Open Calculus: Reducing Costs, Not the Learning

A tale of 2 courses...

Dr Phillip G Clark – Scottsdale Community College
James Souse – Phoenix College
Maricopa Community Colleges

10 Colleges
37 Associate Degrees
Over 10,000 Courses
Nearly 10,000 Employees
More than 250,000 Students
One of 10 Colleges – Maricopa Community College District
SCCC is the only community college in the United States located on an Indian reservation.

Photos courtesy of www.scottsdalecc.edu
We are the Scottsdale Community College Fighting Artichokes
And our mascot is Artie the Artichoke
We are the only college in the country that offers an associates degree in DJing.
Percent Change Since 1978 for Educational Books, Medical Services, New Home Prices, and CPI

Carpe Diem Blog

Sources: BLS, Census Bureau

Image from the Huffington post 3/21/14
http://www.huffingtonpost.com/2013/01/04/college-textbook-prices-increase_n_2409153.html
Frustration with the Rising cost of education

- **Consumer Price Index 2007 - 2011**
  - The cost for Educational Books and Supplies has risen 26%
  - The cost for Tuition has risen 21%

- **National Center for Education Statistics**
  - Average earnings for college students have dropped by 3%
Where the New Textbook Dollar Goes

{ College Store }

- 10.8¢ College Store Personnel
- 1.7¢ Freight Expense
- 7.2¢ College Store Operations
- 4.4¢ College Store Income

7¢ Publisher’s Income
32.1¢ Publishing Paper Printing, Editorial Costs
11.6¢ Author Income
9.9¢ Publishers General & Administrative
15.3¢ Publishing Marketing Costs

{ Publisher }
Attempts to contain costs

• Containing costs has been difficult.
  – New Editions are released with no significant added value.
  – Used books are often unavailable due to
    • Discontinuation by the bookstore
    • Design of the book itself
    • Need for an Online Software Package
  – Attempts to teach a course without a textbook
    • Limits the resources available to the student
    • Places a much greater workload on faculty
    • Increases printing costs for the college
  – Students do not purchase materials
    • This can have a significant affect on student success
Report: High Textbook Prices Have College Students Struggling

The price of textbooks has increased 82 percent during the last decade, a new report finds.

Due to the high cost of textbooks, 65 percent of students said they decided against buying a book required for class. Of those students, nearly all (94 percent) said they were concerned that doing so would hurt their grade in a class.

"Not only are students choosing not to purchase the materials they are assigned by their professor, but they are knowingly accepting the risk of a lower grade to avoid paying for the textbook," the report said.

Effects of these costs

- US PIRG Report, January 30th, 2014
  - Survey of 2,039 students from more than 150 different universities

- 65% of students choose not to buy a college textbook because it’s too expensive
- 94% report that they suffer academically because of this choice
- 48% say they altered which classes they took based on textbook costs, either taking fewer classes or different classes
- “According to the students surveyed in this report, the rising cost of textbooks not only adds to the overall financial burden of attending college, it can also have a measurably negative impact on their academic performance and student outcomes.”
- 82% of students say they would do significantly better in a course if the textbook were free online and a hard copy was optional!
Maricopa Community Colleges

Costs for a Full-Time Student for a Year (30 credit hours)

- Tuition: $2520 (68%)
- Textbooks: $1200 (32%)
Open educational resources

• During this same time period, Open Educational Resources (OER) have become more established and relevant.
  – 2006, MathAS, a free web based Mathamatics Assessment Tool for online tests and homework
  – 2007, CK-12, an organization providing open content, web based digital textbooks
  – 2007, Open Educational Resource Commons. An organization that provides a single point of access through which educators and learners can search across collections to access over 30,000 items

• The Open Educational Resource movement includes:
  – Rice, Connexions
  – MIT, OpenCourseWare Project
  – Utah State University, Open CourseWare Project
  – University of California, Irvine
  – Gates Foundation
  – Hewitt Foundation
Revise

Reuse

Remix

Redistribute
The Licenses

**Attribution**

**CC BY**

This license lets others distribute, remix, tweak, and build upon your work, even commercially, as long as they credit you for the original creation. This is the most accommodating of licenses offered. Recommended for maximum dissemination and use of licensed materials.

[View License Deed](#) | [View Legal Code](#)

---

**Attribution-ShareAlike**

**CC BY-SA**

This license lets others remix, tweak, and build upon your work even for commercial purposes, as long as they credit you and license their new creations under the identical terms. This license is often compared to "copyleft" free and open source software licenses. All new works based on yours will carry the same license, so any derivatives will also allow commercial use. This is the license used by Wikipedia, and is recommended for materials that would benefit from incorporating content from Wikipedia and similarly licensed projects.

[View License Deed](#) | [View Legal Code](#)

---

**Attribution-NoDerivs**

**CC BY-ND**

This license allows for redistribution, commercial and non-commercial, as long as it is passed along unchanged and in whole, with credit to you.

[View License Deed](#) | [View Legal Code](#)

---

**Attribution-NonCommercial**

**CC BY-NC**

This license lets others remix, tweak, and build upon your work non-commercially, and although their new works must also acknowledge you and be non-commercial, they don’t have to license their derivative works on the same terms.

[View License Deed](#) | [View Legal Code](#)

---

**Attribution-NonCommercial-ShareAlike**

**CC BY-NC-SA**

This license lets others remix, tweak, and build upon your work non-commercially, as long as they credit you and license their new creations under the identical terms.

[View License Deed](#) | [View Legal Code](#)

---

**Attribution-NonCommercial-NoDerivs**

**CC BY-NC-ND**

This license is the most restrictive of our six main licenses, only allowing others to download your works and share them with others as long as they credit you, but they can’t change them in any way or use them commercially.

[View License Deed](#) | [View Legal Code](#)
www.maricopa.edu/oer
Creating OER Awareness and Increasing Adoption

- Presentations
- Call for OER Grants
- Dialogue Days
- Department Meetings
- “Water Cooler” Discussions
- Promotional Items
- CTLs
- College Libraries

http://www.skmurphy.com/startup-stages/scaling-up-stage/
- Collaborative teams of Faculty
- Multi-college proposals encouraged
- Evaluated by Steering Team
- Peer-reviewed Course Materials
Progress Toward the Goal

OER Savings Progress

<table>
<thead>
<tr>
<th>Semesters</th>
<th>Cumulative Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2013</td>
<td>$664,000</td>
</tr>
<tr>
<td>Spring 2014</td>
<td>$1,482,000</td>
</tr>
<tr>
<td>Fall 2014</td>
<td>$2,402,000</td>
</tr>
<tr>
<td>Spring 2015</td>
<td>$3,458,000</td>
</tr>
<tr>
<td>Fall 2015</td>
<td>$4,584,000</td>
</tr>
<tr>
<td>Spring 2016</td>
<td>$5,956,000</td>
</tr>
</tbody>
</table>

($1,056,000)
($920,000)
($1,372,000)
# First-Year Composition (ENG101)

Emphasis on rhetoric and composition with a focus on expository writing and understanding writing as a process. Establishing effective college-level writing strategies through four or more writing projects comprising at least 3,000 words in total. Prerequisites: Appropriate writing placement test score, or a grade of "C" or better in ENG091 or ESL097.

### General Education Designations: FYC

<table>
<thead>
<tr>
<th>SUN# ENG1101</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Class#</th>
<th>Semester</th>
<th>Location</th>
<th>Delivery</th>
<th>Dates</th>
<th>Days</th>
<th>Times</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>31965</td>
<td>Fall 2014</td>
<td>Paradise Valley M 220 - Classroom</td>
<td>In Person</td>
<td>08/25/2014-12/19/2014</td>
<td>M,W</td>
<td>10:30AM-11:45AM</td>
<td>L. McClelland</td>
</tr>
</tbody>
</table>

### Notes

- All textbook and course materials available at no or low cost (<$40) - may include OER (Open Educational Resources).
- Class 31965 costs include Data Processing Class Fee: $5
Launch

• Spring 2012 the department chair asked, can we go completely OER for our Traditional Classes from Basic Math through Trig?
• The Department said yes.
• What was the impact?
Learning Resources

Text Book and Interactive Learning Environment Package Wiley and Pearson Education

- Introductory Algebra
  - 1250 Students
- Intermediate Algebra
  - 1352 Students
- College Algebra
  - 701 Students

$110.26 per Student
$364,173.50 per Year
Learning Resources

OER Text Book and Interactive Learning Environment

- Maximum of $15 per Student
- 86% decrease in costs
- $313,189 in savings
Calculus at SCC

- Textbook
- Online Lessons
- Online Homework
- Homework Assistance
- Interactive Apps
- Problem Solving
He has also come out with a Multivariable edition that is in its first iteration.

If you have questions or difficulties regarding any of the above, please contact me directly at boelkinm at gvsu dot edu.
Exercises

1. Consider the cubic polynomial $p(x) = ax^3 + bx^2 + cx + d$, where $a > 0$. Find all critical values and classify each as a local maximum, local minimum, or neither. Sketch the graph of $p(x)$.

   (a) Sketch the graph.
   (b) Find all critical values.
   (c) Complete the square for each critical value.
   (d) Describe the change in sign of the second derivative.

2. Let $q(x) = \frac{e^{-x}}{x}$.

   (a) Explain how to find the critical value.
   (b) Determine the critical value.
   (c) Complete the square for each critical value.
   (d) Constructions clearly indicate the values and results.

Sketch labeled (b) and (c) to show the graph. Label the critical value for $q(x)$. Indicate the value of $x^2$.
Calculus at SCC

- Textbook
- Online Lessons
- Online Homework
- Homework Assistance
- Interactive Apps
- Problem Solving
- Active Calculus
Online Lessons

Switching Between the Forms

Now our goal is to undo the chain rule to determine a new antiderivative rule. To accomplish this, we take the antiderivative of both sides of the chain rule:

\[
\int \frac{d}{dx} f(g(x)) \, dx = \int f'(g(x)) \cdot g'(x) \, dx
\]

\[
f(g(x)) = \int f'(g(x)) \cdot g'(x) \, dx
\]

SoftChalk allows for questioning, embedding of videos, and access to course content outside of the classroom.

Scores can be directly input into most LMS (including MathAS)

- a. \((x^3 + 4)^6 \cdot 3x^2\)
- b. \(6(x^2 + 4)^5 \cdot 3x^2\)
- c. \(6(x^2 + 4)^5 \cdot 3x\)
- d. \((3x^3)^6\)
Calculus at SCC

• Textbook ✔
• Online Lessons ✔
• Online Homework
• Homework Assistance
• Interactive Apps
• Problem Solving

• Active Calculus
• SoftChalk
MathAS allows for many types of questions including numerical, algebraic, graphing, multiple choice and multiple answer. Also instructors have the option of including help on problems in the form of videos, webpages, apps, etc. There is also flexibility in how answers must be entered, including accuracy, simplification, ordered pairs, etc.
Geogebra is FREE!!!
This problem has a Geogebra app embedded

GEOGEBRA
THE GRAPHING CALCULATOR FOR FUNCTIONS, GEOMETRY, ALGEBRA, CALCULUS, STATISTICS AND 3D MATH!
DYNAMIC MATHEMATICS FOR LEARNING AND TEACHING

#1
Students love it because...

#2
Teachers love it because...

#3
Schools love it because...
MathAS can be used as a complete LMS, including calendar, due dates, messaging system, discussion forums, gradebook and reports for data analysis.
Calculus at SCC

- Textbook ✔
- Online Lessons ✔
- Online Homework ✔
- Homework Assistance ✔
- Interactive Apps ✔
- Problem Solving

- Active Calculus
- SoftChalk
- MathAS
- YouTube Videos
- Geogebra, Desmos, etc.
Problem Solving

Calculus with Polar Coordinates - Length and Area
Adapted by James Sousa and Phil Clark
from Contemporary Calculus by Dale Hoffman
(CC-BY)

1. Find the area of the shaded region in figure 20.

As mentioned before there are the activities and exercises from Active Calculus. Many come via collaboration!!!
Calculus at SCC

- Textbook ✓
- Online Lessons ✓
- Online Homework ✓
- Homework Assistance ✓
- Interactive Apps ✓
- Problem Solving ✓

- Active Calculus
- SoftChalk
- MathAS
- YouTube Videos
- Geogebra, Desmos, etc.
- Textbook, Create own, collaborations, etc.
Open Calculus at Phoenix College

AMATYC 2016
Why Use OER?

1. Everyone has access to the course materials before the first day of class.
   • Work on prerequisite review to determine readiness for calculus.
   • Become familiar with course format.

2. Cost Savings
   • OER text required cost: $0  Optional print copy of text: $12-$17 + shipping
   • Publisher text: $326.50 from bookstore (For Calc I-III)

3. No new editions allows focus on improving content each semester.
Over 5,000 Math Videos Lessons and Video Examples
Most videos are closed captioned.
60,000+ subscribers with 40+ million total views
30 days has 3,878,914 minutes of view time ≈ 7 years 136 days of view time
<table>
<thead>
<tr>
<th>Geography</th>
<th>Watch time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>3,243,317 (84%)</td>
</tr>
<tr>
<td>Canada</td>
<td>121,377 (3.1%)</td>
</tr>
<tr>
<td>Philippines</td>
<td>95,725 (2.5%)</td>
</tr>
<tr>
<td>India</td>
<td>84,266 (2.2%)</td>
</tr>
<tr>
<td>Malaysia</td>
<td>31,142 (0.8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Geography</th>
<th>Watch time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>602,949 (19%)</td>
</tr>
<tr>
<td>California</td>
<td>445,141 (14%)</td>
</tr>
<tr>
<td>Washington</td>
<td>208,696 (6.4%)</td>
</tr>
<tr>
<td>New York</td>
<td>176,427 (5.5%)</td>
</tr>
<tr>
<td>Virginia</td>
<td>177,945 (5.5%)</td>
</tr>
<tr>
<td>Florida</td>
<td>170,865 (5.3%)</td>
</tr>
<tr>
<td>Texas</td>
<td>167,247 (5.2%)</td>
</tr>
<tr>
<td>Utah</td>
<td>158,790 (4.9%)</td>
</tr>
<tr>
<td>Maryland</td>
<td>105,075 (3.2%)</td>
</tr>
<tr>
<td>Georgia</td>
<td>90,179 (2.8%)</td>
</tr>
</tbody>
</table>
Many of these materials were developed for the Open Course Library Project of the Washington State Colleges as part of a Gates Foundation grant. The goal of this project was to create materials that would be FREE (on the web) to anyone who wanted to use or modify them (and not have to pay $200 for a calculus book). They have been used by several thousand students.

The textbook sections, in color, are available free in pdf format at the bottom of this page. Printed versions, in B&W, are available for Calculus I (chapters 0-3), II (chapters 4-8), and III (chapters 9-11) for about $18 each at Lulu.com. Alternate printed versions reformatted in LaTeX are available at CreateSpace.com and Amazon.com or free online at ContemporaryCalculus.com.
New Calculus OER

openstax™

Calculus
Volume 1

Calculus
Volume 2

Calculus
Volume 3

cc
By SA
## Calculus I Course Format

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 2</td>
<td>3</td>
<td></td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Video</td>
<td>Assn</td>
<td>Video</td>
<td>Assn</td>
<td>Video</td>
<td>Assn</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Video</td>
<td>Assn</td>
<td>Video</td>
<td></td>
<td>Test</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Take Home Midterm, Proctored Midterm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Video</td>
<td>Assn</td>
<td>Video</td>
<td>Assn</td>
<td>Video</td>
<td>Assn</td>
</tr>
</tbody>
</table>

**Tuesday October 4, 2016**

- **Announcements**
  - New
- **Discussion Forums**
  - Isolate
- **Chapter 0: Orientation / Welcome to Calculus / Precalculus Review**
- **Chapter 1: Limits and Continuity**
- **Chapter 2: The Derivative**
- **Chapter 3: Derivatives and Graphs**
- **Chapter 4: The Integral**
- **Midterm / Final**
- **Calculus Proofs**

[Show all]
Chapter 1: Limits and Continuity

1.0: Tangent Line, Velocities, and Growth
1.1: The Limit of a Function
1.2: Limit Properties
1.3: Continuous Functions
1.4: The Definition of a Limit

Optional Chapter 1 Review

Chapter 1 Test
Past Due Date of Mon 9/12/16, 11:59 pm. Showing as Review.
This assessment is in review mode - no scores will be saved
1.1: The Limit of a Function

Required Reading 1.1: Limit of a Function

Optional Book Assignment: 1-11, 13, 15, 17-20

Video Assignment 1.1: The Limit of a Function
Past Due Date of Fri 9/2/16, 11:59 pm. Showing as Review. This assessment is in review mode - no scores will be saved.

Watch these videos before starting the Assignment.

Assignment 1.1: The Limits of a Function
Past Due Date of Fri 9/2/16, 11:59 pm. Showing as Review. This assessment is in review mode - no scores will be saved.

Questions
- Q1 (0/10)
- Q2 (0/10)
- Q3 (0/10)
- Q4 (0/10)
- Q5 (0/10)
- Q6 (0/10)
- Q7 (0/10)
- Q8 (0/10)
- Q9 (0/10)
- Q10 (0/10)
- Q11 (0/10)

Points possible: 10
Unlimited attempts.
Post this question to forum

Evaluate the limit: \( \lim_{x \to 8} \frac{x^2 - 12x + 32}{x - 8} \)

Get help: Video

Show Answer

Submit

1.1 The Limit of a Function

Calculus has been called the study of continuous change, and the limit is the basic concept that allows us to describe and analyze such change. An understanding of limits is necessary to understand derivatives, integrals and other fundamental topics of calculus.

The Idea (Informally)
The limit of a function at a point describes the behavior of the function when the variable is near— but does not equal—a specified number (see margin figure). If the values of \( f(x) \) get closer and closer—as close as we want—to one number \( L \) as we take values of \( x \) very close to (but not equal to) a number \( c \), then we say: "The limit of \( f(x) \) as \( x \) approaches \( c \) is \( L \)" and we write: \( \lim_{x \to c} f(x) = L \).

It is very important to note that:

- \( f(c) \) is a single number that describes the behavior (value) of \( f \) at the point \( x = c \).
- \( \lim_{x \to c} f(x) \) is a single number that describes the behavior of \( f \) near, but not at the point \( x = c \).

Example 1. Use the graph of \( y = f(x) \) given in the margin to determine the following limits:

(a) \( \lim_{x \to 4} f(x) \)
(b) \( \lim_{x \to 4} f(x) \)
(c) \( \lim_{x \to 4} f(x) \)
(d) \( \lim_{x \to 4} f(x) \)

Solution. Each of these limits involves a different issue, as you may be able to tell from the graph.
Evaluate the limit: \( \lim_{x \to 8} \frac{x^2 - 12x + 32}{x - 8} \)

Get help: Video

Points possible: 10
Unlimited attempts.
Post this question to forum
Chapter 1 Resources

Chapter 1 Book Odd Problem Answers

Answers to most odd-numbered HW problems from Chapter 1. (A reformatted version will be available soon.)

Section Notes

You will need to download the file. Then open with adobe reader. Under view menu, you will need to rotate the view.

1.0 Tangent Lines, Velocities, Growth
1.1 The Limit of a Function
1.2 Properties of Limits
1.3 Continuous Functions
1.4 Definition of Limit

Example 2. Determine the value of \( \lim_{x \to 3} \frac{2x^2 - x - 1}{x - 1} \).

\[
\lim_{x \to 3} \frac{2x^2 - x - 1}{x - 1} = \lim_{x \to 3} \frac{(2x+1)(x-1)}{(x-1)}
\]

\[
= \lim_{x \to 3} (2x+1) = 2(3) + 1 = 7
\]

\[
\lim_{x \to 3} \frac{2x^2 - x - 1}{x - 1} = \lim_{x \to 3} \frac{2(x^2 - (x-1))}{x - 1}
\]

\[
= \lim_{x \to 3} \frac{18 - 3 - 1}{2} = \frac{12}{2} = 6
\]
OER Calculus Survey (n=116)
Spring 2016: n=43   Fall 2016: n = 73

**Course**
- Calculus 1: 74 (63.8%)
- Calculus 2: 42 (36.2%)

**Type of Class**
- Face to face: 10 (8.6%)
- Hybrid: 17 (14.7%)
- Online: 89 (76.7%)

**Instructor**
- James Sousa: 103 (88.8%)
- Phillip Clark: 12 (10.3%)
How important is it to you that the courses are taught using OER (low cost or no cost course materials)? Please rate from 5 to 1. (5 = very important and 1 = not important)

- 5: 86 (74.1%)
- 4: 18 (15.5%)
- 3: 10 (8.6%)
- 2: 0 (0%)
- 1: 2 (1.7%)

How likely would you be to seek out another course taught with OER (low cost or no cost course materials)?

- 5: 81 (70.4%)
- 4: 21 (18.3%)
- 3: 10 (8.7%)
- 2: 2 (1.7%)
- 1: 1 (0.9%)
How would you rate the quality of the free course materials of this class compared to other math courses you have taken that used publisher materials you had to buy?

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>The course materials for this class are better quality than publisher materials.</td>
<td>79</td>
<td>69.3%</td>
</tr>
<tr>
<td>The course materials for this class are slightly better quality than publisher materials.</td>
<td>13</td>
<td>11.4%</td>
</tr>
<tr>
<td>The course materials for this class are same quality as publisher materials.</td>
<td>19</td>
<td>16.7%</td>
</tr>
<tr>
<td>The course materials for this class are slightly lower quality than publisher materials.</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>The course materials for this class are lower quality than publisher materials.</td>
<td>2</td>
<td>1.8%</td>
</tr>
</tbody>
</table>
Online Course Organization and Format [Please rate the quality/usefulness of the course components. 5 = highest to 1 = lowest]

<table>
<thead>
<tr>
<th>Rating</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>86</td>
<td>75.4%</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>16.7%</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>7%</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>Does not apply</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>
Ebook

[Please rate the quality/usefulness of the course components.
5 = highest to 1 = lowest]

<table>
<thead>
<tr>
<th>Rating</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>49</td>
<td>43.4%</td>
</tr>
<tr>
<td>4</td>
<td>21</td>
<td>18.6%</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>13.3%</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>5.3%</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>4.4%</td>
</tr>
<tr>
<td>Does not apply</td>
<td>17</td>
<td>15%</td>
</tr>
</tbody>
</table>
Chapter Notes [Please rate the quality/usefulness of the course components. 5 = highest to 1 = lowest]

- 5: 69 (61.6%)
- 4: 24 (21.4%)
- 3: 9 (8%)
- 2: 3 (2.7%)
- 1: 1 (0.9%)
- Does not apply: 6 (5.4%)
Video lessons/Online lessons: Please rate the quality/usefulness of the course components. 5 = highest to 1 = lowest

- 5: 99 votes, 87.6%
- 4: 10 votes, 8.8%
- 3: 0 votes, 0%
- 2: 2 votes, 1.8%
- 1: 2 votes, 1.8%
- Does not apply: 0 votes, 0%
Video examples in assignments [Please rate the quality/usefulness of the course components. 5 = highest to 1 = lowest]

<table>
<thead>
<tr>
<th>Rating</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>106</td>
<td>93%</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>5.3%</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>Does not apply</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>
Online homework system [Please rate the quality/usefulness of the course components. 5 = highest to 1 = lowest]

- 5: 94, 82.5%
- 4: 12, 10.5%
- 3: 6, 5.3%
- 2: 0, 0%
- 1: 2, 1.8%

Does not apply: 0, 0%
Comments

“Taking online courses without having to buy a code have been very beneficial to me because most of the time i could not afford to buy a book with a code and i also found that the book was not even needed for most of the course but since i have been doing math on mathas, all i had to spend money on was the class itself and nothing additional and i feel like i have gotten more out of OER then the other courses before that and using this has been more efficient for me learning wise.
OER Calculus Versus Non OER Calculus Success Rates

**Fall 2015**

**Brief/Business Calculus**

OER: \( \frac{48}{73} \approx 66\% \)

(online: 43  f2f: 30)

Non OER: \( \frac{26}{43} \approx 60\% \)

(f2f only)

**Fall 2015**

**Calculus I**

OER: \( \frac{27}{40} \approx 68\% \)

(online: 40)

Non OER: \( \frac{40}{90} \approx 44\% \)

(f2f only)
OER Calculus Versus Non OER Calculus Success Rates

Spring 2016
Brief/Business Calculus

OER: $\frac{45}{70} \approx 64\%$
(online: 45  f2f: 25)

Non OER $\frac{25}{47} \approx 53\%$
(f2f only)

Spring 2016
Calculus I

OER: $\frac{17}{28} \approx 61\%$
(online: 28)

Non OER $\frac{73}{101} \approx 72\%$
(f2f only)

Spring 2016
Calculus II

OER: $\frac{22}{26} \approx 85\%$
(online: 26)

Non OER $\frac{13}{25} \approx 52\%$
(f2f only)
James, I stopped here but left some of the findings/results slides we have used in the past in case we want them.
Findings in 2012-3

• 78.1% feel the open materials support adequately the work that they do outside of class
• 76.2% would recommend the open materials to their classmates
• Exams scores stayed about the same
• Survey Responses from students and faculty mostly positive
• More findings in “The Adoptions of Open Educational Resources by One Community College Math Department”
  – In International Review of Research in Open and Distance Learning 14(4), August 2013
Quality of OER Materials

Questions about quality

• Collaborative effort – constant input and revisions
• Errors can be fixed immediately by faculty
• Can be tailored to individual classroom

• I would argue they are of superior quality to publisher materials
Thorns and Roses – A massive department OER effort

**Thorns**
- Huge amount of development time
- Maintenance and updates
- Distribution (bookstore!)
- Adjunct faculty buy-in

**Roses**
- Cost savings for students
- Department community building and support
- Energy of the new users
- Support of department and administration
- Introduction of creative teaching approaches
OER Implementation Advice

• Start small
• Grow slowly
• Identify faculty champions
• Involve everyone interested
• Gather administrative support
• Gather data, modify materials, continue to grow and learn and improve
Please describe what you like the MOST about the Maricopa Millions Project.

It has been great to have the opportunity to share our great lab program with others in the district and beyond.

The benefit to the student in the end and the focus on saving them money while producing a high quality OER course.

Lisa, Paul, and Rob were very accessible, positive, and encouraging. They were very proactive about meeting with us at certain points throughout the process.

Knowing the OER/Millions project is helping students save money on textbook costs and lowering their overall cost of education. Any such cost reduction can increase the likelihood students will continue their education.

The opportunity to create something unique and beneficial to our students. Also the opportunity to customize the course materials specifically for our needs.

Collaboration & support (some money was nice, as well).
Please describe what you like the **LEAST** about the Maricopa Millions Project.

Hard to find relevant **materials** at the appropriate reading level, spent lots and lots of time searching and deciding what to use and how to organize everything. Even though I liked this part the least, it was still productive.

The training was great but finding **resources that were OER for our specific course was a bit difficult.** Since OER is still relatively new this was an expected hurdle to overcome.

It's not really a 'dislike' - going through the OER process does require you to re-think and re-look at how content is developed and how students respond and learn. That is a good thing but very time consuming!

The amount of work writing a text book is worth way more than we are paid.

I believe that the whole issue of Americans with Disabilities Act considerations was the weak point. As instructors, we were given an overview, but there was no process for formal way to go about ensuring our work met ADA requirements. Discipline instructors are not experts in that kind of stuff, and in my experience there was not adequate support from the campus level.
Please describe how your **STUDENTS** have responded to your OER materials.

So far students are responding very positively to our materials. **They love the low cost. :)**

Students love the OER format and really appreciate the cost savings. I encourage everyone to consider teaching through OER if at all possible.

They love free, especially when the school prints articles for them; **they liked not lugging around a textbook**; they liked interesting articles that they could relate to.

**They love it.** They appreciate not paying for a textbook and in my course, getting real time material from the web is a much more effective and relevant way to teach and learn.

They are actually using the book for a change and like it very much. Also like not having to buy a 200 dollar book.

We are still piloting the textbook so all our feedback is not in yet but so far students really like having the resources readily available and customized specifically for their course.
It takes a village.....

Dr. Donna Gaudet

Professor Jennifer Bohart

Professor Paula Temple

Patricia Dueck

Professor William Meacham

Professor Donna Guhse

Professor Amy Volpe

Dr. Lisa Young

Sian Proctor
Questions?

Dr Phillip G Clark – phil.clark@scottsdalecc.edu
James Sousa – james.sousa@phoenixcollege.edu