

Learning Hypothesis Test the Flipped Way: What Do Students Feel?

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Abstract

The blended approach has been found to be more effective in enhancing learning because this method increases student engagement and involvement, and thus improves their performance. This approach is also more favored among the students of the twenty-first century because by leveraging on technology, blended learning gives more flexibility and autonomy to the students. This paper discusses students' preference towards one of the blended learning techniques that is the flipped classroom method, in learning the hypothesis test. It was found that students preferred the flipped classroom method compared to the traditional teaching primarily because it enhances their understanding. However, a number of students have mixed feelings towards the flipped classroom because they feel the effectiveness of this technique depends on their group members and the contents of the lesson.

Keywords: classroom activity, rotational model, student engagement.

Introduction

Flipped classroom is a type of blended learning model whereby the autonomy of learning is on the students. In specific, flipped classroom is a type of rotational model, the other being station rotation, lab rotation and individual rotation (Staker & Horn, 2012) as shown in Figure 1. The autonomy of learning is on the students whereby most of the learning takes place outside the classroom at their own pace and time. This student-centered approach has been found to increase student engagement and involvement (e.g., Gilboy, Heinerichs & Pazzaglia, 2015) and thus improves students' performance and success rates (e.g., Tune, Sturek & Basile, 2013).

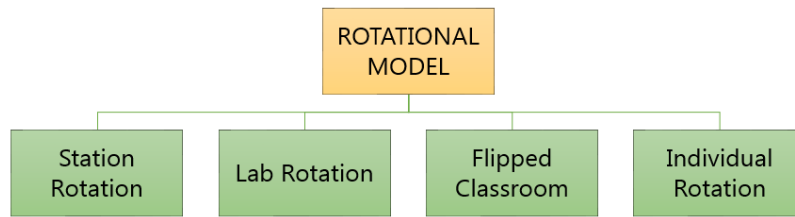


Figure 1 – Rotational Models

Flipped classroom method has generated favorable responses from the students. For example, a study by Dove (2013) found that students enjoyed and preferred the flipped classroom method in learning statistics. Clark's (2015) study also showed evidence of positive response towards this technique as well as evidence of increased engagement and communication among students in a mathematics classroom. Students in this study also attested to the improved quality of instruction and improved use of their class time. Likewise, greater motivation towards learning was observed among students in the flipped environment in the study by Bhagat, Chang and Chang (2016).

Flipped classroom method has been used in different courses and programs of study such as biology (e.g., Jensen, Kummer & Godoy, 2015), chemistry (e.g., Schultz, Duffield, Rasmussen & Wageman, 2014) and in nursing education (e.g., Critz & Knight, 2013). Flipped classroom method has also been used in the teaching of statistics (e.g., Strayer, 2012; Butt, 2014). In mathematics classrooms in particular, flipped technique has been used for example in algebra lessons (e.g., Clark, 2015), arithmetic and geometry lessons (e.g., Lo & Hew, 2017) and trigonometry lessons (e.g., Bhagat, Chang & Chang, 2016).

Studies concerning flipped classroom method have ranged from secondary school students (e.g., Clark, 2015; Lo & Hew, 2017) to undergraduates (e.g., Casasola, Nguyen, Warschauer & Schenke, 2017) as well as involving the teachers (e.g., de Araujo, Otten & Birisci, 2017). In this study, flipped classroom method has been used to teach hypothesis test to a group of engineering students in an undergraduate program at a higher education institution.

Background

As the name implies, flipped classroom flips or swaps what is done in a traditional classroom and what follows afterwards as homework or assignments. As shown in Figure 2, learning first takes place in the online modality followed by the face-to-face classroom activity. Students learn the content materials online before they come to class and then engage in classroom activities facilitated by the teacher (Herreid & Schiller, 2013). In this sense, the teacher takes the role of a guide and does not actually teach. If at all, the teaching is done online with the aid of technological tools such as using self-recorded videos.



Figure 2 - Flipped Classroom

Flipped classroom method gives the students more control of the learning process and thus enhances student engagement and motivation. Students feel a sense of empowerment when they know that they are the one in control of the learning process. Herreid and Schiller (2013) mention some of the advantages of the flipped classroom as: (i) students learn at their own pace, (ii) teacher understands students' learning better, in particular through classroom activities, (iii) lessons can be more easily customized, (iv) more effective and creative use of classroom time, (v) increases students' interest, engagement and involvement, (vi) flexible and relevant use of technology in enhancing twenty-first century skills and (vii) promotes students' thinking both inside and outside of the classroom.

Dove (2013) find that having access to the content materials online gives students the time and flexibility to learn these materials well prior to the classroom activities. Flipped classroom method gives students more time for practice, exploration and interaction with the teacher compared to doing these activities as homework in the traditional lecture format. More importantly, while the flipped technique allows the better students to work independently, the teacher can spend more time on the weaker students as the students work through the problems in class (Tucker, 2012). As Bhagat, Chang and Chang (2016) found the low achievers in their experimental group who were taught using the flipped classroom method performed better than the low achievers in the control group who were taught using the traditional teaching method.

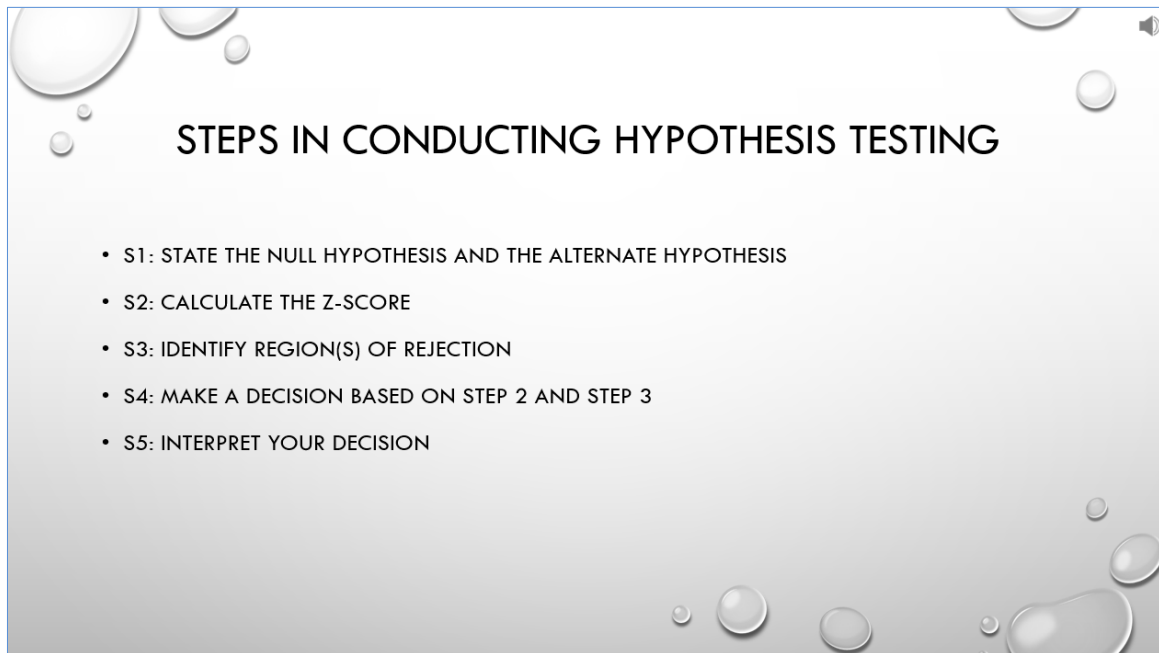
On the other hand, some of the challenges faced in the implementation of the flipped classrooms are: (i) students' resistance towards this method because they are required to do more work, (ii) students are not serious about the online learning resulting in an unsuccessful classroom activity and subsequently unsuccessful learning, (iii) difficulty faced by the teacher in finding suitable resources for the online learning, (iv) time and effort required by the teacher to design and prepare the online learning materials and instructions (Herreid & Schiller, 2013).

Learning Hypothesis Test the Flipped Way

This study purports to investigate students' perceptions towards the flipped classroom method in an undergraduate mathematics program. The subjects of this study are twenty-three students from the mechanical engineering and civil engineering backgrounds. The online learning involved use of power point slides while the classroom activity involved small group discussion and presentation.

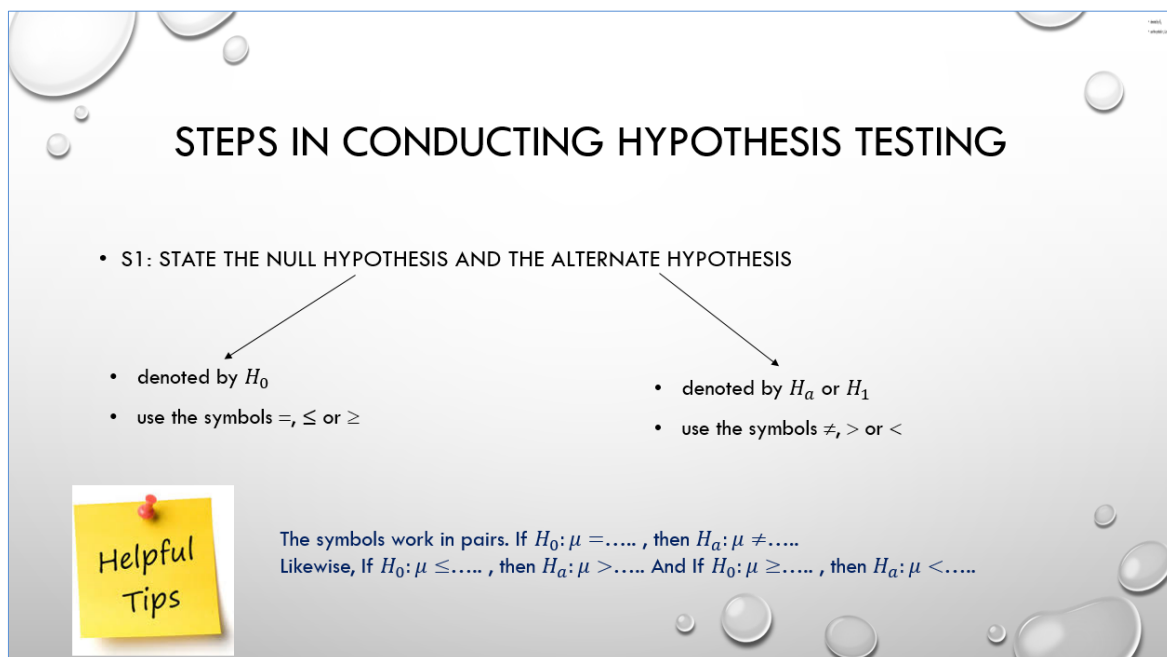
Online Learning

Two sets of power point slides were uploaded on Blackboard learning management system for the students to learn the hypothesis test at their pace independently prior to the classroom activity. The first set of slides are voiced over and contained explanation about hypothesis test and the hypothesis testing procedure (see Figure 3). Each step is explained in detail and so the duration of the first set is six minutes. The second set of the power point slides discusses three examples of hypothesis test situations, showing detailed working steps (see Figure 4). The examples include both the one-tailed tests and the two-tailed test.



STEPS IN CONDUCTING HYPOTHESIS TESTING

- S1: STATE THE NULL HYPOTHESIS AND THE ALTERNATE HYPOTHESIS
- S2: CALCULATE THE Z-SCORE
- S3: IDENTIFY REGION(S) OF REJECTION
- S4: MAKE A DECISION BASED ON STEP 2 AND STEP 3
- S5: INTERPRET YOUR DECISION



STEPS IN CONDUCTING HYPOTHESIS TESTING

- S1: STATE THE NULL HYPOTHESIS AND THE ALTERNATE HYPOTHESIS
 - denoted by H_0
 - use the symbols $=, \leq$ or \geq
- denoted by H_a or H_1
- use the symbols $\neq, >$ or $<$

Helpful Tips

The symbols work in pairs. If $H_0: \mu = \dots$, then $H_a: \mu \neq \dots$
Likewise, If $H_0: \mu \leq \dots$, then $H_a: \mu > \dots$. And If $H_0: \mu \geq \dots$, then $H_a: \mu < \dots$

Figure 3 - Examples of the first set of slides

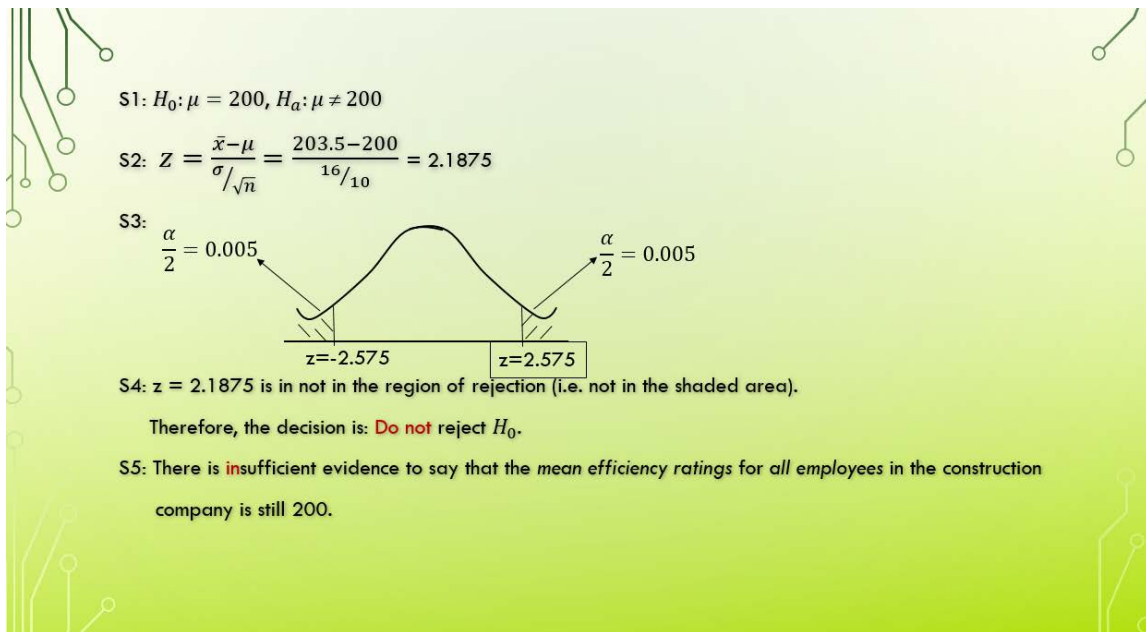


Figure 4 - Example of the second set of slides

Classroom Activity

The students were divided into groups of four by first segregating them according to their English language proficiency. Before the class began, three placards labelled “Good English”, “Mediocre English” and “Poor English” were pasted on different parts of the classroom walls and students were asked to decide for themselves which category they belong to. This is particularly because it is important for the students to be reasonably proficient in English to be able to understand and interpret the hypothesis test questions especially those questions in contextual form. All the students in this class categorized themselves into the “Mediocre English” and “Poor English” groups. Students from the “Mediocre English” group were asked to choose three other students from the “Poor English” group. All together there were eight groups and they each chose one hypothesis question to work on.

The students were provided with papers and colored markers and were given about thirty minutes to write their solution steps on the piece of paper. It was observed that the students collaborated well and every one of them was actively involved in the group discussion. Then, they put up their answers on the walls of the classroom and took turns in presenting them. Most of them provided the correct answers and presented them in a clear and concise manner suggesting that learning has taken place effectively and successfully. In fact, it appeared that students learned hypothesis test better and faster in this way compared to the traditional chalk-and-talk method. Figure 5 shows an example of the hypothesis test question and Figure 6 shows the students’ solution steps for this question.

A light bulb manufacturer has established that the life of a bulb has mean 95.2 days with standard deviation 10.4 days. Following a change in the manufacturing process which is intended to increase the life of a bulb, a random sample of 96 bulbs has mean life 96.6 days. Assuming that the population standard deviation is unchanged, test whether there is significant evidence, at the 1% level, of an increase in life.

Figure 5 - Sample Question

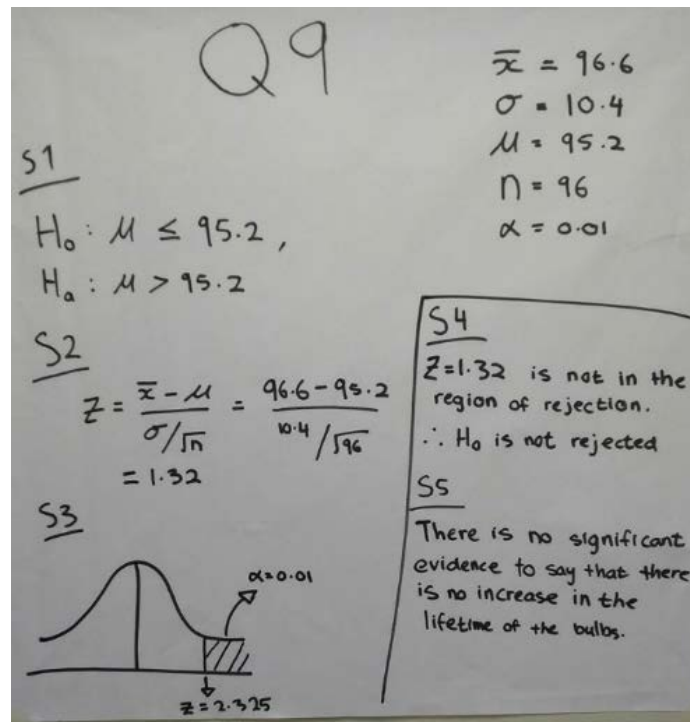


Figure 6 - Students' Work

Students' Perceptions

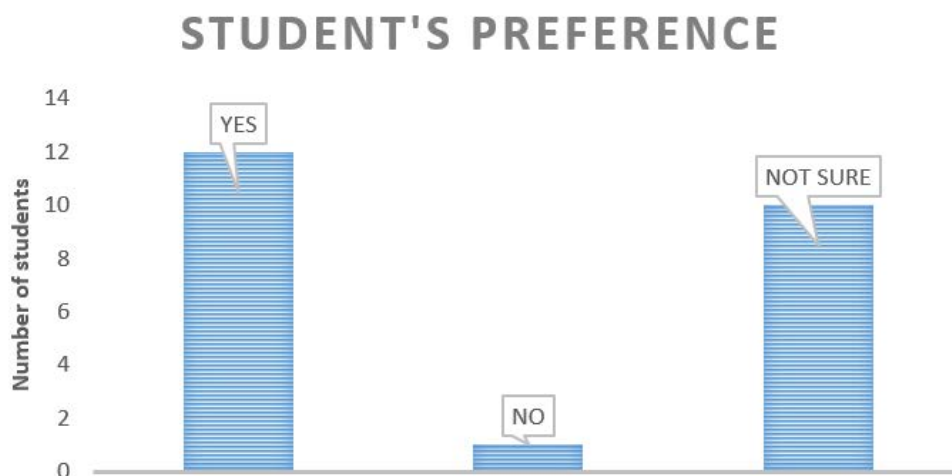


Figure 7 - Students' preference of the learning method

Students' perceptions towards the flipped way of learning were investigated through a simple questionnaire that asked them if they preferred this method of learning and to give reasons for their preference. As shown in Figure 7, twelve students (52.17%) said they prefer they flipped classroom method while one student (4.35%) said he/she prefers the traditional way of learning. The remaining ten students (43.48%) were not sure of their preference.

Table 1 - Students' feedback on the flipped classroom

Positive responses to flipped classroom	We are more actively involved
	Able to work with classmates
	Make students think on their own
	Able to learn from mistakes instantly
	Different teaching method makes the lesson more interesting
	We can discuss together and teach each other
	We are actually doing instead of just copying
	Forces us to study on our own
	This method forces students to understand
	Allows us to understand the topic
	Students can better understand
	Makes students remember easily and understand the topic
	Students can learn faster and learn from mistake
	Easier and better understanding
It makes me understand clearly	
Mixed responses to flipped classroom	Depends on the topic
	Difficult to keep up with the smarter students in the group
	Group members have different approach
	Both methods are interesting
	Some members do not contribute towards the group work
	I like the method but I feel working in group slows down the pace of the lesson
	We are forced to learn it ourselves but the instructor is the best to teach us
	Some topics are better explained by my friends while for some other topics, it is better for the lecturer to explain
I like the group work but it is difficult to complete the task when all members are equally lost	

Table 1 displays the students' feedback on their positive and mixed responses towards the flipped classroom technique. Students who responded positively towards the flipped classroom said that they have better understanding of the lesson using this method of learning. They also like the flipped classroom method because they are actively involved in the problem solving and is able to learn from each other's mistakes. On the other hand, although some students agree that flipped classroom can be effective, they still feel that the teacher is the best person to teach the topic. Besides, they feel the effectiveness of the group work depends a lot on team work which can be compromised if there are members who do not contribute towards the discussion.

Conclusion

In conclusion, students' positive responses towards the flipped classroom method in this study are consistent with earlier studies (e.g., Butt, 2014). The successfulness of any flipped classroom will depend on the amount of work and effort the students invest in their online learning. As such, it is important that the online learning materials are interesting and motivating. Students are unlikely to find reading typed-out notes to be stimulating. Online videos instead of online reading materials have been found to be preferred by the teachers and students (Herreid & Schiller, 2013; Overmyer, 2012). In this study, voiced over power point slides have been used instead of uploading the lecture materials in word or pdf format.

Although initial observation during the classroom discussion and participation suggested successful learning took place, there is small difference between the percentage of students who favored flipped classroom and who still feels traditional teaching has its advantages. The primary reason for students to favor the flipped classroom is because they feel that they can understand the lesson better through active involvement and participation. On the other hand, group dynamics and topic chosen are reasons for the mixed responses towards the flipped classroom in this study.

As pointed out by Tucker (2012), teachers should focus on how the instructional tools are integrated into the overall curriculum instead of just focusing on the tool itself. For instance, the power point slides used in this study demonstrated detailed working steps of the hypothesis test and so students were able to easily understand the procedure and apply it in the class on their own. In addition, although students take ownership and responsibility of learning during the classroom activities, teachers should not assume a passive role. Instead, teachers must be committed in guiding, directing and motivating the students towards effective learning.

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