Affordable Learning Georgia Textbook Transformation Grants

Final Report

Date: 6/1/2015

Grant Number: 45

Institution Name(s): Georgia College

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

Dr. Marcela Chiorescu, Assistant Professor of Mathematics

Jenny Harris, User Engagement Librarian & Assessment Coordinator, Ina Dillard Russell Library

Project Lead: Dr. Marcela Chiorescu

Course Name(s) and Course Numbers: College Algebra, MATH 1111

Semester Project Began: Fall 2014

Semester of Implementation: Spring 2015

Average Number of Students Per Course Section: 40

Number of Course Sections Affected by Implementation: 4

Total Number of Students Affected by Implementation: 159

1. List of Resources Used in the Textbook Transformation

College Algebra, 3rd edition by Stitz and Zeager
- http://www.stitz-zeager.com/ (website)
- http://www.stitz-zeager.com/szca07042013.pdf (e-book PDF)
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Precalculus Prerequisites by Stitz and Zeager
- http://www.stitz-zeager.com/ (website)
- http://www.stitz-zeager.com/ch_0_links.pdf (e-book PDF)

West Texas A&M Virtual Math Lab web tutorials
- http://www.wtamu.edu/academic/anns/mps/math/mathlab/col_algebra/

- Tutorials found in the "Supplemental Resources" box of each section are the property of West Texas A&M University (WAMU). All contents copyright (C) 2001 - 2011, WTAMU, Kim Seward. All rights reserved.
- Creator gave written permission to link to resources on MATH 1111 LibGuide

Supplemental Resources (Videos available via Khan Academy and YouTube)
- Identifying Sets of Real Numbers: https://www.youtube.com/watch?v=htP2goe31MM
- Operations with sets: https://www.youtube.com/watch?v=nI7h8_7Cj_E
- Interval and set notation: https://www.youtube.com/watch?v=wmX1PI-Rs-8
- Solve linear equations: https://www.khanacademy.org/math/algebra/solving-linear-equations-and-inequalities/basic-equation-practice/v/multi-step-equations-1
- Solving linear inequalities: https://www.khanacademy.org/math/algebra/linear_inequalities/inequalities/v/multi-step-inequalities-3
- Multiplying polynomials: https://www.khanacademy.org/math/algebra/multiplying-factoring-expression/multiplying_polynomials/v/multiplying-polynomials https://www.khanacademy.org/math/algebra/multiplying-factoring-expression/multiplying_polynomials/v/more-multiplying-polynomials
- Dividing polynomials:
- https://www.khanacademy.org/math/algebra2/polynomial_and_rational/dividing_polynomials/v/dividing-polynomials-with-remainders
- Solve quadratic equations by completing the square: https://www.khanacademy.org/math/algebra/quadratics/completing_the_square/v/completing-the-square-to-solve-quadratic-equations
- Multiplying and dividing rational expressions: https://www.khanacademy.org/math/algebra2/rational-expressions/multi-div-rational-exp/v/multiplying-and-dividing-rational-expressions-2 https://www.khanacademy.org/math/algebra2/rational-expressions/multi-div-rational-exp/v/multiplying-and-dividing-rational-expressions-3
- Simplify complex fractions: https://www.youtube.com/watch?v=HgIgZ5xbpiU
- Solving rational equations: https://www.youtube.com/watch?v=mIlfGFaqCiE&list=PL7F3777DD8072DF17&index=3
- Adding and subtracting complex numbers: https://www.youtube.com/watch?v=QckPmaq4dVk

- o Multiply complex numbers:
  https://www.khanacademy.org/math/algebra2/complex-numbers-a2/complex_numbers/v/multiplying-complex-numbers
- o Divide complex numbers:
  https://www.khanacademy.org/math/algebra2/complex-numbersa2/complex_numbers/v/dividing-complex-numbers
- o Symmetry about the x-axis, y-axis and the origin:
  https://www.youtube.com/watch?v=b_00W_0lfcc
- o Determine whether a relation is a function:
  https://www.youtube.com/watch?v=b_00W_0lfcc
- o Finding the domain of a function:
  https://www.youtube.com/watch?v=mapnoSD3J1o
  https://www.youtube.com/watch?v=uMyGvvhhWyw
- o Evaluate functions:
  https://www.youtube.com/watch?v=E9YEUQR9NAU
- o Sum of functions:
  https://www.khanacademy.org/math/algebra2/functions_and_graphs/function_expressions/v/sum-of-function
- o Difference of functions:
  https://www.khanacademy.org/math/algebra2/functions_and_graphs/function_expressions/v/difference-of-functions
- o Product of functions:
  https://www.khanacademy.org/math/algebra2/functions_and_graphs/function_expressions/v/product-of-functions
- o Quotient of functions:
  https://www.khanacademy.org/math/algebra2/functions_and_graphs/function_expressions/v/quotient-of-functions
- o Sum, difference, product and quotient of functions and their domains:
  https://www.youtube.com/watch?v=j2rScesb0fI
- o Test a graph for symmetry:
  https://www.youtube.com/watch?v=PH4LNOAezcI
- o Determine if a function is even, odd or neither:
  https://www.youtube.com/watch?v=oKKcIK_PgEk
- o Graphing piecewise-defined function:
  https://www.youtube.com/watch?v=aK7pO9-qXnU
- o Graph Transformations: Horizontal and Vertical Graph Translations:
  https://www.youtube.com/watch?v=3Q5Sy034fok
- o Graph Transformations: Horizontal and Vertical Stretches and Compressions:
  https://www.youtube.com/watch?v=2S9LUinJ8-w

- o Finding the x- and y-intercepts:
  https://www.khanacademy.org/math/algebra-basics/core-algebra-graphing-lines-slope/core-algebra-graphing-intercepts/v/x-and-y-intercepts
- o Graphing linear functions using slope:
  https://www.youtube.com/watch?v=EbuRufY41pc
- o Applications of linear functions (simple interest formula):
  https://www.youtube.com/watch?v=xQ_oUjWlzTY
- o Find the standard form (vertex form) and the vertex of a quadratic function:
  https://www.khanacademy.org/math/algebra/quadratics/features-of-quadratic-functions/v/ex3-completing-the-square
- o Graphing a parabola using its vertex and x-intercepts:
  https://www.khanacademy.org/math/algebra/quadratics/solving_graphing_quadratics/v/quadratic-functions-3
- o Graphing quadratic functions using transformations techniques:
  https://www.khanacademy.org/math/algebra/quadratics/solving_graphing_quadratics/v/shifting-and-scaling-parabolas
- o Solving quadratic inequalities:
  https://www.youtube.com/watch?v=a10EuIFcphk
- o Solve application of quadratic function:
  https://www.youtube.com/watch?v=OZtqz_xw0SQ
- o Synthetic division:
  https://www.khanacademy.org/math/algebra2/polynomial_and_rational/synthetic-division/v/synthetic-division
- o Evaluate polynomial using the Remainder Theorem:
  https://www.khanacademy.org/math/algebra2/polynomial_and_rational/polynomial-remainder-theorem-tutorial/v/polynomial-remainder-theorem
- o Finding all zeros of a polynomial function:
  Example 1 https://www.youtube.com/watch?v=EEB13cADwFg
  Example 2 https://www.youtube.com/watch?v=Sbpo2phnKxo
  Example 3 https://www.youtube.com/watch?v=rP-___zFngio
- o Finding the end behavior of a polynomial function:
  https://www.khanacademy.org/math/algebra2/polynomial_and_rational/polynomial-end-behavior/v/polynomial-end-behavior
  https://www.khanacademy.org/math/algebra2/polynomial_and_rational/polynomial-end-behavior/v/polynomial-end-behavior-example
- o Sketch the graph of polynomial functions:
  https://www.youtube.com/watch?v=en2ctMSVNEI
- o Finding asymptotes:
  Example 1: https://www.youtube.com/watch?v=HeqfhnKncjc
  Example 2: https://www.youtube.com/watch?v=P0ZgqB44Do4

- Graphing rational function
  Example 1: https://www.youtube.com/watch?v=hWjMovgqvi4
  Example 2: https://www.youtube.com/watch?v=7-7hpHo0Fcw
- Graphing rational function-Example 3:
  https://www.youtube.com/watch?v=BDE73AJrkNA
- Solving rational inequalities
  Example 1 https://www.youtube.com/watch?v=SJecFvUbJOY
  Example 2: https://www.youtube.com/watch?v=Dd-dwlUqkZM
- Composition of functions: https://www.youtube.com/watch?v=S4AEZElTPDo
- Finding the domain of the composition of two functions –
  Example 1: https://www.youtube.com/watch?v=_zy7Uro7i
  Example 2: https://www.youtube.com/watch?v=VsNaX9s1nas
- Introduction to function inverses:
  https://www.khanacademy.org/math/algebra2/functions_and_graphs/function_inverses_2/v/introduction-to-function-inverses
- Finding the inverse of a function:
  https://www.khanacademy.org/math/algebra2/functions_and_graphs/function_inverses_2/v/function-inverse-example-1
- Evaluating logarithms: https://www.youtube.com/watch?v=fGt1YLyIQSc
- Graphing exponential functions:
  https://www.youtube.com/watch?v=ls78_2UBcdY
- Graphing logarithmic functions:
  https://www.khanacademy.org/math/algebra2/exponential_and_logarithmic_func/log_functions/v/logarithmic-function-graphs

2. Narrative

The MATH 1111 course at Georgia College was introduced in Fall 2011 using the Emporium Model. The course is designed such that the students meet with their instructor at a fixed time for 75 minutes once per week and then spend at least three flexible hours in a math laboratory working on assignments. The required material for this class before Spring 2015 was a MyMathLab access code, which is priced at $114 at the Georgia College Bookstore. This code gives access to the e-book version of the 5th edition of College Algebra & Trigonometry by Lial and others, media (video examples, video podcasts, interactive exercises and vocabulary flashcards), homework, quizzes and tests.

The USG's Affordable Learning Georgia initiative provided me with an opportunity to offer more affordable course materials to my College Algebra students. The goal was to replace the textbook with an open source one without any loss in the quality of the materials the students have access to. Although there are many open textbooks, there are not many that can be packaged with an

affordable and reliable software that would allow the students access to algorithmically generated questions for homework and exams.

After extensive research, I decided to build the course around three main elements:

- **An open source textbook**

The freely available e-book adopted was *College Algebra* by Carl Stitz and Jeff Zeager, the third edition.

- **An online software that provides online assignments generated from the exercises of the textbook**

The textbook adopted can be packaged with WebAssign for only $27.95, a 75% savings for every student. WebAssign is a simple online software that provides access to online assignments generated from the exercises in the book and provides a limited variety of built-in tutorials, which I carefully selected for the assignments. It does not provide exercises for the Review Chapter, but I was able to find other exercises freely available in WebAssign, which correspond to the concepts of this chapter.

- **A variety of supplemental resources organized in a LibGuide**

The challenge of adopting an open source book is the limited amount of supplemental course materials the students have access to, resources that are usually made available by the publisher. To compensate for this lack of resources, together with Ms. Jenny Harris we decided to collect a variety of open resources and organize them in a LibGuide hosed on the Georgia College Library's website. We organized the LibGuide for the course in five modules, each module being organized in sections, which contain learning objectives, links to sections of the e-book and supplemental resources (You Tube videos and tutorials). Kim Seward from West Texas A&M University (WAMU) created the tutorials, but she gave us permission to use them. Here is a link to the LibGuide of this course created by Ms. Jenny Harris: http://libguides.gcsu.edu/math1111.

Overall, the project was implemented successfully. It gave us the opportunity to observe that there is a significant progress in the availability of high quality open resources in many subjects, but math still lacks high quality reliable freely available online software.

For only 25% of the students enrolled in this course, the cost savings influenced their decisions, mainly because the students were freshmen and were placed in this course by their advisors.

"I did not know this when I enrolled but the price difference made me very happy and it relieved a lot of stress to know I was paying so little." (College Algebra student course via anonymous survey)

Among all the students registered, 51% thought that the book was adequate for the course. Some felt like the electronic format is more difficult to handle and some of the students chose to rely heavily on the class notes and the tutorials provided in WebAssign and LibGuide, they felt they

were enough to complete their assignments. The tutorials in WebAssign were present more in the first chapter and less or missing in the last four chapters, the students needed to access tutorials or videos from the LibGuide instead. Although I created a direct link to the LibGuide within WebAssign, many students found it inconvenient; they preferred to have the tutorials embedded within their assignments. 58% of students accessed at least once per week the resources from the LibGuide. Overall we overcome all the problems, the ABC rates for my four sections of this course are 78.3%. The drop, fail, and withdraw (DFW) rates are a bit higher than in the previous five semesters, 21.7% in Spring 2015 compared to 17.4% for Fall 2013-Fall 2014.

For a hybrid class as College Algebra, where all assignments (homework, quizzes and tests) are done online, it is very important to have a reliable online software. WebAssign created many problems throughout the semester: it was very slow, gave random errors (It would not allow to type an answer for some problems and not for all students, so it was hard to identify the problem.), many exercises will not specify the format of the answer, and the students got easily frustrated. Since the students didn't have a good experience with WebAssign this semester, I decided to go back to our previously adopted book. The online software that comes with this book, MyMathLab, not only is very reliable but also provides many embedded high quality media resources, which students find very useful and they are hard to replace, all in a single, easily accessible place. Although the cost to the student play an important part in selecting a textbook, the content and the students learning experience play much important roles.

3. Quotes

"I was enrolled by my adviser because freshman do not make their own schedules. However, I am very thankful that the course materials were offered at such a great price! It definitely encourages me to take and continue with the course!" (College Algebra student course via anonymous survey)

[WebAssign] "need more available tutorials for questions. Need to work on the lag problem, the program is slow and often causes my new laptop to lag." (College Algebra student course via anonymous survey)

"LibGuide was hard to understand. When I looked at it all it did was confuse me more."…"I would gladly pay for a textbook if it had better examples/explanations of the work." (College Algebra student course via anonymous survey)

4. Quantitative and Qualitative Measures

Grade distribution after implementation – Spring 2015:

A	B	C	D	F	W
37.1%	34%	13.2%	5.7%	8%	8%

Grade distribution before implementation (Fall 2013-Fall 2014):

A	B	C	D	F	W
33%	31.9%	17.7%	5.7%	4.3%	7.4%

*MATH 1111 LibGuide Total View per month:

	January-15	February-15	March-15	April-15	May-15	Total Views
Total Views	920	595	338	288	129	2273

See supplemental document for more detailed statistics regarding LibGuide usage.

5. Sustainability Plan

While the materials will not be required in a math course in the near future, the resource guide created for the course will be housed on the university library's webpage via a LibGuide and tagged with keywords for students who are seeking assistance with College Algebra. Together with Ms. Harris will continue to add relevant materials to the guide, and Ms. Harris will maintain and update course materials on a regular basis – checking links, videos, updating eBook with newest edition, etc.

I'm also planning to use the LibGuide as a reference for all my math courses and will refer to it each student who lacks basic algebraic skills. I will use it as recommended resource in my Precalculus' course and use it for the first part of the course when I'll review College Algebra concepts. My teaching experience and resource guide will also be shared with the Department of Mathematics for other faculty to utilize this LibGuide in their courses.

6. Future Plans

Outside of the classroom, the Russell Library has worked with multiple departments on campus such as the Center for Faculty Development and the Center for Student Success to educate and inform both faculty and students about the Affordable Learning Georgia initiative and the

adoption of open educational resources (OERs) in the classroom. Representatives from these three departments (Russell Library, Center for Faculty Development, and Center for Student Success) are currently drafting a campus action plan to disseminate across campus and help streamline a process for creating more awareness and understanding about the adoption of OERs. The campus action plan will identify key stakeholders on campus who can assist with the initiative and will also include a campus or regional-wide event held in Spring 2016 aimed at finding, evaluating, and adopting OERs.

Russell Library will continue to host webinars and training sessions regarding OERs and meeting with campus departments to discuss what role the library might play in assisting faculty to identify and use OERs.

Jenny Harris, will serve on a panel at the 27th Annual GaCOMO (Council of Media Organizations) Conference regarding librarians' roles in the adoption of OERs in the classroom via the ALG Textbook Transformation Grant. The conference will be held October 7-9, 2015 in Athens, GA.

We will submit a proposal for the 2016 University System of Georgia Teaching & Learning Conference, once RFPs have been released.

I will also submit a proposal for the 28th International Conference on Technology in Collegiate Mathematics, March 10-13, 2016, Atlanta, Georgia. (This conference publishes the contributed papers in its proceedings, I hope that our results will be published as well.)

7. Description of Photograph

Left-right: Jenny Harris, User Engagement Librarian and Assessment Coordinator, LibGuide creator and Dr. Marcela Chiorescu, Assistant Professor of Mathematics, team lead