Flipped-Classroom Pedagogy

Motivation:

– Students are actively engaged
Shortcomings of Purely Online and MOOCs

Disadvantages:

• Discipline to watch online material regularly
• Lack of timely, face-to-face interaction
• Hard to form social skills and support networks
• Assessments must be auto-graded

“In fact, the learning outcomes for students in purely online conditions and those for students in purely face-to-face conditions were statistically equivalent.”

2010 Dept. of Education Report
Flipped-Classroom or Hybrid Approach

“Instruction combining online and face-to-face elements had a larger advantage relative to purely face-to-face instruction than did purely online instruction.”

2010 Dept. of Education Report
Flipped-Classroom Pedagogy

• Procedure:
  – **Pre-class**: watch a 15-minute module and answer a brief online concept quiz (5%)
  – **During-class**: discuss and solve real-world, design-oriented problems in small groups (?); Clickers (15%)
  – **Post-class**: homework problems on individual basis (15%)
Pre-class: Watch a 15-minute video and answer a brief online concept quiz (5%)

Concept Quiz:
Wind turbines typically use adjustable-speed drives for the following reason:

a. to improve the efficiency of the electric drive.
b. to maximize power harnessed by the turbine blades from wind.
c. to prevent the turbine blades from exceeding their rated speed.

www.cusp.umn.edu/power_electronics.php
During-class: Group Discussion and Clicker-based Assessment (15%)

Clicker Question:
The power electronics of a wind-turbine is supplying $P=1\text{ pu}$ and $Q=0.5\text{ pu}$ to the grid at the grid-end. Assume the grid voltage to be $1.0\angle0^0\text{ pu}$. The reactance between the converter and the grid is $0.05\text{ pu}$. Calculate the converter voltage that should be synthesized.

A. $1.026 \angle 2.79^0 \text{ pu}$  
B. $0.976 \angle 2.936^0 \text{ pu}$  
C. $1.026 \angle -2.79^0 \text{ pu}$  
D. $0.976 \angle -2.936^0 \text{ pu}$
Group Discussion and Clicker-based Assessment

Project-based in-class Discussion
Simulation of DC-DC Converters:

Switch-based model

Average power-pole model
Active Learning Classroom
Wrong Answer – Two More Chances
“Nationwide Implementation and Assessment of an Undergraduate Flipped-Classroom Teaching Model in STEM”

A Proposal Submitted to NSF with 59 Universities Collaborating