HOW TO FLIP CALCULUS
ONE LESSON AT A TIME

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The Calculus Flippers

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The Process
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

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
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

- 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.

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<thead>
<tr>
<th></th>
<th>Flipped</th>
<th>Non-Flipped</th>
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<tbody>
<tr>
<td><strong>Pass</strong></td>
<td>44%</td>
<td>47%</td>
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<tr>
<td><strong># students</strong></td>
<td>200</td>
<td>226</td>
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Thank you for listening!

Any questions?

Any experiences you want to share?

Presentation and handouts at tinyurl.com/FlipCalcLilly2019
References


- TAPPS:
  - [https://serc.carleton.edu/NAGTWorkshops/metacognition/activities/28754.html](https://serc.carleton.edu/NAGTWorkshops/metacognition/activities/28754.html)

- Active learning techniques: [https://www.usf.edu/atle/documents/handout-interactive-techniques.pdf](https://www.usf.edu/atle/documents/handout-interactive-techniques.pdf)