

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:

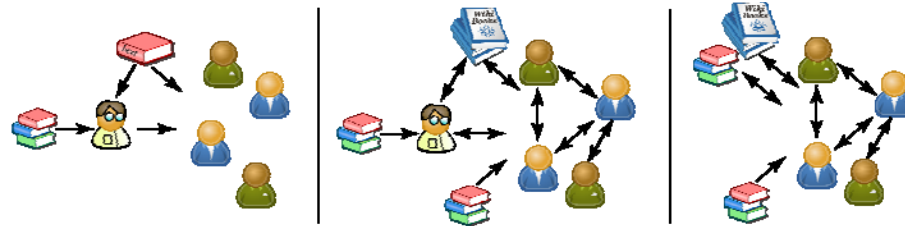
1. How can the instructor engage students in coming up with their own questions on a topic before the class period in which the topic will be covered?
2. How can the instructor get a sense for "where students are at" in time to make adjustments in delivering content?

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

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:

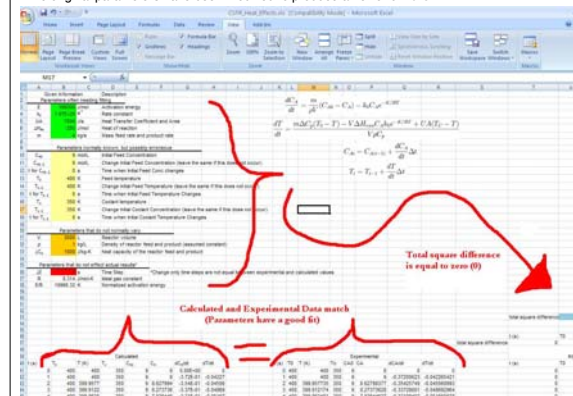
- Peers who have recently made sense of the material can do a better job of explaining the basics that are taken for granted by someone with more expertise.
- Ownership and accessibility of the material
 - Topics are explained in terms of students' own thoughts, own language, and own voice

From http://controls.engin.umich.edu/wiki/index.php/Fitting_ODE_parameters_to_data_using_Excel
Fitting ODE parameters to data using Excel

Authors: Anthony Campbell, Victoria Cardine, David Hines, Stephen Kerns/Date Revised: 14th September 2007

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2 Adding in the Solver Application in Excel 2007
3 Using Excel Solver to Fit ODE Parameters
4 Worked out Example 1: Mass Balance on a Surge Tank
5 Worked out Example 2: Fitting a heated surge tank model (a heated CSTR) parameters to data in Excel
6 Sage's Corner
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The original parameters have been modified to produce an error of zero.



- In the example on the left:
 - Students provided invaluable support to their fellow classmates by providing a step-by-step tutorial. This mitigated the great unforeseen difficulty that was caused because CAEN had just upgraded to the 2007 version of Excel.
 - Annotations help provide more of a 1-on-1 tutoring session feel.

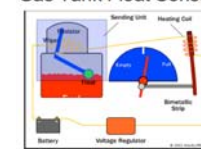
- The example below shows how students used a powerpoint presentation to make connections with prior knowledge and with everyday life.

From <http://controls.engin.umich.edu/wiki/index.php/LevelSensors>

Sage's Corner

Automotive Applications of Level Sensors

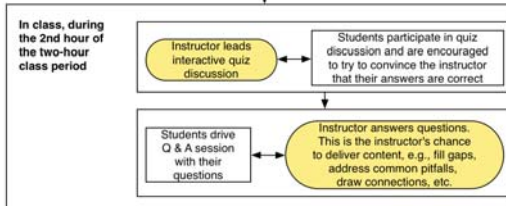
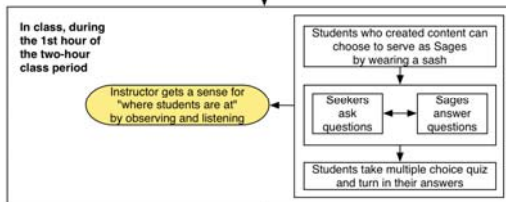
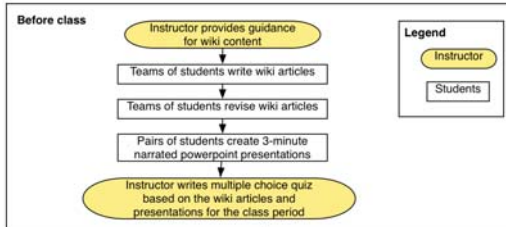
Gas Tank Float Sensor



- As fuel leaves tank, float lowers
- Wiper moves further down resistor
 - More resistance
 - Less current
 - Coil cools
 - Strip pulls with contracting metal

A copy of the slides can be found here: [Unrated Slides](http://controls.engin.umich.edu/wiki/index.php/LevelSensors)

2. Mechanics



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 assess and 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 discussion board, the wiki textbook is more helpful, coherent, and looked at more often

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>