



The Flipped Classroom Model in an Introductory Astronomy Course

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INTRODUCTION

This education research project was conducted at the Casper Planetarium with students from Kelly Walsh High School in Casper Wyoming. The students were enrolled in a semester long introductory astronomy course and were eligible to take the course for college credit.

This project was designed to determine to what extent the flipped classroom model of instruction would impact student engagement and achievement in an introductory astronomy course.

In the flipped classroom model, class lectures are delivered via video that students watch at home. Students then use class time to complete lecture tutorials, answer end of chapter questions, explore astronomy simulations, complete labs and take quizzes. This allows students to collaborate with their peers and have access to the instructor when they are struggling with a concept.

METHODS AND MATERIALS

The following instruments were used to collect data on student achievement and engagement in the flipped astronomy classroom.

- Astronomy Diagnostic Test (ADT)
- Comparison of 2016 class to previous four classes in the areas of assignments, quizzes, and labs.
- Engagement in Previous Science Classes Questionnaire.
- Flipped Classroom Engagement Questionnaire.
- Pre and Post course student interviews.
- In-class formative assessments.

RESULTS

This educational research project showed the flipped classroom model had the following impacts on student achievement and engagement:

- The mean scores on the Astronomy Diagnostic Test (ADT) increased from 40% on the pre-test to 71% on the post-test (n=18 pretest, n=15 posttest) (Figure 1).
- The normalized gain on the ADT was determined to be medium at 46% (n=18 pretest, n=15 posttest) (Figure 1).
- Students in the 2016 semester showed the greatest improvement over past years in the area of labs. The mean lab score for 2016 was 82% (Figure 2).
- When surveyed, 65% of students in the flipped class indicated they collaborated with their peers either all the time or often (Figure 3).
- In past lecture classes 38% of students indicated they collaborated with their peers sometimes and 31% indicated the collaborated often (Figure 3).
- In the flipped class, 53% of students asked questions about the topic sometimes and 38% asked questions often (Figure 4).

CONCLUSIONS

Results of the Astronomy Diagnostic Test (ADT) showed clear growth from the beginning of the course to the end. In the area of Labs, the 2016 flipped classroom showed significant improvement over all but one of the previous 4 years. The 2016 flipped classroom group showed improvement over the 2012 class in the area of Assignments and improvement over the 2105 class in the area of Quizzes. Growth on the ADT and improvement in lab scores indicated a slight increase in student achievement in the flipped classroom. In the area of engagement, students in the flipped class took notes less often than in their previous non-flipped classes. However, students in the 2016 flipped astronomy class asked questions of their teacher more often, and collaborated with their peers more often than in their previous classes. While the students in the flipped class didn't ask the instructor for help with assignments as often as in previous classes, there was clear evidence of increased student engagement in the flipped class.

STUDENT QUOTES

"I really *loved* the format of this class, it worked really well for me" (Female senior)

"I thought the lecture videos helped keep my brain on topic; and I liked the fact that they weren't too long." (Male junior)

"I like the ability to ask questions in class, it makes working on the homework a lot less stressful." (Male senior)

"I liked having the ability to share ideas, not just work on my own." (Female senior)

"I felt like I knew the topic when I came to class so I was ready to jump into the assignment." (Male senior)

"I think it helped reduce the homework I had in an evening. I could watch the video over lunch and be ready for class that afternoon." (Female senior)

ABSTRACT

Direct instruction is a very passive mode of learning for students. This study investigated the impact of the flipped classroom model of instruction on student engagement and achievement in an introductory astronomy course. Achievement was measured using the Astronomy Diagnostic Test prior to and following the course, and a comparison of the treatment semester to the previous five classes in the areas of assignments, quizzes and labs. Students were surveyed and interviewed regarding their feelings about the flipped classroom model.

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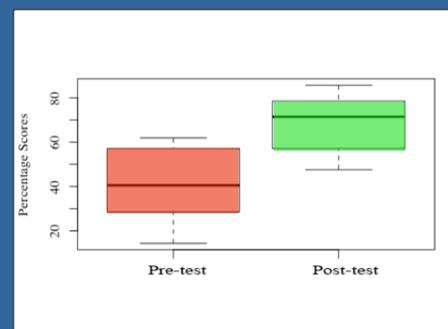


Figure 1. Results of Astronomy Diagnostic Test, (n=18, n=15)

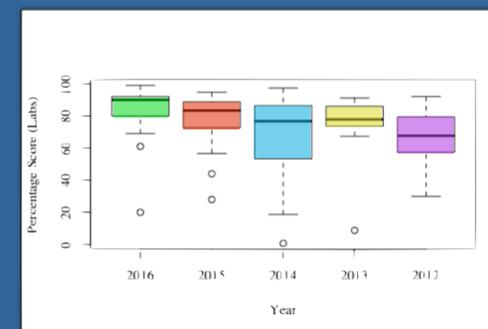


Figure 2. Comparison of Lab Scores, (n=18, n=17, n=21, n=13, n=18)

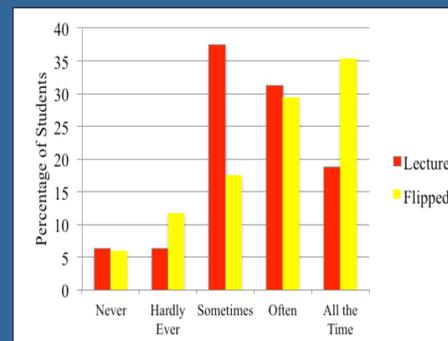


Figure 3. Collaboration with peers, (N=16, N=17)

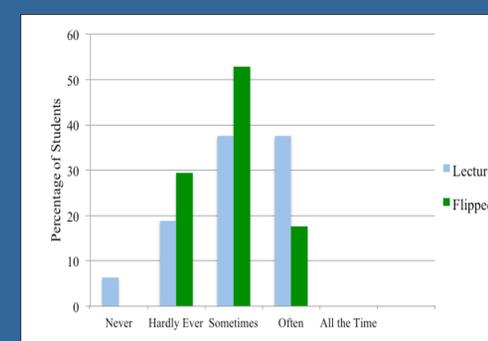


Figure 4. Asking Questions on the topic (N=16, N=17)