Spring 2016

Elementary Statistics

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Elementary Statistics

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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.

Syllabus

August 2015

Course Outline for MATH 2200 – Elementary Statistics

Text: Diez, Barr, and Cetinkaya-Rundel, OpenIntro Statistics, 3rd Edition
(PDF only, chapters and sections used listed below)

I. Intro to Data Descriptive
    A. Data Basics
    B. Overview of data collection principles
    C. Observational studies and sampling strategies (optional)
    D. Experiments (optional)
    E. Examining Numerical Data
    F. Considering categorical data

II. Probability
    A. Defining Probability
    B. Conditional probability
    C. Sampling from a small population (optional)
    D. Random Variables (optional)
    E. Continuous Distributions

III. Distributions of random variables
    A. Normal distribution
    B. Evaluating the normal distribution
    C. Binomial Distributions (optional)

IV. Foundations for Inference
    A. Variability in estimates
    B. Confidence intervals
    C. Hypothesis Testing
    D. Examining the Central Limit Theorem
    E. Inference for other estimators

V. Inference for numerical data
    A. One sample mean with t distribution
    B. Paired data
    C. Difference of two means

VI. Inference for categorical data
    A. Inference for a single proportion
    B. Difference of two proportions
    C. Testing for goodness of fit using chi-square
    D. Testing for independence in two-way tables

VII. Introduction to linear regression
    A. Line fitting, residuals, and correlation
    B. Fitting a line by least squares regression

Non-optional material   35 hours
Optional material, review, and testing   8 hours

Each chapter should take 2-3 50 min. class meetings or 1-2 75 min. class meetings.

Software
Students in this course should be exposed to statistical software on graphing calculators or in software packages such as Minitab, Excel, or SPSS.

This course should include at least four one-hour exams (two of which should be returned before midterm), and a comprehensive final exam. If an instructor is unable to complete the course outline or administer the minimum of exams he or she should notify the department head.

Initial Proposal

Application Form

Personal

Details

*Submitter First Name:	Jared
*Submitter Last Name:	Schlieper
*Submitter Title:	Ph.D.
*Submitter Email Address:	jared.schlieper@armstrong.edu
*Submitter Phone Number:	912-344-2754
*Submitter Campus Role:	Proposal Investigator (Primary or additional)
*Applicant First Name:	Jared
*Applicant Last Name:	Schlieper
*Co-Applicant Name:	Greg Knofczynski
*Co-Applicant Name:	Michael Tiemeyer
*Applicant Email Address:	jared.schlieper@armstrong.edu
*Applicant Phone Number:	912-344-2754
*Primary Appointment Title:	Assistant Professor, Mathematics
*Institution Name(s):	Armstrong State University

Proposal Details

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

Jared Schlieper, Assistant Professor, Mathematics, Armstrong State University, jared.schlieper@armstrong.edu

Greg Knofczynski, Associate Professor, Mathematics, Armstrong State University, greg.knofczynski@armstrong.edu

Michael Tiemeyer, Assistant Professor, Mathematics, Armstrong State University, michael.tiemeyer@armstrong.edu

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

James Brawner, Professor and Department Head, Mathematics, Armstrong State University, james.brawner@armstrong.edu

*Proposal Title:	183

*Course Names, Course Numbers and Semesters Offered:

Math 2200 Elementary Statistics Fall, Spring and Summer semesters with multiple sections.

*Final Semester of Instruction:	Spring 2016
*Average Number of Students per Course Section:	35
*Number of Course Sections Affected by Implementation in Academic Year:	25-30
*Total Number of Students Affected by Implementation in Academic Year:	1050
*List the original course materials for students (including title, whether optional or required, & cost for each item):	Introduction to the Practice of Statistics by Moore, McCabe, Craig required $200
*Proposal Categories:	No-Cost-to-Students Learning Materials
*Requested Amount of Funding:	$15,800
*Original per Student Cost:	$200
*Post-Proposal Projected Student Cost:	less than $20
*Projected Per Student Savings:	$180
*Plan for Hosting Materials:	D2L

*Project Goals:

The main goal of this transformation is to adopt a high quality open-source textbook for Elementary Statistics in order to ensure all students have access to the course textbook at the start of the course and to reduce the cost of higher education while maintaining academic integrity and success. Also, we wish to bring awareness of open-source materials to students, faculty, and administration so that others may introduce similar materials to further reduce costs.

*Statement of Transformation:

In an academic year, an average of 1100 students take Elementary Statistics as a requirement for their degree program. Fortunately, like many math departments, the Armstrong math department has chosen a typical statistics book that is used in Math 2200. However, the current text costs $190--through the publisher's website, and it's approximately $225 at the campus bookstore--and it includes an access code to use its associated online homework system. One reason the department chose the current text was that the cost to students was lower compared to the previous text. The previous text is now similarly priced at $225--again, through the publisher's website--and it also includes access to its associated online homework system. Our current text is moving to a new edition in 2015 along with an expected price increase; every three to five years the publishers release new editions that are generally more expensive than previous ones.

This high price for one textbook is not new to higher education; a study has shown that the price of textbooks has increased four times higher than inflation in the past twenty years (Allen, 2010). In 2005, the Government Accountability Office found that the yearly cost of textbooks in college amounted to $900. So it is no wonder that many students will "wait to see if they need the textbook" or forgo purchasing it altogether. However, those that wait or opt out often find they need the resource too late into the course, and they find themselves at a severe disadvantage.

In Fall 2013, approximately 38% of our undergraduate population were first-generation college students and approximately 56% qualified for federal Title IV funding such as Pell Grants, subsidized loans, etc. Many non-traditional students also populate our Elementary Statistics course and they tend to have several financial obligations beyond those of traditional students. So roughly $200 for a textbook that students will use for only one course is unreasonable economically for our students. This undue financial burden can hinder academic progress regardless of academic ability.

Open-source textbooks can help relieve our students financial burden in the Elementary Statistics course as well as mitigate the delay in acquiring the textbook. Several sources are available for finding a quality open-source textbook including those mentioned in this call for proposals. One such source is The American Institute of Mathematics(AIM), which has an ongoing Open Textbook Initiative to identify open-source and open-access textbooks suitable for use in a traditional university course. Using AIM's evaluation criteria and recommendations from our department colleagues as a guideline, we aim to adopt a no-cost open-source textbook for Elementary Statistics in order to alleviate part of our students' financial burden.

Allen, N. (2010). A cover to cover solution: How open textbooks are the path to textbook affordability. The Student Public Interest Research Group. Retrieved from http://www.studentpirgs.org/sites/student/files/reports/A-Cover-To-Cover-Solution_4.pdf

U.S. Government Accountability Organization. (2005, July). College textbooks: Enhanced offerings appear to drive recent price increases (Publication No. GAO-05-806). Retrieved from http://www.gao.gov/new.items/d05806.pdf.

*Transformation Action Plan:

We will identify the currently available open-source statistics textbooks. Several options include OpenIntro Statistics by David M. Diez, Christopher D. Barr, and Mine Çetinkaya-Rundel, SticiGui by Philip Stark, Online Statistics Education by David Lane, and Introductory Statistics offered by OpenStax. Of these and others we find, we will review each to determine if they cover the required content for Elementary Statistics in a fashion that is expected within the department. We will adopt the most suitable to our department.

Since we will adopt a text that would fit nicely with the current course design, there should be minimal redesign of the course.

Drs. Knofczynski, Schlieper and Tiemeyer are faculty members in the Department of Mathematics, and they are subject matter experts with respect to Elementary Statistics. All have extensive experience teaching Elementary Statistics, and Dr. Knofczynski designed the Online Elementary Statistics course. All will be responsible for identifying possible textbooks to adopt, and after a list has been made, each will independently review the textbooks. Afterwards, they will decide together which text to adopt based upon their reviews.

In order to provide open access to the new materials, they will be hosted publicly on a repository such as GitHub, or the address will be given if the materials are already available publicly. In addition, the materials will be made available in Desire2Learn.

*Quantitative & Qualitative Measures:	To measure the quantitative impact of the transformation, we will compare the DFW rates of the transformed class to the historical average for the course as well as to the rates of the other sections offered during Spring 2016. To measure the qualitative impact of the open-source resources on the students, we will ask students to complete a survey and open-ended questionnaire about the resources, including questions such as "Are you satisfied with the quality of the textbook for this course?", "Do you wish the instructors in your other courses would adopt open-source texts?", and "How do you think the quality of the textbook may be improved?"

*Timeline:

October 2015 - Kick-off Meeting; identification and review of open-source materials.
November 2015 - Identification and review of open-source materials.
December 2015 - Adoption of open-source materials; Midterm Status Report.
Spring 2016 - Implementation of open-source materials; generation of survey and questionnaire for quantitative and qualitative feedback.

May 2016 - Final Status Report.

*Budget:

For this proposal we are requesting $15,800 for release time and travel. We request a two-course release for Drs. Knofczynski, Schlieper, and Tiemeyer where each course release costs $2,500, totaling 6 times $2,500 equals $15,000. We also request $800 to travel to the kick-off meeting.

*Sustainability Plan:

Drs. Knofczynski, Schlieper, and Tiemeyer teach about 10 sections of Elementary Statistics per fall and spring semesters, so this transformation will have a lasting impact on the course. Each section seats about 35 students, so this transformation will save the students roughly $35,000 in textbook costs every semester. If the transformation is successful, then it may be possible to convince the department to adopt open-source materials for all sections of the course, which would save students even more.

During the first and subsequent semesters in which the new text will be used in the course, the students and other faculty will be asked for edits they wish to see to the text. Since the text is open source, it can be edited and re-distributed immediately.

To share our experience with open-source materials with our department, we will provide a presentation of our selection process and experience with the text at our biweekly department colloquium.

Add Other Email Addresses for Notifications

Enter recipient(s) email address(es): michael.tiemeyer@armstrong.edu,greg.knofc zynski@armstrong.edu

textbook for our elementary statistics course, and edit the text as needed to fit our learning objectives. The text will be available to students at no cost. This will provide a tremendous benefit to our students, who often have to pay over $200 for a text. In addition to easing the financial burden of our students, the open-source text can be fine-tuned to meet the desired learning outcomes, and will be assessed to measure student improvement in elementary statistics. I heartily endorse this textbook transformation project and believe that it will be a model for future textbook transformations. Drs. Schlieper and Tiemeyer have previously adapted a no-cost calculus text that our students are currently using.

James N. Brawner, Ph.D.
Professor and Head of Mathematics
Armstrong State University

Final Report

Affordable Learning Georgia Textbook Transformation Grants

Proposal 183 Final Report

Instructions:

A. Your final report submission must include four separate component files:

1. *Completed report form. Please complete per inline instructions. The italicized text is provided for your assistance; please delete the italicized text before submitting your report.*

2. *Course Outline document with links to the materials as used per day, week, or unit, organized chronologically. View Course Outline Example*
   a. *For each resource, give the title, author, Creative Commons licenses (if appropriate), and freely accessible URL to the material. Include all open-access links to all adopted, adapted, and newly created course materials.*

3. *Supporting data on the impact of your Textbook Transformation (survey, analyzed data collected, etc.)*

4. *A photograph of your team and/or your students for use in ALG website and materials.*
   a. *Photograph must be 800x600 pixels at minimum (length x height).*
   b. *Photograph must be taken together: individual team member photographs and website headshots not accepted.*

B. Go to http://affordablelearninggeorgia.org/site/final_report_submission to submit these four components of your final report. Follow the instructions on the webpage for uploading your documents. You will receive a confirmation email. Based on receipt of this report, ALG will process the final payment for your grant. ALG may follow up with additional questions or to request your participation in a publication, presentation, or other event.

Date: 5/20/2016

Grant Number: 183

Institution Name(s): Armstrong State University

Team Members (Name, Title, Department, Institutions if different, and email address for each): Dr. Jared Schlieper, Assistant Professor, jared.schlieper@armstrong.edu; Dr. Greg Knofczynski, Associate Professor, greg.knofczynski@armstrong.edu; Dr. Michael Tiemeyer, Assistant Professor, michael.tiemeyer@armstrong.edu

Project Lead: Dr. Jared Schlieper

Course Name(s) and Course Numbers: Math 2200 Elementary Statistics

Semester Project Began: Fall 2015

Semester(s) of Implementation: Fall 2015 and Spring 2016

Average Number of Students Per Course Section: 28.3

Number of Course Sections Affected by Implementation: 3

Total Number of Students Affected by Implementation: 85

1. **Narrative**

   A. Describe the key outcomes, whether positive, negative, or interesting, of your project. Include:

   Our project started by considering open statistics textbooks for Math 2200. The choice was between OpenIntro Statistics and OpenStax statistics books. The OpenStax book is similar to the old book our department uses, while the OpenIntro book fit better with our teaching styles. We chose the OpenIntro Statistics book that is available at OpenIntro.org. Dr. Schlieper used the OpenIntro book in two sections of Math 2200 in Fall 2015. The lecture slides were edited to include clicker questions. WebWork, an open source online homework delivery system, was also selected and implemented. Dr. Knofczynski implemented the textbook in his online section for Spring 2016. Due to the course releases provided by the grant, Dr. Knofczynski's course was the only course where the book was used in Spring 2016. This limited the data that was collected regarding the text. The students appreciated the low cost of the textbook and other materials (ebook is free, hardcopy is approximately $10). For the upcoming summer and fall semesters, the text will be available in the bookstore as well as available through Amazon.

   The biggest challenge was finding or creating "good" homework questions in WeBWorK. The main issue being that questions in WeBWorK did not always follow the same methods as we do as instructors. For example, some problems used z-scores to find probabilities while others did not. This causes confusion for students. Correcting these problem and writing new ones was done throughout the spring semester. Our WeBWorK server will be updated this summer and will now include our updated problems. Before next semester, we need to create even more problems that better match the problems in the textbook. It would also be beneficial to have better training with problem authoring in WeBWorK.

   Our department has decided to adopt an open source textbook for Math 2200. We have provided our course outline for others to use as well as creating an outline for the OpenStax book as well. The department is recommending to use either with OpenStax being the option for those instructors who prefer WebAssign for online homework.

   Student performance seems to be the same or slightly better based on Dr. Schlieper's courses but more data is needed. As listed below, DFW rate in Dr. Schlieper's sections went down from 56.8% with previous textbook to 30.1% with the OpenIntro book. More data is needed in order to rule out other possible reasons for the decline.

2. **Quotes**

   The following are quotes from students in Dr. Knofczynski's online section Spring 2016.

- I purchased the book because I thought it'd be easier for me to use than the E-Text, but it has not been very helpful at all.
- I find that reading the chapters that are assigned combined with watching the videos posted on d2l are the most helpful resources.
- I don't really find the textbook or homework to be helpful in understanding the material. I'm glad and very grateful it was free! The textbook reads like a technical manual - there's a lot of jargon to sift through, I often feel that the book assumes I have some innate knowledge of the subject at hand and glosses over material.

3. Quantitative and Qualitative Measures

3a. Overall Measurements

Student Opinion of Materials

Was the overall student opinion about the materials used in the course positive, neutral, or negative?

Total number of students affected in this project: ___12___

- Positive: ___3___ % of ____12____ number of respondents
- Neutral: ___0____ % of ____12____ number of respondents
- Negative: ____9__ % of ____12____ number of respondents
  Students portrayed on overall gratitude of not having to pay for a textbook, however, the textbook selected may not have been the best fit for an online course.

Student Learning Outcomes and Grades

Was the overall comparative impact on student performance in terms of learning outcomes and grades in the semester(s) of implementation over previous semesters positive, neutral, or negative?

Student outcomes should be described in detail in Section 3b.

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

Student Drop/Fail/Withdraw (DFW) Rates

Was the overall comparative impact on Drop/Fail/Withdraw (DFW) rates in the semester(s) of implementation over previous semesters positive, neutral, or negative?

Drop/Fail/Withdraw Rate:

30.1% of students, out of a total 73 students affected, dropped/failed/withdrew from the course in the final semester of implementation.

Choose One:

- _XX_   Positive: This is a lower percentage of students with D/F/W than previous semester(s)
- ___   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

Student performance seems to be the same or slightly better based on Dr. Schlieper's courses but more data is needed. The DFW rate in Dr. Schlieper's sections went down from 56.8% with previous textbook to 30.1% with the OpenIntro book. More data is needed in order to rule out other possible reasons for the decline. Some possibilities besides the book change could be the composition of students in the courses as well as the time of the courses. The sections included in the numbers above occur at different times and may include students who were repeating the course.

4. Sustainability Plan

All materials used in the transformation are available on openintro.org. The edited slides and homework sets will be posted on a department webpage. We will submit our created homework problems to the Open Problem Library so that others may use them in the future. Our department has decided to adopt an open source textbook for Math 2200. We have provided our course outline for others to use as well as creating an outline for the OpenStax book as well. The department is recommending to use either with OpenStax being the option for those instructors who prefer WebAssign for online homework. Instructors using the OpenStax book will be referred to the OpenStax webpage.

5. Future Plans

We will continue to find and use open educational resources in our courses. We will continue to adjust the materials in Math 2200 to better serve our students. One avenue to further improve Math 2200 would be to develop activities that allow students to apply concepts from class on real data sets or other items of interest to students.

6. Description of Photograph

(left-right) Dr. Jared Schlieper, team lead and instructor of record; Dr. Greg Knofczynski, subject matter expert and instructor of record; Dr. Michael Tiemeyer, subject matter expert;