

Small Changes to Make Lecture More Active

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Outline

- 1 My Context
- 2 Small Activities
- 3 Other Ideas

About Me

- Assistant Teaching Professor in the Math Department
- 5 years teaching full time
- PhD from Rutgers before that
- Coordinate Differential Equations class for engineers
- Involved in many departmental and division-wide efforts

My Courses

The courses I teach vary quite a bit in how tightly they are structured/coordinated.

- Lower level courses tend to have a lot more structure
 - Common exams, common final, common way of determining course grades, need for parity among all sections
- Other courses have much less structure
 - Common topics, common course components, flexibility in most other areas

Small Changes for a more Active Lecture

My goal for this part is to discuss several methods that can be used in a small way to add or allow for more active learning in classes. These are designed to work no matter how much structure or forced commonality a course has.

- 1 Pre-Class Videos
- 2 Clicker Questions
- 3 Interactive Problem Solving

Pre-Class Videos

- It is not the best use of class time to go over very basic content.
- That time is better spent on more engaging or advanced discussions of the material.
- Students could learn this material by reading a book, but who does that?

Solution: Pre-class videos

Implementation

My choice of implementation is PlayPosit.

The screenshot shows a video player interface. On the left, a poll question asks: "Which of the following matrices is in row echelon form?" with four radio button options: $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{bmatrix}$, $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 0 & 0 & 0 \end{bmatrix}$, $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$, and $\begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 1 \end{bmatrix}$. The main video area shows handwritten notes: "(Does the back substitution for you)" and two matrices. The first matrix is $\begin{bmatrix} 1 & 0 & 2 & 3 & 4 \\ 0 & 1 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 & 2 \end{bmatrix}$ with the 1s in the first column boxed. A pink arrow points down to the second matrix: $\begin{bmatrix} 1 & 0 & 2 & 0 & -2 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 2 \end{bmatrix}$. The right sidebar contains the text "ODEs", "Elimination and Row Reduction", and "Introduction Video".

- Can be videos you make yourself or other youtube videos
- Embedded questions to keep/force engagement
- Can be scored and automatically imported to Canvas

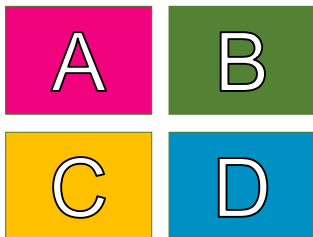
Clicker Questions

- Need to give students the opportunity to work problems or actively engage with the material being discussed
- Also need a way to determine where everyone is at with the material to adjust teaching

Solution: Clicker Questions (poll questions during remote instruction)

Implementation

I don't use actual clickers, but just have them vote in class



- Quick check of student understanding
- I usually discuss the answer/solution afterwards
- Same questions are written into a Canvas quiz that is due after class. Students submit this with the correct answers for auto-graded course credit.

Interactive Problem Solving

- Students need to engage with the problem solving process during class
- They aren't necessarily ready to start with that as soon as they enter/from just the pre-class content
- Need to make sure everyone is on the same page once the class is done

Solution: Interactive Problem Solving (I do-We do-You do)

Implementation

Three types of examples that they will see over the course of the class

- Examples in the videos that they have seen before class
- Examples that I will lead the discussion of, asking for input as we go
- Examples that they will start, and I'll write my solution on the notes behind them

Depending on timing, one of these may be skipped in the process, but ideally, all three of these are included.

My Notes

I want to show what this looks like in the notes that I actually use in class. I teach off an iPad, so this is all prepped in advance, and students have access to some of this in a notes file on Canvas before class.

Slightly Larger Ideas

The previous three ideas require minimal changes to course structure, grading policy, or topic coverage to implement. Not that they don't take effort, but they are fairly universal.

The upcoming ideas require a bit more large-scale changes to be able to implement properly, but can also have large benefits for engagement.

Reassessments

This applies exclusively to my Differential Equations courses

- Standards-based grading
- Discrete set of learning outcomes
- Students can reattempt quizzes until they show understanding of that objective

Reassessment and resubmission is one of the cornerstones of this grading scheme, so obviously that needs it.

Implementation

With that grading setup, reassessments are everywhere in my differential equations courses

- Exam Resubmissions
- Compounding exams
- In-Class make-up quizzes
- Extra online quiz opportunities

However, you don't need all of these or the grading scheme to get the benefit of reassessment.

Exam Resubmissions

One way to get this benefit is through exam resubmissions

- After students have their exam returned to them, they can revise and resubmit the questions from it
- Can also include a reflective component (exam wrapper) to help prepare for future exams
- Can give them points back on the exam or a separate assignment

The key benefit here is that it gets students actually reading and using your feedback.

Make-up Quizzes

A more involved process is to allow students to reattempt quiz or exam problems later on

- Optional quizzes given later in the semester that students can take to replace their earlier quiz on that topic
- Similar idea for exam problems (maybe using the final exam)
- Can be time- or number-limited in order to force students to take earlier attempts seriously

The key benefit here is that it focuses more on eventually learning the material as opposed to getting it on that first quiz attempt and gets the students to revisit topics later in the semester instead of just ignoring them if they got it wrong the first time.

Flipped Classroom

The extreme version of the pre-class videos

- (Almost) All of the lecture content is delivered in video or text form before class
- Minimal direct-instruction time in class
- Majority of class is spent on active learning: group work, problem solving, etc.

Implementation

Things that I have seen and learned in this process (from myself and others):

- Students will generally want some amount of direct instruction at the start of the class
- Mix up the groups throughout the semester
- Adjust to the group of students that you have
- Accountability from in-class work is generally a good thing

Thanks for your attention!

Questions?

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