Flipping General Physics: First Experience & Lessons Learned

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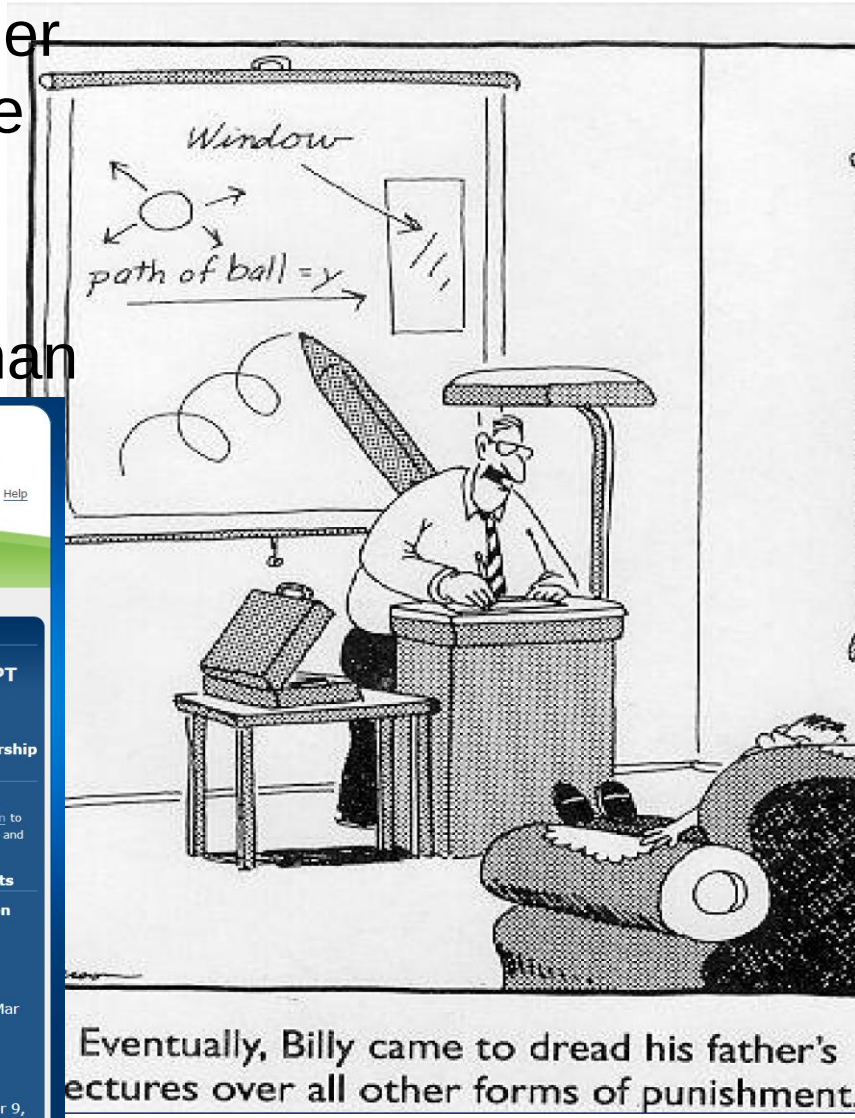
What led me to change?

1. We should not waste time together on things we can do when we are not together.
2. My students learn some topics better from a five minute video than
3
4



Student Workflow

- **Before class**
  - Watch lecture video
  - Work “easy” problems via We
- **During class**
  - Alternate between
    - ConcepTests
    - Group problem solving
  - *Ad hoc* ten-minute lectures when and if needed.
- **After class**
  - Work “hard problems” via WebAssign.

Most HW sets include a mixture of hard questions on the last topic and easy questions on the next topic.

My workflow

Questions driving design:

1. What do I want the students to know and be able to do?
2. How can I and they determine whether they know it and can do it?
3. What instruction do they need for the above?
4. What activities yield deep understanding?

Given the answers to the above questions,

1. Prescribe pre-class activities (lecture videos and easy problems, and perhaps reading and simulations).
2. Choose in-class activities to uncover misunderstandings and gaps.
   - Float during group problem time, ask questions, give hints as last resort
   - Respond in class to widespread struggles with mini-lectures and modified activities.
3. Assign follow-up homework problems to solidify gains.

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The right kind of space is critical

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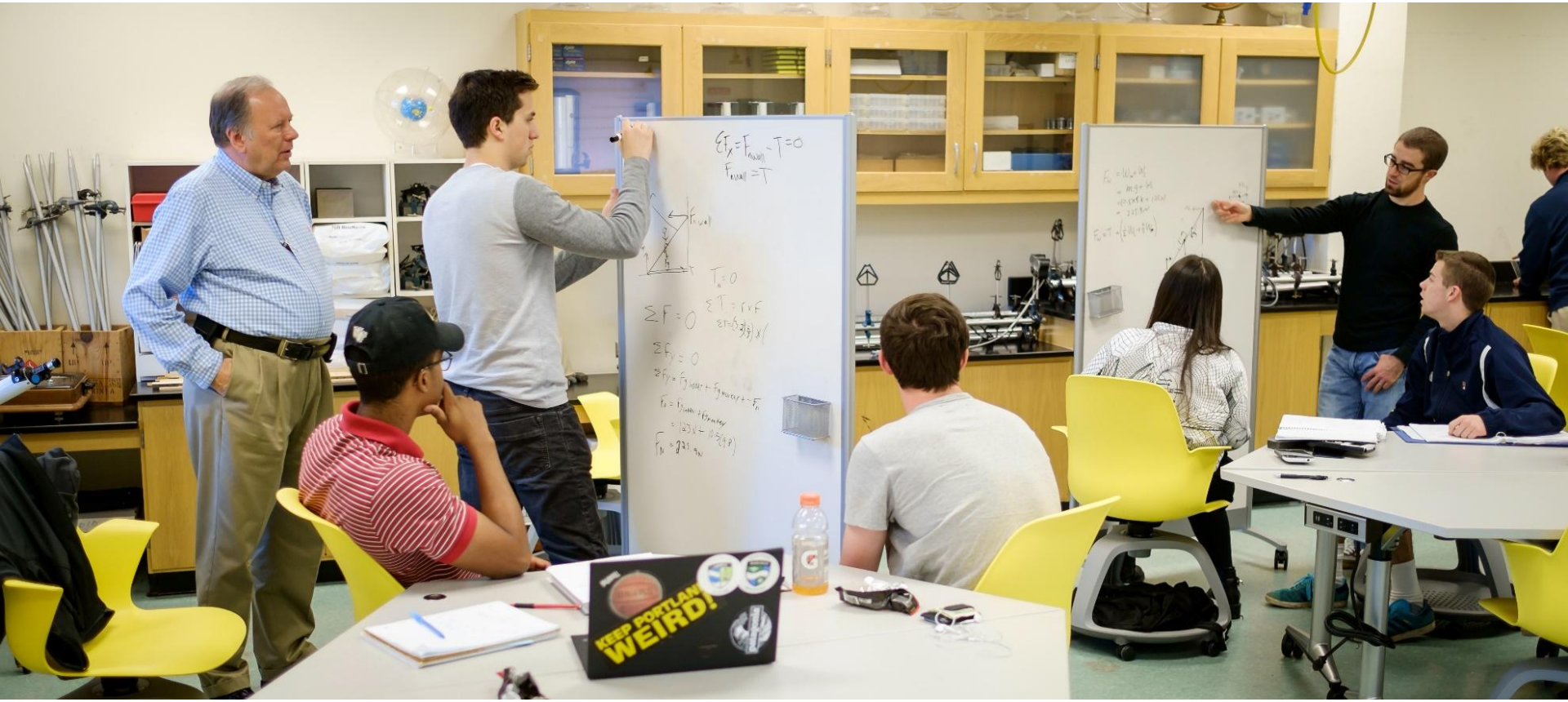
Students work in groups of three.
Instructor and each TA support 3 groups of three students.



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Samples of videos

A few lessons learned

1. **Getting buy-in from students is important**.
   - Students who heard first-day sales pitch: 70% continued in same section second semester.
   - Students who joined after first-day sales pitch: 0% continued
2. This approach naturally drives the teacher toward “backward design” and other **effective pedagogical approaches**.
3. **Twenty-five minutes of class lecture becomes a five minute video** that takes four hours to create from existing material.
4. **Students want more example problems** than we provided in our videos.
5. **I am not yet good at this approach; nonetheless, it works!**

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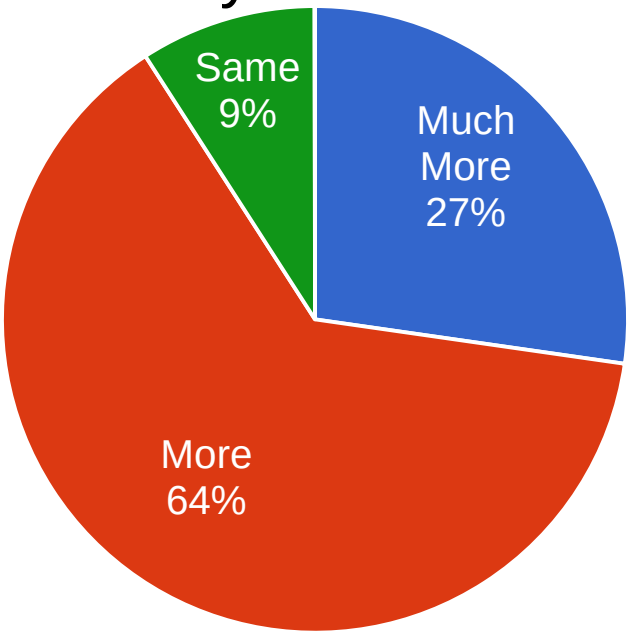
Student assessment of the flipped approach to teaching

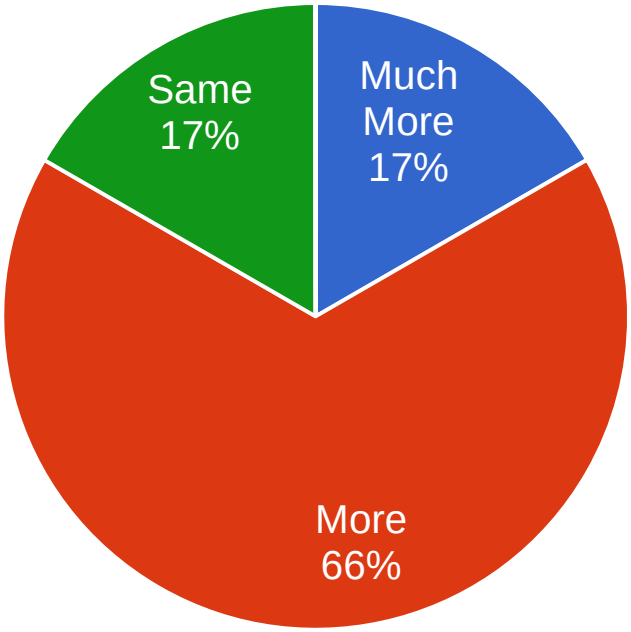
How much do you feel you learned in this courses compared to most of your courses?

Fall 2014, mostly 1st and 2nd year students



Much More More Same Less Much Less

Fall 2015, mostly 3rd and 4th year students

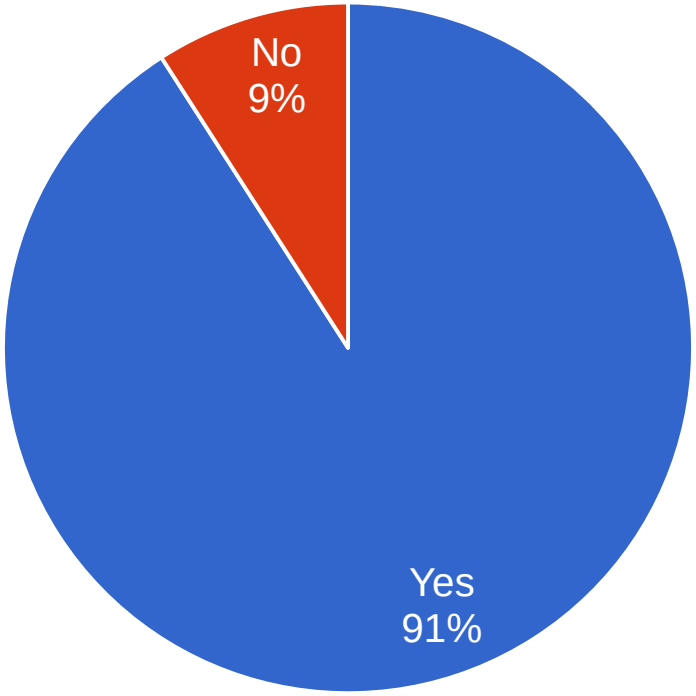


Much More More Same Less Much Less

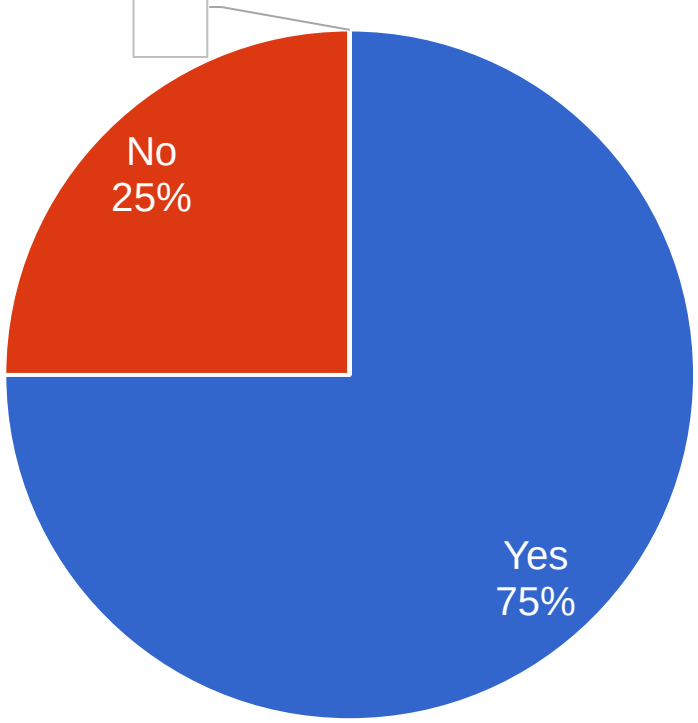
Student self-assessment of learning

Would you recommend other physics faculty adopt this approach?

Fall 2014, mostly 1st and 2nd year students



Fall 2015, mostly 3rd and 4th year students



Student comments

- **From a student in General Physics II, who had been in a more traditional section the previous semester: "Last semester, I left every class confused. This semester I leave every class understanding."**
- **From a student dropping the class: "I am dropping this class because I am no longer pre-med and do not need physics, but I had to stop by to tell you to keep teaching this way. I learned more in this class than in any science class I have ever taken."**

Questions and Comments?