
Applicant First Name:	Susan
Applicant Last Name:	Finazzo
Applicant Email Address:	sfinazzo@gsu.edu
Applicant Phone Number:	770-278-1361
Primary Appointment Title:	Assistant Professor, Biology
Institution Name(s):	Georgia State University, Perimeter College
Co-Applicant(s):	--
Submission Date:	Tuesday, January 23, 2018

Proposal Title:	351
Proposal Category:	No-Cost-to-Students Learning Materials
Final Semester of Instruction:	Fall 2018
Are you using an OpenStax textbook?:	No

Team Members (Name, Email Address):

Dr. Susan Finazzo, Assistant Professor, Biology, Georgia State University, Perimeter College, Newton Campus; sfinazzo@gsu.edu
Amy Rollins, Lecturer, Biology, Georgia State University, Perimeter College, Newton Campus; arollins@gsu.edu

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

Dr. Michael Sakuta, Associate Chair, Science Department, Georgia State University, Perimeter College, Newton Campus

Course Names, Course Numbers and Semesters Offered:

Introduction to Biology 1-Biol 1103L--Fall, Spring and Summer

List the original course materials for students (including title, whether optional or required, & cost for each item):	
Average Number of Students per Course Section:	24
Number of Course Sections Affected by Implementation in Academic Year:	50
Average Number of Students Per Summer Semester:	215
Average Number of Students Per Fall Semester:	494
Average Number of Students Per Spring Semester:	515
Total Number of Students Affected by Implementation in Academic Year:	1009
Requested Amount of Funding:	$10,800
Original per Student Cost:	$32.75

Post-Proposal Projected Student Cost:	$0.00
Projected Per Student Savings:	$32.75
Projected Total Annual Student Savings:	At Perimeter College the savings realized by students would be $39,300.

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

N/A

Project Goals:

Overarching Goal:

Develop an introductory biology laboratory manual which supports the tenets recommended by Vision and Change to integrate core concepts and competencies throughout the curriculum, focus on student-centered learning for all students and employ relevant, effective, outcome-oriented, engaging activities.

Specific Goals:

Develop multiple modular activities within each topic commonly taught in the first semester of the biology laboratory course. Generally, 14 to 15 weeks of instruction are offered in a semester.
Identify student learning outcomes for each topic appropriate to course level.
Give faculty the flexibility to select activities to meet their student learning goals with their current campus resources.
Activities will include at-home or technology assisted modules for distance learning or online laboratory sections.
Activities will include vendor neutral options that are not equipment specific.
Activities will include modules leading to scaffolded skill development.
Content and competencies will link and scaffold between modules to improve cognitive mapping.
All modules will include a case study, story, or working biologist link as an opener to engage student.
All modules will include frequent mistakes/common errors section.
All modules will include pre- and post- assessment tools.
All modules will include safety instruction pertinent to activities in the module.
Develop instructor resources and provide them online for free download.
Laboratory prep manual
Assessment guide
Online resources
Scaffold learning of fundamental skills to move students from novice learners to more

intermediate learners.
Improve course retention and student success. Student retention in classes using these materials will increase by 5%; student success (A,B,C,D rate will improve by 3% in classes using these materials).
Improve student attitudes (attitude survey) of the relevance and importance of biology.
Save students individually approximately $33.00, save students collectively (Perimeter College) approximately $39,000.00.
Insure that the course, learning outcomes and assignments adhere to the philosophy of transparency in teaching and learning.
Have the modular materials posted online so that faculty can download the entire manual or selected modules for their use.
Present this work at a statewide meeting (USG Teaching and Learning Conference) and national meeting (National Association of Biology Teachers).

Statement of Transformation:

TRANSFORMATION DESCRIPTION

In 2009 biology educators, organized by the American Association for the Advancement of Science and with support from the National Science Foundation, convened and generated the seminal report, Vision and Change in Undergraduate Biology Education, A call to Action (Vision and Change in Undergraduate Biology Education A Call to Action, 2011) . Vision and Change (V&C) put forth a number of recommendations on the direction in which biology education and pedagogy should move based on sound and vetted education research. Unfortunately, change is not easy and although change is occurring, it is occurring slowly and in isolated pockets. The tenets of V&C relevant to this proposal are that biology curriculum should integrate core concepts and competencies throughout the curriculum, curriculum should focus on student learning for all students, and curriculum should be active, outcome-oriented, inquiry-driven and relevant. Relevancy in particular seemed to resonate with students. Student voices were actively sought in all aspects researched by the working group. When asked about the biology laboratory experience, the overwhelming student response was that ‘canned’ labs were ineffective and uninteresting.

The proposed transformed course would include engaging active learning activities tied to real world scenarios (case studies) that would exemplify core concepts, and introduce and reinforce competencies. Since the students enrolled in this course are primarily freshman, a high level of scaffolding will be implemented particularly in moving the students toward inquiry-driven experimentation. Anecdotally, many of the students attending Perimeter College are not initially academically prepared to undertake inquiry-driven experimentation. Scaffolding, built into the lab exercises will help the students grow from novice learners along the continuum toward expert learners.

STAKEHOLDERS

BIOL1103 Introduction to Biology is a high-enrollment course, and potentially the only life science course a student may take. Similarly, the laboratory accompanying the course may be the only college-level science laboratory the student may experience. The laboratory where the student actually ‘does science’ and engages in the scientific process must be a quality experience. It is essential to engage students in relevant curriculum, insure the development of foundational skills and grow scientific literacy.

Faculty teaching the course are also stakeholders as is the institution offering the course. Faculty outside the discipline are also stakeholders, since the broadly-based skills acquired in these foundational, general education courses are needed by students to complete upper level courses in other science and non-science disciplines.

Georgia, and society in general, are stakeholders in the success of students in this course and their sound understanding of science. These students may not become biologists or teachers but the majority of these students will become parents and voters; they need to understand science to be productive, knowledgeable and contributing members of society.

IMPACT ON STAKEHOLDERS AND COURSE SUCCESS.

There are three significant impacts on students:

Financial: Although the initial cost of the lab manual is not very high, students cannot recoup any of that investment. College bookstores do not buy back opened lab manuals. Therefore, whatever money students spend on a lab book is lost money.
Skill development: Foundational skills (graphing, following directions, critical thinking, teamwork, effective communication) that will be introduced and developed in this course will serve the student not only throughout their academic career, but are often cited by employers as needed workforce skills (Burrus, Jackson, Xi, & Steinberg, 2013; Ryan, 2016).
Science literacy/relevance: The importance of science and technology in today’s world is indisputable. Students will have a better understanding of these at the completion of the course.

Impact on faculty stakeholders:

Faculty teaching the course using these materials will be able to use them as they are provided or customize the materials to suit their own learning objectives and campus resources.
Faculty will be provided with a model on how to scaffold learning of fundamental skills, such as graphing, and provided information (instructor resources) on assessment.
Potentially, this transformation may encourage faculty to implement these practices in their lectures or other biology classes.

Impact at the institutional stakeholder level:

Successful implementation should lead to increased student success and higher retention in the course.
A positive experience in the course may lead undecided students to select a STEM pathway. Successful implementation of the transformation would potentially increase the number of students in the STEM pathway.
Enacting the proposed curriculum would align the College's curriculum with the current expectations of NSF and the National Academy of Science.

Impact at the state stakeholder level:

Georgia would have a more science (biology) literate citizenry.
Graduates would have more exposure to workforce-required skills.

IMPACT ON THE COURSE, PROGRAM, DEPARTMENT, INSTITUTIONS, ACCESS INSTITUTION, AND/OR MULTIPLE COURSES.

The potential impact of this transformation as envisioned could be significant. At the course level, transformed curriculum could increase engagement, student success and retention. The introductory biology course serves as the general education science requirement for a large number of undecided students, these students may decide to matriculate in a science major if they enjoy and are successful in this course. The department and institution will benefit from the increased retention and student success. Additionally, students who enjoyed the course may choose another biology course elective. Although all students benefit from engaged learning (active learning) strategies (Freeman, et al., 2014), students with academic deficits, and minority students exhibit the greatest academic gains when these strategies are introduced into the curriculum. Access institutions in particular would benefit from using this transformed curriculum. The skills acquired in this course will lay the foundation for future courses. Students will learn how to be better students and move from novice learners to intermediate learners which will benefit faculty teaching these students in other courses. Transformation should be its own reward and pay its own benefit. However, more often than not, transformation and the success which accompanies it, leads to further transformation.

Transformation Action Plan:

THE IDENTIFICATION, REVIEW, SELECTION, AND ADOPTION/ADAPTATION/CREATION OF THE NEW COURSE MATERIALS.

Currently there is no complete introductory biology laboratory manual available through an open access venue. In recent conversations with representatives of OpenStax there appeared to be some interest in this project, but currently nothing in development that would assist with this project. Preliminary library research of open commons and other royalty free materials found significant listings of activities for the K-12 educational sector but little material

appropriate for higher education.

A further complication that has impeded the progress in laboratory curriculum development is the monetary commitment of campuses to specific equipment/vendors. Instructions detailed in a lab manual for the use of a specific tool may work on campus A that has the tool, but campus B with a different tool or version of tool has to amend the lab manual or find a different lab manual. Since equipment is expensive, it is more cost effective to simply not change or amend the curriculum. This project will endeavor to create modules that are ‘equipment or tool’ neutral.

The PI on this project, Dr. Susan Finazzo, has extensive experience in writing and editing laboratory manuals. She is the coauthor of a nationally published microbiology manual. She also served as the editor and one of the primary authors of a grant-funded re-write of an introductory biology manual at a previous institution.

1. Topic Identification and Selection: Topics for the first semester course are fairly standard, however the pedagogical approach can vary widely.

o Topic review of major lab manuals

o Topic review from campuses within Perimeter

o Syllabus solicitation from sister colleges (completed)

o Typical topics:

§ Scientific method

§ Measurement

§ Microscopy

§ Chemistry

§ Cells

§ Enzymes

§ Respiration

§ Photosynthesis

§ Cell division

§ DNA

§ Inheritance

§ Biotechnology

§ Plants

§ Evolution

2. Module example

o Module: Enzymes

• Possible case studies: fever and enzyme activity; enzymes and clean clothes; enzymes and tender meat; enzymes and disease processes, enzymes and food

• Module Activities

ü Enzyme specificity

ü Effect of temperature on enzyme activity

ü Effect of pH on enzyme activity

ü Possible enzymes and sources: pineapple (bromelin/papain), potato or liver (catalase), amylase (saliva, germinating seeds), potato (catecholase), yeast (invertase), pectinase, pepsin

ü Several student activities would be developed under each category (enzyme activity, effect of temperature, effect of pH). Additionally, online options would be explored as pre-lab or alternative options

ü These are traditional approaches to this topic. Often the traditional approach emphasizes the approach and mechanics versus the concepts. The approach we would take would emphasize the concepts, not the mechanics. Additionally, in-line with V&C, the investigators would like to explore less traditional but more demonstrative approaches to these topics.

o How faculty will use the modules: Faculty will be able to select activities from within various modules based on the time allotted per lab period and the learning objectives of the lab. For example, a faculty member could use an activity from the DNA module during the same period with the biotechnology module. The premise is to provide faculty with ample and varied activities from which they could design a manual that satisfies the needs of their students and can be accomplished with the materials and they have on their campuses or that are available to their students.

3. Review of Materials: Materials would be circulated within the Perimeter College biology curriculum committee for review and comment. There comments would be evaluated and appropriate revisions considered.

THE COURSE AND SYLLABUS INSTRUCTIONAL DESIGN/REDESIGN NECESSARY FOR THE TRANSFORMATION.

The design of the syllabus will still be the purview of the individual faculty member.

As a broad, general education course, introductory biology and the accompanying laboratory course have historically been taught chapter by chapter starting with a brief history and definition of biology and the scientific method and proceeding from the chemical level of organization through the organismic levels of life. Biology has been taught in chunks and it has been left up to the student to connect the chunks. Unfortunately, those connections are not always obvious to the student. Faculty, as expert learners, frequently are unaware that their novice learner students are not ‘getting it.’ Without those connections that build on previous knowledge, true learning does not occur. The lab experience is the same. Students typically perform a lab in chemistry during week 2 and an enzyme lab in week 3 and a cell lab in week 4. All of those activities are related and should build upon each other, but typically are presented, taught and assessed as independent activities. Students do not see the connections and they are not inherently evident. Learning is easier when the connections are evident and students can build a cognitive knowledge map. Likewise, students cannot be expected to master core concepts and competencies, nor should they be assessed on these when they have only been exposed to them once. Some form of repetition in which concepts are introduced one week and then reinforced in activities during a succeeding week is beneficial. Learning requires repetition and repeated exposure to a concept. As part of the redesign the team members will explore ways to connect activities both conceptually and thematically. The pedagogical approach as well as the actual activities will be heavily scrutinized to optimize active learning, and integrative conceptual cognitive mapping. The campus instructional designer will be included in these discussions.

THE ACTIVITIES EXPECTED FROM EACH TEAM MEMBER AND THEIR ROLE(S): SUBJECT MATTER EXPERTS, INSTRUCTIONAL DESIGNER, LIBRARIAN, INSTRUCTOR OF RECORD, ET AL.

Dr. Finazzo and Ms. Rollins are the subject matter experts. Dr. Finazzo has over twenty years of teaching experience at access institutions. She has co-authored a nationally published microbiology laboratory manual and has contributed and edited an introductory biology laboratory manual. She is currently a member of the Introductory Biology Taskforce which is examining pedagogical issues faced by faculty teaching introductory biology. She has presented posters (Gordon Research Conference, USG Teaching and Learning Conference) with colleagues on scaffolding and skill development in teaching biology. Ms. Rollins has over

ten years of teaching experience within the USG. Her background is in environmental studies and she worked in that industry before coming to Perimeter College. She has taught all of the associate level biology and environmental science courses offered by the college.

Dr. Finazzo and Ms. Rollins will divide the topics equally. Each team member will develop the materials for their modules including: instructor resources, identification of online alternate activities, at least 3 alternate in-class activities, case study or equivalent, pre-test, post-test, lab data sheet and questions, concept maps or similar devices for linking module (intrinsic, extrinsic) concepts and recommended assessment strategies.

Ms. Rollins and Dr. Finazzo will consult on the selection of all assessment instruments. Initial efforts have been made with the campus librarian to identify royalty free materials. Dr. Finazzo and Ms. Rollins will continue this effort into the spring. They will work collaboratively with the campus instructional designer on curriculum design to implement the ideals of Vision and Change. The instructional designer will also assist in creating a portal for access to the final product.

Dr. Finazzo will serve as the primary editor for the materials. She will serve as the PI with regard to communication with external stakeholders. She will also serve as the photographer and photo editor for images to be included in the modules. Dr. Finazzo has credentials in institutional research and has worked in the area of institutional research and assessment. She will oversee assessment efforts.

THE PLAN FOR PROVIDING OPEN ACCESS TO THE NEW MATERIALS.

Materials will be provided to faculty through the curriculum committee course site in D2L, the College’s learning management system. Once faculty select the modules they choose to use, they can download them into their course shell where their students would have free access to them.

Quantitative & Qualitative Measures:	QUALITATIVE MEASURESStudent attitudes toward biology-Students will be surveyed at the beginning and end of the semester using the Colorado Learning Attitudes about Science Survey (CLASS) for use in Biology (Semsar, Knight, Birol, & Smith, 2011)Student's perception of class-Students will be asked at the end the mid-point and end of the semester to respond to a set of questions regarding their perceptions on the efficacy of the course approach and to offer constructive criticism.QUANTITATIVE MEASUREStudent Success-Data will be gathered through institutional research. ABCD and WF rates will be calculated and compared to previous semesters. The college-wide success rate (students earning an A, B, C, or D) for students in the introductory biology laboratory was ~70%. Approximately 30% of the students enrolled in the course earn a W or F grade. Although this rate is not exceptionally high for an introductory science class at an access institution, improving the pass rate even marginally improves the student's chances of making satisfactory academic progress and remaining in college. Additionally, a significant focus of this transformation is to improve the student's understanding and biology literacy (see qualitative measures) so although gains in retention and success are expected, gains in learning are the major goal. Since initial populations may be small, other factors to be considered important are demographic metrics, age, math courses completed, major, GPA, number of college credit hours completed. The team will work closely with members of IR to develop the data approach. Student matriculation and success in the following semester will also be determined and compared to previous semester enrollments. (retention)Declared major-Student majors and changes in majors will be followed for 2 semesters.Skill development-Students will participate at the beginning and end of the semester in a survey which will explore their understanding and skill of graphing.

Timeline:

SPRING 2018:

1. Complete review of royalty free resources.

2. Identify topics/modules to be developed. Identify specific areas to target for online instruction.

3. Review/codify the components of each module. Storyboard sample module. Images, art, photographs needed for each module will be identified.

4. Meet with instructional designer in the late spring to discuss the project and storyboard in detail.

5. Dr. Finazzo and Ms. Rollins each create a module of a topic of their choice.

6. Principals meet to review and compare each other's materials to insure consistency. Continue storyboarding modules.

7. Order any materials needed for activities.

SUMMER 2018:

1. Meet weekly to discuss progress and review modules.

2. The goal will be to complete one module per week, including lab trial.

3. Photographs, royalty free art and diagrams will be created for each module.

4. Each completed module will be internally reviewed and edited by the team members.

5. Send completed materials to the biology curriculum committee for review. The review of materials may extend into the fall semester.

6. Collect comments from the curriculum committee and make changes as appropriate.

FALL 2018:

1. August 2018 post modules in D2L.

2. Use materials on Newton Campus of Perimeter College during Fall Semester of 2018.

3. Administer student skill survey, attitude survey the first week of class.

4. At midterm, administer student perception of course survey.

5. At midterm, contact IR to discuss data fields to be collected.

6. At the end of the semester, administer the following surveys: skill, attitude, perception of course.

7. Request data from IR at the end of the semester.

8. Review student feedback and make changes as appropriate.

Budget:

PERSONNEL

Dr. Finazzo-$4,960.67 $3,729.83 summer salary (7.5% of academic year salary) plus $1,230.84 fringe benefits (33% negotiated rate) for content development = $4,960.67

$2,954.55 summer salary (7.5% of academic year salary) plus $975 fringe benefits (33% negotiated rate) for content development = $3,929.55

TOTAL PERSONNEL = $8,890.22

TRAVEL

$800.00 in travel is requested for attendance at the kick-off meeting on February 22, 2018

TOTAL TRAVEL = $800.00

SUPPLIES

$1,109.78 is requested for materials and supplies related to textbook development. New labs will be designed. The supplies are necessary to perform the activities to insure the labs work as envisioned.

TOTAL SUPPLIES = $1,109.78
TOTAL REQUEST = $10,800

Sustainability Plan:

The course is offered every semester. The modular nature of the materials will facilitate the maintenance and updating of the course materials. Dr. Finazzo will assume that responsibility as service to the College. Dr. Sakuta has given his assurance that the College will support this initiative.

REFERENCES

Burrus, J., Jackson, T., Xi, N., & Steinberg, J. (2013). *Identifying the Most Important 21st Century Workforce Competencies: An Analysis of the Occupational Information Network.* Princeton: Educational Testing Service.

Freeman, S., Eddy, S., McDonough, M., Smith, M., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, 8410-8415.

Ryan, L. (2016, March 2). *12 Qualities Employers Look for when They are Hiring*. Retrieved from Forbes - Leadership: https://www.forbes.com/sites/lizryan/2016/03/02/12-qualities-employers-look-for-when-theyre-hiring/#3860d56d2c24

Semsar, K., Knight, J., Birol, G., & Smith, M. (2011). The Colorado Learning Attitudes about Science Survey (CLASS) for Use in Biology. *CBE- Life Science Education*, 268-278.

Vision and Change in Undergraduate Biology Education A Call to Action. (2011). *Vision and Change.* Washington, DC: American Association for the Advancement of Science.

DEPARTMENT OF SCIENCE

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Georgia State University | PERIMETER COLLEGE

October 25, 2017

Affordable Learning Georgia
2500 Daniells Bridge Road
Building 300
Athens, Georgia 30606

Dear Affordable Learning Georgia Grant Committee:

As the Associate Chair of the Science Department at the Georgia State University Newton Campus, I am writing this letter in full support of Georgia State University's Textbook Transformation proposal for Biology 1103L Introductory Biology I Laboratory.

A 2013 article in the Huffington Post stated that college textbook prices have increased faster than health care costs, housing prices, tuition, and inflation over the last three decades. At that time, prices were up a staggering 812%. Often, students don't have a choice to buy a different textbook; the professor dictates which book he will use. Ethan Senack, higher education advocate at Student PIRGs, said, "[Students] can either spend hundreds of dollars to buy the textbooks, take time away from studying to work extra hours to pay for their books, or they can go without the book and accept the consequences." Often students borrow money to finance the purchase of textbooks, in addition to tuition, leading to a greater amount of student debt at the end of their college careers.

A free textbook with numerous hands on, wet and dry activities will encourage many instructors to adopt the book because there will be something for everyone. For students, the benefit is obvious; they get a free textbook with up-to-date experiments. Looking ahead, updates to the text can be handled easily as the curriculum changes. It might be as simple as uploading the changes to a web page. This is the vision of the Introductory Biology for Non-majors laboratory manual that Dr. Finazzo is proposing to create with her co-author Amy Rollins. Dr. Finazzo is an experienced laboratory manual author and editor. While at Broward College she led a grant-supported team in the complete revision and rewrite of the non-majors biology laboratory manual and remained the editor of the manual for several years. That manual is still in use. Additionally, she is a co-author of a microbiology manual that is distributed by a major national educational publisher. Dr. Finazzo is also actively involved at the national level in pedagogical issues related to challenges faced by faculty teaching introductory biology. Dr. Finazzo is well versed in the discipline, the instructional challenges and has the skills needed to complete this project.

DEPARTMENT OF SCIENCE

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As such, my department is fully committed to the transformation of the Biology 1103 laboratory manual and the savings it will provide to each of our students as well as in other sections taught by other instructors both at GSU and across the USG system. We look forward to beginning work on this project.

Sincerely,

Michael Sakuta

Dr. Michael Sakuta
Professor of Chemistry
Associate Chair, Science Department
Georgia State University, Perimeter College, Newton Campus
Covington, GA 30014

Textbook Transformation for Biology 1103 Lab Manual

Submitter Name	Glenn Pfeifer
Submitter Title	Director, Grants Development and Administration
Submitter Email	gpfeifer@gsu.edu
Submitter Phone Number	678-891-2528
Submitter Campus Role	Grants Development and Administration, Perimeter College
Applicant Name	Dr. Susan Finazzo
Applicant Email	sfinazzo@gsu.edu
Applicant Phone Number	770-278-1361
Primary Appointment Title	Assistant Professor, Biology
Institution Name(s)	Georgia State University, Perimeter College
Team Members	Dr. Susan Finazzo, Assistant Professor, Biology, Georgia State University, Perimeter College, Newton Campus; sfinazzo@gsu.edu Amy Rollins, Lecturer, Biology, Georgia State University, Perimeter College, Newton Campus; arollins@gsu.edu
Sponsor, Title, Department, Institution	Dr. Michael Sakuta, Associate Chair, Science Department, Georgia State University, Perimeter College, Newton Campus
Proposal Title	Textbook Transformation for Biology 1103 Lab Manual

Course Names, Course Numbers and Semesters Offered	Biology 1103L				
Final Semester of Instruction	Fall 2018				
Average Number of Students Per Course Section	24	**Number of Course Sections Affected by Implementation in Academic Year**	**50**	**Total Number of Students Affected by Implementation in Academic Year**	1009
Average Number of Course Sections Per Semester	Fall 22 Spring 24 Summer 10				
Award Category (pick one)	☒ No-or-Low-Cost-to-Students Learning Materials ☐ Specific Core Curriculum Courses				
Are you planning on using an OpenStax textbook?	☐ Yes ☒ No				
List the original course materials for students (including title, whether optional or required, & cost for each item)	Required Introductory Biology I Lab Notebook Author: Lochamy ISBN: 9780738099880 Copyright Year: 2017 Publisher: HAYDAN-MCNEIL PUBLISHING Cost: $32.75				

Requested Amount of Funding	$10,800.00
Original Per Student Cost	$32.75
Post-Proposal Projected Per Student Cost	$0.00
Projected Per Student Savings	$32.75
Projected Total Annual Student Savings	If the free resources are adopted only by the faculty at Perimeter College, the savings realized by students would be $39,300 (based on enrollment estimates). If the free resources are adopted by the GSU-Atlanta faculty the savings would be appreciably greater.

NARRATIVE

1.1 PROJECT GOALS

Overarching Goal:

Develop an introductory biology laboratory manual which supports the tenets recommended by Vision and Change to integrate core concepts and competencies throughout the curriculum, focus on student-centered learning for all students and employ relevant, effective, outcome-oriented, engaging activities.

Specific Goals:

- Develop multiple modular activities within each topic commonly taught in the first semester of the biology laboratory course. Generally, 14 to 15 weeks of instruction are offered in a semester.
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- Save students individually approximately $33.00, save students collectively (Perimeter College) approximately $39,000.00.
- Insure that the course, learning outcomes and assignments adhere to the philosophy of transparency in teaching and learning.
- Have the modular materials posted online so that faculty can download the entire manual or selected modules for their use.

- Present this work at a statewide meeting (USG Teaching and Learning Conference) and national meeting (National Association of Biology Teachers).

1.2 STATEMENT OF TRANSFORMATION

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Georgia, and society in general, are stakeholders in the success of students in this course and their sound understanding of science. These students may not become biologists or teachers but the majority of these students will become parents and voters; they need to understand science to be productive, knowledgeable and contributing members of society.

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There are three significant impacts on students:

1. Financial: Although the initial cost of the lab manual is not very high, students cannot recoup any of that investment. College bookstores do not buy back opened lab manuals. Therefore, whatever money students spend on a lab book is lost money.
2. Skill development: Foundational skills (graphing, following directions, critical thinking, teamwork, effective communication) that will be introduced and developed in this course will serve the student not only throughout their academic career, but are often cited by employers as needed workforce skills[Bur13].
3. Science literacy/relevance: The importance of science and technology in today's world is indisputable. Students will have a better understanding of these at the completion of the course.

Impact on faculty stakeholders:

1. Faculty teaching the course using these materials will be able to use them as they are provided or customize the materials to suit their own learning objectives and campus resources.
2. Faculty will be provided with a model on how to scaffold learning of fundamental skills, such as graphing, and provided information (instructor resources) on assessment.
3. Potentially, this transformation may encourage faculty to implement these practices in their lectures or other biology classes.

Impact at the institutional stakeholder level:

1. Successful implementation should lead to increased student success and higher retention in the course.
2. A positive experience in the course may lead undecided students to select a STEM pathway. Successful implementation of the transformation would potentially increase the number of students in the STEM pathway.
3. Enacting the proposed curriculum would align the College's curriculum with the current expectations of NSF and the National Academy of Science.

Impact at the state stakeholder level:

1. Georgia would have a more science (biology) literate citizenry.
2. Graduates would have more exposure to workforce-required skills.

IMPACT ON THE COURSE, PROGRAM, DEPARTMENT, INSTITUTIONS, ACCESS INSTITUTION, AND/OR MULTIPLE COURSES.

The potential impact of this transformation as envisioned could be significant. At the course level, transformed curriculum could increase engagement, student success and retention. The introductory biology course serves as the general education science requirement for a large number of undecided students, these students may decide to matriculate in a science major if they enjoy and are successful in this course. The department and institution will benefit from the increased retention and student success. Additionally, students who enjoyed the course may choose another biology course elective. Although all students benefit from engaged

learning (active learning) strategies [Fre14], students with academic deficits, and minority students exhibit the greatest academic gains when these strategies are introduced into the curriculum. Access institutions in particular would benefit from using this transformed curriculum. The skills acquired in this course will lay the foundation for future courses. Students will learn how to be better students and move from novice learners to intermediate learners which will benefit faculty teaching these students in other courses. Transformation should be its own reward and pay its own benefit. However, more often than not, transformation and the success which accompanies it, leads to further transformation.

1.3 TRANSFORMATION ACTION PLAN

THE IDENTIFICATION, REVIEW, SELECTION, AND ADOPTION/ADAPTATION/CREATION OF THE NEW COURSE MATERIALS.

Currently there is no complete introductory biology laboratory manual available through an open access venue. In recent conversations with representatives of OpenStax there appeared to be some interest in this project, but currently nothing in development that would assist with this project. Preliminary library research of open commons and other royalty free materials found significant listings of activities for the K-12 educational sector but little material appropriate for higher education.

A further complication that has impeded the progress in laboratory curriculum development is the monetary commitment of campuses to specific equipment/vendors. Instructions detailed in a lab manual for the use of a specific tool may work on campus A that has the tool, but campus B with a different tool or version of tool has to amend the lab manual or find a different lab manual. Since equipment is expensive, it is more cost effective to simply not change or amend the curriculum. This project will endeavor to create modules that are 'equipment or tool' neutral.

The PI on this project, Dr. Susan Finazzo, has extensive experience in writing and editing laboratory manuals. She is the coauthor of a nationally published microbiology manual. She also served as the editor and one of the primary authors of a grant-funded re-write of an introductory biology manual at a previous institution.

1. Topic Identification and Selection: Topics for the first semester course are fairly standard, however the pedagogical approach can vary widely.

- Topic review of major lab manuals
- Topic review from campuses within Perimeter
- Syllabus solicitation from sister colleges (completed)
- Typical topics:
  - Scientific method
  - Measurement
  - Microscopy
  - Chemistry
  - Cells
  - Enzymes
  - Respiration
  - Photosynthesis
  - Cell division

- DNA
- Inheritance
- Biotechnology
- Plants
- Evolution

2. Module example

- Module: Enzymes
  - Possible case studies: fever and enzyme activity; enzymes and clean clothes; enzymes and tender meat; enzymes and disease processes, enzymes and food
  - Module Activities
    - ✓ Enzyme specificity
    - ✓ Effect of temperature on enzyme activity
    - ✓ Effect of pH on enzyme activity
    - ✓ Possible enzymes and sources: pineapple (bromelin/papain), potato or liver (catalase), amylase (saliva, germinating seeds), potato (catecholase), yeast (invertase), pectinase, pepsin
    - ✓ Several student activities would be developed under each category (enzyme activity, effect of temperature, effect of pH). Additionally, online options would be explored as pre-lab or alternative options
    - ✓ These are traditional approaches to this topic. Often the traditional approach emphasizes the approach and mechanics versus the concepts. The approach we would take would emphasize the concepts, not the mechanics. Additionally, in-line with V&C, the investigators would like to explore less traditional but more demonstrative approaches to these topics.

- How faculty will use the modules: Faculty will be able to select activities from within various modules based on the time allotted per lab period and the learning objectives of the lab. For example, a faculty member could use an activity from the DNA module during the same period with the biotechnology module. The premise is to provide faculty with ample and varied activities from which they could design a manual that satisfies the needs of their students and can be accomplished with the materials and they have on their campuses or that are available to their students.

3. Review of Materials: Materials would be circulated within the Perimeter College biology curriculum committee for review and comment. There comments would be evaluated and appropriate revisions considered.

THE COURSE AND SYLLABUS INSTRUCTIONAL DESIGN/REDESIGN NECESSARY FOR THE TRANSFORMATION.

The design of the syllabus will still be the purview of the individual faculty member.

As a broad, general education course, introductory biology and the accompanying laboratory course have historically been taught chapter by chapter starting with a brief history and definition of biology and the scientific method and proceeding from the chemical level of organization through the organismic levels of life. Biology has been taught in chunks and it has been left up to the student to connect the chunks. Unfortunately, those connections are not always obvious to the student. Faculty, as expert learners, frequently are unaware that their novice learner students are not 'getting it.' Without those connections that build on previous knowledge, true learning does not occur. The lab experience is the same. Students typically perform a lab in chemistry during week 2 and an enzyme lab in week 3 and a cell lab in week 4. All of those activities are related and should build upon each other, but typically are presented, taught and assessed as independent activities. Students do not see the connections and they are not inherently evident. Learning is easier when the connections are evident and students can build a cognitive knowledge map. Likewise, students cannot be expected to master core concepts and competencies, nor should they be assessed on these when they have only been exposed to them once. Some form of repetition in which concepts are introduced one week and then reinforced in activities during a succeeding week is beneficial. Learning requires repetition and repeated exposure to a concept. As part of the redesign the team members will explore ways to connect activities both conceptually and thematically. The pedagogical approach as well as the actual activities will be heavily scrutinized to optimize active learning, and integrative conceptual cognitive mapping. The campus instructional designer will be included in these discussions.

THE ACTIVITIES EXPECTED FROM EACH TEAM MEMBER AND THEIR ROLE(S): SUBJECT MATTER EXPERTS, INSTRUCTIONAL DESIGNER, LIBRARIAN, INSTRUCTOR OF RECORD, ET AL.

Dr. Finazzo and Ms. Rollins are the subject matter experts. Dr. Finazzo has over twenty years of teaching experience at access institutions. She has co-authored a nationally published microbiology laboratory manual and has contributed and edited an introductory biology laboratory manual. She is currently a member of the Introductory Biology Taskforce which is examining pedagogical issues faced by faculty teaching introductory biology. She has presented posters (Gordon Research Conference, USG Teaching and Learning Conference) with colleagues on scaffolding and skill development in teaching biology. Ms. Rollins has over ten years of teaching experience within the USG. Her background is in environmental studies and she worked in that industry before coming to Perimeter College. She has taught all of the associate level biology and environmental science courses offered by the college.

Dr. Finazzo and Ms. Rollins will divide the topics equally. Each team member will develop the materials for their modules including: instructor resources, identification of online alternate activities, at least 3 alternate in-class activities, case study or equivalent, pre-test, post-test, lab

data sheet and questions, concept maps or similar devices for linking module (intrinsic, extrinsic) concepts and recommended assessment strategies.

Ms. Rollins and Dr. Finazzo will consult on the selection of all assessment instruments. Initial efforts have been made with the campus librarian to identify royalty free materials. Dr. Finazzo and Ms. Rollins will continue this effort into the spring. They will work collaboratively with the campus instructional designer on curriculum design to implement the ideals of Vision and Change. The instructional designer will also assist in creating a portal for access to the final product.

Dr. Finazzo will serve as the primary editor for the materials. She will serve as the PI with regard to communication with external stakeholders. She will also serve as the photographer and photo editor for images to be included in the modules. Dr. Finazzo has credentials in institutional research and has worked in the area of institutional research and assessment. She will oversee assessment efforts.

THE PLAN FOR PROVIDING OPEN ACCESS TO THE NEW MATERIALS.

Materials will be provided to faculty through the curriculum committee course site in D2L, the College's learning management system. Once faculty select the modules they choose to use, they can download them into their course shell where their students would have free access to them.

1.4 QUANTITATIVE AND QUALITATIVE MEASURES

QUALITATIVE MEASURES

- Student attitudes toward biology-Students will be surveyed at the beginning and end of the semester using the Colorado Learning Attitudes about Science Survey (CLASS) for use in Biology [Sem11].
- Student's perception of class-Students will be asked at the end the mid-point and end of the semester to respond to a set of questions regarding their perceptions on the efficacy of the course approach and to offer constructive criticism.

QUANTITATIVE MEASURE

- Student Success-Data will be gathered through institutional research. ABCD and WF rates will be calculated and compared to previous semesters. The college-wide success rate (students earning an A, B, C, or D) for students in the introductory biology laboratory was ~70%. Approximately 30% of the students enrolled in the course earn a W or F grade. Although this rate is not exceptionally high for an introductory science class at an access institution, improving the pass rate even marginally improves the student's chances of making satisfactory academic progress and remaining in college. Additionally, a significant focus of this transformation is to improve the student's understanding and biology literacy (see qualitative measures) so although gains in retention and success are expected, gains in learning are the major goal. Since initial populations may be small, other factors to be considered important are demographic metrics, age, math courses completed, major, GPA, number of college credit hours completed. The team will work closely with members of IR to develop the data approach. Student matriculation and success in the following semester will also be determined and compared to previous semester enrollments. (retention)
- Declared major-Student majors and changes in majors will be followed for 2 semesters.
- Skill development-Students will participate at the beginning and end of the semester in a survey which will explore their understanding and skill of graphing.

1.5 TIMELINE

SPRING 2018:

1. Complete review of royalty free resources.

2. Identify topics/modules to be developed. Identify specific areas to target for online instruction.

3. Review/codify the components of each module. Storyboard sample module. Images, art, photographs needed for each module will be identified.

4. Meet with instructional designer in the late spring to discuss the project and storyboard in detail.

5. Dr. Finazzo and Ms. Rollins each create a module of a topic of their choice.

6. Principals meet to review and compare each other's materials to insure consistency. Continue storyboarding modules.

7. Order any materials needed for activities.

SUMMER 2018:

1. Meet weekly to discuss progress and review modules.

2. The goal will be to complete one module per week, including lab trial.

3. Photographs, royalty free art and diagrams will be created for each module.

4. Each completed module will be internally reviewed and edited by the team members.

5. Send completed materials to the biology curriculum committee for review. The review of materials may extend into the fall semester.

6. Collect comments from the curriculum committee and make changes as appropriate.

FALL 2018:

1. August 2018 post modules in D2L.

2. Use materials on Newton Campus of Perimeter College during Fall Semester of 2018.

3. Administer student skill survey, attitude survey the first week of class.

4. At midterm, administer student perception of course survey.

5. At midterm, contact IR to discuss data fields to be collected.

6. At the end of the semester, administer the following surveys: skill, attitude, perception of course.

7. Request data from IR at the end of the semester.

8. Review student feedback and make changes as appropriate.

1.6 BUDGET

PERSONNEL
Dr. Finazzo-$4,960.67 $3,729.83 summer salary (7.5% of academic year salary) plus $1,230.84 fringe benefits (33% negotiated rate) for content development = $4,960.67

$2,954.55 summer salary (7.5% of academic year salary) plus $975 fringe benefits (33% negotiated rate) for content development = $3,929.55

TOTAL PERSONNEL = $8,890.22

TRAVEL
$800.00 in travel is requested for attendance at the kick-off meeting on February 22, 2018

TOTAL TRAVEL = $800.00

SUPPLIES
$1,109.78 is requested for materials and supplies related to textbook development. New labs will be designed. The supplies are necessary to perform the activities to insure the labs work as envisioned.

TOTAL SUPPLIES = $1,109.78

TOTAL REQUEST = $10,800

1.7 SUSTAINABILITY PLAN

The course is offered every semester. The modular nature of the materials will facilitate the maintenance and updating of the course materials. Dr. Finazzo will assume that responsibility as service to the College. Dr. Sakuta has given his assurance that the College will support this initiative.