PRE-CLASS ONLINE MODULES: "LOW COST" VERSION OF A FLIPPED CLASSROOM?

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Motivation
Preparation before class can significantly improve the learning process by "priming" the mind of students before they enter the classroom. Online modules can enhance student learning as a form of flipped classroom at relatively low cost to the instructor.

Research Questions
How do these online modules...

- Improve the learning process or speed at which material is learned?
- Improve retention of course material or depth of understanding?
- Influence students with varying technical background?

Online Modules
Issue modules via Lesson Builder in CTools

Module Topics
- Mechanical Energy
- Electricity
- Resistive Circuits
- Diodes
- EM Waves
- Solar Energy & Solar Cells
- Batteries

Modules consist of:
- Short videos (typically Youtube)
- Short problems and solutions
- Approximately 20-30 minute commitment before class

Project Design
Introduce online modules via CTools and assess student understanding and confidence in material

Specific course details:
- Engineering 100, Winter 2014
- Emphasis on solar energy
- Introductory physics and circuits

Assessment
Concept Inventory
20 questions on mechanical energy, resistive circuits, diodes, and energy

Quizzes
Single question at end of class related to material just presented

Example: You would like to charge a battery with capacity of 2 Wh. Given a solar cell power conversion efficiency of 15% and incident solar power of 1000 W/m^2, what area of solar cell would be required to provide the required power to fully charge the battery in 10 hours?

Survey of confidence:
- I do not feel confident even starting the problem.
- I have an idea of where to start but don’t feel confident in implementing the concepts
- I am fairly confident, but I am having difficulty understanding _________
- I am confident in the material

Results
Quiz Performance

- No correlation observed between quiz performance and modules, though quiz performance is generally high for all students

Confidence in Material

- Slight increase in confidence reported for groups receiving modules, but not conclusive

Conclusions
While the initial data do not indicate pre-class modules significantly help students understand the material, better assessment tools may more effectively evaluate the impact of the modules. Additionally, feedback from surveys on the value of the online modules will be solicited to better understand student perspective on module worth, and additional data, including the exam scores and end of semester concept inventory, will be analyzed to evaluate whether the modules have a long-term impact on learning the material.

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