Flipping the class room for Theory of Computation: an experiential Report

Fall 2012, University of Florida

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Course Structure

--the first 3 weeks as traditional lectures (ignoring the videos existed),

--next 2 weeks as purely problems/proofs in class (requiring 100% viewing of videos), emphasizing the problem solving process, blind alleys and dead ends included, rather than just presenting an already digested solution.

--all remaining weeks as a mixture of problems/proofs + depth lectures (still requiring 100% viewing of videos): focus on extending the problems done in class in various directions, extending and generalizing. Also emphasizing key points in video lectures and increasing depth beyond video lectures

--In addition, they had a textbook that was followed in the video lectures, plus sample tests and hw problems worked out on my course website.

--Overall, the background/motivation of the students was well above average.

Student Feedback

Reaction was generally positive to the "mixture" mode, but only among those who watched the videos (about half; about a quarter were consistent viewers; about half watched about half the time; the remaining quarter seldom watched the videos).

However, the set of viewers dwindled as the semester went by. One student complained about the increased (depth of) content. They felt the traditional lecture style limited the amount of content and that it was more manageable for them.

I gave three 2 hour, in class, closed book tests, and will give a 2- hour final.

Test 1 was after 5 weeks. Performance was as expected.

Test 2, at 8 weeks, covered/tested more difficult material than Test 1 and additionally included problems from the "depth lectures". There were complaints about problems on Test 2 that were on the "depth lectures" material - since the problems done in class had been on the video lectures material and no special problems on the depth material had been assigned or done in class. Performance reflected this.

I rectified this for Test 3, at 12 weeks. I worked the depth lectures purely around and extending problems based on the video material and I made Test 3 a bit easier but tried to cover all key material. They still complained, but this time about the length/clarity of the test rather than the difficulty. Performance reflected this.

I will rectify this too in the final.

Student Learning:
I think 50% learnt a lot. About 35% learnt a reasonable amount.
The remaining 15% started out fairly well, but essentially dropped out.

In past semesters, when I taught the course traditionally, and the students had the same level of background/motivation, I would say more or less the same percentages were in effect, although the phrase "learned a lot" includes perhaps 15% deeper content and independent thought now, as opposed to traditional.

Peer Interaction: I did not see any more peer interaction now than in a traditional course. In any case, this depends too much on personalities to really make a comparison from year to year; several years' data would be needed. There was talk of joint "video viewing marathons" and the same students discussed test questions together, but I think essentially only one small group of students worked together. If anything, I would say the videos isolated students from each other, they felt more "independent." Classroom attendance is certainly poorer when videos are available (both now and in previous EDGE offerings).

However, nobody came to my office hours. In general, they waited for me to direct choose and direct the content. Only 1 student really took charge of their learning using me as mentor, making specific requests of what they would like to see. This is something one ideally expects when so much effort is put on producing online/animated content. Maybe this would change if the class is improved as follows.

Lessons I learnt about flipping the classroom:

--Videos would be way better if camera stayed entirely on the board - camera on lecturer is unnecessary - voice is sufficient. The videos need to be redone in any case, now that the purpose is clear and different from before.

--"Depth lectures" are a good idea, but only if focused around problems that are based on regular video lecture material (other wise no time to do depth lectures AND do extra problems on the depth lectures).

--Stick to some pre-set direction, even in the problem solving sessions and depth lectures. Students caught me about 4-5 times either overlooking something crucial, or just unable to fix a problem on the spot, or just botching an explanation until complete confusion reigned. These are the perils of not sticking to choreographed lectures and instead doing problems impromptu, or "depth lectures" extending these problems on the spot, based on student questions and interest. I suppose students learn something also from these missteps, but it is not an efficient use of class time. A compromise would be to stick with impromptu, but quickly rein in if disorder ensues; you can always send an email later patching up holes. I did this 2 times and it worked well.

--Make tests challenging, but keep it to the level of difficulty of problems done in class, and the students should feel they had enough time to say what they could possibly say in an in-class exam of reasonable duration.

Resources needed:

--Intersperse video viewing with quizzes to ensure people have watched the videos before they come to class. Give 25% of total grade to these quizzes The quizzes could be nontrivial exercises that are robot graded and randomly chosen in a student-specific manner from a bank. They should be multiple choice, or require a simple LaTex expression as answer - written proofs will have to be restricted to the tests.