Impact of Assigned Seating in a Flipped Course on Student Performance

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Abstract

For the past three years, the undergraduate Thermodynamics I course at North Carolina State University has been taught in the flipped format. In a flipped course, the concepts delivered in a traditional lecture are instead provided through online content which allows face-to-face class time to be used on applying the concepts to problem solving. The author has previously used the answers to final exam questions from students during multiple semesters to assess the effectiveness of flipping the course. The current study analyzes the effect of working in teams on individual student success. Students are assigned to a team and to a row of seating in the classroom. Student performance is determined by results of individual tests during the semester. Analysis shows that the students with the highest grades are mostly immune to the effects of assigned teammates but there are mixed results for other students.

Keywords

Flipped class, assigned seating, thermodynamics

Introduction

At North Carolina State University, Thermodynamics I is taken by sophomores, juniors, and seniors from several different engineering disciplines. The most important objective of the course is analysis of systems using the first and second laws of thermodynamics[1]. Numerical problems and conceptual questions are used to test the students.

This course has been taught by the author as a flipped class for approximately three years. Flipping a class gives students more active learning opportunities during class time by changing the delivery of content to online access[2]. Students are expected to watch video lectures of the author explaining concepts and working example problems before class so that they can apply the concepts to a problem set during class. The instructor occasionally gives short lectures in class to emphasize important points from the videos and extensively discusses solutions to the problems worked in class. Students work in groups in a fixed-seat classroom to solve these problems and are encouraged to discuss their work with each other.

Possible Advantages and Disadvantages of Teamwork

The flipped method emphasizes problem-solving and relies on teamwork. Students who are excelling in the course are able to explain their work to their teammates, and this repetition of the problem solutions reinforces their understanding. Students who are struggling can have the work explained by someone other than the instructor which can aid in their learning. This allows for

students to be exposed to different teaching styles and hopefully increase their amount of success[3].

However, students can negatively impact their teammates' performance as well. Students who come to class unprepared and without books and notes burden their teammates by being unable to contribute to the classwork. Also, research has shown that students who multi-task during class, by going on social media for example, negatively impact their own GPA and that of nearby students[4,5]. Additionally, a low-performing student paired with a high achiever may not take the time to learn the material themselves, instead relying on the other student.

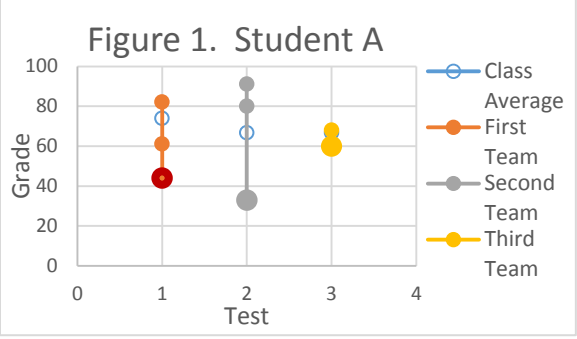
Analysis

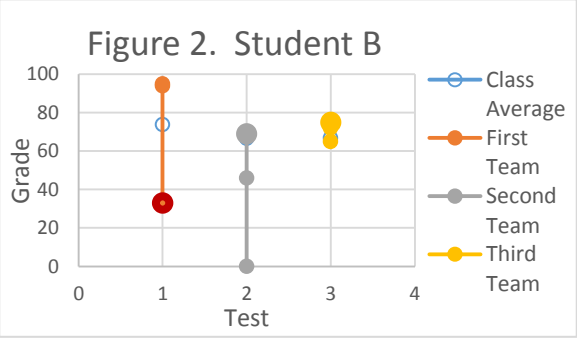
During the semester, students work in teams of three. There are three tests and the students' teams are re-assigned after each of the first two tests. Initially, the teams are assigned by alphabetical order with a few exceptions to accommodate students who enroll after the first day of class. The team assignments also assign the row in the classroom where the team is to sit. The teams are re-assigned after the first test so that everyone works with different teammates and has a chance to sit near the front of the classroom at some point.

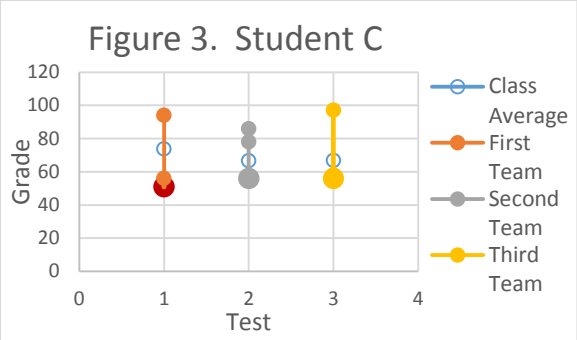
The current study is a microscopic analysis of the issue and focuses on the performance of twelve students in one class section. The section had 47 students who completed the course (i.e. who did not withdrawal) and assumes regular, if not absolute, attendance. The focus of this study is on students whose first test grade was below 60% (labeled as Students A-G) and students whose grades on all of the tests was above 89% (labeled as Students H-L). This microcosm of the class is meant to determine if any trends exist in the test grades for the highest-performing and lowest-performing students.

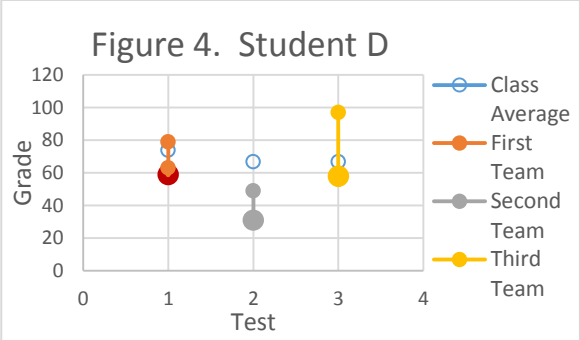
Each of the following figures represents the performance of one of the twelve students. They show the grade on each test compared to the class average and the grades of their teammates. The average grades for the class on tests 1, 2, and 3, were 74%, 67%, and 67%, respectively. On each figure, the student's grade is shown for each test with the largest marker. The other two markers per test represent the grades of the teammates.

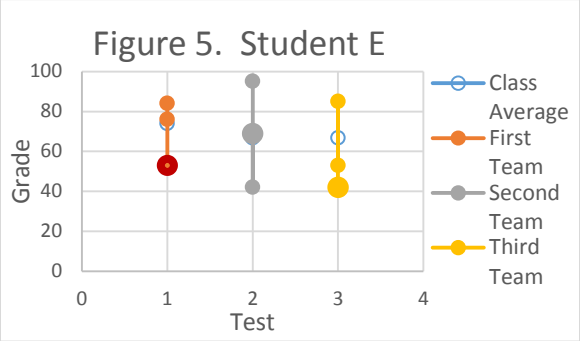
Figures 1-7 show the performance of students who earned less than 60%, or a D, on the first test. For three of these students (C, F, and G), their grade on test 1 was their lowest and each worked with a high-performing student for tests 2 and 3. Since the class average was highest for test 1, the improvement is significant.

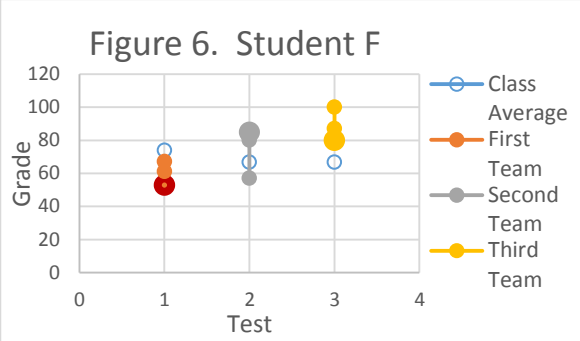


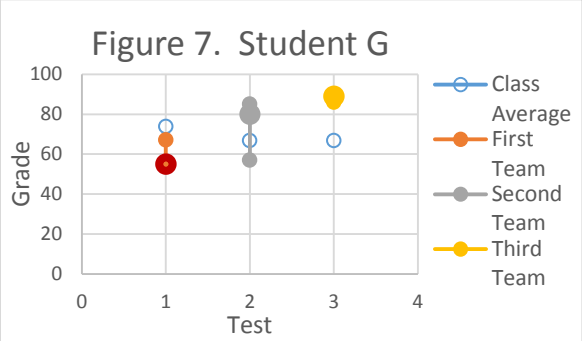






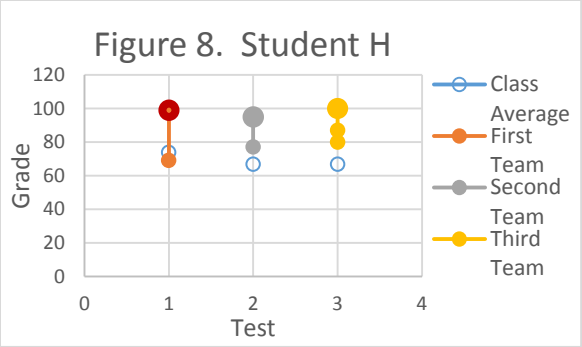


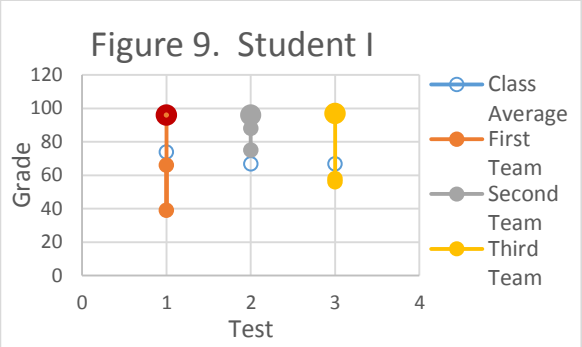


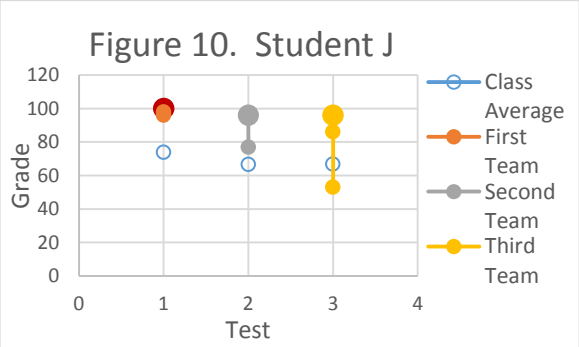


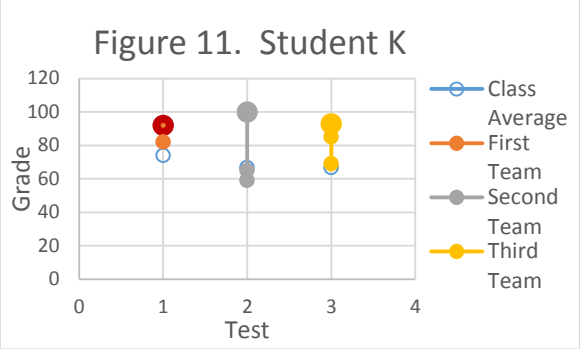
Three of the above students, A, C, and D, were the lowest performing in each team for each test, so working with new teammates appears to have had little effect on their grades. These students also had test grades that were below the class average despite, in almost every case, having a teammate that earned a grade above average.

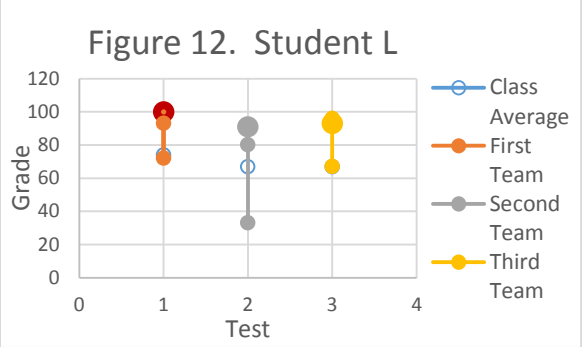
Figures 8-12 show the performance of students who earned an A (or greater than 89%) on each test. These high-performing students had grades well above average.











Students H through L remained the highest performing students in each of their teams for all three tests (except for Student L in test 3). Most of their teammates scored just below or above the class average. Teammates for Student I and L had one low grade for one test each.

Conclusions and Future Work

The analysis shows that within this class section, student performance was not definitively impacted by teammate performance for these twelve students. The highest- and lowest-performing students generally did not see changes in their grades due to the students with which they worked. More detailed statistical analysis will be done to determine how likely a student will benefit from a teammate's performance. The next step in this research will include broadening the study to include more students and comparing the results to that of strategically assigned seating done in other sections that intentionally pairs high-performing and low-performing students together[6].

References

1 Cengel, Yunus and Michael Boles, Thermodynamics: An Engineering Approach, McGraw Hill, New York, 2015.

2 Zappe, Sarah Elizabeth, Robert M. Leicht, John I. Messner, and Hyeon Woo Lee, "'Flipping' the Classroom to Explore Active Learning in a Large Undergraduate Course", American Society for Engineering Education, 2009.

3 Kolb, David A. and Alice Y. Kolb, The Kolb Learning Style Inventory 4.0: Guide to Theory, Psychometrics, Research & Applications, Experience Based Learning Systems, 2013.

4 Junco, Reynol, "In-class Multitasking and Academic Performance", Computers in Human Behavior 28, 2236-2243, 2012.

5 Sana, Faria, Tina Weston, and Nicholas J. Cepeda, "Laptop Multitasking Hinders Classroom Learning For Both Users and Nearby Peers", Computers & Education 62, 24-31, 2013.

6 Cox, Jacob, Jason Cody, Jesse Fleming, and Matthew Miller, "Seat Assignment Contribution to Student Performance in an Information Technology Classroom", ASEE Northeast Section Conference, 2012.

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The author has been a Teaching Assistant Professor at North Carolina State University in the Department of Mechanical and Aerospace Engineering for five years. She teaches undergraduate courses in the thermal-fluid sciences. She is the course coordinator for Thermodynamics I and has implemented the flipped format for over three years.