

Affordable Learning Georgia Textbook Transformation Grants

Final Report

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Grant Number: 277

Institution Name(s): Georgia Southern University

Team Members:

- **Scott Kersey, Associate Professor, Dept. of Mathematical Sciences, skersey@georgiasouthern.edu**
- **Stephen Carden, Assistant Professor, Dept. of Mathematical Sciences, scarden@georgiasouthern.edu**

Project Lead: Scott Kersey (Calculus) and Steve Carden (Statistics)

Course Name(s) and Course Numbers:

- **Calculus I, Math 1441 (4 sections)**
- **Introduction to Statistics, STAT 2231 (4 sections)**

Semester Project Began: Spring 2017

Semester(s) of Implementation: Fall 2017

Average Number of Students Per Course Section: 38

Number of Course Sections Affected by Implementation: 8

Total Number of Students Affected by Implementation: 304

1. Narrative

As stated in our proposal, the goal of this project was to develop and implement Calculus I and Introductory Statistics classes using free-to-student OER course materials, and to compare with classes run using traditional non-free course materials. The free course materials included the open source WeBWork homework system and OpenStax textbooks, as well as course notes and additional homework assignments.

One hurdle to overcome was the installation of WeBWorK – although we have been using it for years on an external server, the university required that we comply to new security standards. To overcome this, we worked with the Provost and ITS to install WeBWorK on university computers. This installation will improve sustainability of our project.

The implementation included 2 classes each of Statistics and Calculus using our free OER materials, and 2 classes each using traditional materials for comparison. The OER classes used OpenStax textbooks and the WeBWorK open source homework system. In our classes we used some existing WeBWorK problems, and wrote some of our own. Supporting documents include some WeBWorK problems for the OpenStax Calculus I textbook, and WeBWorK problems for Statistics. The free course materials saved our students hundreds of dollars, each.

Our overall conclusion is that the effectiveness of our OER classes were as effective as classes using traditional materials, but probably no better. The benefit therefore comes in other ways: costs, ease of use, adaptability, ... For example, with OER materials students have what they need on day 1 (or earlier) of the semester compared with traditional materials that students wait to purchase until after the semester begins, thereby delaying their start in the courses.

The analysis of our implementation includes a survey (for calculus) and a statistical analysis (for statistics). The data shows in particular that the OER materials were effective, and that the students appreciated the “free” course materials, and would take a free OER course again in the future.

The reliance of the OpenStax texts in our courses was minimal. This is mainly due to having our own course materials (notes, handouts, homework). Moreover, both of us do not prefer the OpenStax textbooks, and will not use them in the future for these courses. We will continue to develop our OER courses and materials, using different textbooks.

The experience and impact for ourselves as instructors and students was mostly positive. We are both committed to OER and the potential to develop high-quality courses with free course materials, and our students

benefit from the cost-savings with no apparent loss in quality of the course.

2. Quotes

Calculus I students who used OER materials

- This was my 1st free course materials class and I was so thankful! This was a huge burden off my shoulders because I had to purchase more books.
- I very much appreciated that webwork was free. Although I do believe it is not as good an experience as MyMathlab, which gives you examples and more help with each problem. But webwork is not terrible. And thank you Dr. Kersey, I found your teaching style and attitude helpful!
- I really enjoyed webwork as it made easier to study and gave me lots of practice.

Introductory Statistics Students

- The homework being free, as well as allowing multiple attempts, taught me how to solve problems more confidently. The layout of the notes was extremely neat and made focusing on the main points a breeze!
- I really liked the organization and lecture outlines. It helped a lot when taking notes and looking back at what to study
- ...great organization, loved the outlines because they helped me stay focused instead of writing note after note.

3. Quantitative and Qualitative Measures

3a. Overall Measurements

Student Opinion of Materials

Total number of students affected in this project: 228

Calculus in two sections who use OER materials

(based on questions III.7 through V.5 of Calculus survey)

- Positive: 66.4 % of 53 number of respondents
- Neutral: 18.4 % of 53 number of respondents
- Negative: 15.2 % of 53 number of respondents

Statistics

- Positive: 96.7 % of 76 number of respondents
- Neutral: 3.3 % of 76 number of respondents
- Negative: 0 % of 76 number of respondents

Student Learning Outcomes and Grades

Calculus

- ___ Positive: Higher performance outcomes measured over previous semester(s)
- X Neutral: Same performance outcomes over previous semester(s)
- ___ Negative: Lower performance outcomes over previous semester(s)

Statistics

- ___ Positive: Higher performance outcomes measured over previous semester(s)
- X Neutral: Same performance outcomes over previous semester(s)
- ___ Negative: Lower performance outcomes over previous semester(s)

Student Drop/Fail/Withdraw (DFW) Rates

Calculus

33% of students, out of a total 75 students affected, dropped/failed/withdrew from the course in the final semester of implementation.

- ___ Positive: This is a lower percentage of students with D/F/W than previous semester(s)
- X Neutral: This is the same percentage of students with D/F/W than previous semester(s)
- ___ Negative: This is a higher percentage of students with D/F/W than previous semester(s)

Statistics

18.4% of students, out of a total 76 students affected, dropped/failed/withdrew from the course in the final semester of implementation.

- Positive: This is a lower percentage of students with D/F/W than previous semester(s)
- X Neutral: This is the same percentage of students with D/F/W than previous semester(s)
- Negative: This is a higher percentage of students with D/F/W than previous semester(s)

3b. Narrative

The main takeaway from a comparison of classes from before to after adoption of OER materials is that the main performance summaries are essentially unchanged, while student attitudes have improved due to the cost-savings and accessibility of OER materials.

We mention one more important qualitative observation. While both the calculus and statistics course used materials (lecture notes, homework sets, etc.) that were consistent with and followed the OpenStax texts, virtually all of the students seem to have interacted primarily with the lecture notes rather than the text. We speculate this may be part of a trend with the newer generation of students to view the textbook as the last, rather than the first, source of information for a course.

We should mention that the fall semester experienced 6 days of canceled classes due to Hurricane Irma, and some students did not return to class, which could influence the results.

Calculus

In Calculus, the student DWF rates were about the same (perhaps a little lower) for the OER group. Student attitudes, however, were different. The attached survey contains many questions concerning the course and methods of instruction. In particular, by a very high percentage, students who used the OER course materials prefer to use them again, and students who did not use the OER course materials would prefer an OER course. As well, the

results from pre-tests and post-tests were about the same for the OER and non-OER groups.

Statistics

For statistics, the DFW rate went from 15% of 68 students to 18% of 76 students. This difference is well with the range of standard random variation between samples; indeed, the p-value for a test of difference of proportions is .55, providing practically no evidence of a difference.

Similarly, a comparison of questions from the final exam were practically identical. The statistics faculty have a set of eight questions used on final exams to assess student outcomes. The results of two sections of statistics each from spring and fall were compared. The results are summarized in the table in the attached file.

As can be seen from the last row on the attached table, the overall results are slightly higher using OER materials, but are still within the range of ordinary random variation from sample to sample.

Student opinions in the statistics sections were collected via a survey giving the prompt “The organization and clarity of the course material was...”, with answer options on a Likert scale: very poor, poor, satisfactory, good, and very good”. For the purposes of the results in section 3a., we classified “very poor” and “poor” as a negative opinion, “satisfactory” as neutral, and “good” and “very good” as positive. 62 students completed the survey. No students were in the negative opinion classification, two students were in the neutral classification, and the remaining 60 students were in the positive classification.

4. Sustainability Plan

To provide sustainability with our implementation, our course materials and the newly installed WeBWorK are available for other faculty. During a department meeting this Fall, we demonstrated our materials, and invited faculty to adopt these in the Spring 2018 semester. Indeed, for Statistics, this has happened sooner than expected. Two first-time instructors used the OpenStax text with the lecture notes and WeBWorK sets created/compiled by Dr. Carden. These sections had different instructors and were not included in the previous evaluation to prevent confounding, but it shows a willingness to use open-access resources in the department.

All course materials (including notes and homework problems in WeBWorK) will be made available on our faculty web pages (Calculus on Dr. Kersey’s, and Statistics on Dr. Carden’s). Secondary hosting will be on the shared

network drive used by Georgia Southern's math department.

5. Future Plans

Our foray into teaching with free OER course materials has been positive. We were optimistic going into the project, and are enthusiastic looking forward. There are a lot of open-source course materials available and publishing possibilities that we will utilize in our courses in the future, as we continue to develop and improve our own course materials. We are proponents of WeBWork, and will continue to write problems and get more faculty involved. In the future we will consider developing OER for other courses, and consider about how to improve our current classes.

6. Description of Photograph

Dr. Steve Carden (left) taught Introductory Statistics and Dr. Scott Kersey (right) taught Calculus I using OER course materials during the Fall 2018 semester at Georgia Southern University.