

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

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

Institution Name	Southern Polytechnic State University		
Team Members (Name, Title, Department and email address for each)	Associate Professor Lake Ritter, Mathematics, lritter@spsu.edu Associate Professor Shangrong Deng, Mathematics, sdeng@spsu.edu		
Sponsor, Title, Department	Academic Affairs, "A Course Model for Calculus II with Open Access Text and Tools", Department of Mathematics		
Course Name, Course Number and Semester Offered (Spring 2015 Required)	Calculus II, MATH 2254 Spring 2015		
Average Number of Students in the Course	30-36/section 815/year	Number Course sessions per Academic year	27
Award Category (pick one)	<input checked="" type="checkbox"/> No-Cost-to-Students Learning Materials <input 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>[Material Title, opt req]</i> Text: <i>Stewart Calculus 7e</i> (req.) WebAssign (req. or opt. per instructor)	<i>[Cost]</i> \$180 (buy, used), or \$105 (rent, used), or \$69 (ebook rental) \$75.70 Total Cost	
Projected Per Student Cost	\$69--\$255.70	Projected Per Student Savings (%)	100%

1. Goals

The goal of the present project is to determine the impact of no-cost alternative course materials on student success in Calculus II and to assess the feasibility of integrating these no-cost alternatives into the Calculus sequence (I and II). In particular, we endeavor to determine: **(1)** Whether student success rates are affected by using no-cost materials and if such impact is positive, negative or neutral; **(2)** The feasibility (ease of use, reliability) of no-cost alternatives to both students and teaching faculty; and **(3)** What issues will need to be addressed to facilitate adoption of no-cost materials department wide and for the two course (Calc. I & II) sequence (e.g. material adaptations, faculty training needs).

1.1 Statement of the Problem: Identified Needs

The Wall Street Journal reported in 2012 that the Student Loan debt in the United States topped the one trillion mark surpassing the entire combined credit card debt in this country (WSJ 2012). Due to the Georgia's HOPE Scholarship Program, students in our state have fared better than those in many others. But even HOPE has suffered financial woes with reductions to tuition coverage and elimination of funding for books and fees. In light of this, we strongly support the USG's "ALG" initiative to reduce students' textbook burden and skyrocketing higher education costs.

As a polytechnic institution, SPSU is deeply invested in high quality STEM programs. Mathematics is integral to programs in science and engineering. In fact, 58% of the current baccalaureate programs (25 out of 43) at SPSU require mathematics courses up to at least the level of Calculus II. Unfortunately, the success rates (DFW) are amongst the poorest in the institution for any one course. Table 1 summarizes the SPSU offerings, enrollment and success rate of Calculus II over the past three years. Calculus II is an important gateway to higher level applied mathematics, and is typically the first course in which students are expected to extensively utilize prior mathematical knowledge to successfully solve problems.

Year	Sections/yr	Students Enrolled	No. Passed (w/A, B, C)	%Success ($\geq C$)
2011	24	797	340	42.7%
2012	26	808	391	48.4%
2013	29	843	400	47.4%

Table 1: Number of sections of Calculus II, students served, and students passing with a grade of C or better by year. (Source Web Reports wshr0700; does not included Honors versions of Calculus II)

Poor performance in college calculus class is not unique to SPSU. It has inspired, among other approaches, the production of new textbooks and electronic course aids including homework systems. Unfortunately, the price tag for such items can be prohibitive exacerbating the aforementioned financial burden on the student.

1.2 Transformational Action Plan

Proposed Program: We are proposing a program to introduce No-Cost-To-Students materials. We have identified Calculus II (MATH 2254) as the subject of this pilot program due to its

significance to programs and its student success record as noted above. We seek to improve the teaching and learning of Calculus II by integrating free online Java applets, the free online homework system *WebWork*, and the open access calculus text by David Guichard and others.

The Guichard text (http://www.whitman.edu/mathematics/calculus_late_online/), is one of the top approved texts by the American Institute of Mathematics as noted on the *ALG top 50 courses* list. We chose this text because it is well written, very similar to (if not better than) our current departmental textbook: Calculus by Stewart, 7-th edition, and for its ease of use.

WebWork is a free open-source, web-based interactive homework system. WebWork can provide instant feedback to students and give students the opportunity to correct mistakes in almost real time. Automatic homework grading provides instructors with analytical data on students' performance. Preliminary studies have concluded that inclusion of online homework is at least as effective, and sometimes more effective, than traditional homework (LaRose 2010; Emerson and Mencken 2011). WebWork is sponsored and promoted by the Mathematical Association of America (MAA, webwork.maa.org), and SPSU has implemented a server for WebWork and presently hosts a WebWork portal (<http://webwork.spsu.edu>).

Pictures and mini-movies can make concepts visible. We will collect and organize Calculus applets. For example, a series of applets by Thomas S Downey is available for educational purposes at no cost. We will integrate Java applets into the teaching.

Assessment of Student Success: In spring 2015, each investigator will teach two sections of Calculus II, one using the current format typical in the department, and one using strictly the no-cost materials referenced herein. Data on student performance will be collected by (1) inclusion of common questions on assessment instruments (quiz, midterm, final exam), (2) DFW rate, and (3) overall GPA per class.

Assessment of Feasibility & Expansion: A study of the feasibility of and student response to the no-cost alternatives will be done by conducting surveys of students and faculty (the precise survey protocol to be determined during the planning phase). We expect to conduct initial surveys early in the term, gateway surveys on/around the midterm, and exit surveys. The principal investigators will conduct a self assessment of the experience of teaching with the alternate format with special attention given to potential need to modify/adapt the materials, difficulties with reliance on electronic materials (unforeseen IT needs), and identification of topics required for faculty training. We will also survey mathematics faculty to assess needs and concerns and to determine feasibility of adopting no cost materials for the two course sequence.

1.3 Project Timeline

- Team meeting, designing the courses, collecting Java applets, getting to know more about WebWork as superusers and also as instructors. (Oct., 2014 – Jan., 2015)
- Initial progress report (Dec., 2014)
- During the whole project (Oct., 2014—June, 2015), the following tasks will be implemented: collect applets, select problems, set up problem sets, collect data, monitor students progress, and add instructors to the WebWork server for anyone willing to try.
- Conduct surveys and workshops (April and May 2015).
- Two courses completed, Final report (June, 2015)

- Presentation to the annual meeting of the Mathematical Association of America or the Annual International Conference on Technology in Collegiate Mathematics.

1.4 Budget:

Item Description	Cost
Course Release/Compensation (Deng)	\$5000
Course Release/Compensation (Ritter)	\$5000
MAA SE Conference Travel (Ritter)	\$800
Total	\$10,800

Details:

Compensation (Deng): \$3876 (2.3 work units) release time, \$1124 (29%) benefits

Compensation (Ritter): \$3876 (2.5 work units) release time, \$1124 (29%) benefits

Travel: \$35 Registration, \$184 Lodging, \$140 per Diem, \$441 transportation

1.5 Sustainability:

We foresee no major obstacles to long term use of no cost materials in the Calculus course. The text chosen is available in both Late and Early Transcendental versions. So should the department calculus format change in the future, the same text can be used. The primary course content is somewhat static, so no real need exists for continuous updates/new editions. The WebWork system is supported and maintained by the MAA, and SPSU hosts a WebWork portal. As part of the program, we will design faculty training to facilitate faculty buy-in and create ease of transition for the department. The culture within the department strongly favors open access. We fully expect that, if we can show that student success is at least as good using alternative materials, SPSU math faculty will embrace No-Cost-to-Students text and material adoption.

References:

- (1) Mitchell J. and Jackson-Randall, M., Student-Loan Debt Tops \$1 Trillion, WSJ, March 22, 2012 12:46 p.m. ET
- (2) LaRose, G. P. (2010) The Impact of Implementing Web Homework in Second-Semester Calculus. PRIMUS, Vol. 20, No. 8, pp. 664-683
- (3) Emerson T.L.N. and Menken, K.D. (2011) Homework: To require or not? Online graded homework and student achievement. *Perspectives on Economics Education Research* Vol. 7: No. 1