Effects of the Traditional Flipped and the In-Class Flipped Classroom Models on the Students' Performance in Geometry: A Comparative Analysis

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Abstract

This study focused on analyzing and comparing the effects of the Traditional Flipped Classroom Model and the In-Class Flipped Classroom Models on the students' performance in Geometry. A quasi-experimental design was utilized with 60 Grade 9 students from two sections of Statefields School, Inc., during the third term of school year 2017 – 2018 as respondents. Two sections from Grade 9 were randomly chosen to form the control group and the experimental group of the study. The control and experimental group were exposed to the Traditional Flipped Classroom Model and the In-Class Flipped Classroom Model respectively. Pretest and posttest on selected topics in Geometry were administered to determine the mathematical performance of the respondents who were matched according to their pretest scores. Findings revealed that learning took place among students in both Flipped Classroom Models as evidenced by the increase in their mean score. Furthermore, through the use of the paired samples t-test, significant gains were observed in the mathematical performance of the students under both Flipped Classroom Models. Thus, the Flipped Classroom Models are both effective in improving the students' performance in Mathematics. The use of the t-test for independent samples pointed out that there is no significant difference between the mathematical performance of the respondents when they were exposed to the Traditional Flipped Classroom Model and the In-Class Flipped Classroom Models. No significant difference was observed between the gain scores of the respondents as well. Therefore, both classroom models are equally effective in improving the students' performance in Mathematics.

1. Introduction

One of the latest trends in education that has been generating a lot of discussions and buzz is the Flipped Classroom Model [1]. Even though flipping the classroom is nothing new, it is a great first step in reframing the role of the teacher in the classroom [2].

The concept of flipped classroom [3] is "that which is traditionally done in class is now done at home, and that which is traditionally done as homework is now completed in class". The main goal of a flipped classroom is to enhance student learning and achievement by reversing the traditional model of a classroom, focusing class time on student

understanding rather than on lecture. Teachers are no longer the main source of information; instead, they take on more of a tutorial role.

The study of flipped classroom is based on the theory of Bloom's Revised Taxonomy of Cognitive Domain [4]. This taxonomy provides six levels of learning: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating [5]. In implementing the flipped classroom model, remembering and understanding, the lowest levels of cognitive domain, are practiced outside class hours while in the classroom, the learners focused on higher forms of cognitive work such as applying, analyzing, evaluating, and creating [6].

The Flipped Classroom Model requires students to watch video lectures at home or any place convenient to them. However, this may not always be possible because there are students who do not have a computer and an internet connection or are not willing to participate. To address this, the flipped classroom is modified by moving the at-home learning part of the flipped classroom in the classroom, which is called the In-Class Flip [7]. The In-Class Flipped Classroom adopts the Station Rotation Model where students move around the classroom to different learning stations and at least one station must be an online learning station [8]. The In-Class Flipped Classroom Model seems to be advantageous than the traditional flipped classroom model because the teacher can observe whether students who are really watching the video content have a better chance to understand the lesson, and the device are presumably safer. However, this model is not without challenges because it does not make for tidy one-period lesson plans. This requires more preparation at the beginning, and no extra class time is gained [9].

2. Objectives of the Study

The main objective of the study was to analyze and compare the effects of the Traditional Flipped Classroom and the In-Class Flipped Classroom Model using the pretest and posttest mean scores of the students' performance in selected topics in Geometry.

3. Methodology

Research Design

A quasi-experimental design was used in this study to determine the effects of the Traditional Flipped Classroom model and the In-Class Flipped Classroom model on the students' performance in selected topics of Geometry. In this study, the different Flipped Classroom Models served as the independent variables and the dependent variable is mathematical performance of the students as measured by the pretest and posttest mean scores.

Respondents of the Study

Based on the pretest scores, 30 matched pairs of Grade 9 students of Statefields School, Inc., School Year 2017 – 2018, from two sections, 9C Lucio San Pedro and 9E Fernando Amorsolo, were taken as respondents of this study. By random assignment, one section was designated as the control group and the other, the experimental group. The control group was exposed to the Traditional Flipped Classroom Model and the experimental group was exposed to the In-Class Flipped Classroom Model.

Research Instrument

A validated teacher-made, content-based achievement test which served as pretest and posttest was the main instrument of the study. The achievement test is a 20-item test which consists of topics on Parallelism of Lines, Quadrilaterals, Triangle Similarity, and Right Triangle Theorems. This test underwent content validation by a panel of experts in Mathematics and item analysis. Shapiro-Wilk test was used to check for normality of the pretest scores. Using Cronbach's Alpha, the achievement test was found to have a reliability coefficient of 0.816 which indicates good support for internal consistency reliability [10].

Video lectures based on the lesson plans prepared by the researcher and validated by the subject area coordinator were also prepared by the researcher and administered to both control group and experimental group. The video lecture for each lesson runs for approximately 0-15 minutes [3].

Data-Gathering Procedure

A pretest was administered to both groups in order to determine the mathematical performance of the respondents before the experiment and to check on their comparability. The result of this pretest was used as the basis for matching the respondents of the study.

Each student in the control group was given a YouTube account and a weekly schedule for watching a specific video lesson which is uploaded on YouTube. However, since the videos were uploaded in advance, the students were given the option to watch the videos for the next lessons as well. Privacy settings of the videos were included to allow only the students from the control group to access the videos. Before starting the lesson, the students were given 5 minutes to discuss and review among themselves the lesson from the video that they were assigned to watch and then they were given a drill on the lesson for the day. Depending on the result of the drill, seatwork and group activities or more examples are provided and the teacher tutored the students who had a hard time understanding the lesson.

On the other hand, the experimental group was subjected to the In-Class Flipped Classroom Model. Unlike the control group, students in the experimental group were neither given a You Tube account nor a weekly schedule for watching a lesson. Instead, they watched the lesson inside the classroom. After listening to the overview of the lesson provided by the teacher, the students watched the video lecture at the same time in a classroom equipped with televisions. Afterwards, exercises were given to check if the respondents understood the lesson and the seatwork and group activities followed. Otherwise, more examples were given.

After the implementation of the Traditional Flipped Classroom Model and the In-Class Flipped Classroom Model, a posttest was given to compare the students' mathematical performance. All throughout the experiment, seatwork exercises, group activities and the assessment materials given to the two groups were the same. The researcher handled both groups for a period of 12 weeks.

Regular classes were held for both sections, but for the purposes of the study, only the performance of the matched pairs was reported.

Statistical Treatment

In analyzing the mathematical performance of the students, the means and the standard deviations of the pretest and posttest mean scores were obtained. The pretest and posttest means indicate the extent of the respondents' mathematical performance while the standard deviation indicates the consistency of their mathematical performance [11].

The t-test for independent samples was used to determine if the differences between the two groups' pretest mean scores as well as their posttest mean scores are statistically significant. The paired samples t-test was used to determine if learning occurred after subjecting the groups to different flipped classroom models. Cohen's d value was also computed in order to identify the effect size of the data.

4. Results and Discussion

The mean and the standard deviation of the pretest and posttest scores were used to determine the extent of the mathematical performance of the respondents. The paired samples t-test and the t-test for independent samples were applied to compare the mathematical performance of the two groups.

Effects of the Traditional Flipped and In-Class Flipped Classroom Models

Figure 1 below shows the frequency distribution of the pretest scores of the control and experimental groups after exposure to the Traditional Flipped and In–Class Flipped Classroom models, respectively.

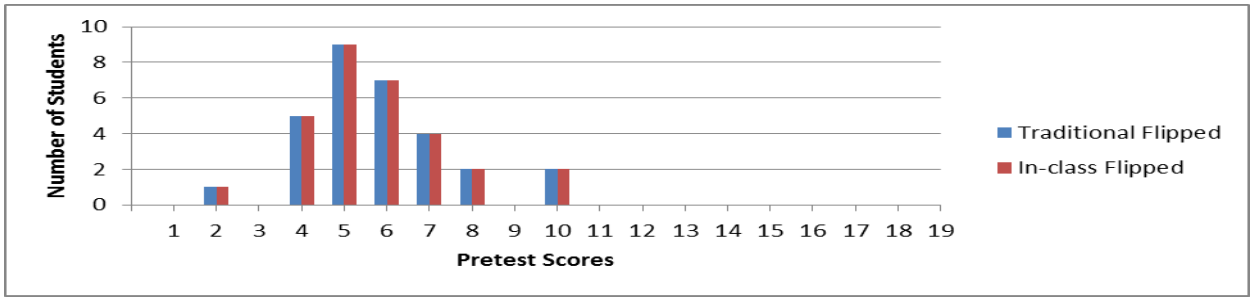

*Figure 1.*Frequency Distribution of the Pretest Scores

It can be noted that the respondents from the Traditional Flipped Classroom and In-Class Flipped Classroom have the same pretest scores. As such, the scores of both classes overlap in the bar graph. Also, based on the Shapiro-Wilk test of normality, the skewness is 0.664 which is less than 1, it can be concluded that the pretest scores are at least approximately normal [10].

Figure 2 shows the frequency distribution of the posttest scores of the control and experimental groups after exposure to the Traditional Flipped and In–Class Flipped Classroom models, respectively.

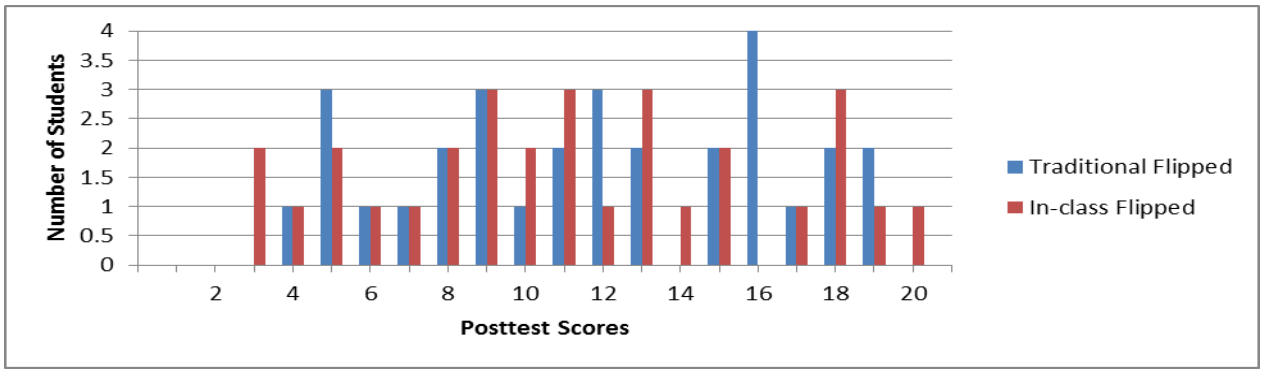

*Figure 2.*Frequency Distribution of the Posttest Scores

The variation of the scores of the two groups can be observed from the graph. Though the scores are quite spread out, it can be observed from the graph that the number of respondents from the two groups who obtained almost the same score is close to one another, especially from those who obtained scores of 4 to 15. However, there are more respondents in the control group with scores of 16 and above than those in the experimental group. It can be inferred from these data that the Traditional Flipped Classroom Model produced more high performing respondents than the In-Class Flipped Classroom Model.

Table 1 presents the means and the standard deviations of the pretest and posttest scores of the respondents, the result of the paired samples t-test comparing the pretest and posttest mean scores of the respondents in the In-Class Flipped Classroom as well as in the Traditional Flipped Classroom together with the result of the paired sample t-test and the effect size.

Table 1. Statistical Data of the Pretest and Posttest Scores

Group	**Pretest**		**Posttest**				
	Mean	**SD**	**Mean**	**SD**	**t-value**	**Mean Gain**	**Effect Size**
Traditional	5.77	1.74	11.80	4.60	8.653 (S)	6.03	1.74
In-Class	5.77	1.74	11.13	4.93	6.243 (S)	5.36	1.45

Legend: NS – Not Significant; S – Significant

As reflected in the table, the control group obtained a higher posttest mean score. Also, it can be observed that there is a larger increase in the posttest mean score of the control group that was subjected to the Traditional Flipped Classroom Model; however, the difference of 0.67 in the mean gains is not sufficient to conclude that the respondents subjected to the Traditional Flipped Classroom Model performed better than those subjected to the In-Class Flipped Classroom Model. Furthermore, the small difference in the standard deviations of the posttests is not enough to say that the control group performed more consistently than the experimental group. The mean gains of 6.03 and 5.36 of the respondents exposed to the Traditional Flipped Classroom and the In-Class Flipped Classroom, respectively, indicates that learning took place using both models.

The t-value of 6.243 at the 0.05 level of significance (2-tailed) implies that there is a significant difference between the pretest and the posttest mean scores of the In-Class Flipped Classroom. Similarly, as reflected in Table 1, a significant difference exists between the pretest and the posttest mean scores of the respondents subjected to the Traditional Flipped Classroom with t-value of 8.653 at the 0.05 level of significance (2-tailed). This result supports the suggestion of [9] that flipping the classroom, even modifying as an In-Class version, still brings higher student achievement.

Additionally, mean gains of 6.03 and 5.36 for the Traditional and In-Class Flipped Classroom Model, respectively, indicate an increase in the posttest mean score, an evidence that learning took place among the respondents under each model. The effect sizes of 1.74 and 1.45 indicate that there is a remarkable difference between the respondents' performance before and after exposure to the In-Class Flipped and Traditional Flipped classroom models. These results confirm the findings of [14] and [15] which suggests that the use of the Traditional Flipped Classroom models bring about significant learning gains in the students' mathematical performance. However, this debunks the argument of [16] which suggests that the Flipped Classroom Model brings no statistically significant increase in the mathematical performance of the students. This confirms the accuracy of the matching of respondents done and the comparability of the two groups right from the start of the experiment.

There is no significant difference between the posttest mean scores of the two groups. This implies that the mathematical performance of the two groups does not differ significantly even after different Flipped Classroom Models were used. The Traditional Flipped Classroom Model and the In-Class Flipped Classroom Model are equally effective in improving the respondents' mathematical performance.

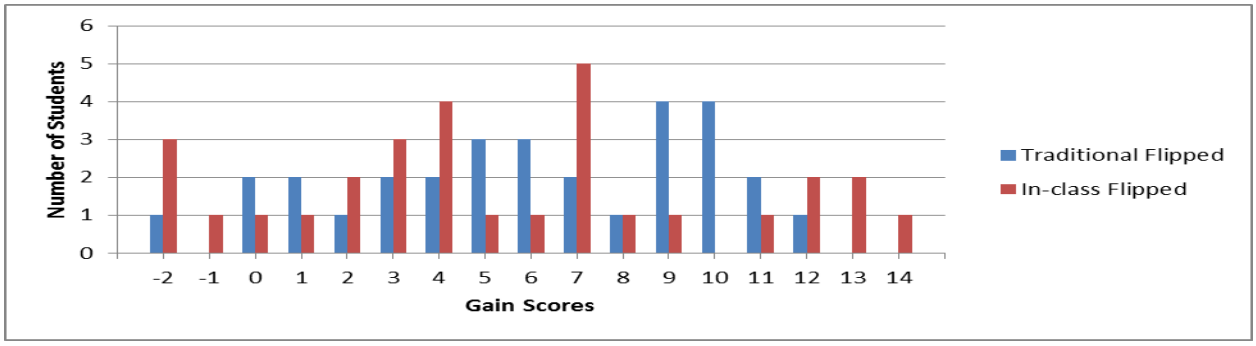

*Figure 3.*Frequency Distribution of the Gain Scores from the Pretest and Posttest Scores

The data shown in Table 1 can be seen clearly from the graph in Figure 3 which shows the frequency distribution of the gain scores of the respondents after exposure to the Traditional Flipped and In-Class Flipped Classrooms. It can be deduced from the graph that 27 respondents in the Traditional Flipped Classroom and 25 from the In-Class Flipped Classroom performed better in the posttest than in the pretest as evidenced by the positive gain scores. It is worth mentioning that there is an increase of at least 10 points in the posttest scores of 7 respondents exposed to the Traditional Flipped Classroom Model and 6 respondents exposed to the In-Class Flipped Classroom Model. This indicates that both classroom models are equally effective in improving the respondents' mathematical performance. However, since some respondents exhibited very little improvement or no

improvement at all in their mathematical performance, it can be said that the use of the Flipped Classroom Models is not a guarantee for improved performance all the time. This contradicts the argument of [12] that students from flipped classrooms exhibited a huge performance boost. Additionally, it should be noted that there are more respondents in the In-Class Flipped Classroom who obtained a larger increase in their mathematical performance than those in the Traditional Flipped Classroom.

Comparison between the Effects of the Traditional and In-Class Flipped Classroom Models

The t-test for independent samples was used to determine if any significant differences between the gain scores of the Traditional Flipped and In-Class Flipped Classrooms are reflected in the table below.

Table 2. Statistical Data of the Posttest Mean Gain Scores Under the Traditional and the In-Class Flipped Classroom Models

Group	Posttest Gain Scores		
	Mean	SD	t-value
Control	6.03	3.82	0.602 (NS)
Experimental	5.37	4.71	

Legend: NS – Not Significant; S - Significant

The t-value of 0.602 at the 0.05 level of significance (2-tailed) between the Traditional Flipped Classroom and the In-Class Flipped Classroom implies that there is no significant difference between their mean gain scores. This implies that the improvement in the mathematical performance of the two groups does not differ significantly; thus, providing more evidence that the In-Class Flipped Classroom is as effective as the Traditional Flipped Classroom Model in improving the mathematical performance of the respondents.

5. Conclusions

Based on the findings of the study, it can be said that learning took place in majority of the respondents in both classes. The mathematical performance of the two classes improved after exposure to the two Flipped Classroom Models. Moreover, both models demonstrated equal effectiveness in improving the respondents' performance in mathematics.

6. Recommendations

In the light of the conclusions, the researcher recommends that teacher training on the implementation of the Traditional Flipped and the In-Class Models be conducted. They may be given the freedom to choose either model for their class since both models are effective in improving mathematical performance. School administrators may consider allowing online classes so that students will have time to watch the given lectures in advance. Future researchers may conduct further studies on the Traditional and In-Class Flipped Classroom Models in different subject areas to confirm the findings of this study. Lastly, producers of video-editing and screen casting software may consider integrating the Flipped Classroom

Model in their software. This can help teachers greatly since here might be teachers who are not knowledgeable in making educational videos.

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