

## Flipping an Introduction to Applied Statistics Course for Mathematics Teacher Candidates

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### **Abstract:**

Flipping a classroom has gained interest in our university as well as high schools and universities across the nation. Students were provided in advance with a reading quiz and a worksheet for each class day. For each class, several YouTube videos were recommended for viewing before the class. Towards the end, I only posted one video per concept. All these were freely available on the internet from organizations such as Khan Academy. Small groups of students completed the pre-class assignments in class if they were unable to complete them before the class. Then students did all the homework in class as groups with peer assistance and occasional help from the instructor. I facilitated the environment and helped on individual basis. Reading quizzes and work modules were worth 25% of the grade and in addition, homework, exams, weekly quizzes, computer assignments, 3 lesson plans, and a poster were worth the remaining 75%. Students who valued the self-learning were mostly juniors and seniors. They liked flipping the course until three-fourths of the semester and preferred to be lectured on later topics. Students had mixed feelings about the value of flipping the course. What I did and what I would do and not do next time based on the experience will be discussed in this paper.

### **What is flipped learning?**

Flipped learning is a pedagogical approach in which direct instruction moves from group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creativity in the subject matter (FLIP Learning).

### **Why did I flip a course?**

I have heard a lot about flipping a class and its advantages over a few years and our university was actively promoting the idea of flipping courses. Flipping the classroom establishes a framework that ensures students receive a personalized education tailored to their individual needs (Bergmann and Sams, 2012). I teach an introduction to applied statistics class for mathematics teacher candidates. I thought it will be a new experience for teacher candidates and if they liked the flipped class, they could use the method once they become teachers. From what I have read and from what I know now, a flipped class increases the student engagement, provides more classroom time for individual student questions and tutoring, encourages student centered learning, and creates habits of self-learning, increases interaction, and provides more opportunity to give attention to struggling students. “Flipping the classroom works

great at the university level because students are very motivated when they reach that level” Bogan and Ogles (2014). After many years of teaching at the university level, I have a better understanding about the students in our institution and not all of them are highly motivated but they sure are more academically matured than high school students.

### **Preparation**

I prepared all the necessary classroom material during a summer with a grant support from the university. I visited many websites with YouTube videos of subject material and selected 3 videos for each concept. Students were encouraged to watch at least two videos. Canvas learning management system was used to facilitate the class. Freely available applets with good reputation from sources such as <http://www.rossmanchance.com/> were recommended when appropriate. “It is essential for the instructor to be highly organized in his or her approach to the flipped classroom. This is important not only because so many different activities occur in a given class period, but also because many students require scaffolding to successfully tie together all the material for a given topic (Schwartz, 2014).”

### **Method of learning**

For each class day, I provided a section to read and write a one page reading quiz which requires five short, written answers. Also I provided worksheets for every class day. Students were instructed to complete the worksheet before coming to the class. Bogan and Ogles (2014) state that practice work should not be mindless worksheets but be exciting. I had all the worksheets made before the semester but I made some changes to the remaining worksheets as semester progressed depending on my observations and students’ input. Bergman and Sams (2014) state that they observed that when the teacher becomes a facilitator, the classroom becomes a center for learning. In class, students made small groups and discussed their answers. “The small-group activities are critically important pieces of the flipped course. Hence finding the right composition of the groups is essential. Not knowing the background of each student, an instructor may need to shuffle the membership of each group for the class period multiple times until the right mix is found.--- The stronger students will ideally serve as peer instructors to those who need additional explanation. Of course, the stronger students also benefit from this activity, as forming and expressing their thoughts in ways their peers can understand will further solidify their understanding (Schwartz, 2014)”. I walked around and asked the students to defend their answers among their group. Usually they reasoned out and figured out the correct answer. Some students worked alone on some days when groups are ahead and I worked with them individually or a fellow student worked with them individually. Bogan and Ogles (2014) describes how important it to be a personal tutor during the class, especially for a mathematics class. Bennett (2013) explains how he had to improve individual instruction as demanded in class by different style learners. McLaren (2013) stresses the importance of individual activities even within a flipped classroom cooperative learning environment.

Once they handed in the two pre-class assignments for the day, I asked them to start working on their homework. Homework assignment were usually printed on the worksheet in case if some students wanted to try before class. Some students have completed or tried almost all the problems at home. They

compared and checked each other's answers helped the others during class. I walked around and helped students individually. I got to communicate with most of the students during any class period. Occasionally I went to the board and explained a concept or did a problem if majority of the students were having difficulties. This happened more and more towards the end of the semester and I taught the Analysis of Variance, Correlation and Regression Analysis, and Categorical Data and Frequency Tables as a traditional class. An in-class quiz was given every week and four in-class exams were given during the semester. Quizzes and exams were not group activities. In addition, students had to do 3 lesson plans and a high school level statistics poster. Through the lesson plans, I introduced the Common Core Standards and state standards for high school probability and statistics. Students were supposed to identify which standard is covered by their lesson plan. I conduct a high school statistics poster contest and hopefully these students will encourage their future students to participate.

### **What did the students like?**

I had a mix of students from freshman to senior. Seniors and juniors liked the flipped class except when the concepts were beyond Elementary Statistics, a class which most of them had before this class. Freshman students did not have enough learning experience to take advantage of the flipped class. Students loved the fact that they could move on their own pace and ask questions one-to-one if they had difficulties. I gave them long computer assignments using Minitab but they liked those assignments and thought those assignment were useful to understand concepts. They enjoyed learning a statistical software. Students loved the interaction with the instructor and other students, but some preferred if the student were shuffled to create new groups every other week or so.

### **What did the students not like?**

Students disliked the idea of printing and completing worksheets every day of class. As the instructor, it was a way I could get a daily feedback but it was a lot of grading work for me too. Most students suggested to have the first half of the semester flipped and the second half of the semester a traditional class. I let them turn in a few late assignments but some students were missing classes regularly due to life demands. These students did not like the flipped class. Few students who are used to procrastinate till the day before assignments and somehow do well in traditional classes did not like to work regularly. Few students who were not teacher candidates had an option to write a 5 page paper which they did not like much.

### **What did I like/dislike?**

I had more grading to do every day of classes which was important because I get to see their level of understanding but grading was not fun. At first, I did not like the fact I became an individual tutor rather than the lecturer but I got used to it. I loved the one-to-one interaction with students. Most of the time peer learning was happening in class and I had nothing much to do. It was sometimes hard to get the attention of the whole class if I had to explain a concept several groups did not understand. If a student

was struggling in class, I could help immediately. Traditional lecture classroom without tables was not conducive to the flipped learning. Students tried to make circles of chairs but it is better to have a classroom with roundtables. I totally agree with the following:

“For the most part my students accepted and embraced the flipping of my classes. The students that wanted to work ahead really loved it and it put less pressure on the students that needed to move slower. Students who could work faster were getting bored in the traditional classroom as we had to move at the pace of the slowest student. However some of the slower students could move faster if they had more one-to-one help but this was at a premium in the traditional classroom. But by flipping my class all the students could move at their own pace and one-on-one time was no longer a premium but became common place. As with anything some students were resistance but that was mainly because they have been well trained in playing the school game and wanted to be lectured to and worksheets. (Prindle, 2013).”

## **Evaluations**

Course Design =Low-High, Difficulty=25%-85%, and Workload=25%-95%

## **Some Student Evaluation Comments**

“I did not mind the flipped classroom format, however I do believe a little lecture before we work on our own would be beneficial.” “Do the flipped course for the first half and then do regular note taking class after that.” “Perhaps do more in the classroom so that we are prepared for the homework. Being in a flipped class is difficult when learning new concepts. More videos like in the beginning would help too.” “I don’t care for the flipped concept.” “The word and reading modules were okay at first, but when the material got more challenging I did not like them.” “I liked the flipped classroom idea, but I think there needs to be more structured discussion during class period. I often left class feeling stressed and unsure about the material covered.” “Not conducive to those who learn better in a classroom setting.”

## **Did flipping a class help the learning experience?**

Yes and No! Senior and junior students seems to like the self-learning to a certain extent. Flipping helped me to interact with the students a lot and get to know them better in terms of the learning. Most students became active learners.

## **Assessment**

Hour Tests (40%), Reading quizzes & writing (10%), Work Modules (15%), Homework (15%), In class quizzes (10%), Computer Assignments (5%), Lesson Plans (3%), and Poster (2%).

### What would I do different next time?

I will teach them a well-known note taking method [Bergman and Sams (2012) instruct their students in the Cornell note-taking method in which they take notes, record any questions they have and summarize their learning], find a classroom with round tables, collect assignments on time except two assignments they are allowed turn within two weeks after the due date, shuffle students groups every two weeks, teach the first 25% of the course 100% flipped, next 25% of the course 75% flipped, third 25% of the course 50% flipped and the last 25% of the course 25% flipped, keep experimenting what percentage of a certain chapter should be flipped, continue the reading quizzes, reduce the amount of work in worksheets and redesign some worksheets, emphasize the importance of independent learning in life, spend some time during the first two class meetings to discuss research findings of flipped classes, make my own videos or voice recordings using Tech Smith Relay® and Doceri®, better organize the course, have learning objectives written for each class and survey whether students have learned the expected material, give them a second opportunity to do the quizzes as a group, and add oral presentations by students based on questions from worksheets.

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