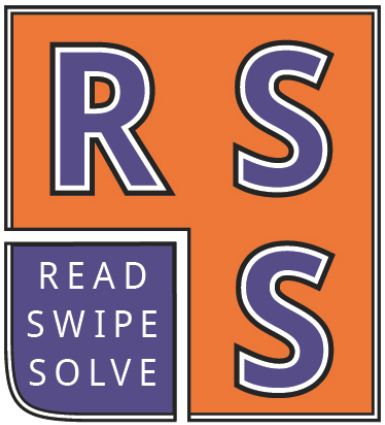
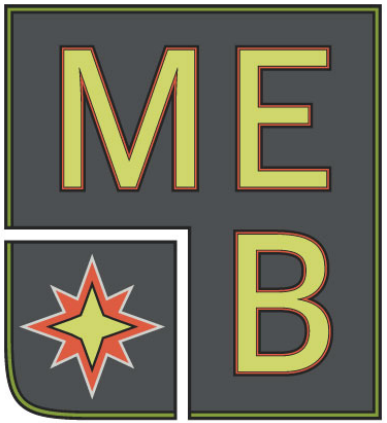
The beginning and end of a web native textbook for Material and Energy Balances



Matthew Liberatore



THE UNIVERSITY OF
TOLEDO
1872

Acknowledgments: Charles Vestal, Marc Donnelley, Yusef Ben-Masuad, Brian Yoon, Jake Newsom, countless TAs

When you renew your AIChE membership, Please join the Education Division of AIChE!!!!

Disclaimer: I may financially benefit from sales of the books discussed in this talk

Failure

"The major difference between achieving people and average people is their perception of and response to failure." John C. Maxwell

Read "Failing Forward" by John C. Maxwell

Its called a pivot

Inkling changed from e-publishing to e-training

Only work with “enterprise partners”

Little guy lost this round

Failure builds character

Education technology = everywhere

15 seconds

Think of 3 different educational technologies

Education technology = everywhere

Clickers

Online homework

YouTube

E-books

Taking notes on tablets

Apps

Software

Simulators

Interactive technology wins

Multimedia learning modules > text-based presentations T. Stelzer, et al., Am. J. Phys. 2009, *77*, 184–190.

Textbook << Internet C. S. Lee, et al., J. Eng. Ed. 2013, 102, 269–288.

Interactive web-native content > static web content Edgcomb &Vahid, ASEE Conf. Proc. 2014 and 2015.

Interactive simulations well received Falconer & Nicodemus, CEE 2014 and ASEE Conf. Proc. 2015.

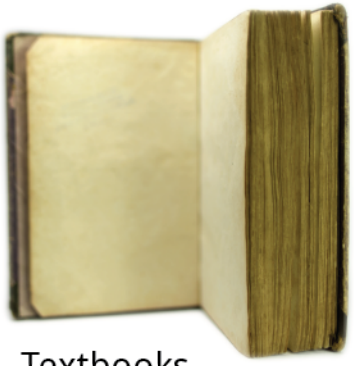
Tracking mouse to find misconceptions Branch & Butterfield, ASEE Conf. Proc. 2015.

21st Century Textbook = Interactive

Pen

Printing Press

The Evolution of Publishing



Textbooks

Adobe®

PDF & ePublishing

Why Software Trumps 'Print'

Type of Textbook	Cost	Interactivity	Updates
Native web-based	Lower	Yes	Frequent
Traditional	Higher	No	Once per decade

MEB = The comprehension course

The 1st chemical engineering course

A gateway to the rest of the curriculum

Concepts covered:

- Mass/mole/atom balances
- Reacting systems
- Vapor-liquid equilibrium
- Energy balances
- Transient systems

Building from the bottom up

Goal: Develop problem solving skills and conceptual understanding

How:

Quick hitting concepts

Scaffolded, tiered examples

Interactivity and decision making

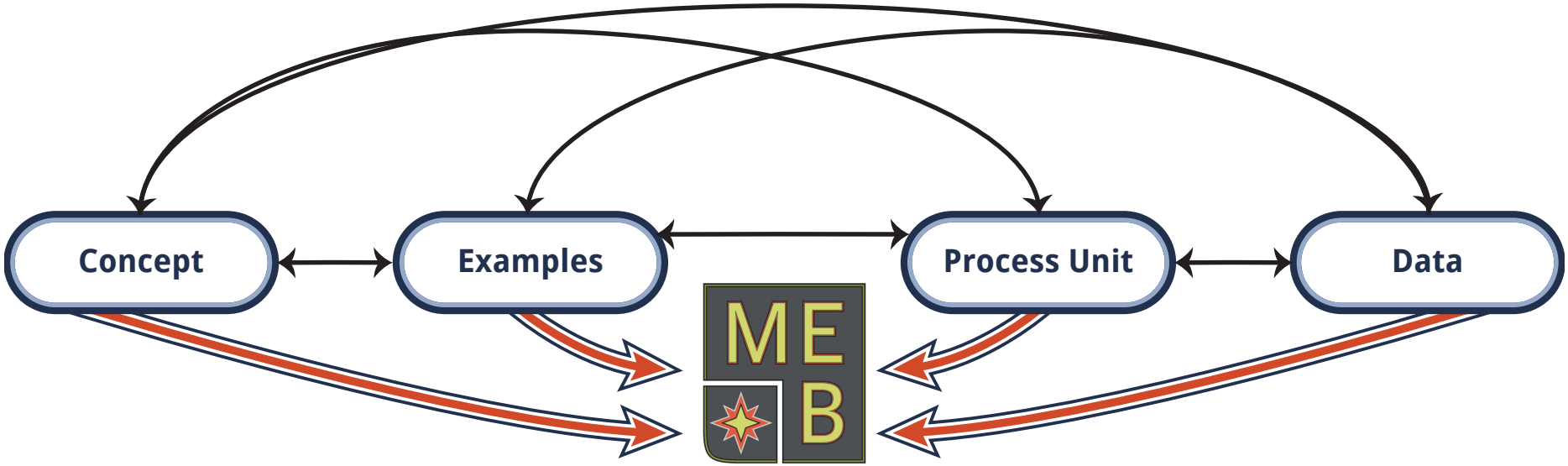
Bring Active Learning To The Textbook

Scaffolded Tool for Active Reading©

Minimum Text

Non linear

Interactive Feedback



Quick Hitting Concepts

Fundamentals of Material and Energy Balances

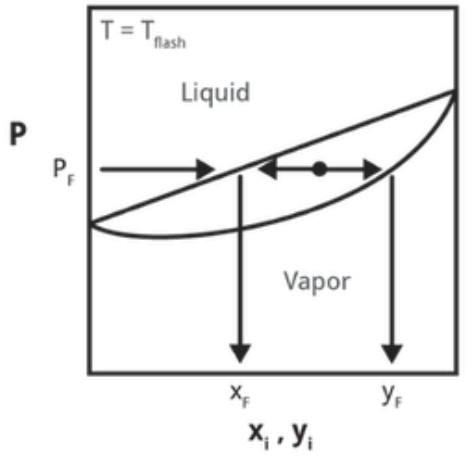
ME B

Search

- Concept: Raoult's law
  - Raoult's law practice
- Concept: Bubble and dew point
  - Constructing a two component pressure-composition (Pxy) diagram
  - Constructing a two component temperature-composition (Txy) diagram
  - Flash separation
- Example[+]: Closed vessel with BT
  - Closed vessel with BT - concept question
  - Closed vessel with BT - answers only

Flash separation

Flash is another type of vapor-liquid equilibrium. In this case, a fluid of known composition is placed at a set temperature and pressure. The temperature and pressure are selected so at equilibrium both vapor and liquid phases are present. Generally, one of the product phases (liquid or vapor) contains a large fraction of one of the species from the initial mixture.



6-5

Figure 6.5 Pxy diagram showing flash separation

Example: Concept Question

Question 1

A liquid mixture containing 79 mol% cyclohexane and the balance n-pentane enters a flash tank. The tank is maintained at 98°C and 29 psia. The flow rate of the entering stream is 96 mol/min.
Part a. Draw and label a process flow diagram.
Part b. Find the molar flow rates (mol/min) and mole fractions of the exiting stream(s).
Concept question. The entering flow rate increases by 17%, the composition of the pentane in the exiting liquid stream will:

- Increase
- Decrease
- Stays the same

Need help with this one? Get a hint or show answer.

CHECK ANSWER

C6 flash - concept question

Scoreboard

0% Complete

- Correct
- Wrong
- Unanswered

Total

Notes 0

inkling

Example: Concept Question

Question 1

A liquid mixture containing 79 mol% cyclohexane and the balance n-pentane enters a flash tank. The tank is maintained at 98°C and 29 psia. The flow rate of the entering stream is 96 mol/min.
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Concept question. The entering flow rate increases by 17%, the composition of the pentane in the exiting liquid stream will:

- Increase
- Decrease
- Stays the same ✓

That's correct!
The flow rate does not change the compositions exiting the tank. Raoult's law is independent of flow rate .

Need help with this one? Get a hint.

DONE

C6 flash - concept question

Scoreboard

- Correct
- Wrong
- Unanswered

Total

Notes 0

inkling

Process Unit

Flash tank

Flash separation is a simple process unit where T, P are altered to create separation of one or more components. The exiting vapor and liquid streams are in equilibrium providing one extra equation for each component in equilibrium. The process may be called flash evaporation and the equipment is commonly known as a flash drum. Additional information on flash can be found elsewhere.

6-13

Figure 6-13 Flash tank.

Process Unit: External Resources

Article Talk Read Edit View history Search

Flash evaporation

From Wikipedia, the free encyclopedia

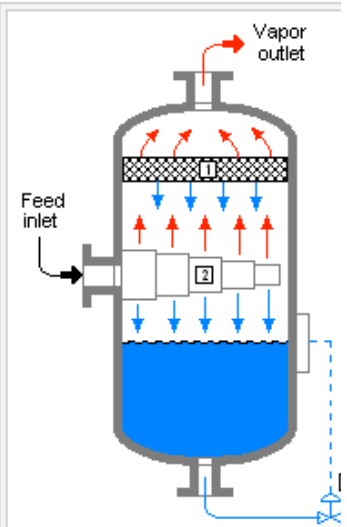
Flash (or partial) evaporation is the partial vapor that occurs when a saturated liquid stream undergoes a reduction in pressure by passing through a throttling valve or other throttling device. This process is one of the simplest unit operations. If the throttling valve or device is located at the entry into a pressure vessel so that the flash evaporation occurs within the vessel, then the vessel is often referred to as a flash drum.[1][2]

If the saturated liquid is a single-component liquid (for example, liquid propane or liquid ammonia), a part of the liquid immediately "flashes" into vapor. Both the vapor and the residual liquid are cooled to the saturation temperature of the liquid at the reduced pressure. This is often referred to as "auto-refrigeration" and is the basis of most conventional vapor compression refrigeration systems.

If the saturated liquid is a multi-component liquid (for example, a mixture of propane, isobutane and normal butane), the flashed vapor is richer in the more volatile components than is the remaining liquid.

Uncontrolled flash evaporation can result in a boiling liquid expanding vapor explosion (BLEVE).

Contents [hide]



A typical flash drum

Videos views increase

20 equipment videos links in FMEB

15 showed increase in views per month

BEFORE: 2,000 views/month

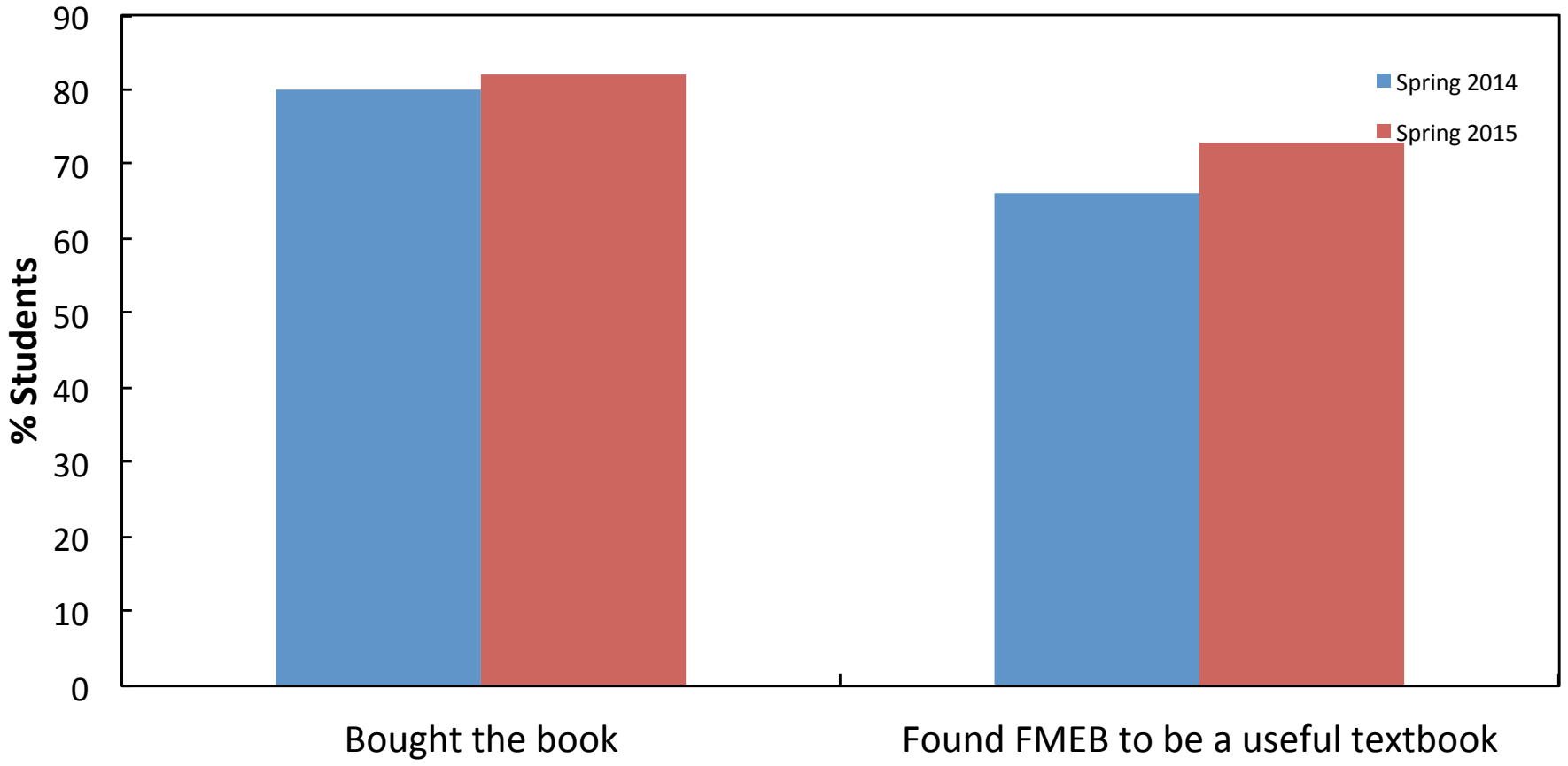
AFTER: 3,000 views/month

50% increase averaging all videos

70% increase for 15 videos increasing

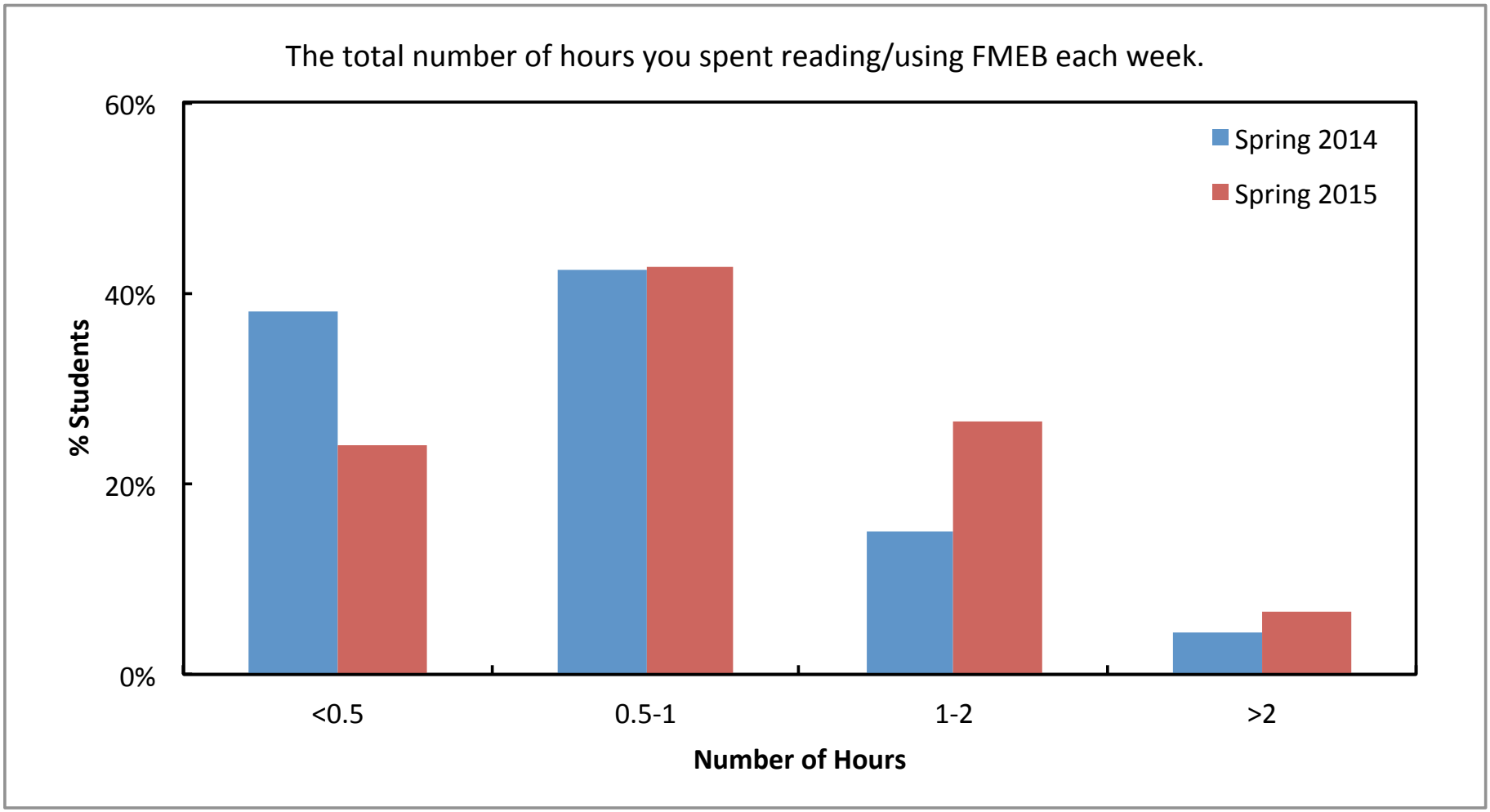
No correlation with chapter for less viewed

Surveying the Students



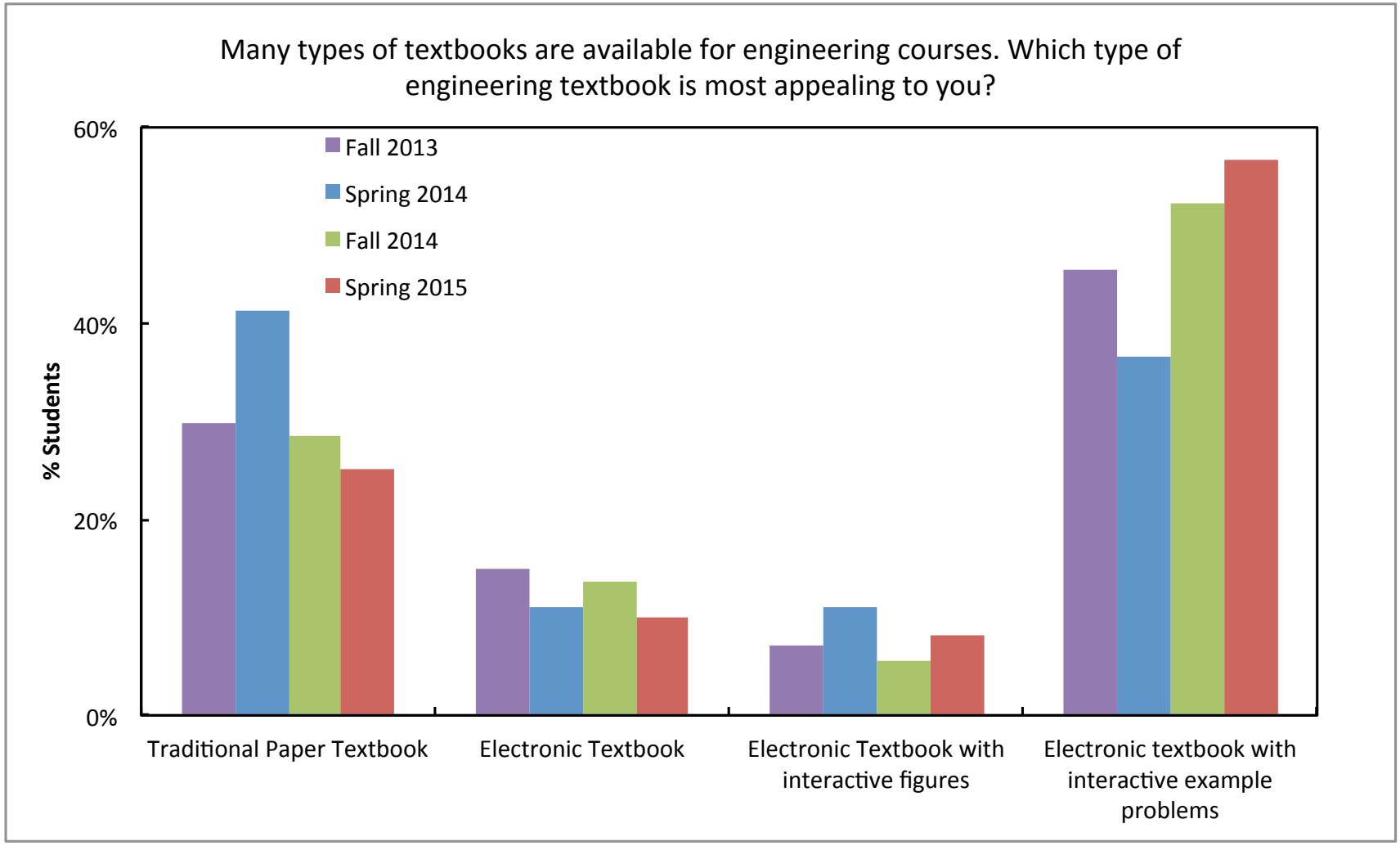
Moving in the right direction

Students using FMEB more



Need to control based on web analytics

Students want…



Vestal CEE Teaching Tip 2016 (to appear)

A new path forward = zybooks

Over 50,000 students using in 2015

Started by CS faculty in 2012

Fully interactive

Comprehensive feedback to student AND instructor

Less text, more action™

Zybooks promotional movie clip

Over 50,000 students using in 2015

Started by CS faculty in 2012

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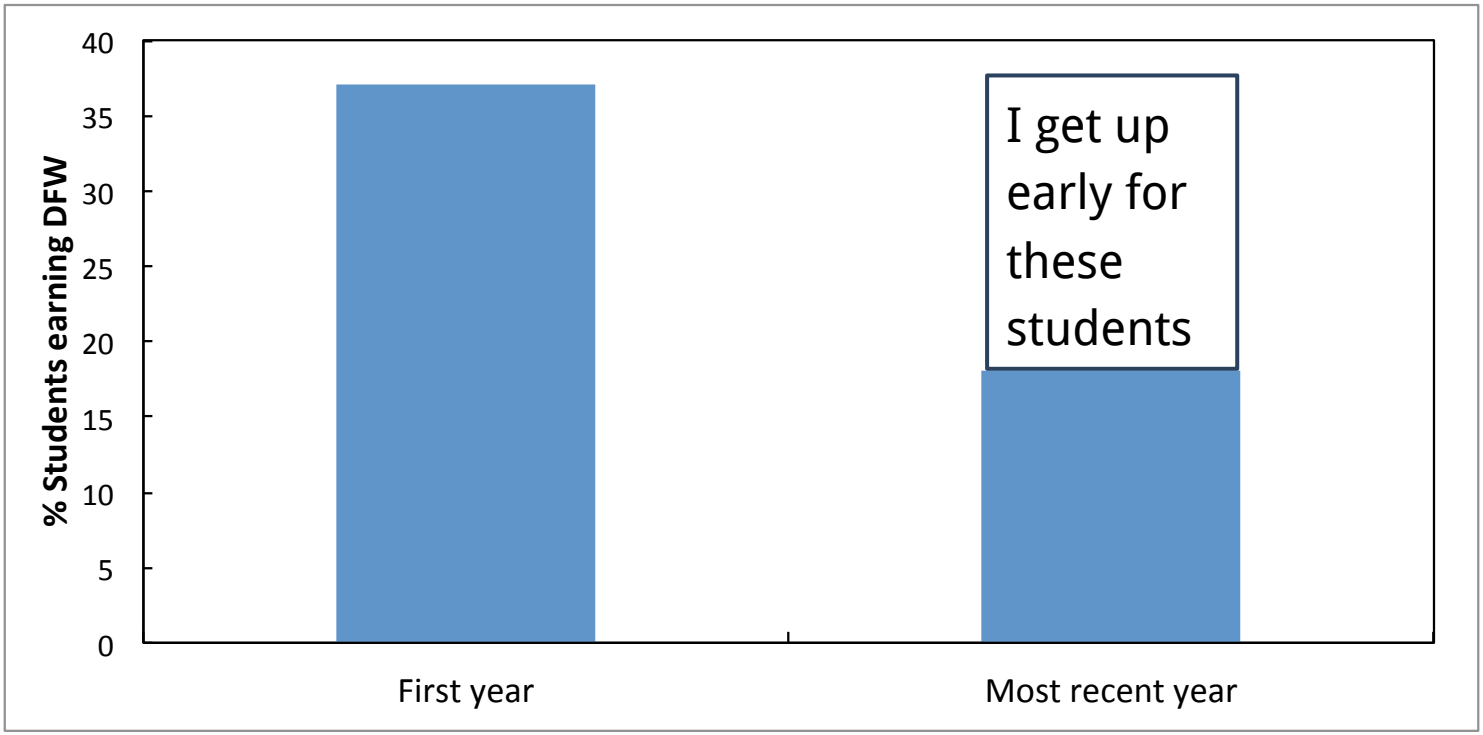
Summary

Goal: Bring active learning to a textbook



Failure builds character

New and better things are coming - zybooks