Interactive Simulations combined with Screencasts and ConcepTests

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Introduction/Project Overview

We propose to prepare interactive *Mathematica* simulations that focus on important concepts for chemical engineering thermodynamics, a junior-level course that will have a total enrollment (2 sections) in fall 2015 of about 190 students. These simulations will be incorporated into ConcepTests that will be used in class with clickers and peer instruction. The simulations will also be posted on our web site, and short simulations for a two-hour exercise had higher mastery of the concepts than students who did a laboratory exercise. In another example they found that 80% of students mastered a concept using a simulation in a quantum course, whereas only 20% mastered the concept in a course with traditional instruction. They found that when something unexpected was observed in a simulation, students question their understanding, and this motivated them to change parameters and observe how the simulation behaves.

Clicking on the button on top right of this this simulation displays a temperature-entropy diagram for the same cycle. The pull-down menu in the upper left corner displays a schematic of the cycle, as shown on the right of Figure 2. This simulation allows students to better understand how the pressures chosen for system operation affect the overall performance.

We propose to prepare additional simulations for thermodynamics so that all the important concepts are represented in interactive simulations. We also propose to prepare short (2-4 minute) screencasts that describe how to use each interactive simulation. The screencasts will be prepared using Camtasia software and processed to remove dead times and 0.002 Tc -0.002 Tw -12.815 -1.141 Td [(w -14.55 Tc 0 Tw [)2()]TJeck[(w -14.)]TJ /TT1 1 T

behavior. Links to the simulation and accompanying screencast would be provided on D2L so student can use them on their own.

Assessment

Assessing the effectiveness of the combined ConcepTests/interactive simulations/screencasts will be done by comparing student performance on conceptual questions on the final exam. The objective will be to determine if student performance improves when interactive simulations and screencasts are added to ConcepTests. Since this course was taught using ConcepTests and clickers in fall 2014, comparisons will be made to student performance on the conceptual questions on the fall 2014 final exam. The conceptual question were about 40% of the total exam points. The student solutions to this exam were saved. The average performance on each question will be calculated and then compared to student performance on conceptual questions for the fall 2015 course. Student performance on questions on the same concept, with and without interactive simulations, can be compared to determine if the simulations increased student understanding. The conceptual questions on the exam are not multiple choice, but are short answer and thus provide a good measure of student understanding. Although this comparison is not an extensive assessment, it should provide an indication of the value of the interactive simulations, and with the limited budget, it is the only realistic assessment possible.

Timeline

The interactive simulations and screencasts will be prepared during the summer so they are complete

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