HOW TO FLIP CALCULUS ONE LESSON AT A TIME

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The Calculus Flippers

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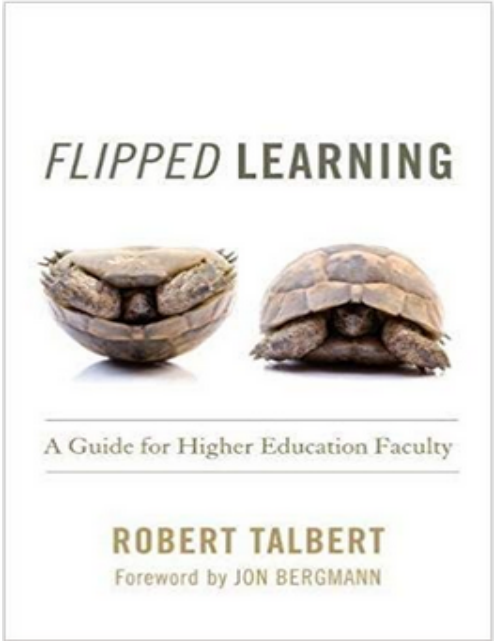
The Process

Image from https://www.shutterstock.com/search/make+things+happen

Course in a Box – Common Structures

- Common syllabus and pacing guide
- Pre-reading assignments from textbook and/or common videos on definitions and concepts; added example videos in second semester
- Lesson plans and in-class activities based on Talbert's structure
  - ✓ Creating student learning outcomes
  - ✓ Developing lesson plans and guided practice
  - ✓ Identifying active learning strategies and activities

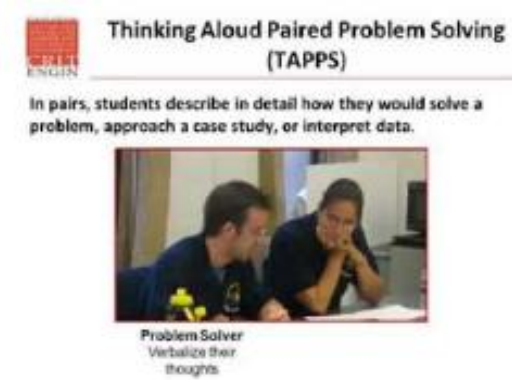


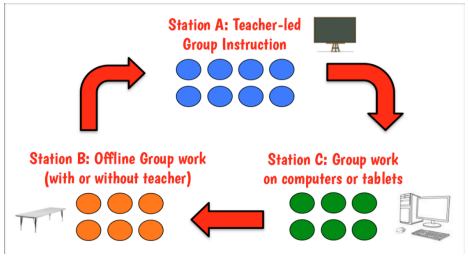
Implementation

- Had weekly meetings to discuss challenges and brainstorm solutions
- Developed and gave mid-semester survey to get feedback from students
- Identified common types of questions for midterms
- Jointly created a common final exam given to both flipped and non-flipped sections

In-Class Activities & Assessment

- Think-Pair-Share
- Thinking Aloud Paired Problem Solving (TAPPS)





- Stations
- Working on board

Assessed via

- ✓ Minute paper on conceptual questions
- ✓ In-class quizzes for advanced LOs
- ✓ Hand in and/or present group work

Challenges Encountered and Our Solutions

Image from https://premiergazette.com/2018/03/glenwakeman-entrepreneur-solutions/

Challenges

What challenges have

- YOU encountered if you have flipped already

OR

- can YOU imagine to happen in a flip?

Accountability for Pre-Class Work

- Send out email reminders to students about work due

Accountability Checks:

- ✓ Online quiz before class
- ✓ In-class quizzes at start of class
- ✓ Students randomly selected to write definitions/formulas on board
- ✓ Notes from pre-class work for random check or as ticket-in-the door
  - 3-2-1 notes
  - Definitions and formulas

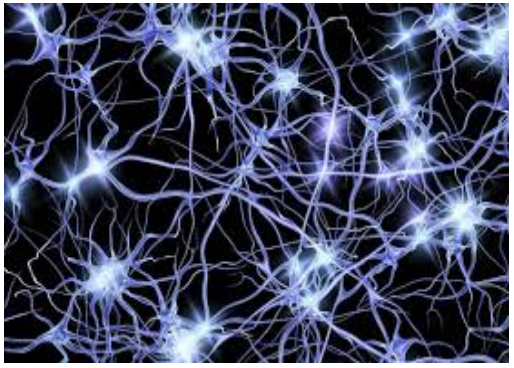
Other Challenges

To Summarize or Not to Summarize

- Do a partial, targeted summary

Students Feel Instructor is not Teaching

- Learning does not happen when lecture notes are copied from the board
- Discuss neuroscience as it relates to learning and making connections
- Roaming instructor who checks in during group work



Other Challenges

Underprepared students

- Videos and/or worksheets on pre-requisite topics
- Discuss learning strategies – exam wrapper

Students feel overwhelmed

- Keep in mind the rule that students should do two hours of work for every hour in class
- Adjust homework assignments in light of time needed for prep work

Students resistant to groupwork

- Have students work on their own first, and then work as a pair

Image from https://antiguaobserver.com/2018-grade-six-national-results/

What Instructors Observed

- ✓ Several students got motivated and engaged, and one even inquired about flipped Calculus II
- ✓ Students in flipped section almost always stayed for the whole test, while half of the non-flip students would give up during the half-way mark.

Mid-Semester Evaluation

- All students were given an anonymous Google survey controlled by the coordinator.

Student suggestions for improvement

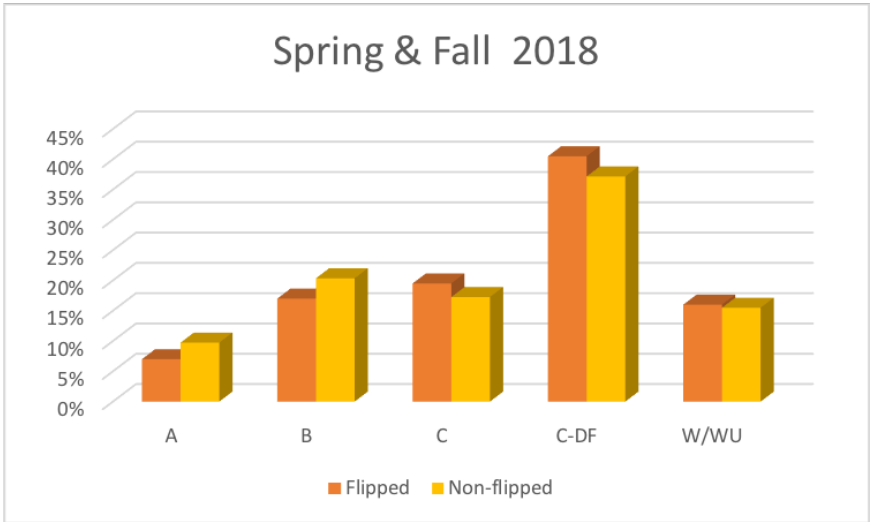
- ✓ Important to wrap up class with giving solutions and/or validating student solutions
- ✓ Curate videos to match content and terminology from class
- ✓ Adjust amount and types of homework problems
- ✓ Provide more examples (both in-class and videos)

Student Comments from Surveys

- I like this type of class more than the regular teaching method, it allows us to look at more practice problems!
- It took a while to get used to this "flipped" version of calculus, but I now understand its benefits and appreciate the preparedness and independence I am gaining in my studies.

- To improve the course, I suggest going back to traditional teaching. Please and thank you.
- Not my type of learning, so even though I already took calculus in my senior year I was confused.

Results Across All Sections



	Flipped	Non-Flipped
Pass	44%	47%
# students	200	226

- Flipping did do no harm
- Incoming preparation of students is weak (as measured by MDTP)
- Need to follow students into subsequent courses to see whether there is a difference in performance.

Thank you for listening!

Any questions?

Any experiences you want to share?

Presentation and handouts at **tinyurl.com/FlipCalcLilly2019**

References

- Talbert, R. (2017). *Flipped Learning: A Guide for Higher Education Faculty*. Sterling, VA: Stylus Publishing
- TAPPS:
  - https://www.uwlax.edu/globalassets/offices-services/catl/teaching-guides/group-learning-materials/think-aloud-pair-problem-solving.pdf
  - https://serc.carleton.edu/NAGTWorkshops/metacognition/activities/28754.html
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