



Flipping your  
classroom

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flipping

My flavor of  
flipped  
classroom

Excuses,  
excuses!

The nuts and  
bolts of  
flipping

A model class  
period

# *Flipping your classroom in an upside down world*

Lola Thompson

Utrecht University

June 23, 2022



# What is a “flipped” classroom?

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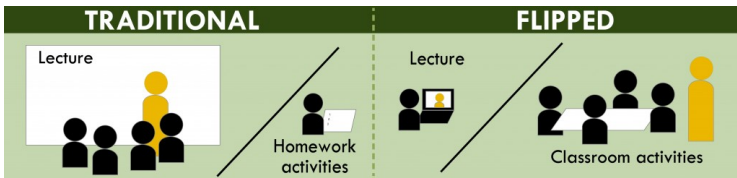
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A “flipped classroom” is a pedagogical model in which the traditional lecture and homework elements are reversed.



# Why use a flipped classroom?

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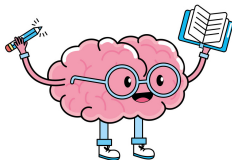
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In a normal class, students passively consume knowledge during the lecture and test their understanding on their own when they work on the homework.

In a flipped class, students passively consume knowledge on their own, but then test their understanding during class time (when the instructional staff can help).



# Why now?

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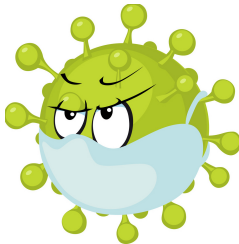
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Why now? We all just experienced a one-in-a-lifetime disruption to our normal teaching practices. In particular:

- students are used to watching videos from home
- students are eager for human contact
- we all just had to re-imagine our teaching anyway



# Things to keep from the pandemic

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## Things to keep from the pandemic:

- the audio/visual technology that you or your department purchased
- your old videos (perhaps after dividing them into “knowledge clips”)
- a willingness to think outside the box with your teaching



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# My flavor of flipped classroom





# My flavor of flipped classroom

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- Class time is mainly spent on group work and student presentations. I will give mini-lectures at the beginning of class to answer common student questions.
- Working groups are assigned (engineered) by me. They consist of 3-4 students and rotate every 2 weeks.
- Textbooks and internet resources are explicitly forbidden.
- I do give hints on the worksheet problems. The size of the hint is proportional to the amount of effort that the group has expended.
- At the end of class, groups of students present some of the patterns that they have found, and conjectures that they have made.



# How I “sell” IBL to students and colleagues

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This course models what it is like to be a researcher in number theory:

- Students experience the research process. They perform computations, use the data to make conjectures and then try to prove their conjectures.
- Students work with one another as research collaborators.
- Students use LaTeX to write up their work and submit a final project. Projects are graded on both mathematical correctness and on the quality of exposition.





# A typical week

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Monday	Tuesday	Thursday
hand-in problems due; students request other problems for mini lectures	Mini lecture; group work; presentations	Mini lecture; group work; presentations

**Lecture Videos:** Students watch lecture videos (5-10 minutes) on background material outside of class.

**Mini Lectures:** Students are invited to request problems in an online forum for me to present in class. Every week, I choose the most popular problems from the previous week to go over.

**Group Work:** Students work together on worksheets.

**Presentations:** Groups present their discoveries on selected problems for one another.



# Excuses, excuses!

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**Excuse #1:** *I am afraid to make such a radical change in the way that I teach (especially if I do not yet have tenure).*



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**Excuse #1:** *I am afraid to make such a radical change in the way that I teach (especially if I do not yet have tenure).*

**Excuse #2:** *I don't want to have to go out and buy an expensive recording device.*



# Excuses, excuses!

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**Excuse #3:** *I will spend way too much time writing and recording the take-home lectures.*



# Excuses, excuses!

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**Excuse #4:** *My students won't actually watch the take-home lectures. (They might even be upset about having to do extra work outside of class.)*



# Excuses, excuses!

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**Excuse #3:** *I will spend way too much time writing and recording the take-home lectures.*

**Excuse #4:** *My students won't actually watch the take-home lectures. (They might even be upset about having to do extra work outside of class.)*

**Excuse #5:** *I am teaching one section out of many and I don't have much flexibility in the grading or pace of the course.*



## Flipping your classroom

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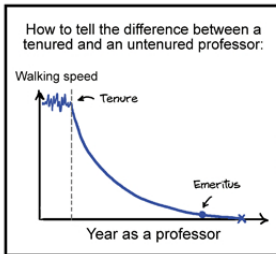
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**Excuse #1:** *I am afraid to make such a radical change in the way that I teach (especially if I do not yet have tenure).*



# Compromise: a partially-flipped classroom

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A week in the life of my Calculus students:

	Monday	Wednesday	Friday
<b>Class period</b>	In-class lecture	Worksheets	In-class lecture
<b>Homework</b>	WeBWork; view take-home lecture	WeBWork	WeBWork





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**Excuse #2:** *I don't want to have to go out and buy an expensive recording device.*



# Flipping technology

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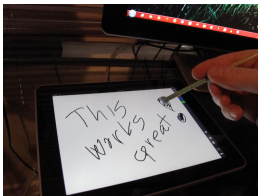
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What I have used:



\* iPad + stylus + Zoom



\* Livescribe Echo SmartPen



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**Excuse #3:** *I will spend way too much time writing and recording the take-home lectures.*



# Extra Time? Only At First.

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It does take extra time to create video lectures, design worksheets, etc. But if you will teach this class many times, then it takes essentially no prep time when you teach it in the future. You will never need to prepare another lecture!

(Also, you do not need to make the perfect lecture videos. Often your first attempt is good enough...)



# Advantages of flipping

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## Advantages:

- Research shows that active learning is *better for the students*. Flipping can buy you more class time for active learning techniques.



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## Advantages:

- Research shows that active learning is *better for the students*. Flipping can buy you more class time for active learning techniques.
- Flipping does not need to take (much) extra prep time.



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- Flipping does not need to take (much) extra prep time.
- Flipping can allow for more control over the pace than other active learning styles.
- Students may even perceive that you're a better teacher because you're doing something non-standard!.





# Disadvantages of flipping

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## Disadvantages:

- Most students will not buy into flipping immediately.



# Disadvantages of flipping

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## Disadvantages:

- Most students will not buy into flipping immediately.
- Technological snafus can be a headache.



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## Disadvantages:

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- Students may not give the same weight to take-home lectures that they give to in-class lectures.



# Disadvantages of flipping

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## Disadvantages:

- Most students will not buy into flipping immediately.
- Technological snafus can be a headache.
- Students may not give the same weight to take-home lectures that they give to in-class lectures.
- Flipping can make it more difficult to coordinate with other sections.



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## The nuts and bolts of flipping



# Larger Classes

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How to adapt for larger classes (40 - 60 students):

- request 2-3 seminar-style rooms instead of one large lecture hall (moveable tables and chairs are key!)
- train TAs to work as secondary instructors
- instructor circulates through all classrooms throughout the period
- “instructional team” (TAs + instructor) meets at least once per week



# Fostering Group Work

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Getting students to work together:

- icebreaker activities
- putting them in groups for two weeks at a time
- organizing the groups in fun ways (e.g., hobbies, favorite ice cream flavor, zodiac sign, etc.)



# Getting students to embrace a new teaching style

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There are a number of steps that you can take to encourage student “buy-in”:

- Request a classroom space that doesn't look like a traditional lecture hall!
- Share some short readings on the benefits of this learning style (e.g., “The five elements of effective thinking”).
- Remind the students of all of the amazing things that they have achieved in your class.





# Structuring the worksheets

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To create the worksheets:

- Take the homework problems that you would normally give, then break them into smaller parts (“breadcrumbs”).
- Feed the breadcrumbs to students over several worksheets.
- Give your students the time/space to connect the dots.
- Prepare a list of hints for your teaching assistants, just in case the students get stuck.



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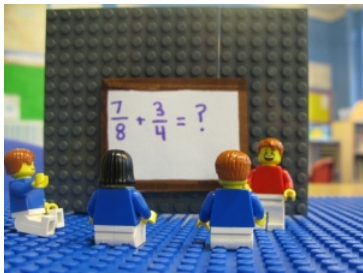
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# A model class period



[Break for worksheets]



# A model class period

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**Conjecture:** If  $n = 4$  then  $(n - 1)! = 6 \equiv 2 \pmod{4}$ . If  $n \neq 4$  and  $n$  is composite then  $(n - 1)! \equiv 0 \pmod{n}$ . If  $n$  is prime then  $(n - 1)! \equiv -1 \pmod{n}$  (Wilson's Theorem).

*Where this is going...*



# A model class period

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*Where this is going...*

From Set #9:

**Prove or Disprove and Salvage if Possible**

P1. For any integer  $n$ ,  $(n - 1)! \equiv -1 \pmod{n}$ .



## Other common threads

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Some other common threads that you may have noticed:

- P1, P2 on Set #5 are used to prove the Unique Factorization Theorem (P1 on Set #7)
- P3 on Set #5 is used to prove that  $\pm 1$  are the only self-inverses (mod  $p$ ), which is needed to prove Wilson's Theorem (P2 on Set #7).
- E1(d) on Set #7 is useful for thinking of the right bijection to construct for Fermat's Little Theorem (P3 on Set #7).



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# Thank you!

