A student-driven approach to teaching a large required class

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1. Abstract

Goal: Find a way to provide enough guidance, structure, and motivation to engage students in driving class with their questions and with “where they’re at”

Challenges:
1. How can the instructor engage students in coming up with their own questions on a topic before the class period in which the topic will be covered?
2. How can the instructor get a sense for “where students are at” in time to make adjustments in delivering content?

Current approach for teaching a senior level required course, Chemical Engineering 466 - Process Dynamics and Controls:
Facilitate a collaborative environment that engages students in
• Co-authoring a wiki textbook for the world
• Peer teaching and peer reviewing

2. Mechanics

Before class
Instructor provides guidance for each content
Teams of students write wiki articles
Teams of students write wiki articles
Pairs of students create 3-minute narrated powerpoint presentations
Instructor writes multiple choice quiz based on the wiki articles and presentations for the class period

In class, during the 1st half of the two hour class period
Instructor asks a question for “where students are at” by Lawrence and learning
Students who struggle with content can choose to go by my own personal guidance
Issues quiz questions
Sage’s answer questions
Students take multiple choice quiz and turn in their answers

In class, during the 2nd half of the two hour class period
Students participate in quiz discussion and are encouraged to tell the instructor that their answers are correct
Students due Quiz A session with quiz questions
Instructor answers questioning. This is the instructor’s choice to deliver content, e.g. - Will provide, not common pitfalls, their connections, etc.

3. Preparing students for the future

What students are accustomed to
What is being asked of the students
What we are preparing students for

4. Content driven by students

The wiki textbook is co-authored by all of the students as they take turns throughout the term:
• Creating and revising wiki articles
• Providing worked out examples
• Creating simulators to experiment with
• Illustrating concepts by creating 3-minute narrated powerpoint presentations

Benefits:
• Peers who have recently made sense of the material can do a better job of explaining the basics that are taken for granted by someone with more expertise.
• Ownership and accessibility of the material
• Topics are explained in terms of students’ own thoughts, own language, and own voice

The original parameters have been modified to produce an error of zero.

5. Timely feedback for the students and the instructor

• Daily quizzes that do not affect grade much
• Encouraging students to argue in favor of their answers provides instructor and other students with information about pitfalls and misconceptions
• Timely feedback for the students
• Providing many different ways for students to find out what they don’t know while they can still get help
• Simulators provide feedback for the students on what does and doesn’t work as students try to apply what they are learning
• Timely feedback for the instructor
• Effective teaching depends on the instructor acquiring pedagogical content knowledge, i.e., knowledge about what works well in helping students learn the course material
• By having students drive the class, class time can be used to address what students need help with
• By being able to be responsive to students’ needs, the content that the instructor delivers has greater impact because the students are ready for the answers
• Acquiring technological pedagogical content knowledge, i.e., how to effectively use technology in helping students learn the course material
• Learning how to help students create and experiment with simulators
• Learning that compared to using a 1-on-1 tutoring session feel.

6. A supportive environment for active learning

• Engaging students by empowering them to contribute in meaningful and creative ways
• Supporting students’ exploration of the material that is driven by what they find interesting and useful
• Making a class of 113 students feel smaller
• Accommodating many learning styles/modes:
  • Multiple perspectives of the same material
  • Learning by authoring, presenting, and teaching
  • Learning by trial and error with simulators

http://controls.engin.umich.edu/wiki