



# A Recitation Component Improved Student Analytical Skills and Course Performance in STEM Courses

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## ABSTRACT

A recitation component was designed to improve the analytical reasoning skills of students in large enrollment STEM courses like genetics (100+ students). The recitation component consisted of weekly active learning sessions dedicated to utilizing scientific principles taught in class to strengthen students' analytical and problem solving skills. During these problem solving sessions, the recitation instructor worked in small groups to help students actively analyze scientific problems. Quiz and exam grades of students attending the recitation session (attendees) were compared to grades of students not attending the recitation sessions (non-attendees). These comparisons were made for each exam during the semester. Attendees final grades were compared with non-attendees grades from the previous year. To determine if attendance at these recitation sessions improved analytical skills and better prepared students for future STEM courses, the STEM grades of attendees were analyzed in the semester following the recitation sessions.

## PURPOSE

- Utilize active learning as a means to reinforce student learning.
- Provide students with additional assessment material to improve student performance on exams
- Improve student ability to analyze and solve scientific problems within a course and future STEM courses.

## METHODS & ANALYSIS

- The effectiveness of the recitation was compared by a pre- and post- online quiz.
- Student attendance at office hours was monitored to determine if recitation decreases the need for additional tutoring.
- Students were surveyed to determine if they felt recitation sessions helped improved their performance in STEM related coursework.
- Student course performance was compared between students attending recitation with those not attending recitation within the same semester.

## METHODS & ANALYSIS

- Student course performance was compared between students attending recitation with those from the previous semester.
- Student course performance was compared between students attending recitation with those not attending recitation in future STEM courses.

## RESULTS

Figure 1: Frequency of Student Improvement on Post-Recitation Quizzes.

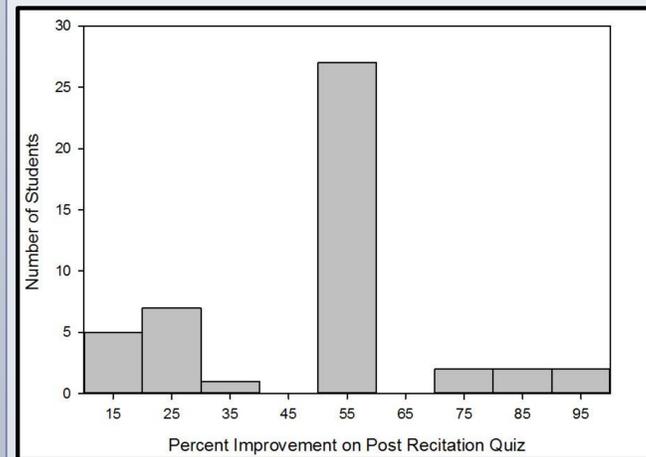
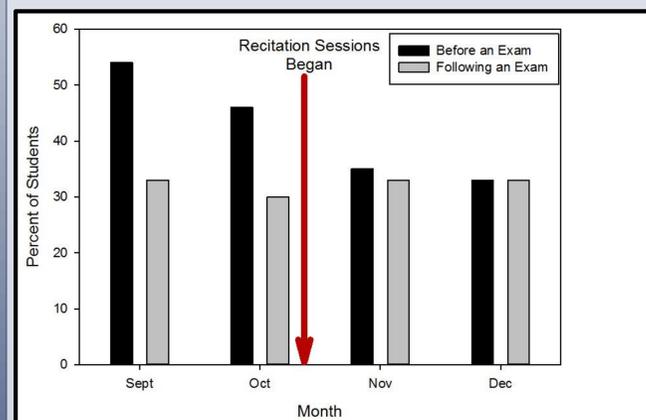


Figure 2: Percent of Students Attending Office Hours Before and After Exam following the Implementation of Recitation Sessions.



- Figure 1 shows that students attending recitation were able to increase their ability to answer problem sets between 15-100%. Most commonly students were able to improve their ability to answer questions by 50-60%.
- Data shows that the percent of students attending office hours before an exam decreased by approximately 30% from September through December (Figure 2).

## RESULTS

Figure 3: Comparison of Mean Grades between Students Attending Recitation versus that Not Attending. The asterisk represents a statistically significant difference between the group of students attending recitation (shown in grey) when compared to those students not attending recitation (shown in black).

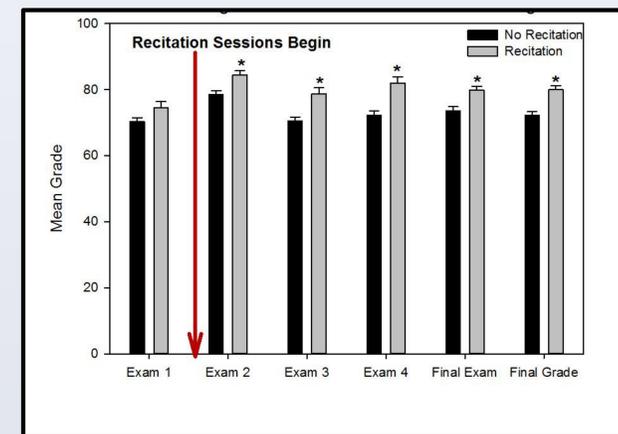
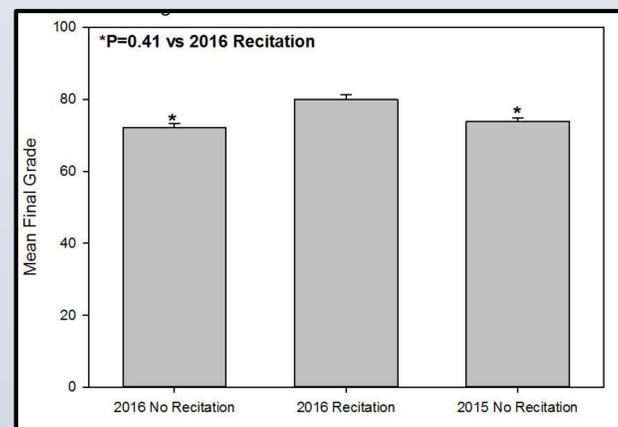


Figure 4: Comparison of Final Grades between Students Attending Recitation in fall 2016 with Students Not Attending in fall 2016 and 2015.



- STEM students attending recitation were compared to students not attending recitation within the same semester the results the mean exam score increased significantly for exam 2 (P=0.002), exam 3 (P=0.041), exam 4 (P<0.001), final exam (Figure 3).
- The students attending recitation showed a 5-8% percent improvement in performance on exams throughout the semester and 5% increase in final grade (Figure 3).
- When the final grade of students attending recitation in fall 2016 were compared to students from a previous semester where a recitation session was not offered they statistically improved their final grade by approximately 8% (P=0.041), Figure 4.

## RESULTS

Figure 5: Comparison of Final Genetics Grade to Student Grades in Next Semester STEM course. NO REC FG: no recitation final grade; RE FG: recitation final grade; SC EX1: stem course exam1; SC EX2: stem course exam 2

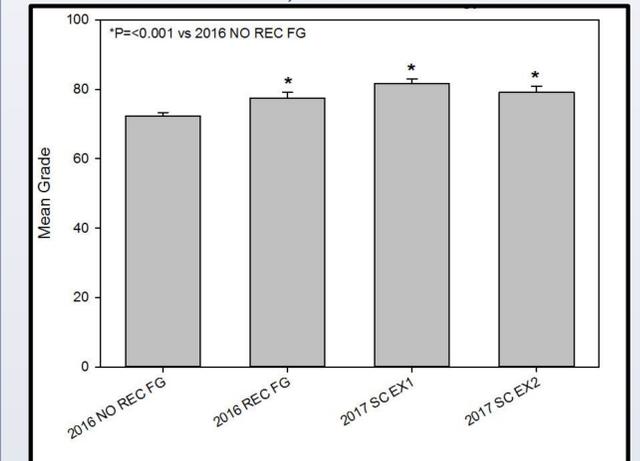
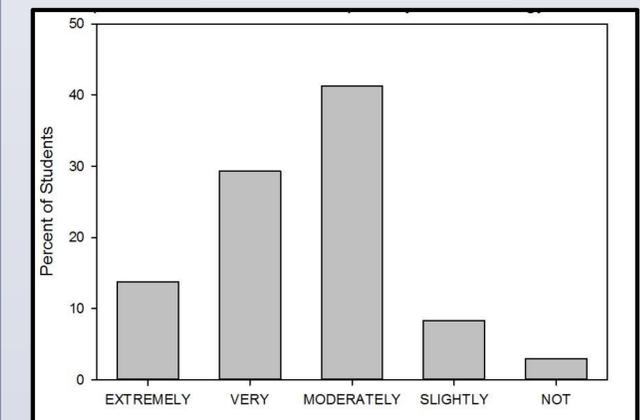


Figure 6: Percent of Students that Felt Recitation Sessions Improved their Analytical Skills and Assisted them in other STEM courses.



- When the performance of students attending recitation were compared to exams on future STEM courses, they showed ~10% improved in exam grades (Figure 5).
- 95% of students felt that analytical skills from recitation sessions helped them with STEM courses (Figure 6).

## CONCLUSIONS

- The data demonstrates that student participation in a recitation session improves their performance on exams throughout the semester and-increases their final grade.
- The recitation session was also found to help reduce the number of times a student attends office hours for assistance on course related questions.
- Finally the improved analytical skills they obtain from recitation sessions continue to strengthen their performance when taking other STEM courses like Cellular Biology.