

## Application Details

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### Manage Application: ALG Textbook Transformation Grants

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**Award Cycle:** Round 6

**Internal Submission Deadline:** Monday, August 1, 2016

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**Application Title:** 238

**Application ID:** #001141

**Submitter First Name:** Thomas

**Submitter Last Name:** Gonzalez

**Submitter Title:** Professor of Mathematics

**Submitter Email Address:** tgonzalez@daltonstate.edu

**Submitter Phone Number:** 706-272-2488

**Submitter Campus Role:** Proposal Investigator (Primary or additional)

**Applicant First Name:** Thomas

**Applicant Last Name:** Gonzalez

**Co-Applicant Name(s):** Michael Hilgemann, Jason Schmurr

**Applicant Email Address:** tgonzalez@daltonstate.edu

**Applicant Phone Number:** 706-272-2488

**Primary Appointment Title:** Professor of Mathematics

**Institution Name(s):** Dalton State College

**Submission Date:** Monday, August 1, 2016

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

Thomas Gonzalez, Professor of Mathematics, Department of Technology and Mathematics, Dalton State College, tgonzalez@daltonstate.edu

Michael Hilgemann, Associate Professor of Mathematics, Department of Technology and Mathematics, Dalton State College, mhilgemann@daltonstate.edu

Jason Schmurr, Associate Professor of Mathematics, Department of Technology and Mathematics, Dalton State College, jschmurr@daltonstate.edu

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

Dr. Andy Meyer, Interim Vice President for Academic Affairs, Dalton State College

Dr. Lee Ann Nimmons, Chair, Department of Technology and Mathematics, Dalton State College

**Proposal Title:** 238

**Course Names, Course Numbers and Semesters Offered:**

Calculus and Analytic Geometry I, MATH 2253, beginning Spring 2017

Calculus and Analytic Geometry II, MATH 2254, beginning Summer 2017

Calculus and Analytic Geometry III, MATH 2255, beginning Fall 2017

**Final Semester of Instruction:** Fall 2017

**Average Number of Students per Course Section:** 30

**Number of Course Sections Affected by Implementation in Academic Year:** 16

**Total Number of Students Affected by Implementation in Academic Year:** 481

**List the original course materials for students (including title, whether optional or required, & cost for each item):** Calculus: Early Transcendentals by James Stewart, Required, \$309

**Proposal Category:** No-or-Low-Cost to Students Learning Materials

**Requested Amount of Funding:** 15400

**Original per Student Cost:** 309

**Post-Proposal Projected Student Cost:** 0

**Projected Per Student Savings:** 309

**Projected Total Annual** \$99,086

**Student Savings:**

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

The textbooks will be pdf documents created using LaTeX. Git will be used for version control. The free textbooks will be hosted using Brightspace/Desire2Learn and the source code will be hosted on GitHub. The online text will also be submitted to MERLOT, at <https://www.merlot.org>

**Project Goals:**

The goals of this project include

Creating an open textbook for the three Calculus sequence courses taught at Dalton State College that has zero cost to students. This involves an extensive revision of the existing APEX Calculus textbook to match learning outcomes. Content will be added, revised, and reordered to make up for differences between the textbook and Dalton State's course learning outcomes. For MATH 2255 this will also involve manually coding and revising the material from Strang's Calculus into LaTeX to fill gaps in the APEX Calculus book.

Replacing the current expensive textbook in Calculus I, Calculus II, and Calculus III with a free textbook for all sections taught at Dalton State College using a staggered schedule so that all sections of all three Calculus courses are using the free textbook by Fall 2017;

Providing the free textbook to all students enrolled in any of these Calculus classes by placing it within the Brightspace/Desire2Learn Learning Management System and making it available to the public on an easily accessible website;

Creating a set of online WebWork problems to accompany the free textbook that instructors and students at Dalton State College can access for free when they take or teach any of the Calculus courses;

Collecting both qualitative and quantitative information from students and instructors using the free textbook in regards to how well the free textbook is helping the students learn the material and how it compares to the previous textbook;

Using the collected feedback from students and instructors to revise and improve the textbook and modify it for its best use at Dalton State College;

Host the textbook and its source code on Brightspace/Desire2Learn, GitHub, and MERLOT.

**Statement of Transformation:**

Currently the Dalton State College mathematics department uses Stewart's *Calculus: Early Transcendentals* for our Calculus sequence of MATH 2253, MATH 2254, and MATH 2255. Every student at DSC in a STEM major takes at least one of these courses. The text sells for

\$309 in the bookstore. Some of our sections require it to be bundled with WebAssign access, for a total of \$335. Dalton State College has a national reputation as one of the most affordable four-year public institutions in the country, and as a result we attract many students who have difficulty affording expensive textbooks. In addition, prohibitive textbook costs conflict with our college's mission of providing broad access to quality higher education for residents of northwest Georgia.

We propose to replace the textbook and the WebAssign access with a combination of free online texts and a free online homework system. This will reduce student costs for the Calculus sequence to zero. Additionally, it will aid our students and instructors by providing course materials specifically tailored to the outcomes of Dalton State's Calculus courses.

The primary online text is the open-source textbook *APEX Calculus*. This text, which was begun as a collaborative open-source project at the Virginia Military Academy, has already been successfully adopted by several colleges and universities around the country. It is now in its third edition. Because the Dalton State course MATH 2255 contains some material not addressed in *APEX Calculus*, for MATH 2255 we plan to also use a chapter from Strang's *Calculus*. This text is freely available through MIT Open CourseWare. We also intend to take advantage of the open-source nature of *APEX Calculus* to customize the textbook to fit the learning outcomes of our courses. We expect this to have a positive impact on our department's instructors and students, since the course materials will be completely aligned with the course objectives and content.

The online homework system is called WebWork. This system is supported by the Mathematical Association of America, and is offered at no cost to students. We propose to create a complete suite of online homework sets in WebWork to complement the online text. WebWork offers the major advantages of online homework systems: instant feedback to students, a sophisticated mathematical free-response engine, and many opportunities for graded problems with minimal instructor time required. For those instructors who have limited experience with online homework systems, our homework sets will be easy to integrate into their courses and easy to customize if desired. Since Dalton State already maintains a WebWork server, our use of WebWork will not impose any additional cost on the department.

#### **Transformation Action Plan:**

All Dalton State mathematics faculty will be surveyed as to their opinions on the current Calculus textbook with regards to the order and presentation of topics and to how well it aligns with the learning objectives of the Calculus courses. During the Spring 2016 semester,

all current Math 2253, Math 2254, and Math 2255 students will be surveyed as to their opinions on the current Calculus textbook with regards to cost, ease and frequency of use, and how well it helps them achieve the learning objectives of the course. They will also be surveyed for their opinions on the use of an online textbook instead of a traditional printed text. Once all surveys have been collected, the team consisting of Tom Gonzalez, Mike Hilgemann, and Jason Schmurr will utilize this information while creating and customizing the new textbook.

All members of the team will collaborate to create the new Calculus textbook using the open source APEX Calculus text by Gregory Hartman as a primary source and using Strang's MIT Open Courseware Calculus text to fill in any missing content that the first online text lacks. Material from both sources will be customized to fit the learning objectives of Dalton State and the majority opinions of the mathematics faculty from the collected surveys. The final textbook will be a PDF document and made available to all students and the public for free. If they choose, students can opt to print all or parts of the text using any of a number of commercial printing services -- this would still be a much cheaper alternative to purchasing Stewart's *Calculus*.

All members of the team will collaborate to create WebWork homework assignments for each section of the new textbook that cover the types of problems students will need to be able to do in order to meet the learning objectives for each Calculus course.

The new free textbook will be adopted for Math 2253 in Spring 2017, adopted for both Math 2253 and Math 2254 in Summer 2017, and all three calculus courses in Fall 2017. The syllabi for these courses will reflect this change in required course materials and will include information on where the textbook can be accessed on the Brightspace/Desire2Learn(GeorgiaView) course site.

The WebWork homework problems will be made available to all mathematics faculty on Dalton State's WebWork server. Instructors of the Calculus courses can adopt or modify these assignments into their courses as they see fit.

The team will pursue Creative Commons licensure for the created textbook. Open public access to the text will be provided by placing the text on github.com and merlot.org.

The LaTeX source code will also be made available for other institutions or individuals to customize the text to their needs.

During the semesters the new textbooks are first adopted, the team will survey all Calculus instructors and students using the new textbook with regard to their opinions on the textbook and WebWork assignments. The surveys will collect opinions related to the ease of use of the materials, the helpfulness of the materials in achieving the learning objectives of the course, and any necessary alterations to the material. In addition, numerical data on grade distributions and pre/post-tests for these semesters will be compared to previous semesters.

This information will be used by the team to assess the impact that the new textbook has had on the courses, to update and modify the textbook, and to fix any discrepancies or errors in the text or problems.

**Quantitative & Qualitative Measures:** Prior to implementation, we will conduct a survey of mathematics faculty to assess instructor experience and opinions on the current textbook. We will also conduct a survey of students to assess their opinions on the text currently in use and their level of comfort with online textbooks. The surveys will collect the following information: Student Survey Qualitative measures: what did they like, what they didn't like, things that could be improved [open-ended questions] Quantitative measures: ease of use, ease of access [Likert scale], text delivery preference, frequency of access [multiple choice] Instructor Survey Qualitative measures: what did they like, what they didn't like, things that could be improved [open-ended questions] Quantitative measures: ease of use, ease of access, alignment with learning objectives [Likert scale], text delivery preference, online homework system preference [multiple choice] During implementation, these student and faculty surveys will also be conducted during each semester to assess opinions on the new free text, according to the following schedule: Spring 2017: MATH 2253 (Calculus and Analytic Geometry I) Summer 2017: MATH 2253 and MATH 2254 (Calculus and Analytic Geometry I, II) Fall 2017: MATH 2253, MATH 2254, and MATH 2255 (Calculus and Analytic Geometry I, II, and III) In our department, it is already standard procedure to use pre- and post-tests to assess student learning objectives in these courses. We will use the data from these assessments as a quantitative measure of student success. In order to measure the level of improvement in student success, data from Spring 2016 and Fall 2016 (pre-implementation) will be compared with data from Spring 2017 and Fall 2017 (post-implementation). Also, we will compare grade distributions in these courses pre- and post-implementation.

## Timeline:

August 22, 2016: Receive notification regarding funding of project.  
September 12, 2016: Two team members attend required kickoff meeting.  
September 2016: Survey math faculty, pre-implementation.  
September 2016: Consult with IRB committee and seek IRB approval for data collection if necessary  
October 2016: Survey students in Calculus sequence, pre-implementation.  
November 2016: Meet with all Spring 2017 MATH 2253 instructors to discuss the new course materials.  
December 2016: Complete WebWork homework sets for MATH 2253.  
December 2016: Complete customization of online text for use in MATH 2253.  
January 2017: Begin using new materials in MATH 2253.  
March 2017: Survey all faculty and students in MATH 2253 who are using the new materials.  
April 2017: Meet with all Summer and Fall 2017 MATH 2253, MATH 2254, and MATH 2255 instructors to discuss the new course materials.  
May 2017: Submit status report from Spring 2017 implementation.  
May 2017: Complete WebWork homework sets for MATH 2254.  
May 2017: Complete customization of online text for use in MATH 2254.  
May 2017: Begin using new materials in MATH 2254.  
July 2017: Submit status report from Summer 2017 implementation.  
August 2017: Complete WebWork homework sets for MATH 2255.  
August 2017: Complete customization of online text for use in MATH 2255.  
August 2017: Begin using new materials in MATH 2255.  
September 2017: Pursue Creative Commons License. Make finished text publicly available online.  
October 2017: Survey all faculty and students in MATH 2253, MATH 2254, and MATH 2255 who are using the new materials.  
December 2017: Submit final report.

## Budget:

Personnel (\$15,000)

\$5,000 per team member:

Tom Gonzalez

Michael Hilgemann

Jason Schmurr

The for salary for redesign of course materials, creation of surveys, implementation of course materials, data collection, data analysis, and preparation for final report.

Other expenses(\$400)

\$400 for the two team members to attend training sessions and expenses related to professional development and consultation.

**Sustainability Plan:**

The number of sections of Calculus I, II, and III offered at Dalton State College have steadily increased in recent years and the three classes are now offered every semester. Eight sections of the three classes were offered in the Fall 2015 semester. Seven total sections were offered for Spring 2016. Nine sections of the three classes are scheduled for the Fall 2016 semester.

Course materials will be maintained by the applicants and other interested department members. Both the textbook and WebWork problems will be stored in online repository on GitHub, <https://github.com>. GitHub is free for public use and facilitates collaboration among multiple contributors. Course materials will be able to be revised, updated, and expanded, not only by departmental members, but by other interested parties outside of the department. The online text will also be submitted to MERLOT, at <https://www.merlot.org>.

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July 28, 2016

Dear ALG Committee:

Drs. Tom Gonzalez, Jason Schmurr, and Mike Hilgemann have asked me to write a letter of support on their behalf with regards to their Affordable Learning Grant Proposal and I am glad to support their efforts. This team plans to replace the current calculus book with open source course materials and online problem sets using WebWorks. This is particularly relevant for this course as this will allow students to use the same textbook and system of problem sets for Calculus I, II, and III. They plan to stagger the implementation so all levels of calculus are using the open educational resources by spring 2017.

Through their implementation of open educational resources they will be able to provide the learning materials for all calculus students at a great savings to students. At Dalton State, about 90% of students are from economically challenged backgrounds, therefore the availability of the free learning materials will support their ability to go to college, progress through the program, and graduate from college. This is especially important considering that the college is an access college our mission is to make college accessible and affordable to students.

The use of open source materials for this course is a particularly appropriate use open educational resources and use of our emporium style math lab. If students choose, they can work through the online materials in the math lab with instructor and tutor service readily available. This project proposed by Drs. Gonzalez, Schmurr, and Hilgemann is an innovative use of open educational resources and I look forward to seeing their implementation. Thanks for your consideration

Sincerely,

Andy Meyer, Ph.D.  
Associate Vice President for Academic Affairs  
ameyer@daltonstate.edu



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June 28, 2016

Dear Grant Review Committee:

The Department of Technology and Mathematics wholeheartedly supports the proposal of Drs. Tom Gonzalez, Mike Hilgemann, and Jason Schmurr to select and adopt a suitable open-source textbook and other course materials for our three-course calculus sequence. The proposal put forth will result in zero cost for students for textbook and course materials in these courses. This will provide a tremendous benefit to our students who currently pay over \$300 for a textbook and an additional cost for an online homework system.

The faculty members involved in this project, Dr. Gonzalez, Dr. Hilgemann, and Dr. Schmurr, each have a history of concern for and commitment to student learning. While the open-source materials will serve to ease some of the financial burden of our students, it will also allow the instructors to easily modify course materials in order to better meet the desired student learning outcomes. The primary textbook will be APEX Calculus which is open-source, and an online homework system, WebWork, will be used at no cost to students.

MATH 2253, MATH 2254, and MATH 2255 (Calculus and Analytic Geometry I, II, III) are offered every semester, making this project both productive and sustainable. It is also hoped that this project will act as a model to perhaps assist other faculty and departments in adopting open-source materials and lead to broader sustainability of this open-source concept.

Thank you for your consideration of this proposal.

Sincerely,

Lee Ann Nimmons, Ph.D.  
Chair, Department of Technology and Mathematics  
Professor of Mathematics  
Dalton State College