

Less time talking at students
and more time talking with them:
Experiences of a neophyte classroom flipper

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The course: Biochemistry 3381A – Biological Macromolecules

~180 students
1 lecture section
three 50-min classes and one tutorial per week

14 classes: Professor A
12 classes: Professor B
11 classes: Me

Traditional lectures supported by textbook readings
Tutorial run by TA
1-2 assignments and 1 test per instructor

Flipping the classroom

Traditional

Flipped

School



Photo: David Levene, *The Guardian*



Photo: thebrokendam.com

Home



Photo: survivorpediatrics.wordpress.com



Photo: Getty Images

Origins of the classroom flip

2011 – Salman Khan TED talk

2010 – Daniel Pink *Telegraph* article about Karl Fisch,
Colorado high school Math teacher: “Fisch Flip”

2007 – Jonathan Bergmann and Aaron Sams,
Colorado high school Chemistry teachers

2000 – Maureen Lage, Glenn Platt, Michael Treglia,
Economics at Miami University (Ohio)

2000 – J Wesley Baker,
Communications at Cedarville University

Research

Deslauriers *et al.* 2011 – Gains in academic performance over traditional lecture; students enthusiastic

Papadopoulos and Santiago Roman 2010 – Gains in academic performance over traditional lecture; students noted increased workload but still enthusiastic

Driscoll 2012 – Flipped classroom more “democratic”: more social interaction and collaborative problem solving, develops personal initiative, more equitable intellectual experiences

Strayer 2012 – Increased collaboration among students; students noted disconnect between in-class work and out-of-class work; the variety of classroom activities was disorienting

Johnson and Renner 2012 – No increase in achievement, students not motivated, implementation problems

My implementation

Before class: Posted lecture (slides with audio)
Textbook readings
Online assignment

In class: Posed questions or problems
Students worked in small groups
Class-wide discussion

Questions, exercises, demonstrations using physical props (4 classes)
OR
Questions and problems based on experimental data (7 classes)

Rope tricks

1. Look at the linear rope. Is the coil RH or LH?
2. Suppose this were a piece of B-DNA containing 200 bp. What would be the twist?
3. Hold part of the rope in one hand and note that twisting the rope with the other hand either unwinds the rope or winds it more tightly.
4. Have one person hold one end fixed, and another rotate the other end 3 turns CCW (looking from the end). When either person lets go, what happens? Also try rotating 3 turns CW.

Rope tricks

5. Have one person hold one end stationary, and another rotate the other end 3 turns CW or CCW. Without further rotation, bring the two ends together, and have one person hold both ends (don't let them rotate!). Adjust the rope so that interwound supercoiling is clearly seen. What is the handedness of the supercoiling? What do you think happens to the twist of the rope?
6. Try repeating the above but rotating the free end the other way, and see what happens.



Figure from CR Calladine and HR Drew (1997) *Understanding DNA* 2nd ed.

Closed circular DNA

- Look at the circular rope. Supposing it's a B-DNA double helix of 200 bp, what are T, W, and L?
- Without breaking the circle, can you make the supercoiling disappear?
- Fill in the missing numbers below.

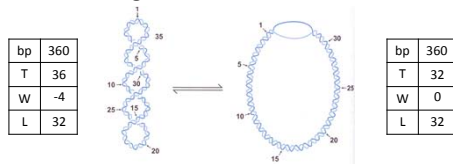


Figure from JD Watson *et al.* (2008) *Molecular Biology of the Gene* 6th ed.

Student feedback – unsolicited e-mail

Hello Professor McLachlin,

I just wanted to let you know that today's class was EXTREMELY effective in helping me to visualize and understand DNA supercoiling concepts. My group and I realized where the holes in our understanding of the material were and managed to patch them up. Great job! You should definitely keep this for next year!

Student feedback – course evaluations

Positive (40 comments)

- I really enjoy your new method of teaching...I do really like the more relaxed feel to your classes and the independent thinking parts of it
- Really like how you post the lectures online beforehand. Like the interactive in class thing...really enjoy your lectures.
- Love the way Dr. McLachlin taught this course. He made effective use of class time, taking up questions and running discussion, leaving the one size fits all lecture for homework. Please encourage other Professors to follow.
- Class discussions were interesting, engaging, and helpful...could be a very cool way to do the course with a bit of tweaking.

Student feedback – course evaluations

Too time consuming (25 comments)

- I would not suggest using the new method. It's a great idea but very impractical considering you tripled the amount of time we spend working on the class material and we have 4 other courses to deal with too.
- Perhaps three hours a week extra watching videos is a lot. Maybe consider doing one or two videos a week.
- It takes up a lot of time. If it could be structured so that Mondays and Wednesdays are regular lectures and Friday classes work out concepts from other lectures.

Student feedback – course evaluations

Difficult for students to manage information (9 comments)

- Sometimes difficult to follow the mechanisms in class. A bit overwhelming, a lot of information in the time. Class should be longer.
- I find it hard to organize myself with information coming from so many different places (textbook, online lectures and class).
- I find it very pointless to come to your in class lectures. They actually confuse me more. I have a hard time when the class [talks] more than you do. Science shouldn't be a discussion it is definitive.

Student feedback – course evaluations

Class sessions did not adequately reflect recorded lecture (8 comments)

- I don't think [class discussions] always reflected the goal of the course. There often seemed to be a disconnect between posted lectures and class sessions and only really one minute topic from each video was really gone over in class.
- Make it more clear what you want us to take away from in class sessions. You can make the online components and in class sessions more related to each other. Each class at first was like a surprise topic. Let us know in advance what studies we will be looking at.

Plans for next year

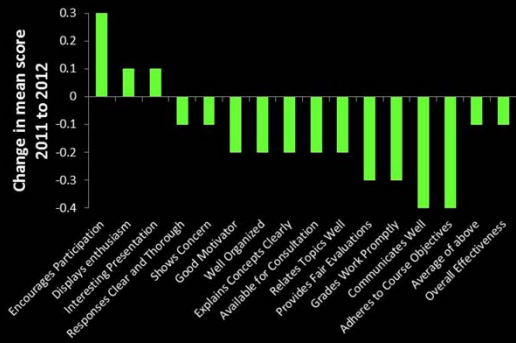
Retain basic format

Be more clear in advance about extra work

Make sure in-class sessions illustrate principles rather than extend concepts

Be less ambitious with in-class activities

Changes in teaching evaluations



Selected resources on the flipped or inverted classroom
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Baker JW. (2000) "The 'classroom flip': Using web course management tools to become the guide by the side." In Selected papers from the 11th International Conference on College Teaching and Learning, JA Chambers, ed., Florida Community College at Jacksonville, Jacksonville FL. pp 9-17. [I have not actually read this paper]

Bergmann J and Sams A. (2012) Flip your classroom: Reach every student in every class every day. International Society for Technology in Education, Eugene, OR.

Classroom Window. "Flipped classrooms: Improved test scores and teacher satisfaction." Accessed July 11, 2013 at <http://classroomwindow.com/flipped-classrooms-improved-test-scores-and-teacher-satisfaction/>

Clintondale High School, Michigan. <http://flippedhighschool.com/>

Deslauriers L, Schelew E and Wieman C. (2011) "Improved learning in a large-enrollment physics class" *Science* 332:862-4 [see also related letters to the editor, *Science* 333:1220-1]

Driscoll III TF. (2012) "Flipped learning & democratic education", Graduate thesis, Teacher's College, Columbia University

Flipped Learning Network. <http://flippedlearning.org/Page/1>

Fulton KP. (2012) "10 reasons to flip" *Phi Delta Kappan* 94(2):20-4

Hamdan N, McKnight P, McKnight K and Arfstrom KM. (2013) "A review of flipped learning" <http://fln.schoolwires.net/site/Default.aspx?PageID=63>. [A document produced by the Flipped Learning Network without external peer review.]

Johnson G. (2012) "Students, please turn to YouTube for your assignments" *Education Canada* 52(5)

Johnson LW and Renner RD. (2012) "Effect of the flipped classroom model on a secondary computer applications course: student and teacher perceptions, questions and student achievement" Graduate thesis, College of Education and Human Development, University of Louisville

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Papadopoulos C and Santiago Roman A. (2010) "Implementing an inverted classroom model in engineering statics: initial results" American Society for Engineering Statistics Proceedings of the 40th ASEE/IEEE Frontiers in Education Conference, Washington DC

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Pearson G. (2012) "Biology teacher's Flipped Classroom: 'A simple thing, but it's so powerful'" *Education Canada* 52(5)

Pink D (2010) "Flip-thinking—the new buzz word sweeping the US" *The Telegraph* Sept 12 2010, accessed July 11 2013 at <http://www.telegraph.co.uk/finance/businessclub/7996379/Daniel-Pinks-Think-Tank-Flip-thinking-the-new-buzz-word-sweeping-the-US.html>

Strayer JF. (2012) "How learning in an inverted classroom influences cooperation, innovation and task orientation" *Learning Environments Research* 15:171-93

Winterbottom S. (2007) "Virtual lecturing: Delivering lectures using screencasting and podcasting technology" *Planet* 18:6-8