

Spring 2015

Evolution and Biodiversity

Timothy Henkel

Valdosta State University, tphenkel@valdosta.edu

Emily Croteau

Valdosta State University, ekcroteau@valdosta.edu

Matthew Waters

Valdosta State University, mwaters@valdosta.edu

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Grants Collection

Valdosta State University



UNIVERSITY SYSTEM
OF GEORGIA

Timothy Henkel, Emily Croteau, Matthew Waters

Evolution and Biodiversity





Grants Collection

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

Each collection contains the following materials:

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



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Syllabus

BIOL 1010 Tentative Schedule

Topic	Chapter Reading
How is science a way of knowing?	1
Why are there different environments?	20.3-20.4
What is a population?	19.1
How do populations change over time?	19.2
What is a community?	19.4
Concept Coach Sections	19.1,19.2,19.4,20.3
Exam 1	
How do matter and energy move through ecosystems?	20.1-20.2
What makes organisms different?	8.2; 9.1
How can natural selection result in evolution?	11
How can we determine if a population is evolving?	11
What are other mechanisms that can result in evolution?	
Concept Coach Sections	11.1, 11.2, 20.1, 20.2
Exam 2	
What is a species?	11
How can we classify organisms?	12.1-12.2
How is evolutionary relatedness observed in biodiversity?	11
Concept Coach Sections	11.3, 11.4, 12.1, 12.2
Exam 3	
Bacteria & Archea	13
Protists	13
Fungi	13
Plants	14
Animals	15
Concept Coach Sections	13.1-13.4, 14.1, 15.1
Exam 4	
Does biodiversity matter?	21
Where have all the organisms gone?	21
Concept Coach Sections	21.1 + Student Survey

Course Textbook: OpenStax Concepts of Biology with Concept Coach

https://cnx.org/contents/v5a_xecj@3.4:Pj8cW7X1@4/

Concept Coach Sections must be completed prior to the exam for credit

Initial Proposal

**Affordable Learning Georgia Textbook Transformation Grants
Proposal Form**

Please complete per inline instructions; completed form not to exceed four pages.

Institution Name	Valdosta State University		
Team Members (Name, Title, Department and email address for each)	Timothy Henkel, Assistant Professor, tphenkel@valdosta.edu Emily Croteau, Assistant Professor, ekcroteau@valdosta.edu Matthew Waters, Associate Professor, mwaters@valdosta.edu Department of Biology		
Sponsor, Title, Department	Robert Gannon, Professor and Head of Department of Biology		
Course Name, Course Number and Semester Offered (Spring 2015 Required)	BIOL 1010 – Evolution and Biodiversity BIOL 1030 – Organismal Biology Both offered Spring 2015; both offered fall and spring semesters		
Average Number of Students in the Course	250 – 300 students in each course per semester	Number Course sessions per Academic year	4-6 sections for each course.
Award Category (pick one)	<input type="checkbox"/> No-Cost-to-Students Learning Materials <input checked="" type="checkbox"/> OpenStax Textbooks <input type="checkbox"/> Course Pack Pilots		
List the original course materials for students (including title, whether optional or required, & cost for each item)	<i>Biology: Concepts and Investigations</i> . Marielle Hoefnagel, 3 rd edition with Connect Plus. McGraw Hill Education. required	<i>New Loose Leaf: \$138.75</i> Total Cost: Spring 2015 (450 students): \$62,437.50 Annual (900 students): \$124,875.00	
Projected Per Student Cost	\$138.75	Projected Per Student Savings (%)	100%

1. PROJECT GOALS

- *Adopt the OpenStax non-majors biology textbook Concepts of Biology as part of the non-majors biology science core curriculum courses at VSU.*
- *Develop the necessary course tools to engage students based on the newly adopted resources.*
- *Support the long term use and sustainability of open educational resources in non-majors science curriculum.*
- *Assess student success and perceived engagement with the open educational resources.*

1.1 STATEMENT OF PROBLEM

Within the Valdosta State University Core Curriculum, students are required to take at least 8 credit hours of science courses. Non-science majors enrolled in required core science courses may be less likely to purchase course textbooks because of lack of perceived relevance to their degree plans. A recent survey of over 2,000 college students finds that the cost of textbooks deters students from purchasing required resources, even as students express concern of missed content and the associated grade implications (Senack 2014).

Course materials are selected to provide students necessary resources to achieve the learning outcomes specified by the instructor. Any barrier to obtaining these resources therefore limits the student's ability to meet the learning outcomes of the course, to successfully complete the course, and complete their degree program. With the recent shift in funding of state sponsored colleges and universities based on student retention and completion, barriers to student learning are likely to impact not just the student, but the academic community as well.

The recent rise of quality, peer-reviewed open education resources, such as OpenStax textbooks, provides resources that meet the learning outcomes of core college level courses. These resources are freely available in a digital format, thus removing the financial barrier to student access and potentially increasing the number of students engaging with course materials. In addition, these resources are available in print format at dramatically reduced cost relative to texts from large publishing companies.

By removing the financial barrier to course materials, we hope to increase student engagement in their coursework, which should increase their success in both this course and their academic career. At VSU, BIOL 1010 and BIOL 1030 fulfill the core curriculum science requirements, with a combined annual enrollment of at least 900 students in sections taught by the PIs. This is a population of students that are not likely to purchase course textbooks, and therefore the effect of an intervention such as this may have large impacts on academic success.

While OER textbooks provide a free resource for students, developing a course around a new text requires restructuring of learning goals, creating learning activities, and refining assessment tools to maximize student engagement with the new text. This grant will support the development of these tools.

1.2 TRANSFORMATION ACTION PLAN

The PIs have selected the OpenStax book Concepts of Biology for use in both BIOL 1010 and BIOL 1030 and are piloting the text in both courses in Fall 2014. Previously, both courses had been taught by the PIs for at least 3 years using Hoeffnaegels' Biology Concepts and Investigations. The PIs are also currently set to teach both courses in the Spring 2015.

With support from the present grant we are looking to evaluate our initial implementation of the new textbook and revise our instruction based on feedback and peer evaluation. Specifically, we are looking to:

- develop pre-class assignments that engage students with reading,
- develop in-class activities centered on new readings, and
- develop and revise formative assessment tools that are aligned with new learning objectives of the new text.

The PIs will work together through a peer review process to align revised assessment tools with learning objectives and evaluate implementation of class activities. The PIs bring a combined total of 21 years of teaching non-majors biology. In addition to first-hand experience, the PIs have participated in professional development activities focused on creating learner-centered classrooms and implementing strategies that have been demonstrated to increase student success in science courses (Freeman *et al.* 2014).

Assessment

Since the PIs have been teaching these courses for several years, we will be able to compare DFW rates while controlling for any instructor effect. We will compare DFW rates from the two semesters prior to the new text adoption and two semesters with the new text, grouped by instructor. If access to a free text results in increased adoption by students and increased use results in greater learning gains, we would expect to see a decrease in DFW rates with the new text.

In addition, as part of VSU's Core Curriculum, the PIs worked with colleagues to develop and implement a standardized course assessment tool which has been used since Spring 2013. We will use the same assessment tool in each of the revised courses and compare the percentage of students that exceed, meet and fail to meet expectations. Again, we predict that there will be more students meeting or exceeding expectation if the freely available resource results in higher use and thus greater learning.

Finally, we will also assess students' perception of value of the new resource through surveys given at midterm and end of semester in the Spring 2015.

1.3 TIMELINE

- Oct-14
 - Begin to develop/revise pre-class and formative assessment tools
- Nov-14
 - PIs meet to review and discuss tools and identify additional concerns prior to Spring 2015.
- Dec-14
 - Implement assessment tool with 1st semester new textbook sections
 - Consolidate data from previous semesters for future analysis
- Jan-15
 - PIs meet to discuss any last minute concerns, issues and ideas
- Mar-15
 - PIs meet to discuss status of implementation of new textbook
 - Peer evaluation of class activities and/or new assessment tools
 - Implement 1st student survey of new textbook
- May-15
 - Implement core assessment tool with 2nd semester of new textbook sections
 - PIs meet to discuss success and future barriers based on new textbook
 - Consolidate Spring 2015 data with previous semester data and perform analyses
 - Provide final project report

1.4 BUDGET

Personnel

- Salary support for each PI \$3,333.00 \$9,999.00

Travel

- Travel for PIs to Planning and Organizational Meeting \$800.00

1.5 SUSTAINABILITY PLAN

Both Drs. Croteau and Waters are the primary instructors for BIOL 1030 at VSU and Dr. Henkel is one of two faculty that currently teaches BIOL 1010. All PIs are currently committed to teaching these courses and will use resources which best meets their learning objectives. The present proposal will provide the PIs with necessary resources to revise these courses. Provided there is at least no difference in student success between the old text and the new OpenStax textbook, the instructors will continue to use the tools developed through this proposal.

In addition, the PIs will make their course tools, including all assignments, in-class activities, and formative assessments available to any instructor of record for these courses or interested faculty.

1.6 REFERENCES & ATTACHMENTS

- Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., 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*, 111(23), 8410–8415.
- Senack, E. (2014). Fixing the broken textbook market: How students respond to high textbook costs and demand alternatives. Retrieved August 22, 2014 from <http://www.uspirg.org/reports/usp/fixing-broken-textbook-market>

PROPOSAL SUBMISSION: ALL PROPOSAL DOCUMENTS, REFERENCES, and ATTACHMENTS SHOULD BE SUBMITTED IN A SINGLE EMAIL TO alg@gatech.edu by 5:00 PM, EST, September 8, 2014.



Affordable Learning Georgia
Textbook Transformation Grants

August 28, 2014

Letter of support for proposal submitted by Timothy Henkel, Emily Croteau and Matthew Waters

Dear Committee:

I am writing this letter to offer my full support for this proposal to use an OpenStax textbook in the introductory biology courses BIOL 1010 and BIOL 1030. These courses serve a large number of students at VSU that allow the students to meet the science requirements of the USG core curriculum. Drs. Henkel and Croteau have substantial experience and training in pedagogical strategies associated with teaching science, and Dr. Waters has proven to be an extremely effective teacher in these large-size lecture courses based upon the outstanding teaching evaluations submitted by his students. This, therefore, is a very effective team to undertake this project. It is fair to say that many, if not most, of the students are enrolled in these courses only because they are required to do so, and unfortunately many will not buy the textbooks in an attempt to just get by. That strategy rarely works and therefore this proposal to evaluate a free OpenStax text is expected to significantly improve student success and learning in these courses.

BIOL 1010 and BIOL 1030 are taught every semester and this will continue so long as the current USG core curriculum is in place. There is every confidence that this project will prove to be both successful and easily sustainable for years to come. In addition, this proposal nicely complements a separate undertaking by the Department of Biology to offer the manuals accompanying the co-requisite laboratory courses at a greatly reduced cost to the student beginning in fall 2014.

Thank you for your consideration of this worthy proposal.

Sincerely,

Robert L. Gannon, PhD
Professor and Head of Biology

Department of Biology
College of Arts & Sciences

Address 1500 N. Patterson St • Valdosta, GA 31698-0015
Phone 229.333.5759 • **Fax** 229.245.6585

Final Report

Affordable Learning Georgia Textbook Transformation Grants

Final Report

Date: June 1, 2015

Grant Number: 17

Institution Name(s): Valdosta State University

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

Timothy Henkel, Assistant Professor, tphenkel@valdosta.edu
Emily Croteau, Associate Professor, ekcroteau@valdosta.edu
Matthew Waters, Associate Professor, mwaters@valdosta.edu
Department of Biology, Valdosta State University

Project Lead: Timothy Henkel

Course Name(s) and Course Numbers:

BIOL 1010 – Evolution and Biodiversity
BIOL 1030 – Organismal Biology

Semester Project Began: Fall 2015

Semester of Implementation: Fall 2014/Spring 2015

Average Number of Students Per Course Section: 160

Number of Course Sections Affected by Implementation: 6

Total Number of Students Affected by Implementation: 959

1. List of Resources Used in the Textbook Transformation

Concepts of Biology from OpenStax College, ISBN 1-938168-11-9

2. Narrative

Adopting the OpenStax textbook was equivalent to any new textbook adoption for a course. The material presented aligned fairly well with the previous text used in both courses, which made the transition easier. In-class presentations had to be altered, though this was made somewhat easier by the provided graphics used in the text.

The textbook is a substantial reference text, though some students and instructors noted that the language was very technical in sections for a non-majors audience. In addition, some errors were found in the text. This is where working with an online, open-source text is a great benefit, as corrections and suggestions were added to the errata page on the publisher's website and will be incorporated into future editions.

In setting out with this project, we did not expect there to be a large learning increase solely based on the textbook. Previous surveys have suggested that students are not purchasing college textbooks due to cost and reduced cost may increase student engagement with the material. Our project did not find any increase in student performance using the OpenStax book compared to the pre-OpenStax course offerings. In addition, surveys of our students suggest that while students are very aware of the cost of college textbooks, at Valdosta State University (VSU), cost does not limit their obtaining the required texts. Student's did perceive the text to be useful, informative and valued the content as well as the selection of a free/low-cost text. This perceived value may impact student's perception of their courses and university experience, which could work to maintain or increase student retention at VSU. Finally, given that the OpenStax textbook did not increase student performance, we suggest future work should focus on free/low-cost tools that complement this textbook. These tools should work to engage students in a deeper level with the content outside of class.

3. Quotes

"I think having the free textbook online is an amazing idea. Students already pay enough money for tuition and other fees, and taking off fees for textbooks is such a stress-reliever. I would love if more classes had their textbooks online, especially ones that we actually use in class like this one. It was extremely beneficial in helping study and understand concepts."

"I loved using this textbook. The material was great, and easy to understand. Went well with the class and saved me stress from having to decide if I could have a book for the class or not."

"The textbook expanded on a lot of the topic covered in class that I did not completely understand. For a lost cost book it contained good information that I used to study for my exams; the chapters were easy to read, which helped me understand some of the harder parts of my Biology course."

4. Quantitative and Qualitative Measures

Survey Responses

A survey of student perceptions of the OpenStax textbook was administered during the last week of the Spring 2015 semester (Appendix 1), with 57% of students (n=233) completing the online survey. While the majority of respondents (84%) consider the cost of a textbook before buying the book, 64% claim to buy all required books for their courses. Over half of the respondents were aware that the book used in the course was free, and 22% responded that they selected the course sections because of the free text (Fig 1). Overall, students found the textbook assisted their understanding of concepts covered in class and the graphics and figures were useful (Fig 2).

Students reported use of the OpenStax textbook in the biology courses did not differ from their use of textbooks in other courses (Fig 3). The majority of students (66%) stated they used the free online version of the text and 33% purchased a print copy of the text. Only 13% reported printing off pages from the electronic version.

Impact on Student Performance

We originally hypothesized that the specific textbook used in a general biology course should not impact student achievement, though access to a free textbook may increase engagement with course material and result in increased achievement. Based on survey responses, most students at VSU purchase all required texts, despite their concern about cost. In addition, students reported engaging with the OpenStax book as often as they did textbooks in other courses. Therefore, it does not appear that students were more engaged with the free, open access text.

Student performance was examined by comparing rates of DFW's, rates of failure (achieving a final course grade of F, which is failing in most non-majors courses), and level of achievement on an assessment between the pre-OpenStax course and the OpenStax course. For each treatment, final grades were collected for two semesters, with each instructor teaching one section each semester (n=6). The standardized assessment questions were administered during the final exam of 5 sections for each treatment (pre-OpenStax and OpenStax courses). Level of achievement on the assessment was scored as Exceeds Expectations (scored >8), Meets Expectations (scored 6-8), and Fails to Meet Expectations (scored < 6).

While there is a slight decrease in DFW rates and failure rates in the OpenStax semesters, these differences were not significantly different (Fig 4; $p > 0.05$; Wilcoxon rank-sum). Similarly, while there was a small decrease in the percent of students that failed to meet expectations on the assessment, these differences were not significant (Fig 5; $p > 0.05$; Wilcoxon rank-sum).

The results of this project support the initial claim that the specific textbook would not impact student performance. The consistent level of performance also underscores the quality of information provided by the freely available OpenStax textbook relative to the previous text used. Based on these results, the team will continue to use the OpenStax text as the primary textbook for the two courses.

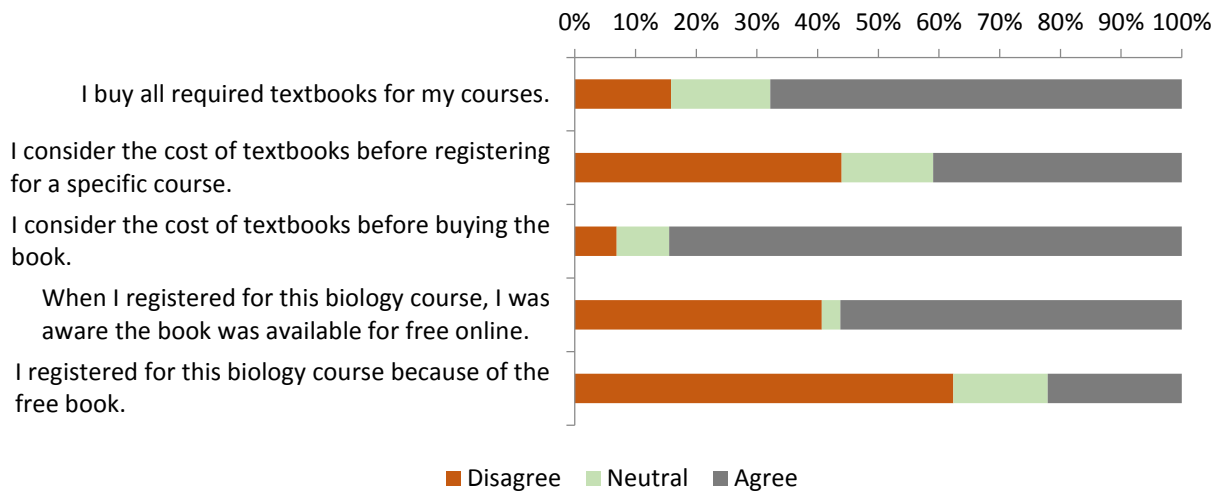


Fig 1: Levels of agreement reported by students regarding the purchasing of textbooks in their courses (n=233 students)

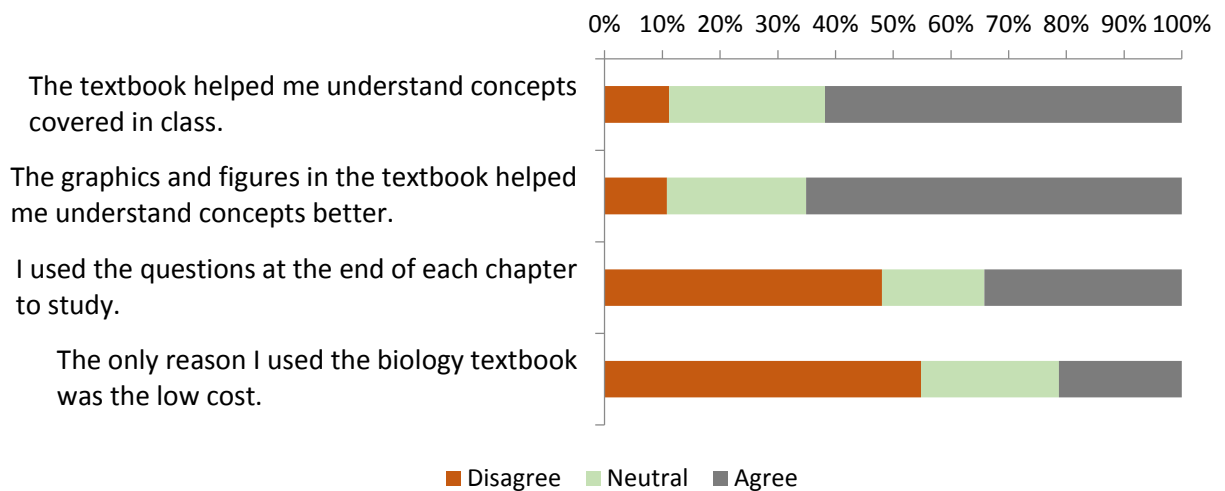


Fig 2: Levels of agreement reported by students regarding the use of the OpenStax textbook *Concepts in Biology* during BIOL 1010 and BIOL 1030 (n=233 students).

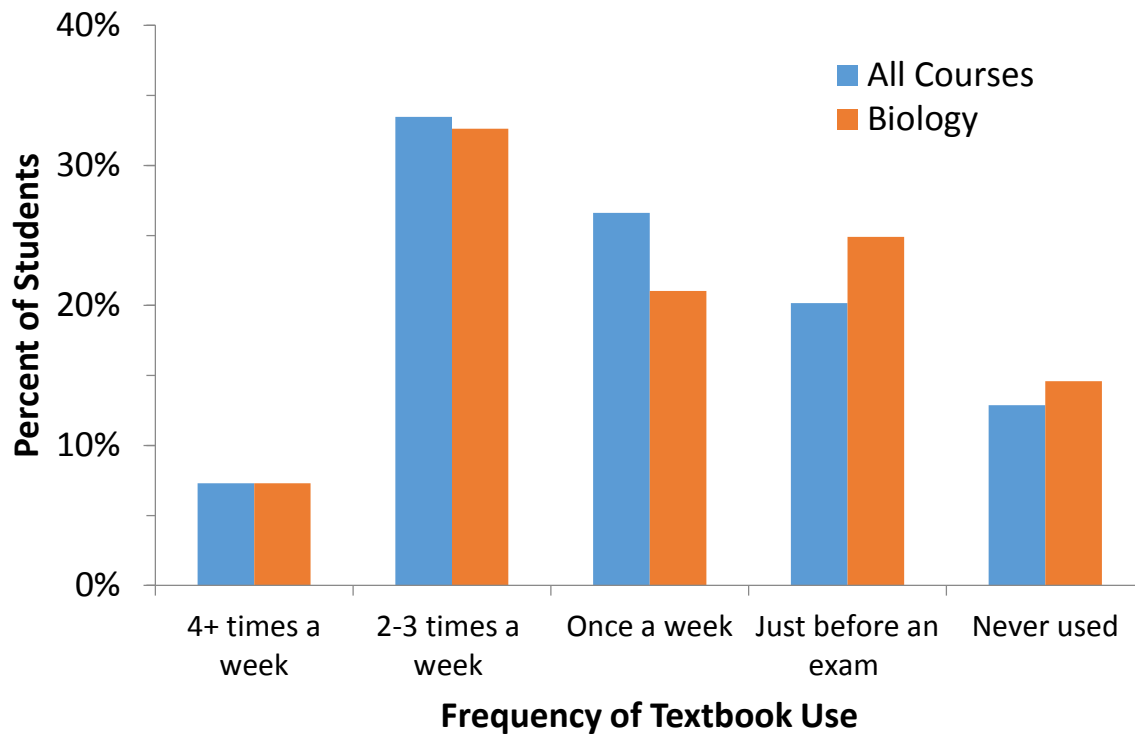


Fig 3: Reported use of textbooks in all of college courses and specifically during their current biology course (n=233 students).

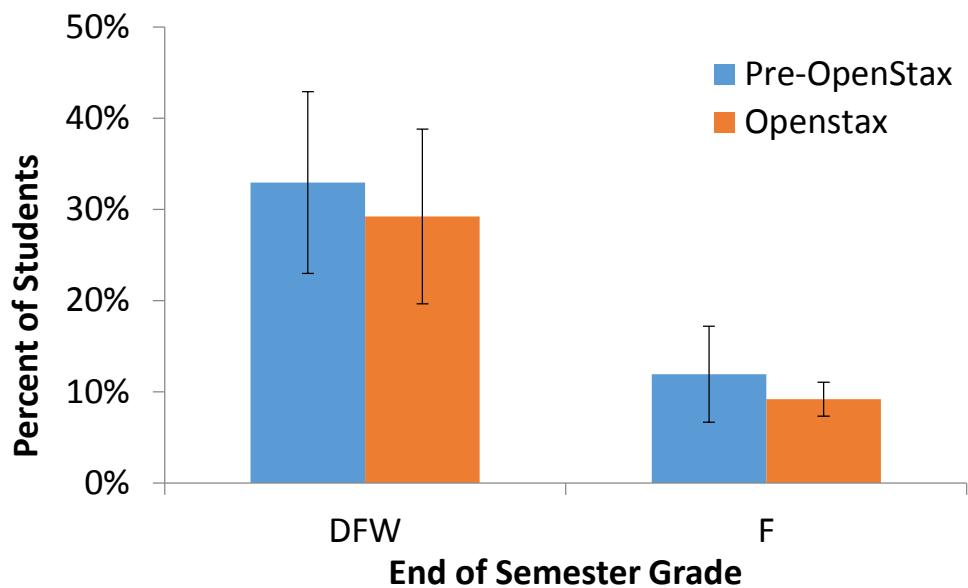


Fig 4: Average DFW and Failure rates (\pm SD) for pre-OpenStax and OpenStax course offerings of BIOL 1010 and BIOL 1030 (n=6).

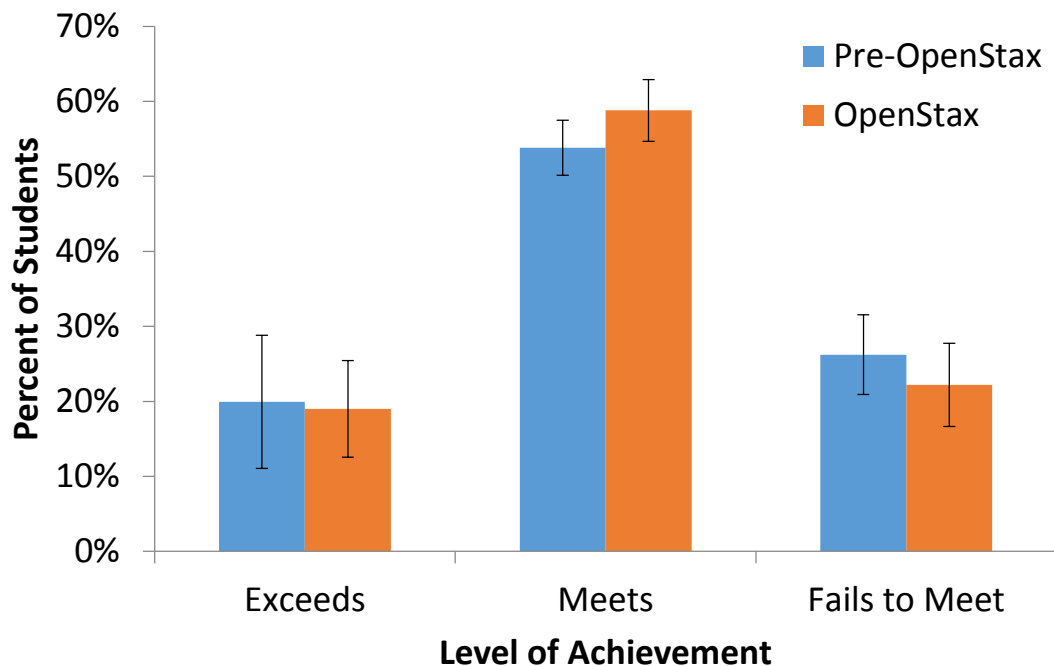


Fig 5: Percentage of students exceeding, meeting, or failing to meet expectations on the standardized assessment questions for pre-OpenStax and OpenStax course offerings (n=5).

5. Sustainability Plan

As stated above, the team is committed to using these resources whenever they teach either course. In addition, we will provide instructors of record copies of our in class materials as requested for their use.

6. Future Plans

Currently, we plan to share this information within the department to promote the use of OpenStax textbooks. There is another team of faculty in the biology department at VSU working on an ALG grant to revise the majors introductory biology course using the OpenStax majors biology book. Given that the OpenStax provide as good a reference as other texts, we hope to encourage more faculty to use these books.

We also recognize that additional tools are needed to increase student performance in these courses. The DFW rate between the two courses was 30% for all semesters examined, and given the increased emphasis on retention, graduation in higher education, and student financial aid like the HOPE Scholarship tied to performance, additional pedagogical approaches should be examined. Like the OpenStax book, these should be free to low cost tools and additional research should focus on identifying these tools and their impact on student performance.

7. Description of Photograph

- From Left to Right: Drs. Timothy Henkel, Emily Croteau, and Matthew Waters

Appendix 1 – ALG Textbook Survey

Survey was administered online using D2L

State Your Level of Agreement (1-5; Strongly Disagree to Strongly Agree)

1. I buy all required textbooks for my courses.
 2. I consider the cost of textbooks before registering for a specific course.
 3. I consider the cost of textbooks before buying the book.
 4. When I registered for this biology course, I was aware the book was available for free online.
 5. I registered for this biology course because of the free book.
-
6. In your experience in other courses, how often did you use the required textbooks? (check one)
 - 4 or more times a week
 - 2-3 times a week
 - Once a week
 - Just before an exam
 - Never used
-

[PAGE BREAK]

Now consider your experience with the biology textbook this semester.

Please state Your Level of Agreement (1-5; Strongly Disagree to Strongly Agree)

7. The textbook helped me understand concepts covered in class.
 8. The graphics and figures in the textbook helped me understand concepts better.
 9. I used the questions at the end of each chapter to study.
 10. The only reason I used the biology textbook was the low cost.
-
11. How often did you use the **biology textbook this semester?** (check one)
 - 4 or more times a week
 - 2-3 times a week
 - Once a week
 - Just before an exam
 - Never used
-
12. Check all that apply
 - I used the free version of the textbook
 - I printed copies from the free version
 - I purchased the ebook app version
 - I purchased the print version of the book

13. Please share any comments or your experience with using the textbook this semester.

(open ended)