Versatile Math

WRITING AN OPEN TEXTBOOK

OUR EXPERIENCE AT FREDERICK CC

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OUTLINE

- **Open resources:** what they are and why we care
- **Our course:** why we chose to write a book for MA 103
- **What we did:** our process and results
- **What we learned:** lessons from the project
- **What you can do:** how to undertake a project like this

OUTLINE

- **Open resources**
- Our course
- What we did
- What we learned
- What you can do

What are open resources?

- Not simply free
- Openness means **sharing**
- Five R's: (from David Wiley)
  1. Retain: make and own a copy
  2. Reuse: use in a wide range of ways
  3. Revise: adapt, modify, and improve
  4. Remix: combine two or more
  5. Redistribute: share with others
- Open sharing leads to high quality, relevant, tailored content for students

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Why do we care?

	Cost to Students	Permissions to Faculty and Students
Commercial Textbooks	Expensive	Restrictive
Library Resources	Free	Restrictive
Open Educational Resources	Free	5 R's (free to share and modify)

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Why do we care?

2012 Florida Student Textbook Survey

In your academic career, has the cost of required textbooks caused you to:

	Never		Seldom		Occasionally		Frequently	
Action	*n*	%	*n*	%	*n*	%	*n*	%
Take fewer courses	9,441	50.8	2,675	14.4	4,390	23.6	2,069	11.1
Not register for a specific course	10,191	54.9	2,646	14.2	3,893	21.0	1,843	9.9
Drop a course	13,598	73.3	2,336	12.6	1,762	9.5	861	4.6
Withdraw from a course	14,714	79.3	2,013	10.8	1,194	6.4	632	3.4
Earn a poor grade because I could not afford to buy the textbook	12,262	66.1	2,932	15.8	2,404	13.0	959	5.2
Fail a course because I could not afford to buy the textbook	15,363	83.0	1,708	9.2	912	4.9	530	2.9
Not purchase the required textbook	6,726	36.4	2,730	14.8	4,843	26.2	4,170	22.6
Other	3,954	73.2	202	3.7	377	7.0	868	16.1

Note: $n = 18{,}587$.

(Source: http://www.openaccesstextbooks.org/pdf/2012_Florida_Student_Textbook_Survey.pdf)

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2012 Florida Student Textbook Survey

What measures have you taken to reduce your required textbook costs? Check all that apply.

	Yes		No	
Action	*n*	%	*n*	%
Do not attempt to reduce textbook costs	510	2.7	18,077	97.3
Buy used copies from the campus bookstore	11,776	63.4	6,811	36.6
Buy books from a source other than the campus bookstore	14,557	78.3	4,030	21.7
Buy a digital version of a textbook	5,296	28.5	13,291	71.5
Buy only the digital textbook chapters needed for the course	1,386	7.5	17,201	92.5
Rent printed textbooks	7,722	41.5	10,865	58.5
Rent digital textbooks	1,818	9.8	16,769	90.2
Use a reserve copy from the campus library	3,807	20.5	14,780	79.5
Share books with classmates	8,058	43.3	10,529	56.6
Sell used books	12,282	66.1	6,305	33.9

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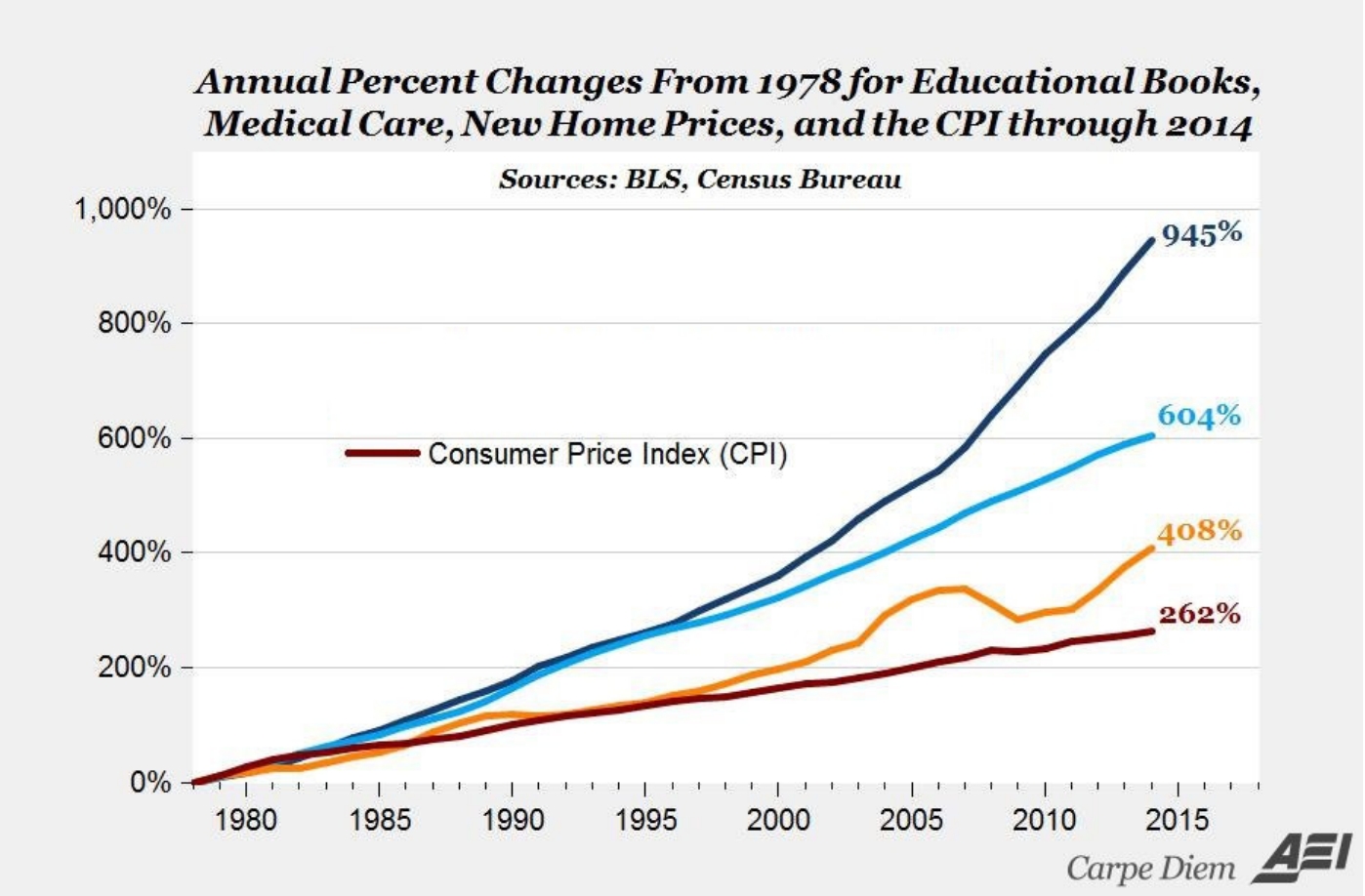
Why do we care?



(Source: https://www.aei.org/publication/the-new-era-of-the-400-college-textbook-which-is-part-of-the-unsustainable-higher-education-bubble/)

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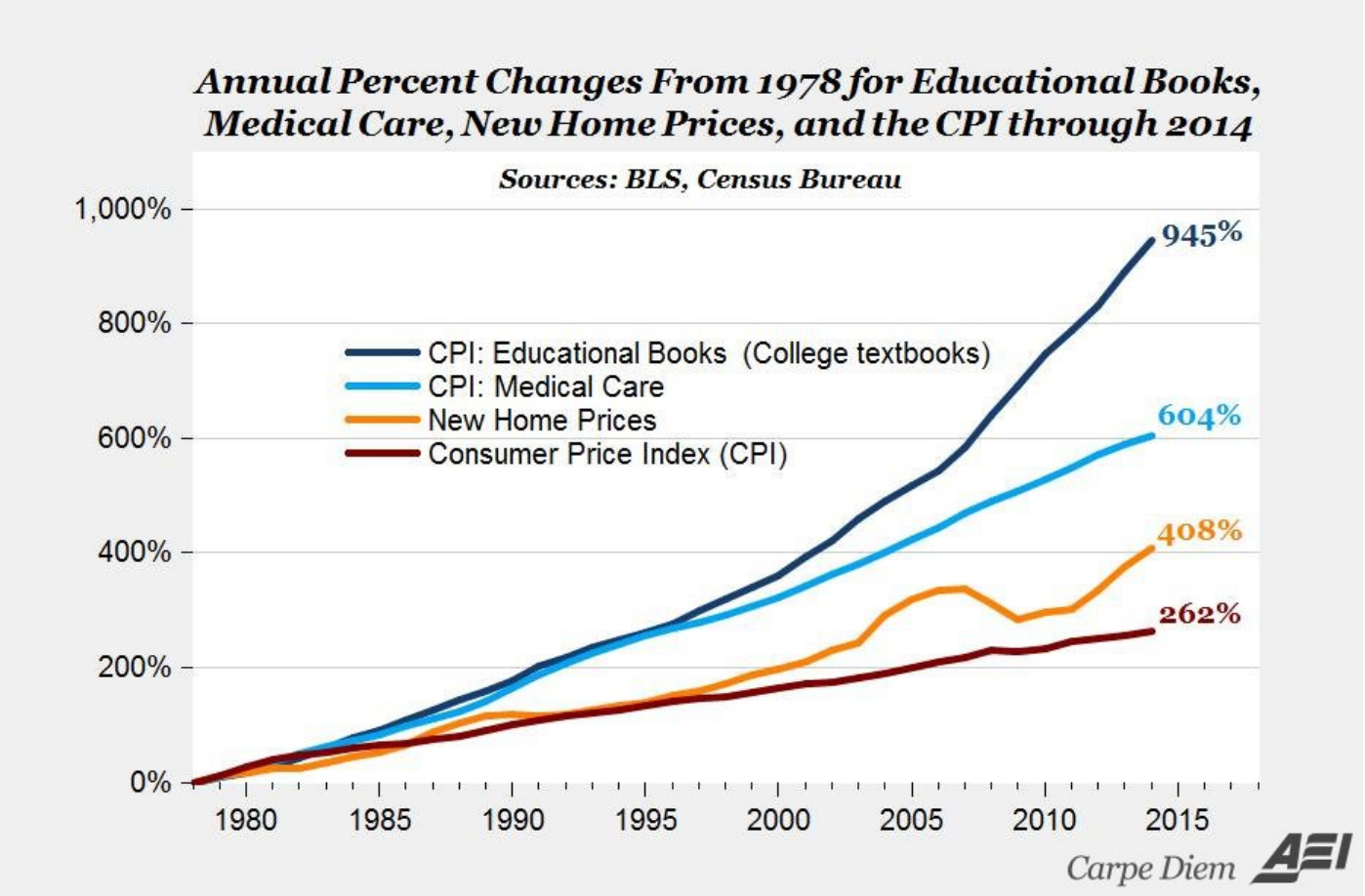

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Why do we care?

- Cost:
  - College Board: estimates $1300/yr
  - Survey data: closer to $700/yr

    (National Center for Education Statistics)
  - First-year and first-generation students are more vulnerable

(Sources: https://bigfuture.collegeboard.org/pay-for-college/college-costs/quick-guide-college-costs, http://mfeldstein.com/reprise-how-much-community-college-students-actually-pay-textbooks/)

- Quality

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What about quality?

"Don't EVER make the mistake that you can design something better than what you get from ruthless massively parallel trial-and-error with a feedback cycle. That's giving your intelligence *much* too much credit."

-Linus Torvalds, creator of the Linux kernel

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Punchline:

- We don't own knowledge; as educators, our job is to share knowledge freely
- Students are suffering from inflated textbook costs
- Not only are open textbooks free, but shareable and remixable (even students can get involved)
- Open textbooks have the potential to be higher quality (in terms of student success) than restricted products from publishers

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Why did we choose MA 103?

- Foundations of Mathematics is a terminal liberal-arts mathematics course
- Previous textbook cost $140

  Thinking Mathematically (Pearson)

- An open textbook was already available for a similar course:

  Math in Society

- Course notes available from FCC professors
- Course is divided into modules

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Our process:

- Obtained a summer grant from FCC
- Designed a layout in LaTeX
- Picked chapters and authors
- Wrote the chapters (using other open resources)
- Found graphics to add
- Wrote and coded homework problems
- Created videos to accompany each example

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Our results:

- Seven chapters so far:
  1. Financial Math
  2. Growth Models
  3. Statistics
  4. Probability
  5. Linear Programming
  6. Logic
  7. Set Theory
- Videos for every example
- Interactive Storylines for every Try It
- Online homework

SECTION 1.3 Simple and Compound Interest

The basic goal of business (as simplistic as it sounds) is to take a small pile of money and turn it into a big pile of money. There, you've had capitalism explained in a single sentence. Because of that, there is value to holding money, because you can use it to make more money.

For instance, say you want to start a landscaping business. It's unlikely that you would have enough money lying around to do so, so you would take out a small business loan and use that money to buy a truck, a trailer, lawn mowers, weed eaters, edgers, blowers, rakes, shovels, etc. Maybe you'd even hire a few employees with that starting capital. However, you wouldn't sit on that pile of cash; instead, you'd use it to acquire that equipment that you'd use to generate revenue by mowing lawns, raking leaves, removing stumps, and so on. Your goal would be to make more money than you took out as a loan; that way, when you pay back the loan, you'll have a little left over to pay your employees and yourself.

Time Value We say then that money has *time value*, meaning that if I have a certain pile of money, I expect it to grow over time if I use it properly. Since everyone treats money this way, if I want to borrow someone else's money and use it for some time, I need to pay them back for the money that they could have made off of it. This is where *interest* comes into play. Interest is essentially the price we pay to use someone else's money—think of it as renting their money. This works both ways—if I want to buy a house, I need money right now, so I borrow from a bank, but I have to, over time, pay them not only the money I borrowed, but also the money they expected to make off of it through their own investments. Likewise, when I place my money in a bank account, the bank pays me interest in return for being able to use that money to invest and make their pile of money a bit bigger. Thus, we talk about the *present value* of money, and its *future value*. The future value is hopefully greater than the present value, since money gains value over time (assuming that inflation doesn't wipe out that gain).

Since interest is given as a rate, the amount of interest you would owe on a particular loan depends on the size of the loan (the interest is a percentage of the amount you take out).

Vocabulary

- **Principal:** The amount of money that is borrowed. This can be paid back in one lump sum, or gradually over time.
- **Simple Interest:** Interest that is calculated based on the principal alone.
- **Compound Interest:** Interest that is calculated based on the principal and the accumulated interest.

Simple Interest

Suppose you take out a loan for \$500 at 10% annual interest rate for 4 years. Each year, $(\$500)(0.1) = \$50$ in interest accrues, so the total interest is 4 times this:

$$(\$500)(0.1)(4) = \$200$$

At the end of the 4 years, you'll have to pay back the principal, \$500, plus the interest, \$200, for a total of \$700, so a present value of \$500 grew to a future value of \$700. Clearly, this growth depends on the interest rate and the amount of time involved.

Simple Interest

The interest, I, earned on a loan with principal P at annual interest rate r (expressed as a decimal) over a period of t years is

$$I = Prt$$

This formula works with other time periods (months, for instance) as long as the interest rate is given in the same terms (so a monthly interest rate, for instance).

Future Value The future value (F) of this principal (or present value) P is the sum of the principal and the interest:

$$F = P + Prt$$
$$F = P(1 + rt)$$

Future value for simple interest

Other kinds of loans (like compound interest) will have different formulas for future value, but the principal is the same: this formula tells how this money will grow.

APR: Annual Percentage Rate Note carefully that t is measured in *years*; this is consistent for almost all the financial formulas in this chapter. This means that interest rates are given as *annual* interest rates. It's also possible to express loans in monthly terms. To do so, the APR is divided into a monthly interest rate; for example, a 12% APR would be 1% monthly, a 6% APR would be 0.5% monthly, etc.

SIMPLE INTEREST — **EXAMPLE 1**

Treasury notes and savings bonds are issued by the federal government to cover its expenses and debt. Suppose you obtain a \$1,000 Series EE savings bond with a 4% annual rate and sell it 8 years later. How much interest will you earn?

Solution

Use the simple interest formula above:

$$I = Prt$$
$$= (\$1000)(0.04)(8)$$
$$= \$320$$

You'll earn \$320 in interest, so at the end you'll have a total of \$1320.

TRY IT

You deposit \$3000 in a savings account at BB&T Bank, earning 5% interest. Find the amount of interest earned and the total amount in the account after three years.

FUTURE VALUE WITH SIMPLE INTEREST — **EXAMPLE 2**

If you deposit \$6200 at 6%, what is the future value of the deposit at the end of 2.5 years?

Solution

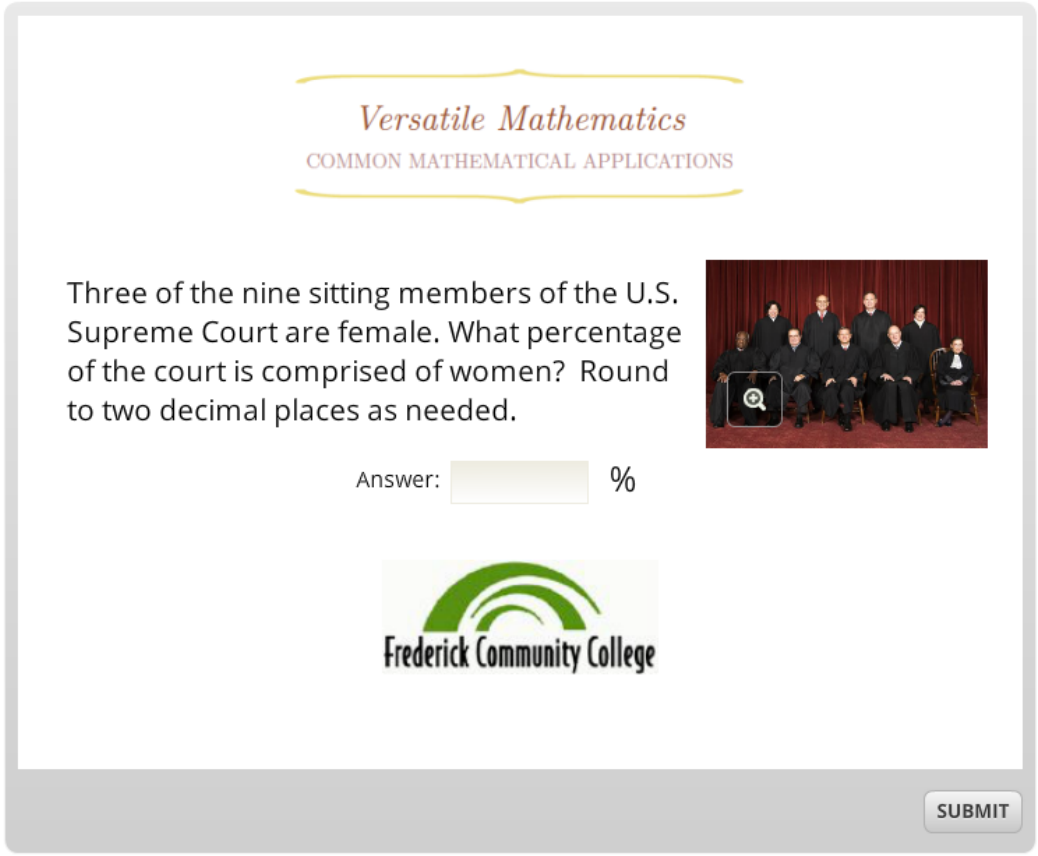
Rather than calculating the interest first and adding that onto the principal, we can use the future value formula to do both steps at once:

$$F = P(1 + rt)$$
$$= \$6200(1 + (0.06)(2.5))$$
$$= \$7130$$

TRY IT

What is the future value of \$2400 at 7% simple interest at the end of three years?

Example Videos and Try It Storylines



Online Homework: MyOpenMath

Course | Messages | Forums | Roster | Calendar | Gradebook | Log Out

Home > MA 103: Foundations of Math > Assessment Josiah Hartley

Section 1.5: Installment Loans and Credit Cards

Show Intro/Instructions

Questions

- Q 1 (0/1)
- Q 2 (0/1)
- Q 3 (0/1)
- Q 4 (0/1)
- Q 5 (0/1)
- Q 6 (0/1)
- Q 7 (0/1)
- Q 8 (0/1)
- Q 9 (0/1)
- Q 10 (0/1)
- Q 11 (0/1)
- Q 12 (0/1)
- Q 13 (0/1)
- Q 14 (0/1)
- Q 15 (0/1)
- Q 16 (0/1)

Grade: 0/16

Print Version

You want to buy a $162,000 home. You plan to pay 15% as a down payment, and take out a 30-year loan at 3.9% for the rest. The bank requires 3 points at closing.

(a) How much is the loan amount going to be? $

(b) How much are the closing costs? $

(c) What will your monthly payments be? $

(d) How much will you pay in interest over the life of the loan? $

Points possible: 1
Unlimited attempts.
Message instructor about this question

Question ID: 54602
License

Submit

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Lessons from our project:

- If possible, start with an existing open resource
- Collaborate
- Consider aesthetics
- Set deadlines and stick to them
- Think about pilot program
- Plan for accessibility
- The first product is not the final product

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How to use an open textbook:

- Find and adopt OER:

Open Textbook Library

open.umn.edu

OpenStax College

www.openstaxcollege.org

- Adapt and remix OER
- Maybe even create a new open textbook

QUESTIONS?