Flipping Physics

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Traditional Format

Problems with Traditional Format: Lectures

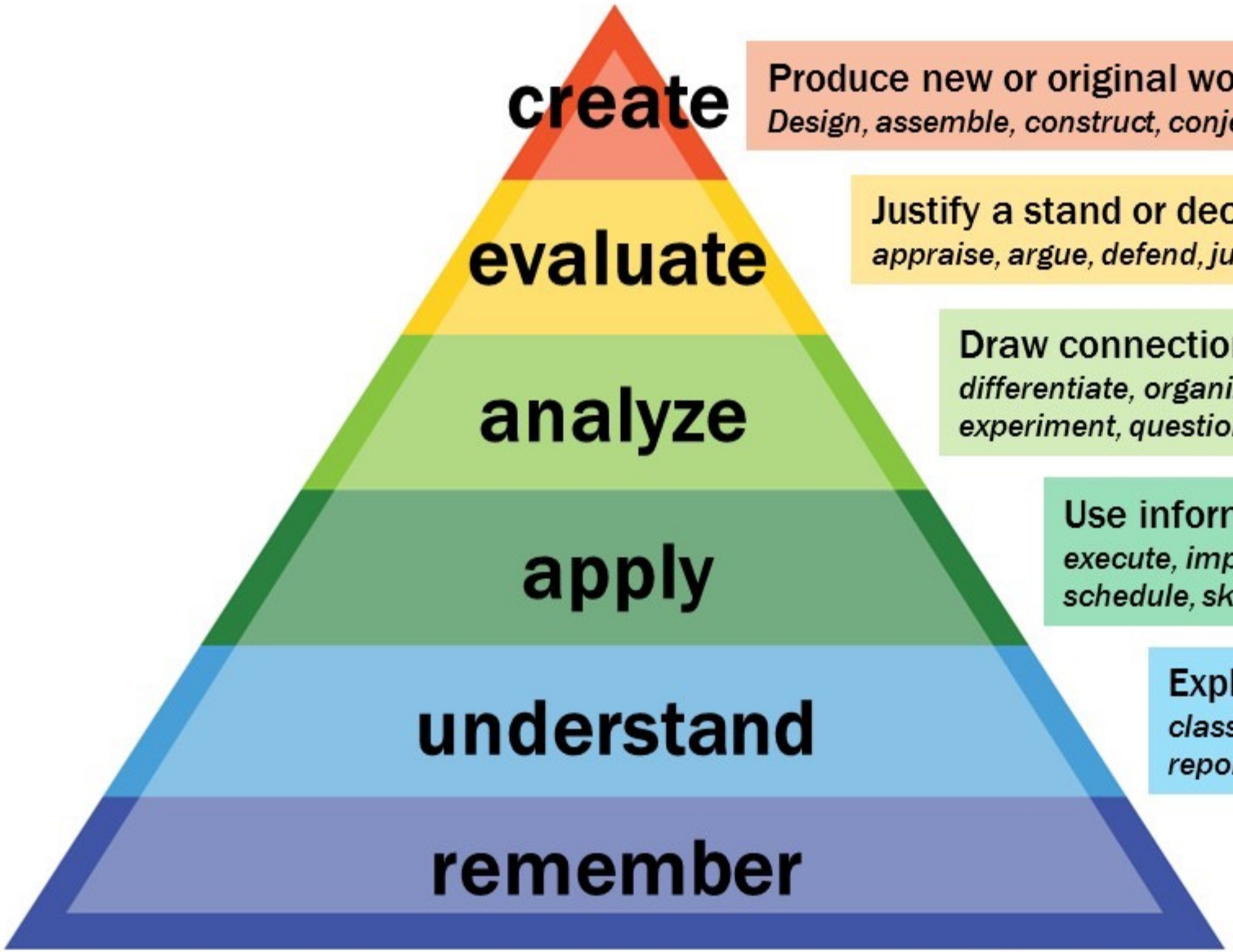
- Students have difficulty maintaining focus during a 75-minute lecture, especially after a long day.
- Students don’t leave the lectures with a strong understanding of the concepts.
- Students have little control over the lecture pace.

Problems with Traditional Format: Homework

- Students try to work homework problems without first understanding the concepts.
- Students find shortcuts in doing homework, including looking up answers online and figuring out what numbers to multiply to get the right answer, without understanding why.
- Students score uniformly well on homework, but there's a huge distribution in test scores.

Flipped Format

Bloom's Taxonomy



Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate

Justify a stand or decision
appraise, argue, defend, judge, select, support, value, critique, weigh

Draw connections among ideas
differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test

Use information in new situations
execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch

Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate

Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state

Advantages of Flipped Format: Lectures

- Students have complete control over lecture pacing:
- Students may adjust the playback speed (0.25X, 0.5X, normal, 1.25X, 1.5X, 2X) by clicking on the Settings (gear-shaped) icon in YouTube.
- Students may pause the video to take notes.
- Students may rewind or replay the video to clarify a difficult point, or may note their questions and raise them in class.
- Recorded lectures average 65 minutes per class period, compared with 75 minutes for an in-class lecture. Watching videos at higher speeds results in even more time savings.

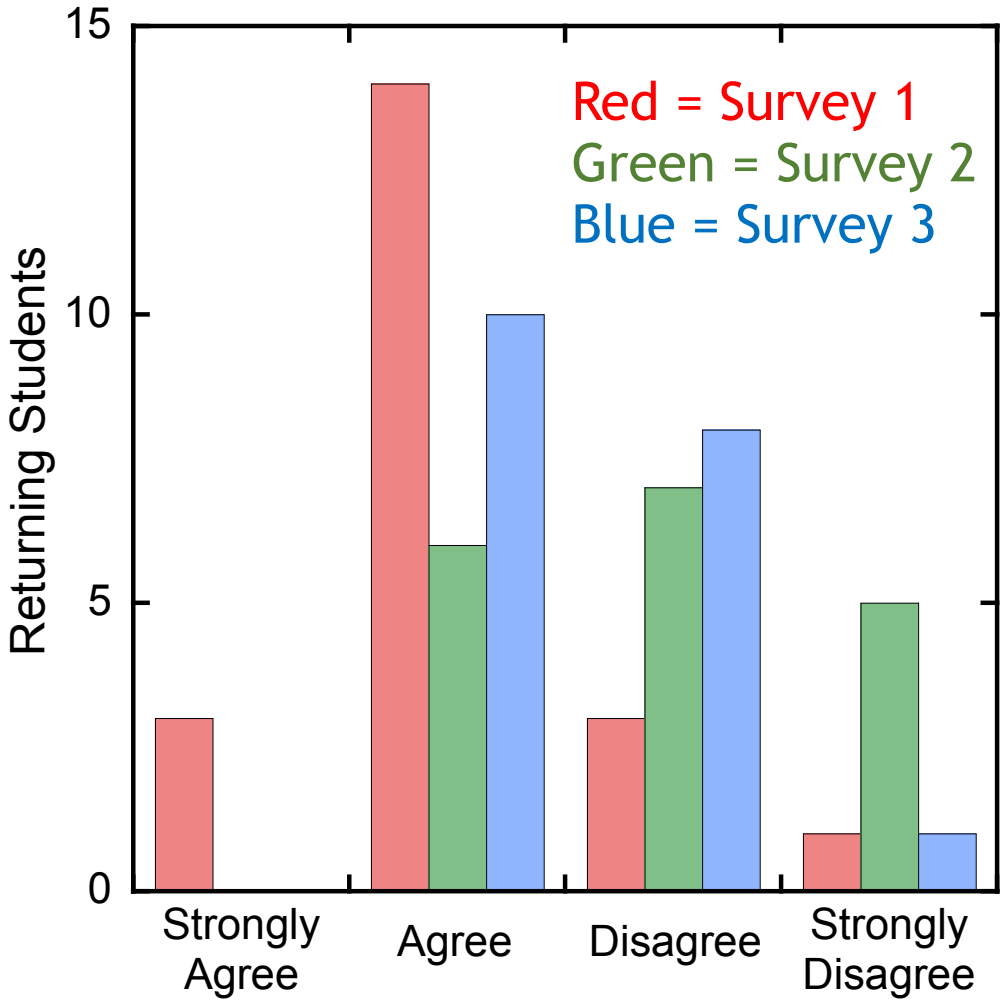
Advantages of Flipped Format: Homework

- The concept quiz at the beginning of each class encourages students to learn the concepts before problems are due.
- Working on problems in class, where help is readily available from other students and the instructor, encourages students to apply concepts and to avoid shortcuts in problem solving.
- Students may work on problems before class to solidify their understanding and to identify questions to ask in class.
- Students learn by helping other students with problems.
- Students may leave class when they have finished the problems.

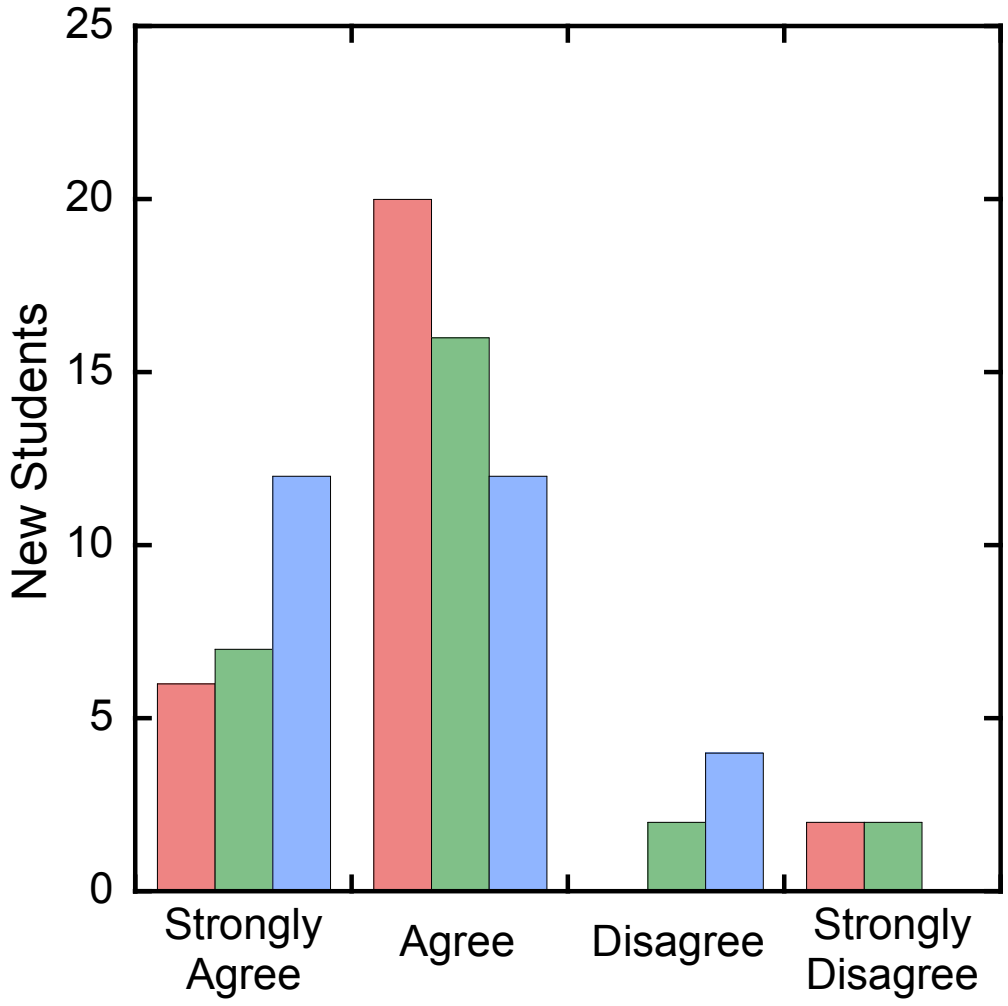
Kahoot! Quiz

Survey Results

1. The flipped format enables me to learn the material more thoroughly and to perform better on tests than the traditional format.

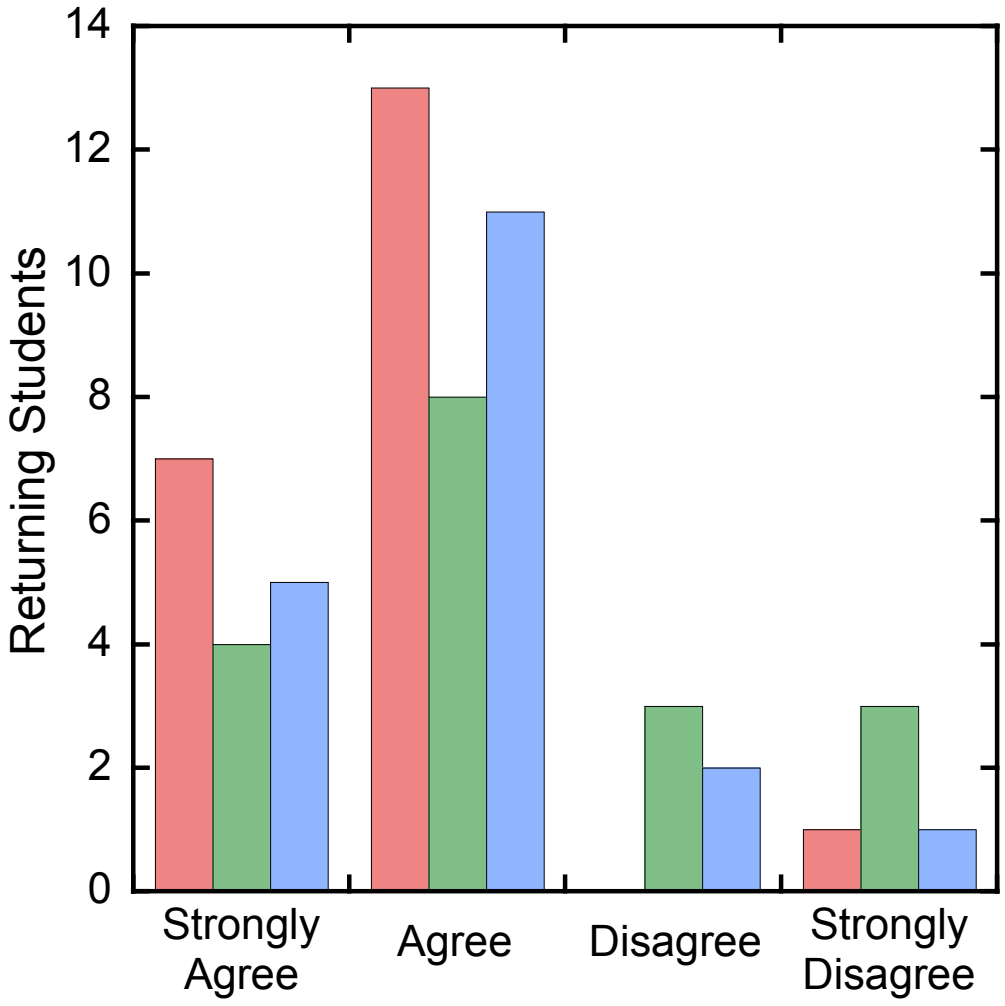


53% of returning students agree

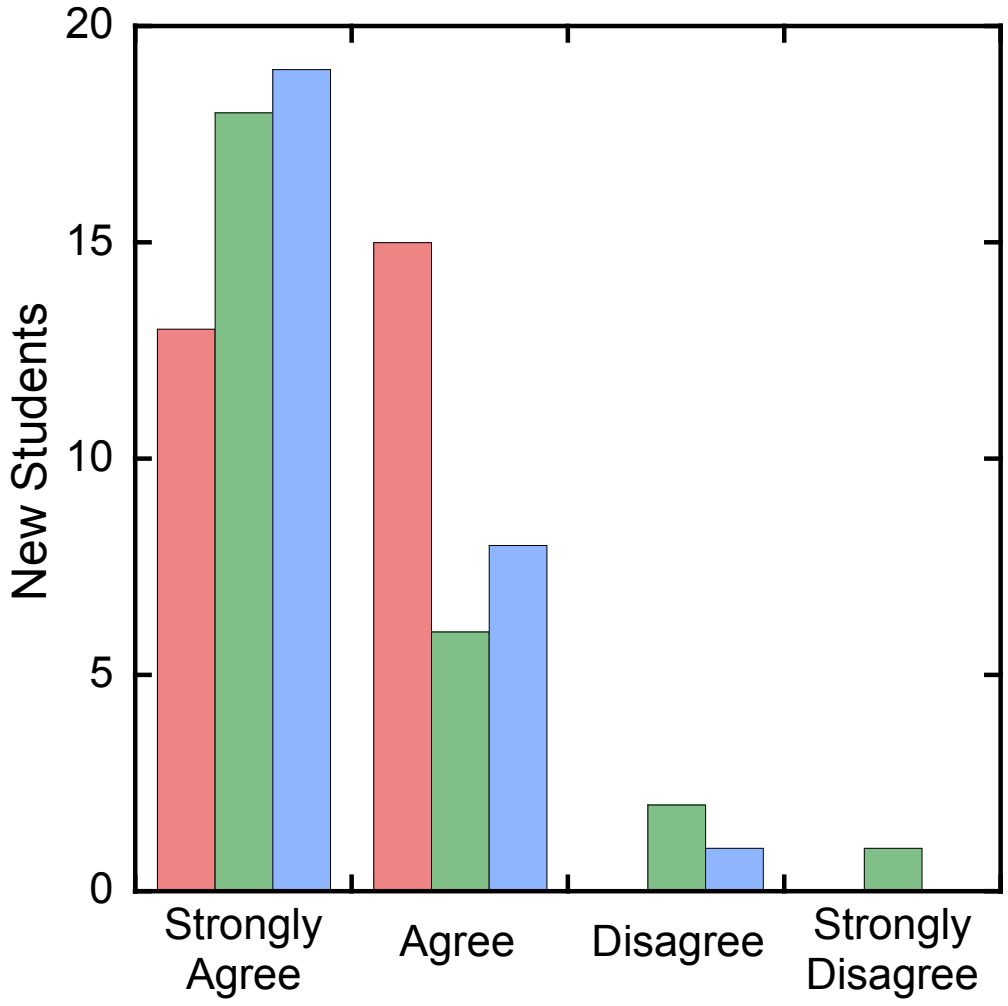


86% of new students agree

2. In-class group problem solving, with the instructor available to answer questions as needed, helps me to understand problems more thoroughly.

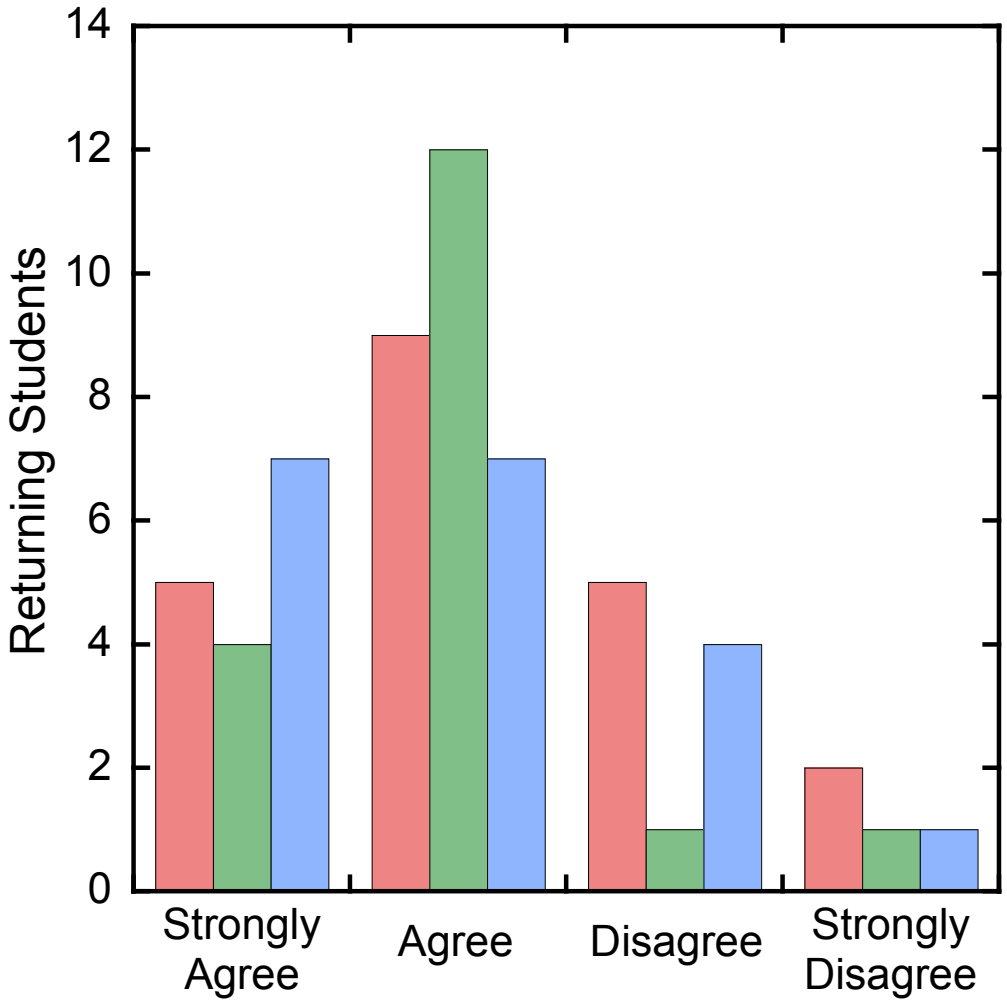


84% of returning students agree

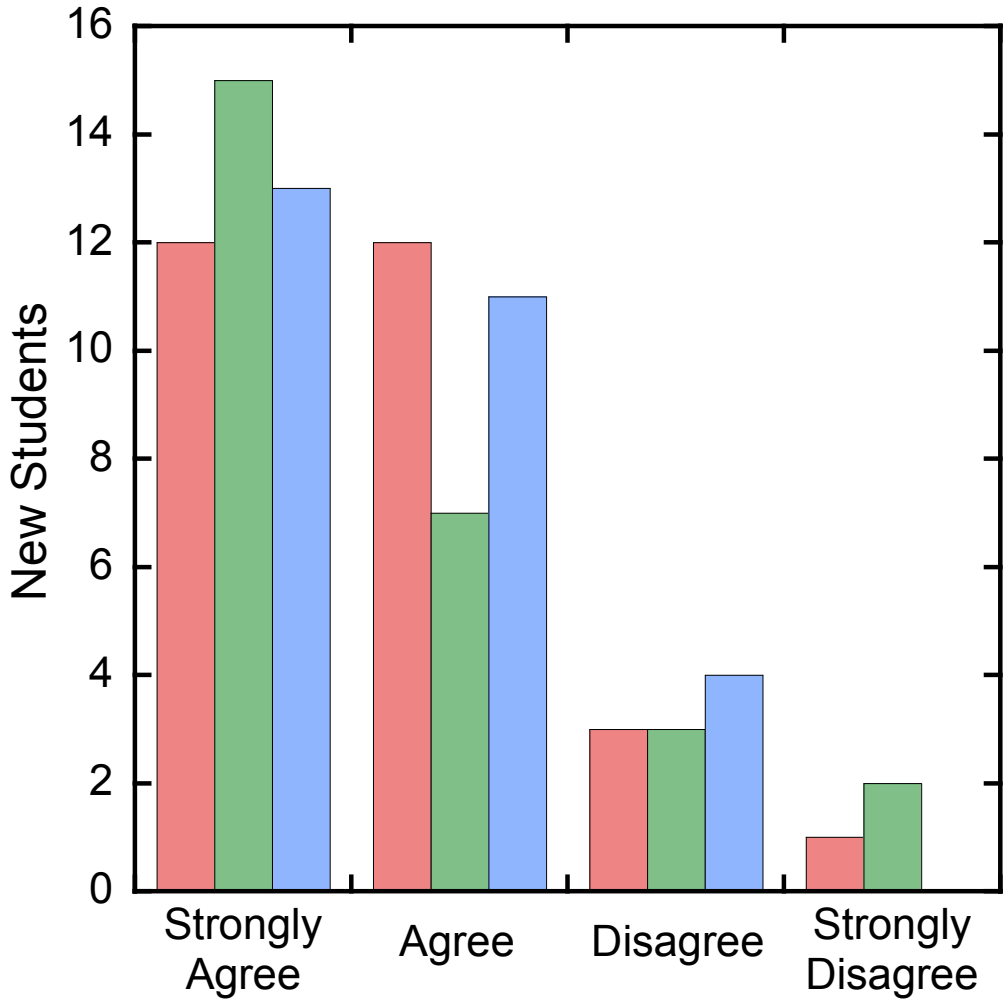


96% of new students agree

3. In-class Kahoot! quizzes motivate me to learn the concepts and to prepare well for problem solving in class.

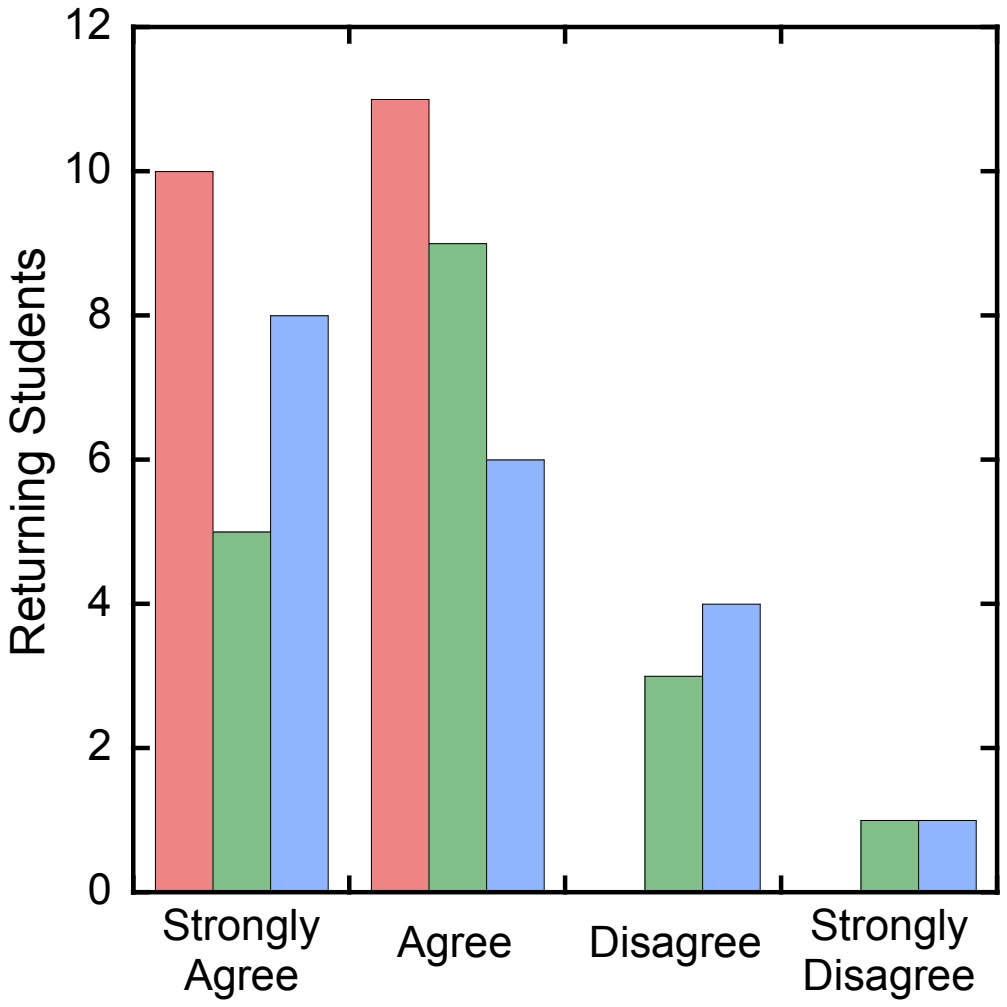


74% of returning students agree

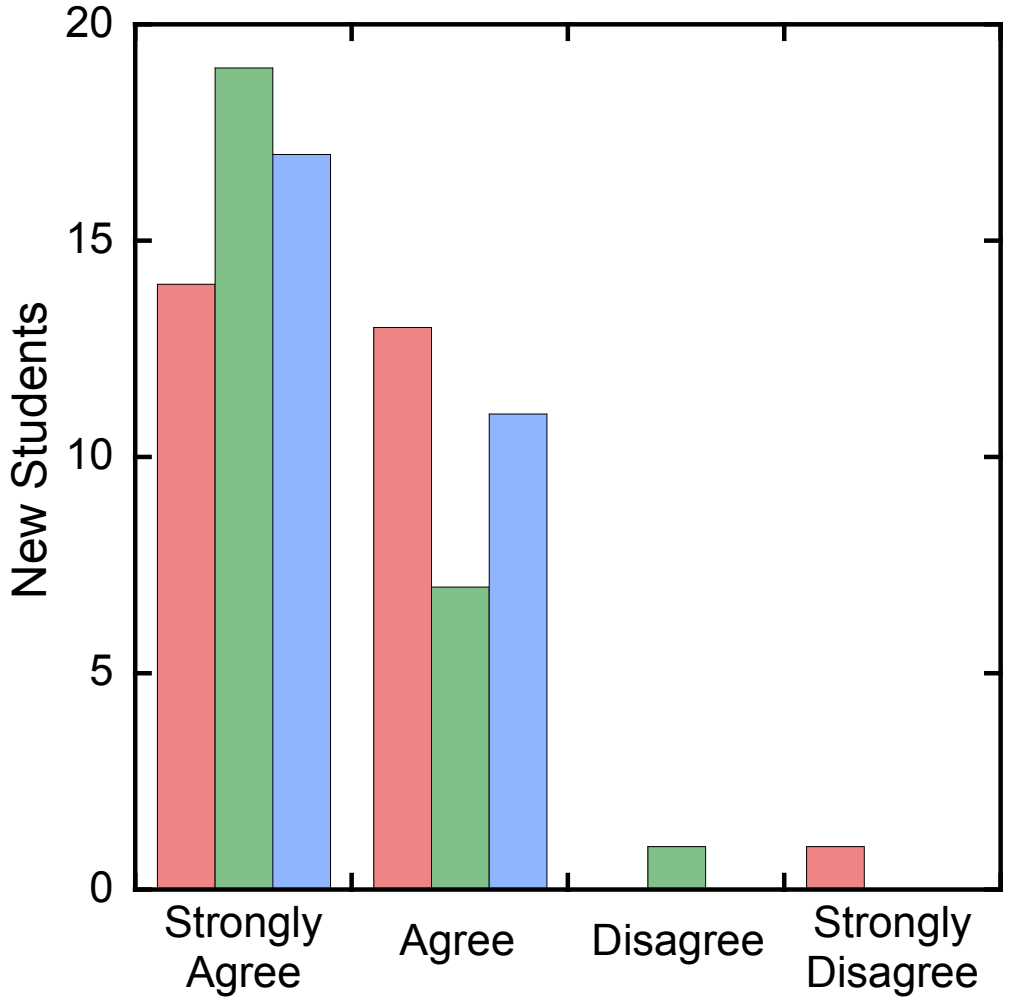


86% of new students agree

4. Learning the concepts before trying to solve problems, rather than the other way around, helps me to understand problems, and the concepts, more thoroughly.

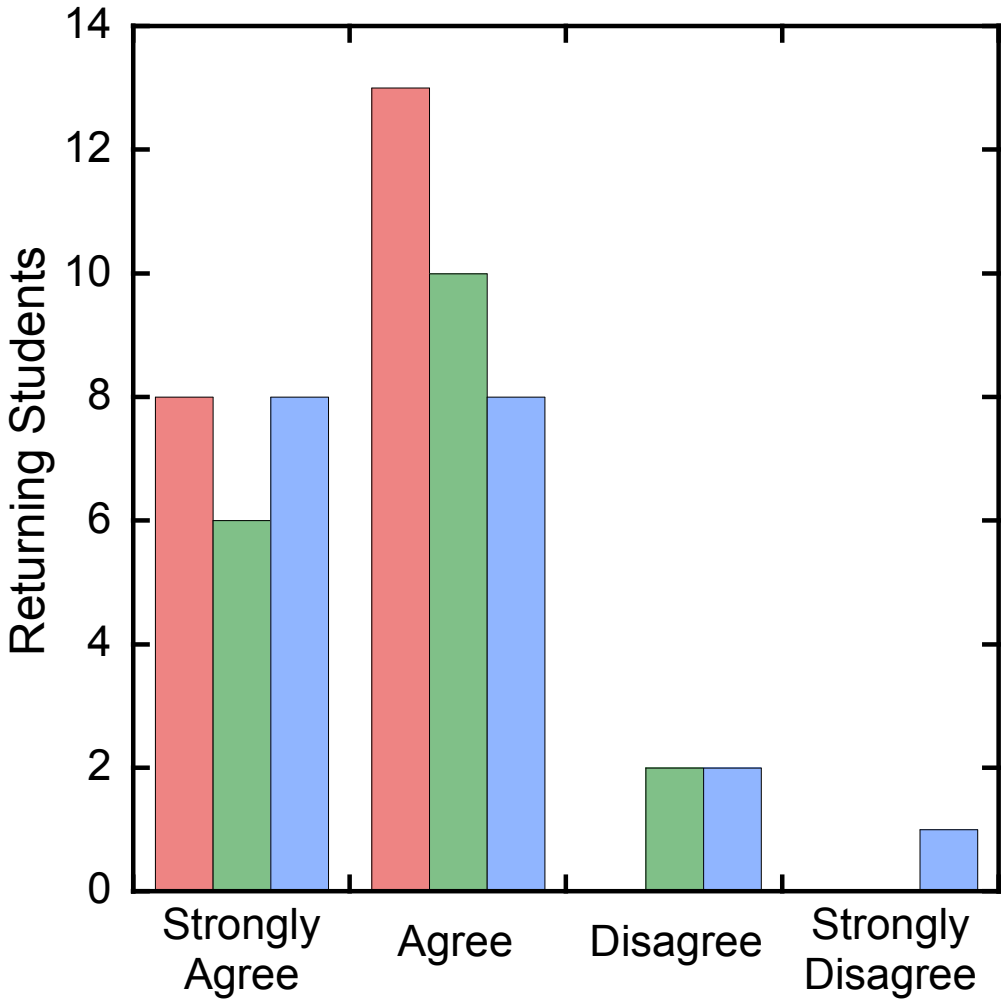


74% of returning students agree



100% of new students agree

5. Having examples presented in class just prior to working on problems helps me to connect these examples to the problems, and to better understand how to solve the problems.



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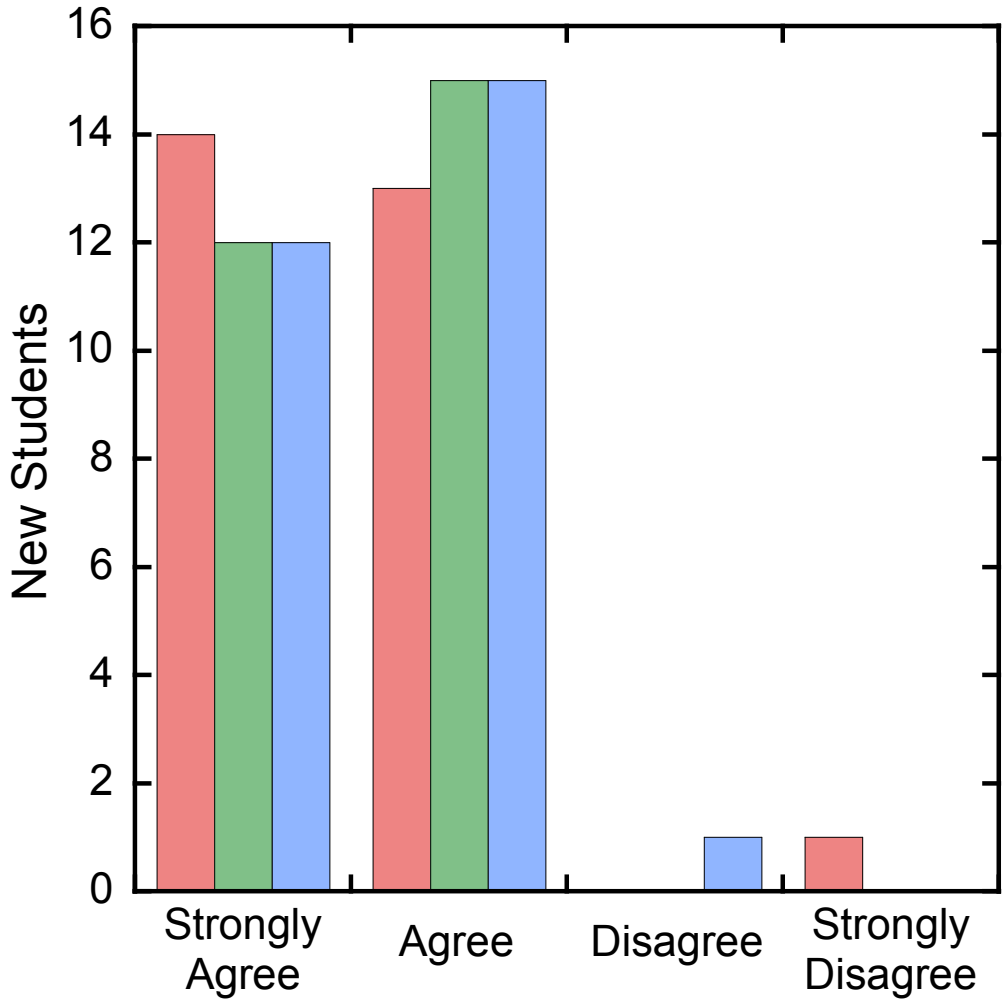
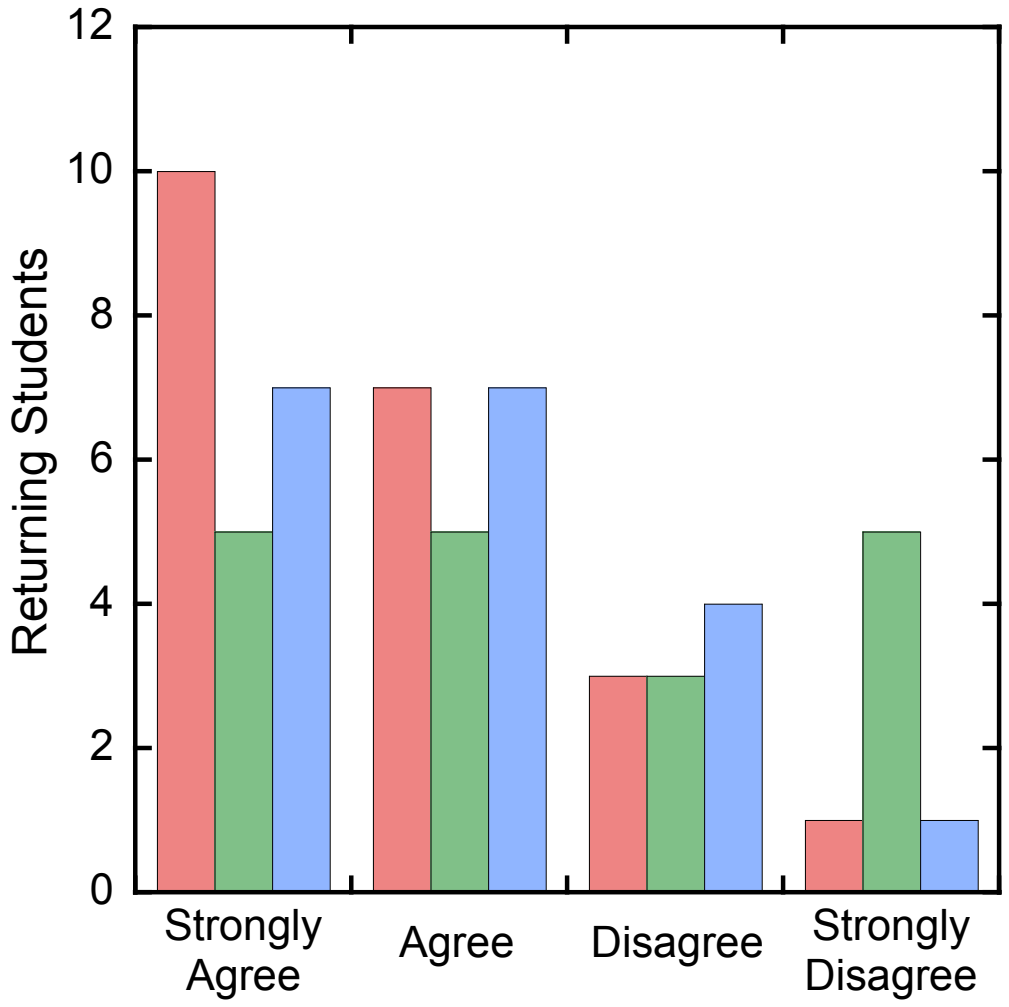
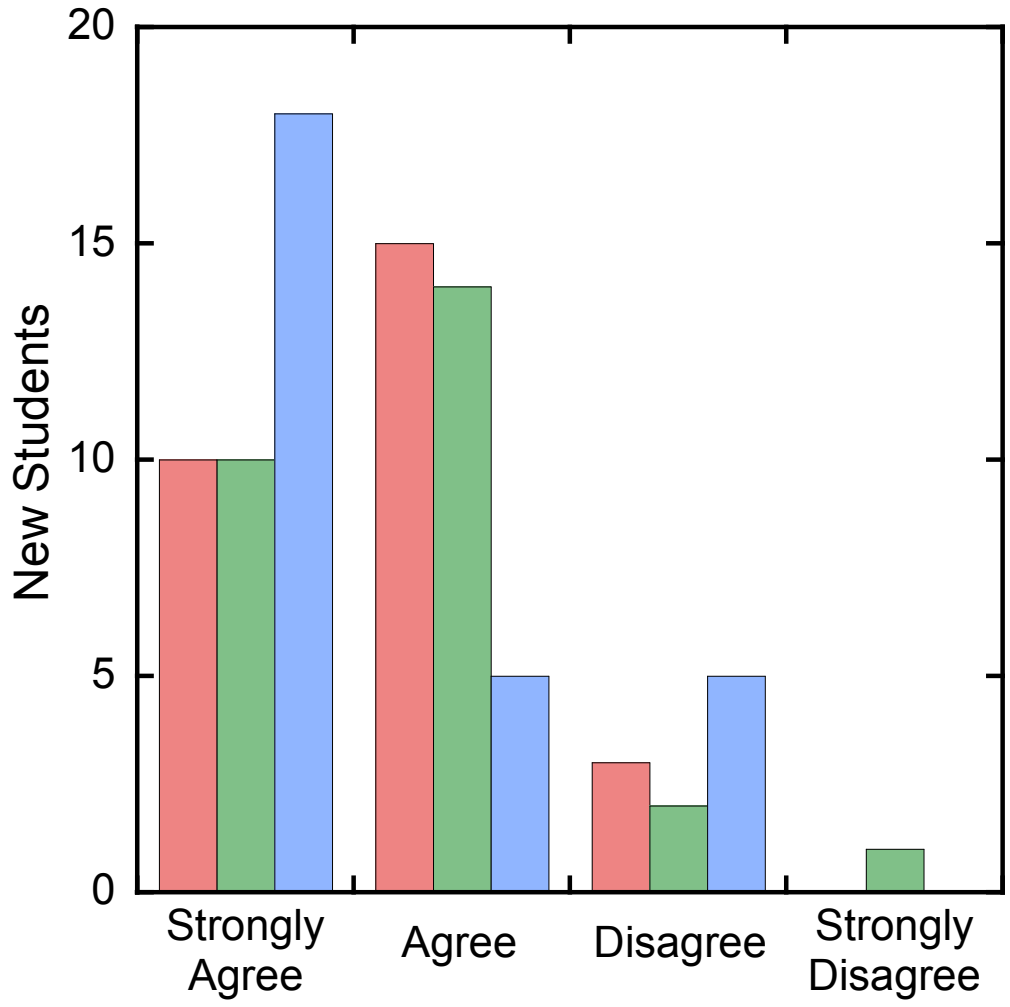


96% of new students agree

6. The flipped format enables me to make effective use of the time that I spend on the
course, and to receive immediate and high-quality help on homework problems.

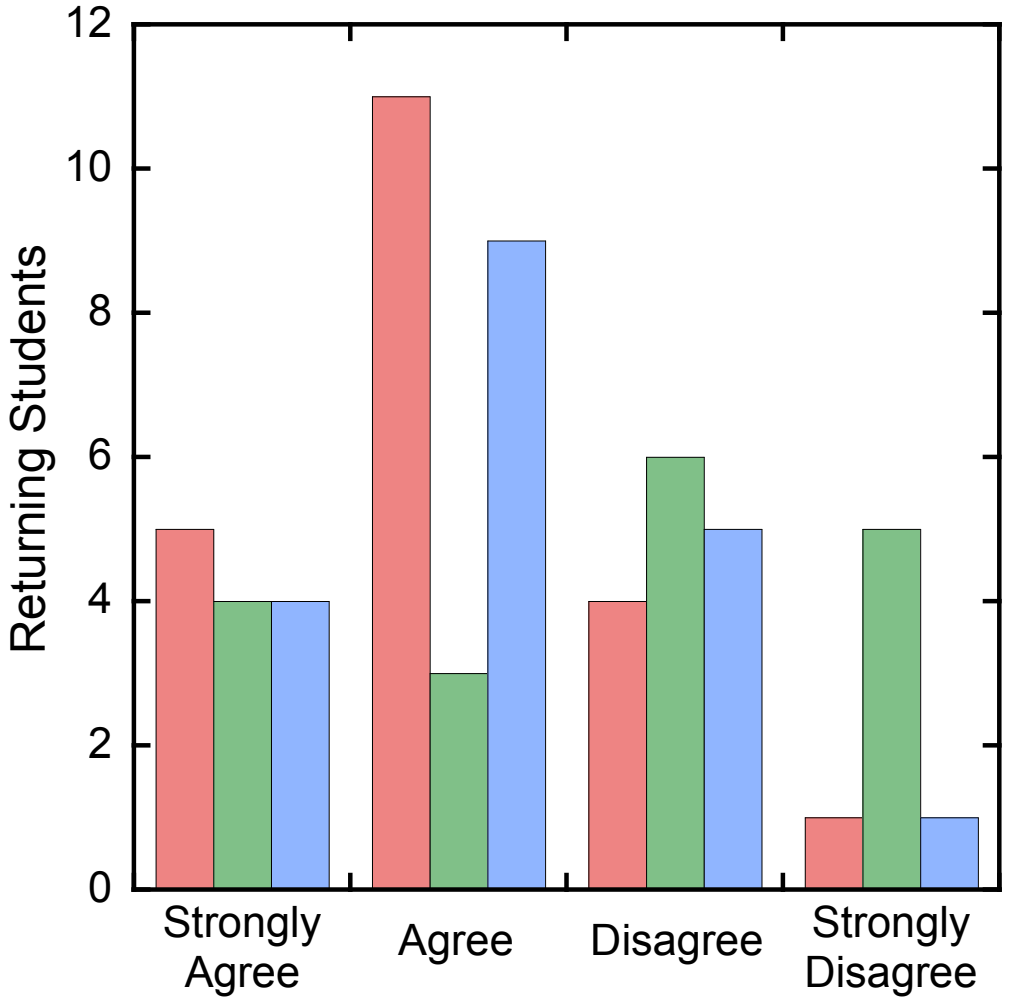


74% of returning students agree

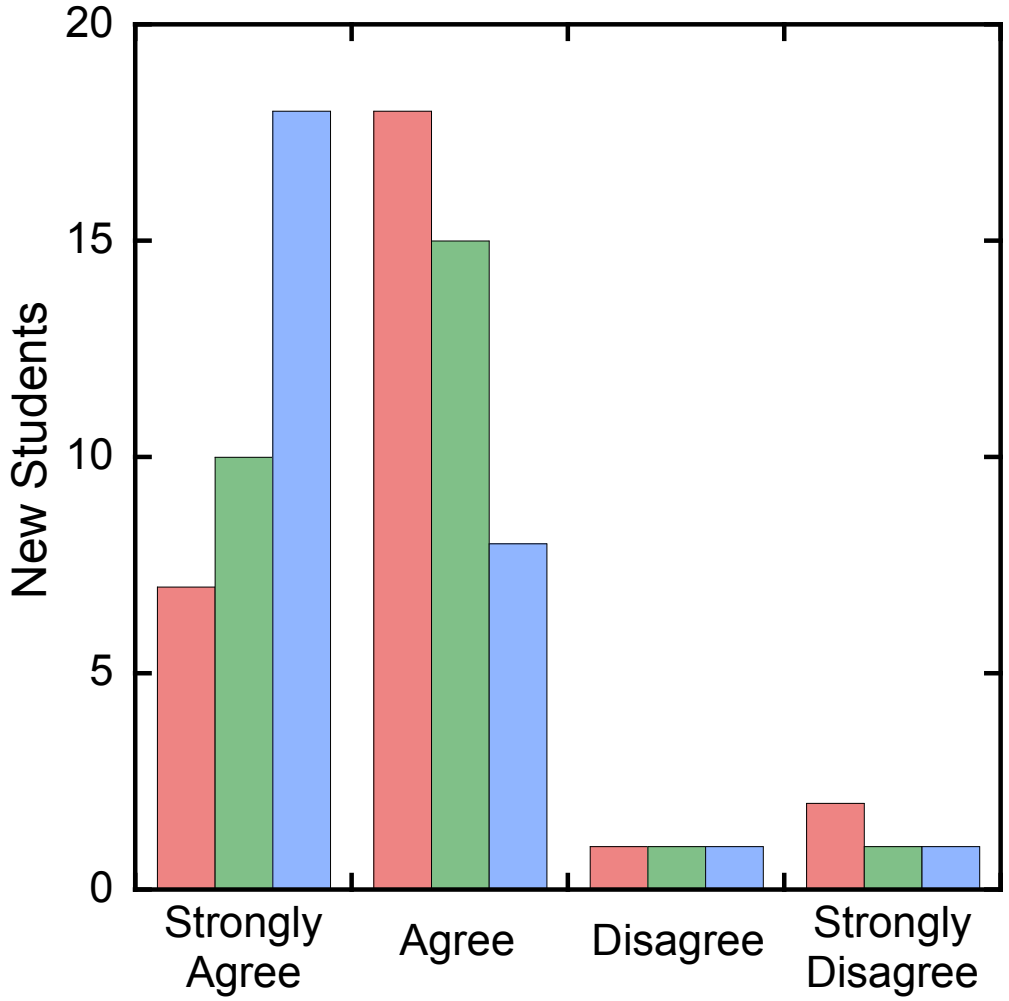


82% of new students agree

7. I recommend that the flipped approach be used in future offerings of PHYS 2110 and 2120.



68% of returning students agree



93% of new students agree

8. Please describe strengths of the flipped classroom approach. What works? What *should not* be changed?

- Watching lectures and learning concepts are reasonably straightforward tasks that can be done at home.
- Working problems is challenging and can be frustrating. Doing problems in class allows for help from peers and professor to create a more optimal, less stressful, more friendly, and more efficient learning experience.
- Helping other students on problems deepens my own understanding of the material.
- The opportunity to ask questions at the beginning of class and the short review before quizzes are both helpful.
- Having concept quizzes every class period solidifies the concepts and prepares me for the homework and the tests.
- YouTube lecture segments are fun to watch, easy to understand, and short enough to fit in between other tasks.
- I love the being able to pause, replay, and speed up the videos.

9. Please describe weaknesses of the flipped classroom approach. What doesn't work? What *should* be changed?

- Not being able to ask questions during lectures is the biggest downside of the flipped format. During traditional lectures, I learn from in-class discussions resulting both from my own questions and questions of my peers, and I miss those discussions in the flipped format.
- Sometimes questions occur to me while watching lecture segments that I can't answer by replaying the video. Not having such answers makes it difficult for me to understand later videos. In class, I forget the questions and their context, so I don't get the help I need.
- I find it harder to learn on my own than in a traditional lecture.

10. Other comments and suggestions:

- The flipped classroom model really works! I feel like I know the material so much better!
- I think that the flipped format could be the teaching of the future. I'm glad I got to be a part of the class, and even though it's taken me awhile to get use to the format. I believe if utilized correctly (like making time to study the whole video and not just the concepts) it will make it very productive learning.
- I think the flipped classroom setting should be continued in these physics courses. It would be great to see it implemented by other teaches in other subjects as well.
- The flipped format made it very difficult for me to learn. I appreciate the innovative attitude but it just wasn't the best learning format for my learning type.
- I feel like I don't prepare for the quizzes because I just write down the concepts, read through them for the quiz and get a ten. If this is a way to help students, I think that it needs to be harder to push them.

1. How much of the grade should quizzes be worth?
    10% (1 student)
    20% (7 students)
    30% (30 students)

2. Which timed, randomized quiz method is preferred?
    (a) in-class Kahoot! (34 students)
    (b) in-class Canvas (3 students)
    (c) at-home Canvas (0 students)

3. Should the time for each Kahoot! question be the same? (yes, 60 seconds)

4. Optimal video length = 15 minutes

5. Optimal review time prior to quiz = 10 minutes