

Peer Instruction or Gaming the System: Does displaying class results affect quality of student discussion?

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Introduction

We are studying strategies for implementing peer-learning in the Introductory Biology classroom. One common peer-learning strategy is the think-pair-share (TPS).

Using clickers in the classroom allows us to display true/false (TF) or multiple-choice (MC) questions to the classroom and have the students register a response. One option of most clicker software is the ability to display a graph showing the responses either as they are registered or when time expires.

For difficult questions we use a TPS (Lyman 1981; Allen and Tanner 2002), to allow the students to discuss with their neighbors and revise their answer (Crouch and Mazur 2001; Mazur 1997; Slater et al. 2006).

This experiment was designed to determine if there is a difference in the quality of peer discussion and student behavior depending on if they have seen the graph of student responses.

Hypothesis: Students learning through peer-discussion and not simply moving to the most common answer.

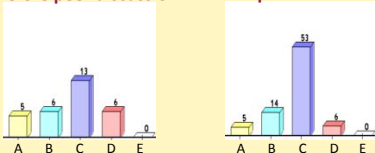
Example of clicker question included in this study.

Mules are the sterile offspring of the mating of a horse with a donkey. What would you predict would be the ultimate long-term effect of sexual selection acting on these two species?

- Break-down of reproductive isolating mechanism and the merging of the two species into one.
- The evolution of more effective postzygotic isolating mechanisms.
- The evolution of effective prezygotic isolating mechanisms.
- There would be no change in sexual selection and a horse would be just as likely to mate with a donkey as with another horse.

Graphs showing student responses

Before peer discussion After peer discussion



Classroom Description

Fig. 1. Grade Distribution of BIO105 Fall 2008.

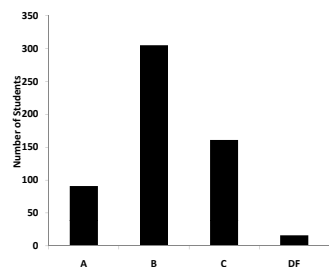


Fig. 2. Student engagement measured by number of responses.

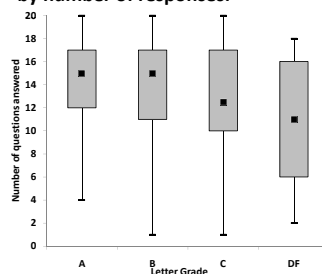
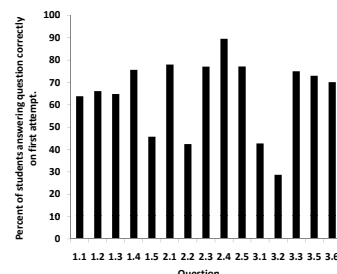
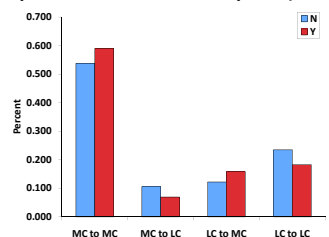


Fig. 3. Difficulty of study questions.

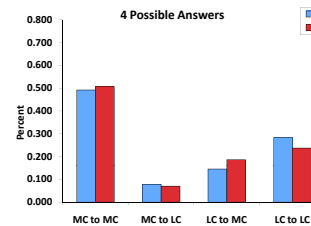
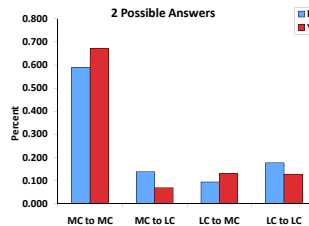


Study Questions and Results

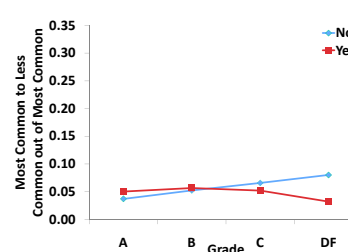
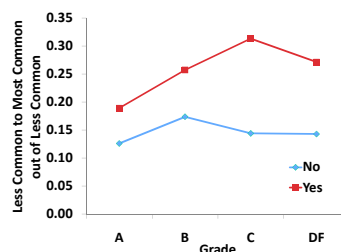
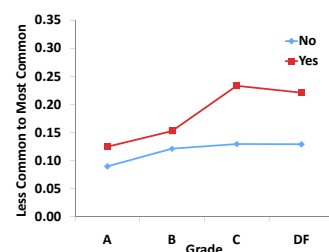
Fig. 4. Does displaying the class responses before peer discussion result in students simply moving to the answer with the most votes? (N=not shown class response, Y=shown class response).



Figs. 5 & 6. Is there an effect of the number of possible responses on a student's behavior?



Figs. 7-9. Do A, B, C, or DF students respond differently to seeing the class responses?



References

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 Allen, D.E., and K.D. Tanner. 2002. Approaches to biology teaching and learning: answers worth waiting for: "one second is hardly enough". *Cell Biology Education* 1: 3-5

Methods

Introductory Biology for Biology Majors is a large (8 sections of ~95 students each) team-taught class. Student grades were based on lecture exams, D2L quizzes, assignments, and lab. Grades were assigned using the following percentage scale: A (90-100), B (89-80), C (79-70), DF (<69). In this experiment, we developed 18 common clicker questions used in all sections. For each question students were allowed to vote and then given an opportunity to discuss with their neighbors before revoting. In one treatment students were shown a graph of the class responses before initiating discussion, in the other treatment they were not. The treatments were set up so that each group of students saw the graph for 50% of the questions.

Results & Discussion

- Students who were shown the class responses before peer-discussion were 30% more likely to change from a less common to the most common answer (Fig. 4). This was independent of the number of possible answers, 2 answers showed a 38% difference and 4 answers a 28% difference (Figs. 5 and 6).

- The data suggest that when shown the most common answer (Figs. 7-9), C-F students are more likely to switch. This may suggest more gaming among the poorer performing students.

- Using the "No" group as a discussion-only control, it appears that more students in the "Yes" group switched to the most common answer. This would be consistent with more of these students "gaming" or switching to the most common answer.

- Our results suggest that while TPS is a valuable teaching tool, when used with clickers it would be better to not show the class responses during the discussion as it may bias students.

Acknowledgements

Students in BIO105 generously agreed to allow us to use their data by filling out an IRB form.

Kirk Gallant deciphered their signatures.