FLIPPED CLASSROOM: AN INNOVATIVE STRATEGY TO IMPROVE ACADEMIC PERFORMANCE IN MATHEMATICS OF GRADE SEVEN STUDENTS OF GUINSURONGAN NATIONAL HIGH SCHOOL

Ma. Pearly Rose V. Llantos[1], Lovely Rose A. Bolante[2], Abegail C. Nablo[3], Ma. Paula Joy B. Llantos[4], Eddie B. Rosales Jr.[5]

[1] *Master Teacher, Guinsurongan National High School, Catbalogan City, Samar, Philippines*
[2] *Licensed Professional Teacher, Samar State University, Catbalogan City, Samar, Philippines*
[3] *Licensed Professional Teacher, Samar State University, Catbalogan City, Samar, Philippines*
[4] *Licensed Professional Teacher, Samar State University, Catbalogan City, Samar, Philippines*
[5] *Licensed Professional Teacher, Samar State University, Catbalogan City, Samar, Philippines*

ABSTRACT

This action research aimed to investigate the effectiveness of the Flipped Classroom Approach in improving the mathematics performance of the grade seven students officially enrolled at Guinsurongan National High School (GNHS) during the School year 2018–2019 in the Division of Catbalogan City, Samar, Philippines. This study used a Pre-Test, Post-test, Quasi-Experimental Quantitative-Descriptive design using Paired T-test and One-Way Analysis of Variance (ANOVA) in analyzing the data from the control group and treatment group of the study. The participants were 60 grade seven students of Guinsurongan National High School who had difficulties understanding and mastering the competencies in the first grading period in Mathematics. The participants were chosen using a non-random or purposive sampling technique and assigned into two groups. The first group was the treatment group, while the other was the control group. The results from the 20-item standardized test of both groups were compared to check for any significant differences. Results revealed that the modification in the teaching-learning process, strategies, and materials with the Flipped Classroom approach in teaching Mathematics greatly influenced the academic performance of the participants in the treatment group compared to the control group. The effects on the students' academic performance in the treatment group were remarkably high compared to the control group. This action research also showed that implementing Flipped Classroom Approach could be an excellent instructional model that could promote students' higher forms of cognitive domains, which is incoherent with the theory of Bloom's revised taxonomy for the cognitive domain.

Keyword: - *Flipped Classroom, Academic Performance, Quasi-Experimental, Grade Seven Students, Guinsurongan National High School*

1. CONTEXT AND RATIONALE

In our century, rapidly developed technologies affect education training as they do in all fields. In parallel with the speed of technological development, education conditions develop as well, and different learning demands come out [3]. Compensating for these demands that come out with this transformation is among the prior responsibilities of education systems. That is why a qualified education system should allow learning and transform the traditional structure into a modern structure with technological opportunities. As changes in knowledge and technology are so fast, education keeps up with it and continues developing with innovative learning approaches [1]. This change and transformation in education training take out a new strategy: Flipped Classroom system [6].

The Flipped Classroom is a student-centered approach to learning where the students are more active than the instructor in the classroom activity. In this case, the instructor facilitates, motivates, guides, and provides feedback on the student's academic performance [5]. Thus, by applying the Flipped Classroom approach to the teaching and learning process, the instructor can improve the traditional classroom discussion to virtual discussion, for which students can listen to the discussion anywhere outside the classroom. The Flipped Classroom approach allows students to attend virtual discussions at their convenience and study at their own pace. This type of approach significantly affects students' interactive learning in distance education. By flipping the class, the students can learn anywhere and have more time to solve problems individually or collaboratively with their peers [8]. Applying Flipped Classroom approach also contributes to a better understanding of technology use in teaching and learning activities. Students will use various technology media in learning activities independently, while the lecturer will use various technology media in their teaching practices [7].

For this reason, it is crucial to study the effectiveness of Flipped Classrooms in teaching Mathematics among grade seven students of Guinsurongan National High School to foster understanding of an educational reform effort for the benefit of the said students.

2. INNOVATION, INTERVENTION AND STRATEGY

In this study, the Flipped Classroom is described as individual video-based learning outside the classroom and group learning inside the classroom. The videos take the place of direct teaching with more individual time for students during class. Homework is no longer done at home but in class, thus the term flipped or inverted classroom [2]. The following are the traits embodied by the flipped classrooms used in this study:

- Students lead discussions in a class of outside content studies and gain more knowledge.
- Students demonstrate high-order thinking skills.
- Students apply content to contextually real situations.
- Students mentor and collaborate and own the learning and can review videos as needed.
- Students ask deep questions, motivate one another, and build a relationship with the teacher.
- Students engage in active learning and move from just sitting.

Roehl, Reddy & Shannon explicated how students got to reflect using the flipped classroom on their learning and how teachers gave immediate feedback [4]. In this study, the teacher used voiceovers for videos and screen capture software and gave instructions with visual aids. Students asked questions at class sessions instead of interrupting a lecture. The class did not slow up because of students not attending due to sports, participation in competitions, or other extra-curricular activities. The teacher made changes to videos as needed.

3. ACTION RESEARCH QUESTIONS

This study aimed to investigate the effectiveness of the flipped classroom in improving the academic performance in Mathematics of the grade seven students officially enrolled during the school year 2018 – 2019 at Guinsurongan National High School in the Division of Catbalogan City, Samar.

Specifically, this study sought to answer the following questions:

- What are the results of the pretests in Mathematics of the control and experimental groups?
- Is there a statistically significant difference in the pretests in Mathematics of the treatment and control groups?
- Is there a statistically significant difference between the treatment group's pretest and post-test in Mathematics after using game-based learning?
- Is there a statistically significant difference between the control group's pretest and post-test in Mathematics after using traditional teaching?
- Is there a statistically significant difference in the post-tests in Mathematics of the treatment and control groups?

4. ACTION RESEARCH METHOD

This study is centered on the effectiveness of the Flipped Classroom in improving the academic performance in Mathematics of grade seven students using the Quasi-Experimental Quantitative-Descriptive method. Paired T-test and One-Way Analysis of Variance (ANOVA) of data utilizing the two-group, control group, and treatment group, pretest-posttest design.

4.1. Participants and Other Sources Of Data And Information

The chosen participants were sixty (60) grade seven students of GNHS. They were identified with difficulties in understanding and mastering the learning competencies in the first grading in Mathematics based on the diagnostic test and pretest. The said students were chosen using a non-random or purposive sampling technique and divided into two groups. One group was assigned as the treatment group, while the other was assigned as the control group. The standardized test results of both groups were compared using the Paired T-test and One Way ANOVA and were checked for any significant differences. It would ensure that all of the participants had relatively the same level of performance in the subject.

4.2. Data Gathering Methods

Data were collected using a standardized 20-item test adopted from Mathematics 7 Module and validated by the Education Program Supervisor (EPS) in Mathematics. The researcher did not modify the instrument to get valid and more reliable results in this study. The test consists of 20 questions that assessed the participants' academic performance in Mathematics in the first grading period.

This study underwent pre-test and post-test administration during the intervention phase. After administering the pre-test, the teacher applied the process of integration of Flipped Classroom in teaching Mathematics as part of the intervention program for the treatment group for the entire first grading period. On the other hand, the control group was given the usual traditional approach intervention program by the same teacher.

After the first grading period, the standardized test was given to the students again, which served as the post-test. After checking the test papers, the researcher compared the groups' test results and analyzed them with the paired t-test and One-Way ANOVA. Then the treatment group's results in the pre-test and post-test were analyzed for any significant difference. This comparison also was made to the control group's performance in the pre-test and post-test. It would show whether the process of Flipped Classroom integration affected students' performance.
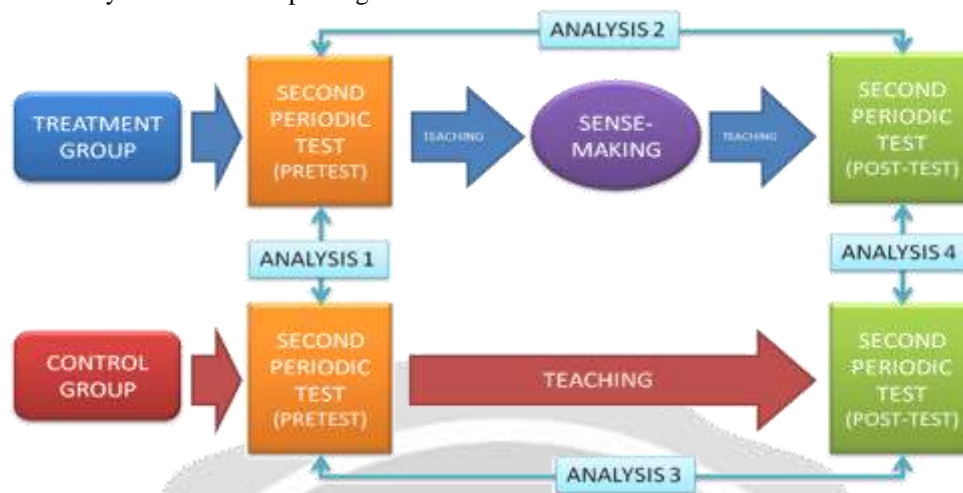
Below is the summary of the research paradigm.

Chart -1: Summary of Research Paradigm

As the paradigm shows, four analyses are to be conducted to ensure the validity of the results. The standardized test used as the pretest and post-test to establish parallelism in the content covered. The only difference in the teaching of the two groups is the integration of flipped classroom in teaching Mathematics as intervention program of the treatment group. Analysis 1 is done to determine any significant difference in the performance of the control group and the treatment during the pretest by using descriptive analysis including mean, standard deviation and percentage. Their performance should have no significant difference in order for the study to be valid. Next, in Analysis 2, the treatment group's results in the two tests were compared while Analysis 3 explored the control group's results in the tests using t-test. Lastly, Analysis 4 investigated any difference in the post-test results of the two groups. The last three analyses revealed whether the process of integration of flipped classroom in teaching Mathematics produced any significant effect in the performance of the treatment group.

The researcher also conducted actual observations in order to determine the extent of manipulation/understanding of the students along performance/proficiency level, hands-on skills on game-based learning of formative, summative, periodical and pretest and post- test results after the administration of the action research.

In analyzing the answers of the participants of the action research, different statistical analysis and treatment of analyzing the data were used such as descriptive analysis and inferential analysis. Table summarizes the statistical treatments that utilized for each research questions posed for the study:

Table -1: Summary of Statistical Treatments for Each Research Question

Research Question	Statistical Treatment
1. What are the results of the pre-tests in Mathematics of the control and experimental groups?	Descriptive Analysis using Average and Standard Deviation
2. Is there a statistically significant difference between the pretest and post-test average scores in Mathematics of the treatment group after using Flipped Classroom approach?	Test of Significance for Difference Between Two Means using One-Way Analysis of Variance (ANOVA)
3. Is there a statistically significant difference between the treatment groups' pre-test and post-test average scores in Mathematics after using Flipped Classroom Approach?	Test of Significance for Difference Between Two Means using Paired T-test

4.	Is there a statistically significant difference between the control groups' pretest and post-test average scores in Mathematics after using traditional teaching?	Test of Significance for Difference Between Two Means using Paired T-test
5.	Is there a statistically significant difference between the pre-tests and post-tests average scores in Mathematics of the control and treatment groups?	Test of Significance for Difference Between Two Means using One-Way Analysis of Variance (ANOVA)

5. DISCUSSION OF RESULTS AND REFLECTION

5.1. Results

The participants of this research study are sixty (60) students from the two heterogeneous sections of the grade seven level of the school, the treatment group and the control group.

The students in the treatment group received the modified instruction, learning styles, and materials through the Flipped Classroom, while the control group did not receive any modification in teaching Mathematics.

Below are the results of the pre-test of the treatment group and the control group:

Table -2: Descriptive Statistics of the Pretests of the Treatment and Control Groups

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest_1	30	3.00	7.00	4.5333	.77608
Pretest_2	30	3.00	8.00	5.8667	1.04166
Valid N (listwise)	30				

On the pre-test of the treatment group, it has an average of 4.5333 and a standard deviation of .77608. The data shows that the students in this group have poor and minimal knowledge about the topic.

On the pre-test of the control group, it has an average of 5.8667which is higher than the treatment group, and a standard deviation of 1.04166, which is lower than the other group. The data shows that the students in this group have more knowledge about the topic than the other group based on the results of the pre-test.

Below is the comparison of between two means using One Way Analysis of Variance (ANOVA) of the treatment and control groups' pre-test results:

Table -3: - Comparison of Means of the Pre-Tests of the Treatment and Control Groups

ANOVA

Pretest

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	26.667	1	26.667	31.608	.800
Within Groups	48.933	58	.844		
Total	75.600	59			

One-Way Analysis of Variance (ANOVA) was used to compare the mean scores of the two groups on the results of their pre-tests. There was no significant difference in scores between the subjects' effects of the two groups (p value=.800). It means that both students from the two groups have minimal knowledge about the topic.

Below is the Paired T-Test on the Comparison of Means of the Pre-Test and Post-Test of the Treatment Group and Control Group:

Table -4: - Paired T-Test Pre-Test and Post-test of Treatment and Control Group

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	SD	SD Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest_1 - Posttest_1	-14.20000	1.15669	.21118	-14.63192	-13.76808	-67.241	29	.000
Pair 2	Pretest_2 - Posttest_2	-8.30000	1.23596	.22565	-8.76151	-7.83849	-36.782	29	.010

In the comparison of means of the pre-test and post-test of the treatment group, there is a mean difference of 14.2000, t-value -67.241, 29 degrees of freedom, and .000 significant difference on the pre-test and post-test. There is a significant difference in the pre-test and post-test of the treatment group after the modification of the teaching-learning process, strategies, and the use of Flipped Classrooms approach in teaching Mathematics. Also, it shows that the modification and the use of Flipped Classroom approach greatly affected students' academic performance in the treatment group.

In the comparison of means of the pre-test and post-test of the control group, there is a mean difference of 8.3000, t-value -36.782, 29 degrees of freedom, and .010 significant difference on the pre-test and post-test. There appears to be a significant difference between the pre-test and post-test of the control group after the usual traditional approach in teaching Mathematics has been made. Also, it shows that the usual traditional approach to teaching Mathematics was effective and has affected the student's academic performance in the control group.

Below are the One-Way Analysis of Variance (ANOVA) and Estimated Marginal Means of Difference on the Comparison of Means of Scores of post-tests of the two groups:

Table -5: - One-Way Analysis of Variance (ANOVA) of the Two Groups

ANOVA

Posttest

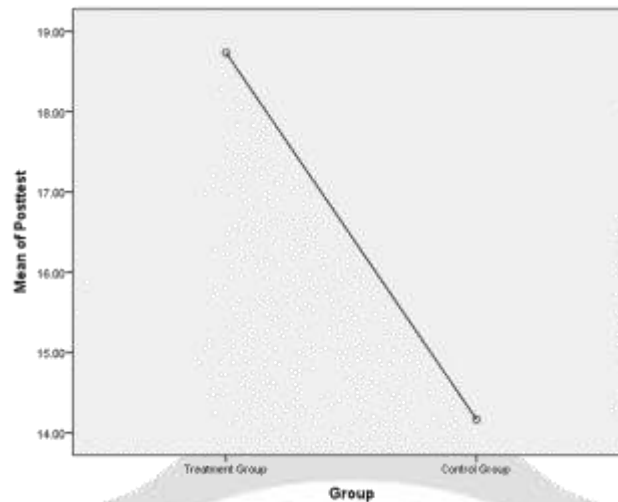|	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	312.817	1	312.817	533.106	.000
Within Groups	34.033	58	.587		
Total	346.850	59			

Figure 1: Estimated Marginal Means of the Two Groups

One-Way Analysis of Variance (ANOVA) was conducted to compare the mean scores of the treatment and control groups after the modification, and the usual traditional approach was made or used. There was a significant difference in scores between-subject effects of the treatment group, M=18.7333, SD= .86834, and the control group, M =14.1667, SD = .64772 MS=210.120, F=533.106 and Sig=.000. The extent of the difference in the means, estimated marginal means = 4.5666, was very high. It means that the modification in the teaching-learning process, strategies, and the use of flipped classroom in teaching Mathematics in the treatment group highly affected and increased the academic performance of the students compared to the control group who received the usual traditional approach of teaching Mathematics. The effects on the academic performance of the students in the treatment group were remarkably high compared to the control group. In addition, the use of Flipped Classroom approach in teaching Mathematics has a positive impact on the least mastered competencies of the students in Mathematics.

5.2. Reflection

This research identified that the study's results provided an understanding of the effectiveness of Flipped Classroom approach in improving the academic performance in Mathematics of grade seven students of Guinsurongan National High School. In general, the findings suggest that the modification in the teaching-learning process, strategies, and materials with the use of flipped classroom in teaching Mathematics in the treatment group highly affected and improved the academic performance compared to the control group who received the usual traditional approach of teaching Mathematics. The effects on the students' academic performance in the treatment group were remarkably high compared to the control group. This action research showed that the correct use of Flipped Classroom approach would be an excellent instructional model that can promote students' higher forms of cognitive domains incoherence with the theory of Bloom's revised taxonomy for the cognitive domain.

6. ACTION PLAN

Programs/ Projects	Objective/s	Strategies/ Activities	Persons Involved	Target Date	Expected Outcomes	Source of Fund
In-Service Training about Curriculum Guide and Different Teaching Strategies	Prepare the Mathematics teachers to adapt to Flipped Classroom Approach.	Conduct an in-service training program for GNHS Mathematics teachers about the Curriculum Guide and Different Teaching Strategies	GNHS Mathematics teachers, administrators and personnel	August 2018	Almost 100% of Mathematics teachers are knowledgeable about Curriculum Guide and Different Teaching Strategies.	School Fund/ LGU Fund
Flipped Classroom Training for GNHS Mathematics Teachers	Promote the use of Flipped Classroom in teaching Mathematics and other subjects at all levels (if possible)	Conduct an in-service training program for GNHS Mathematics teachers and other teachers (if possible) about objectives, techniques, and steps in adapting Flipped Classroom Approach.	GNHS Mathematics teachers, administrators, and personnel.	August 2018	Adaptation of Flipped Classroom	GNHS Mathematics Department's Fund/ LGU Fund
Innovation	Prepare Innovation in adapting Flipped Classroom.	Conduct in-service training program for Mathematics teachers about innovation in adapting flipped classroom	GNHS Mathematics teachers	September 2018	Flipped Classroom with innovation	GNHS Mathematics Department's Fund/ LGU Fund

7. REFERENCES

[1]. Akdemir, K., & Bicer, A. (2015). Educators evaluate flipped classrooms. Education Week

[2]. Bergmann, J., Overmeyer, J., & Wilie, B. (2013). The flipped class: Myths vs. reality

[3]. Celen, K., Celik, A., & Seferoglu, W. (2011). Developing, using, and interacting in the flipped learning movement: Gaps among subject areas. *The International Review of Research in Open and Distributed Learning*

[4]. Roehl, A., Reddy, S. L., & Shannon, G. J. (2013). *The Flipped Classroom: An Opportunity to Engage Millennial Students through Active Learning. Journal of Family and Consumer Sciences*

[5]. Sams, A., & Bergmann, J. (2012). Flip your classroom: Reach every student in every class every day. International Society for Technology in Education (ISTE)

[6]. Toto, W., & Nguyen, N. (2009). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environment Research,*

[7]. Zainuddin, Z., & Attaran, M. (2015). Malaysian students' perceptions of flipped classroom: A case study. Innovations in Education and Teaching International

[8]. Zainuddin, Z., & Halili, S. H. (2016). Flipped classroom research and trends from different fields of study. *International review of research in open and distributed learning*, *17*(3), 313-340.