Learning in a Studio Mode, Spotlighting Teamwork and Interaction

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What is Studio?

- Studio is a new type of classroom design & technology, built upon principles from Physics Education Research.
- Studio is but one part of a larger teaching philosophy, structured around student-centered active learning.

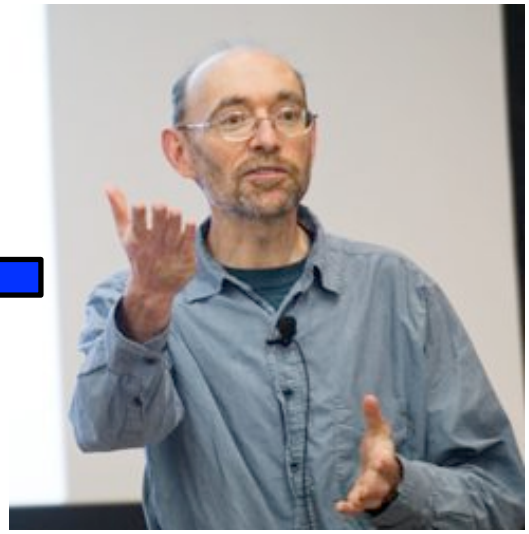
Why do Studio?

- Better learning assessment outcomes (CLASS, FMCE)
- Considerably lower DFW rate
- Better grades on tests and in the course overall
- Students like it better

Class design: Lecture

?

Lecture

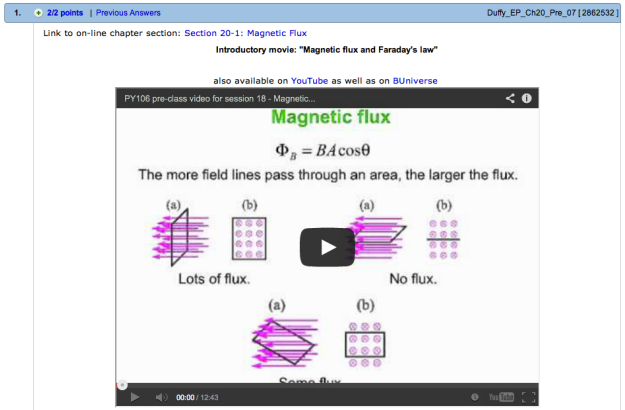


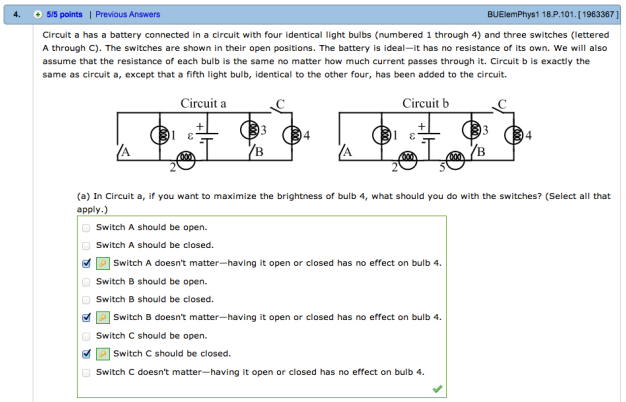
- Lecture is not very effective. Is there a better way to deliver this?

Class design: Pre-Lecture

Pre-lecture

- Multimedia presentations
- Short quizzes
- Written student feedback
- Detailed metrics
- *Prepares both students and faculty for class*

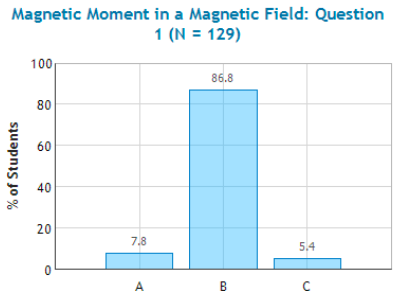


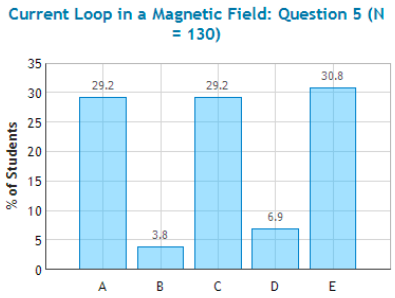


It can be difficult to keep track of the directions for the various forces and fields.

i really didnt understand the idea of loops in the field, could we go over that in more detail

How energy is related to work and how work is related to the magnetic dipole moment is quite interesting, and challenging to me. Can we spend a little more time on these topics?





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Class design: Lecture, Disc, Lab

Pre-lecture | Lecture | Disc | Lab

- Address questions from pre-lecture
- Clicker questions
- Group worksheets
- Simulations

- Work further in small groups
- Assistance from graduate TFs and undergraduate LAs

- Connect hands-on experience to textbook concepts

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Class design: Homework, Help

Office Hours | Online Forums

Pre-lecture | Lecture | Disc | Lab | Homework

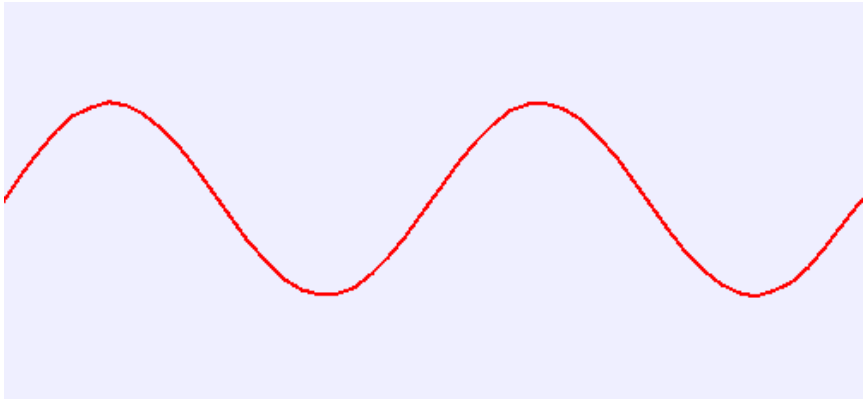
The loop has a resistance of 0.400 Ω, an area of 2.00 m^2, and consists of a single turn. Note that you should be able to do this problem without a calculator, for the most part.

(a) What is the magnitude of the magnetic field passing through the loop at t = 2.60 s?

1.00 ✔ T

(b) What is the magnitude of the induced current in the loop at t = 0.800 s?

5.00 ✖ A



- Opportunity for students to practice
- Online homework offers multiple chances, with immediate feedback
- It also has links, hints, and animations

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Class design: Studio

Office Hours | Online Forums

Pre-lecture | Lecture | Disc | Lab | Homework

In-person, hands-on, and minds-on

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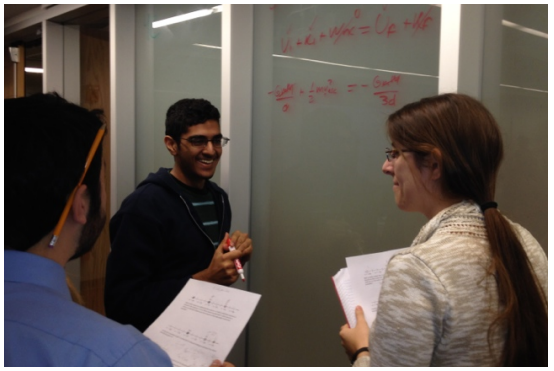
Studio pedagogy

Focus on teamwork & active engagement

- Lecture, discussion, and lab activities combined with technology into optimized learning environment.
- Students in teams of 3, at tables of 9, and at the boards around the room
- Capacity for 81 students supported by one instructor, 2 TF's, and 2 LA's



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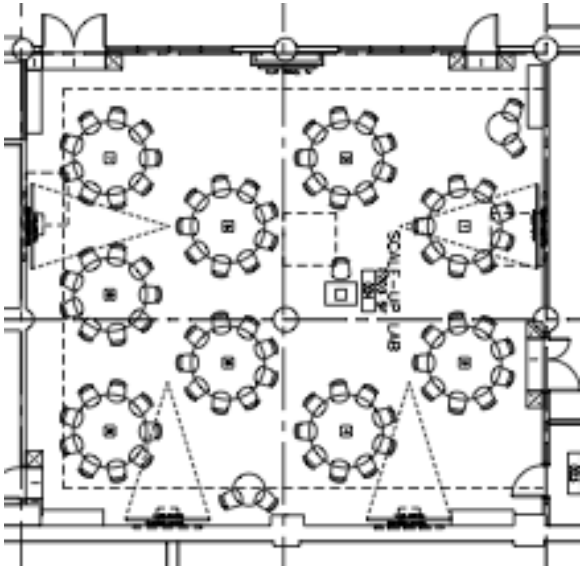
Studio physics at BU



- 1st year of large-scale studio implementation.
- Algebra-based intro physics

3 Studio sections of 81 = 241;

three 2-hour sessions per week.

2 Lecture sections = 198

three 1-hour classes + 1 hour recitation + 3-hour lab (not every week).

- **All students** do the same tests, homework, pre-class quizzes, pre/post tests, and use the same book (Duffy, *Essential Physics*.

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DFW rates

Students who have dropped, failed (received D's or F's), or withdrawn

Section	N	DFW #	Rate
studio	241	8	3.3%
lecture	198	19	9.6%

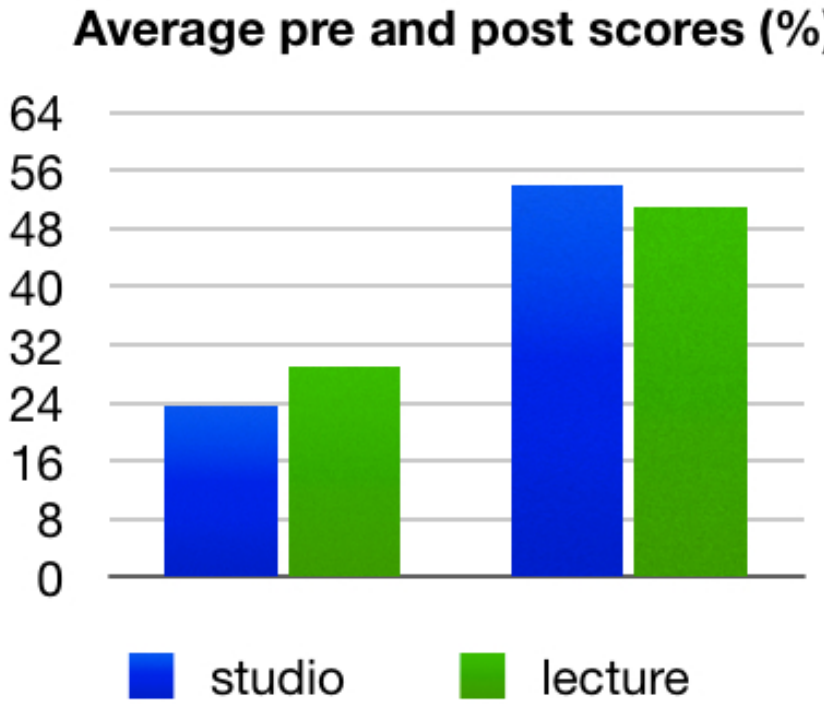
Statistically significant difference, p = 0.01

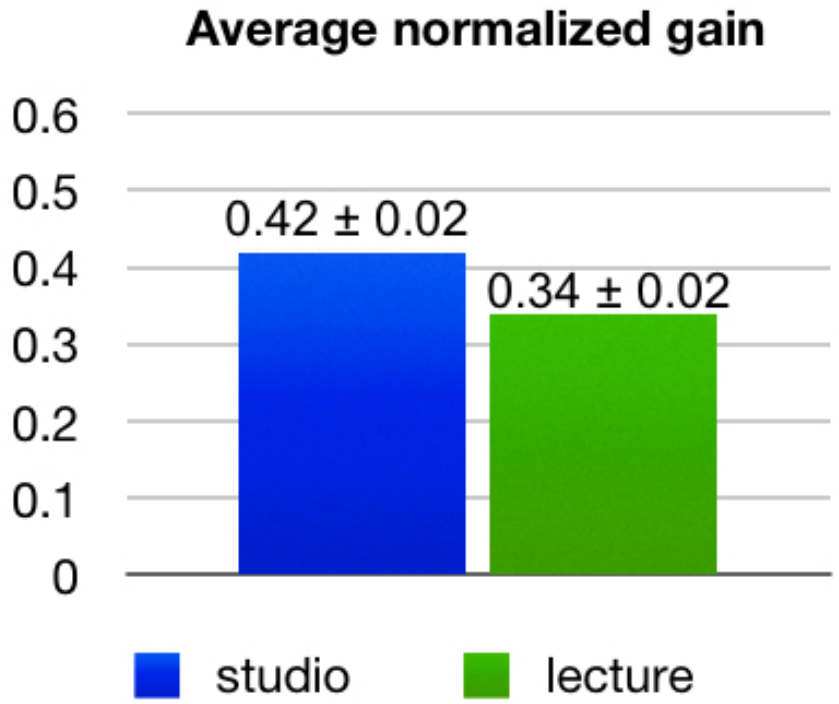
N as of Sept. 18th, two weeks into the semester

FMCE - matched results

$$\text{Gain} = \frac{\text{Post - Pre}}{\text{Max - Pre}}$$

Force and Motion Conceptual Evaluation





N: 215 126

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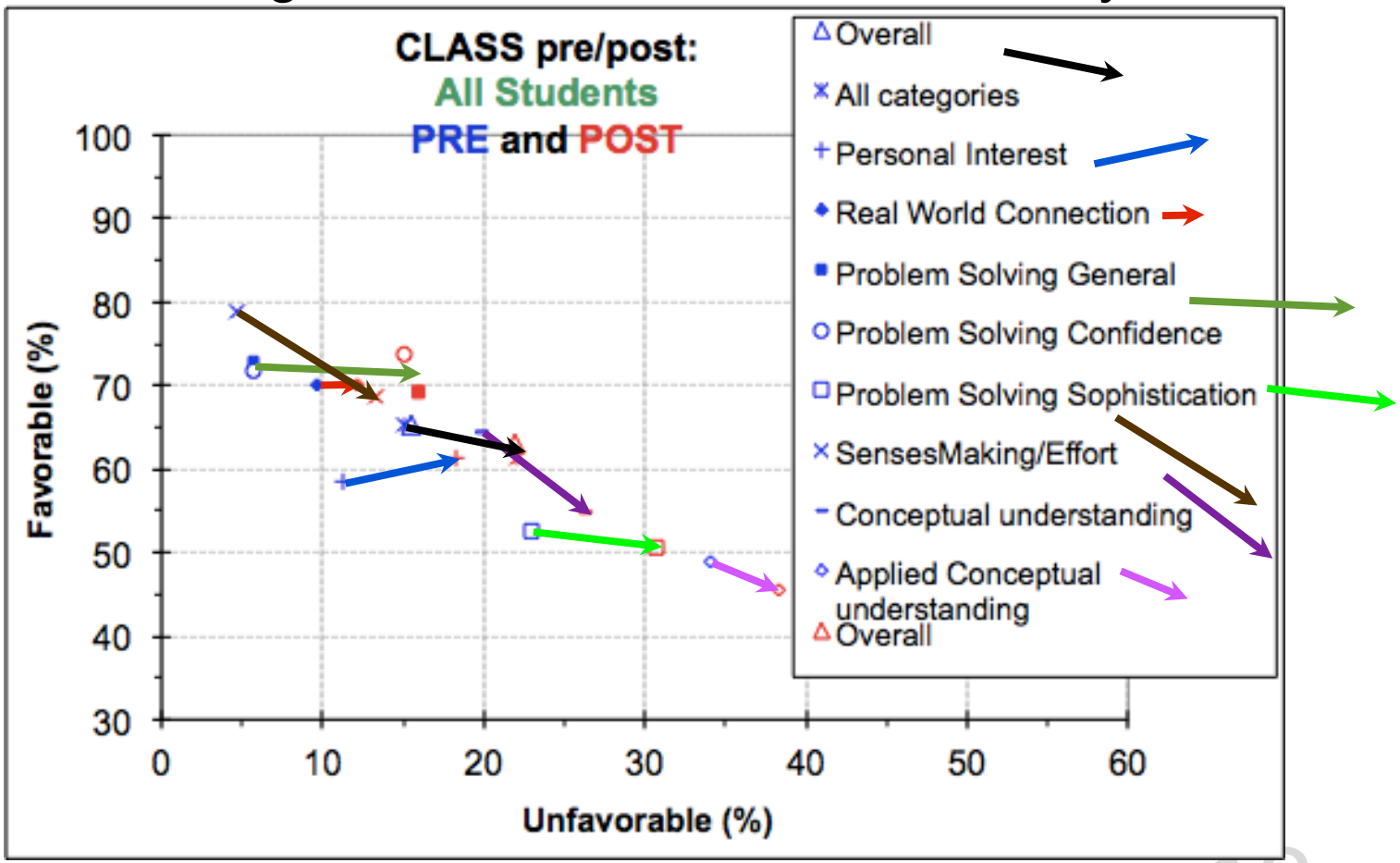
Test, final exam, and overall results

Section	N	Test 1	Test 2	Final	Overall
studio	235	68.9	73.0	68.8	79.1
lecture	183	67.5	68.3	67.1	77.0

All students

CLASS - lecture

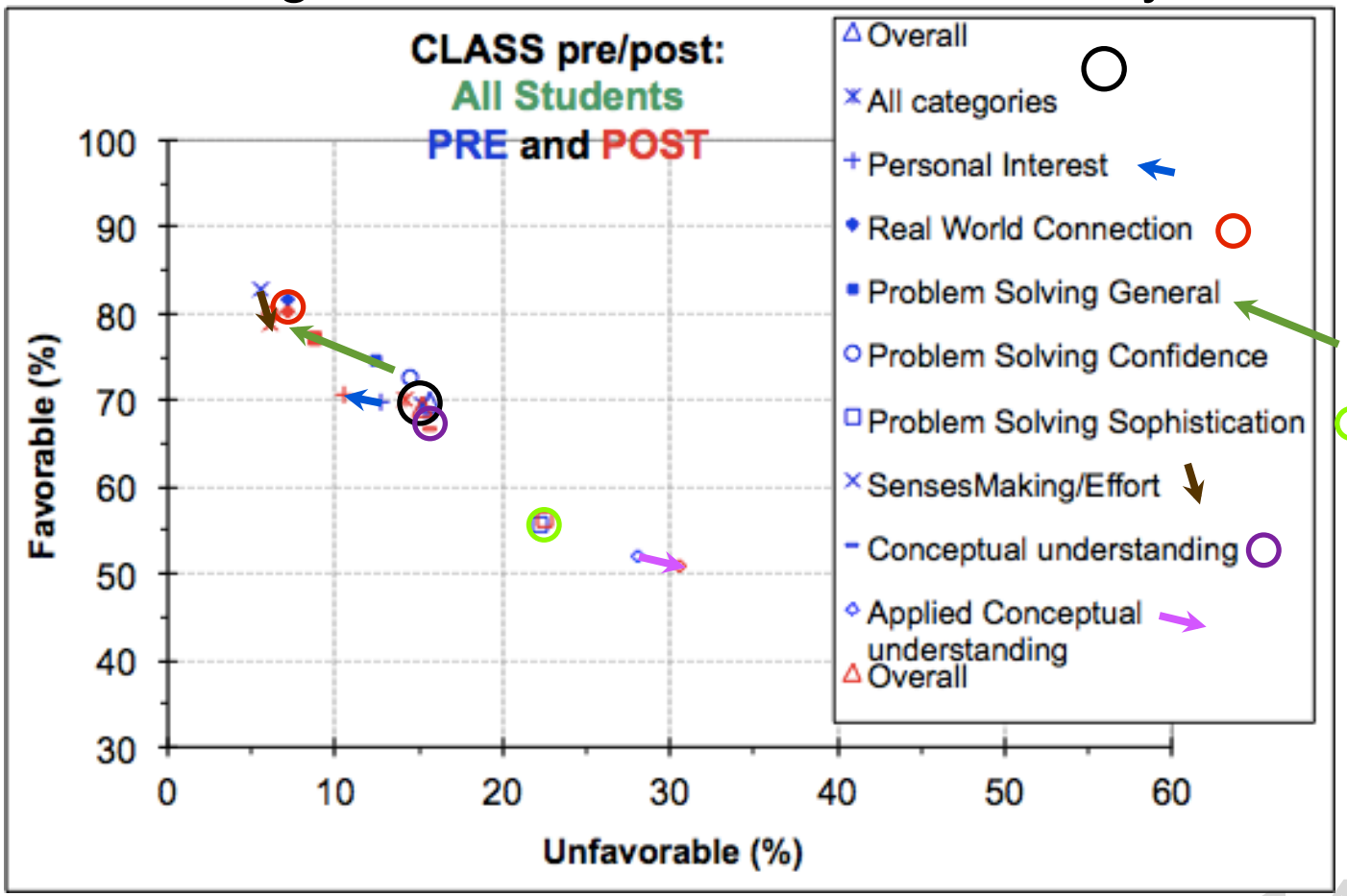
Colorado Learning Attitudes about Science Survey



Shifts down and right – more unfavorable

CLASS - studio

Colorado Learning Attitudes about Science Survey



Essentially no change - a good result!

Student comments

Studio format very useful for learning concepts through problem solving, integrating all parts of the course, encouraging interaction with classmates.

I am very glad I did the Studio Section of this course. I feel like the combo of the pre-sessions and lectures as well as integration of lab/discussion elements worked well.

Studio sections are really good in a way that we can discuss among our groups and also we can get immediate help from teaching assistants or professors.

I really enjoyed the studio set-up, because I feel like I have learned way more through this hands-on teaching approach.

Studio outperforms lecture

- Better CLASS and FMCE outcomes
- Considerably lower DFW rate
- Better grades on tests and in the course overall
- Students like it better

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Studio team:

- **Instructors:** Andrew Duffy, Bennett Goldberg, Mark Greenman, Pankaj Mehta, Manher Jariwala
- **Graduate TF's:** Colin Howard, Adam Iaizzi, Dylan Rankin, Alex Sherman, Hara Troullinou, Ching-Hao Wang, Phil Weinberg, Davis Yang
- **Undergrad LA's:** Alina Agamov, Alex Billias, Jessica Charles, Ben Dickens, Brian Gambardella, Molly Herman, Keiichi Kitanosono, Jonathan Ng, Adam Pearson, Alex Rompala, Kara Siemer, Tyler Wojtasinski, Frank Wong
- **Instructional Labs and Technical Support:** Brian Anderson, Mark Badway, Erich Burton