

Improving student performance with 3-minute active-learning exercises in class

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Background / Relevance

Despite broad scientific evidence that student-centered active-learning practices ¹ improves conceptual understanding, knowledge retention, and performance ²⁻⁴, traditional lecturing remains the most prevalent practice of teaching Science, Technology, Engineering and Mathematics (STEM) subjects at the high school and college level ⁵⁻⁷.

Discipline-Based Education Research (DBER) had concluded how active learning can be implemented in a variety of cultural contexts, class sizes, and disciplines ⁸. However, traditional-lecturing instructors remain reluctant to change to more active-learning approaches since the current recommendations usually require considerable preparation time ⁹. Furthermore, instructors fear that implementing student-centered activities will not allow them to complete the course syllabus ⁹.

Therefore, it would be useful to show the effectiveness of making small active-learning changes to traditional lecturing.

Research Question / Hypothesis

One of the most common challenges that undergraduate biology instructors find is how to incorporate active-learning methods into their teaching without spending too much preparation time or compromising the required syllabus. Here, we hypothesize that even if lecture-based teaching is used, student performance can be significantly enhanced by 3-minute active learning exercises. We also wanted to know if these intervention benefit more certain types of learners than others. If learning can be improved by implementing small changes, this would motivate skeptical instructors to active-learning methods.

Participants / Sample

Research was conducted in classrooms of 20-30 medical school students enrolled in the Genomics and Proteomics course with the same instructor at Universidad Anáhuac – Mexico between 2018 and 2020.

Methodology

Inclusion criteria: All students in the class will be taken into account except for those who opt-out.

Elimination criteria: Students in the case group that do not complete correctly the AL exercise are not considered in that particular evaluation. Students in either the case or control group who miss the class are not considered in that particular evaluation.

Student sorting: Since students come with different learning abilities, study habits, educational backgrounds, etc.; we evaluated the students' performance after traditional lecturing using weekly quizzes for 3 straight weeks prior to starting the study. With the results of these evaluations students were divided into 4 groups (quartiles) depending on their average grades in these preliminary evaluations.

Study design: We conducted 3-minute AL exercises in one group (case) and in the other group (control) the same exercises is solved by the instructor. Groups are randomized so that groups are sometimes case and sometimes control. Performance is assayed by weekly quizzes. Grouping is blinded to the instructor.



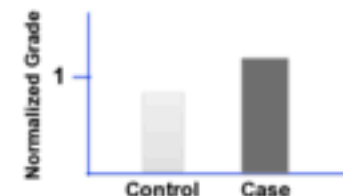
3-minute AL exercises: In-class activity at the cognitive levels of application or analysis ¹⁰. The question is posed by the instructor and gives 3 minutes to hand in their answers using post-its. AL exercises are given a percentage of the grade, so that students take these exercises seriously.

Data Analysis

The grade of each student is normalized with the mean all the grades (case and controls taken together). Analyses are performed in each of the quartiles by comparing case and control in that is compared independently in between case and control groups using a Student t-test statistic.

Other analysis: We will also compare how individual students perform with traditional lecturing vs. AL interventions. This will allow us to identify different types of learners in the classroom and find out what percentage of students benefit from AL.

Expected Results



References

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