A first experience in a flipped Calculus II course

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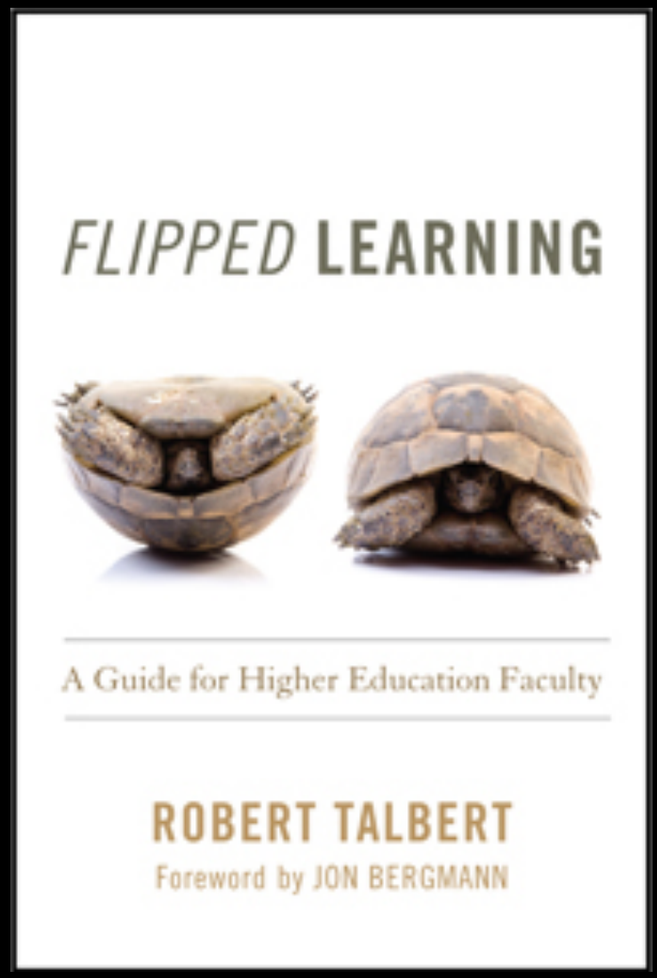
Context

- Dordt College: Small, Christian liberal arts college (~1400 students)
- Typical audience: 20-40 students, mostly engineering majors
- Fifth consecutive semester teaching at least one section of Calculus II (fourth year at Dordt)
- Past sections: brief lectures interspersed with group work
- Conviction that students need more active learning/to take ownership of their learning
- Summer 2017: designing and prepping the class

Resources for flipping

- Robert Talbert's book (2017)
- flippedlearning.org
- 2017 IBL PRODUCT Workshop at DePaul



Day to day

First encounter: Guided Prep

- Delivered on Canvas
- Markdown > Pandoc > HTML
- Contains:
  - Brief written overview of the concepts
  - Learning resources: textbook section, screencast, other online resources
  - Screencast created with beamer > Quicktime and Samson Go Mic
  - Exercises submitted via Google Forms (but: teachers.desmos.com!); due by 11:59pm the night before we discuss the content in class. Full credit for completion.

Second encounter: the class meeting

- Plicker questions/brief (~5 minute) refresher on the topic
- Time to work with classmates on activities
- Scaffolded from straightforward computations to applications/abstract problems
    - Ongoing goal: more complex, higher-level problems for in-class work
- End class with questions, brief discussion, wrap-up

Effectiveness

My thoughts

- Screencasts were not utilized
- Final exam scores fairly low (though other possible explanations exist)
- Class was a lot of fun

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    - “We are almost the teacher because we spend so much time teaching ourselves”
    - “In this class, we are more accountable for keeping track of how we are doing in the class, and in how we are to learn more of the course's content outside of class. It seemed like we were more in charge”

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    - “I was hesitant if this would work for me, but as the semester went on I became more and more used to it.”
    - “I did not learn as much and I feel like I was stumped more often and I didn’t want to ask questions too because everyone else seemed fine with it”

Final thoughts

- Screencasts were sorely underutilized
- Need to develop more robust in-class activities
- Always be selling, from the first day to the last

Thanks!

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Example

Taylor polynomials are also incredibly useful in applications. One such application comes from the field of heat transfer, in which the solution to certain heat conduction problems involves the error function, $\text{erf}(x)$.

By definition,

$$\text{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2}\, dt.$$

Our goal in the next set of exercises is to estimate $\text{erf}(1)$.

1. Use the Maclaurin series of e^x to write the Maclaurin series of e^{-t^2}. What is its interval/radius of convergence?

2. Now use the power series integration theorem to express the integral

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as a Maclaurin series.

3. Approximate $\text{erf}(1)$ using a degree 4 Taylor polynomial.