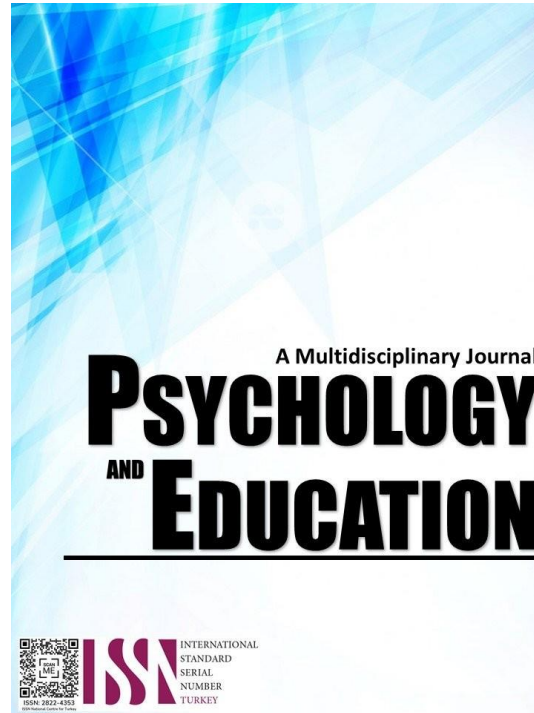


GRADE 9 LEARNERS' ENGAGEMENT AND PERFORMANCE IN FLIPPED MATHEMATICS CLASSROOM



PSYCHOLOGY AND EDUCATION: A MULTIDISCIPLINARY JOURNAL

2023

Volume: 13

Pages: 1014-1024

Document ID: 2023PEMJ1230

DOI: 10.5281/zenodo.8380229

Manuscript Accepted: 2023-24-9



Grade 9 Learners' Engagement and Performance in Flipped Mathematics Classroom

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Abstract

The study's main objective determined the effectiveness of the Flipped Mathematics Classroom in the Academic Performance and Level of Engagement of the Grade 9 students in Rizal High School. A Quasi-experimental method of research that applied two groups pre-test and post-test. Triangulation was utilized to validate support and prove that it was consistent during data collection. Findings in the study revealed that at the start of the study, both students had no statistical difference in Academic Performance and Level of Engagement. After the implementation of Flipped Mathematics Classrooms, the Flipped Group showed a significant difference in terms of Academic Performance and Level of Engagement compared to the Non-Flipped Group. These findings imply that the implementation of Flipped Mathematics Classroom in the Flipped Group showed a high correlation between their Academic performance and Level of Engagements. This present study recommends implementing Flipped Mathematics Classroom to improve the students' Academic Performance and Level of Engagement in learning. A proposed teachers' capability enhancement training on Flipped Classroom was also designed. To further the research, a development of a learning systems can be explored, especially for students who live in rural areas with unstable to poor Internet connectivity.

Keywords: *flipped classroom, level of engagement, academic performance, geometry, mathematics education*

Introduction

In the Philippines, Mathematics is taught as a general education subject in both primary and secondary schools, and students are expected to understand and appreciate its principles as they are applied in real-world problem-solving, critical thinking, communication, reasoning, making connections, representations, and decisions (Guinocor et. al., 2020). Though Math is an essential subject and is relevant in daily living, most students still consider it the most complex subject to learn. It may be due to their cognitive abilities, engagement in learning, time constraint, teacher's delivery of instruction, or their learning environment. The difficulty in learning Mathematics is one of the recognized challenges in society. In the news article of Philstar, the Philippines ranked 77 (the second lowest in ranking), in the Programme for International Students Assessment or (PISA) 2018, with a score of 353 in Mathematics below the average of 489 in participating Organization for Economic Cooperation and Development (OECD) countries. Likewise, the PISA findings reflect the students' performance in the National Achievement Test. The Department of Education identifies the urge to give an eye on resolving these issues and the gap in providing quality education in the Philippines through Sulong Edukalidad, the Department of Education will lead this national effort to improve basic education by conducting rigorous revisions in four important areas: (1) K-12 evaluation and updating, (2) learning facility

improvements, (3) upskilling and reskilling of teachers and school leaders through a changed professional development program, and (4) engagement of all stakeholders for support and collaboration. Saligumba & Segumpan (2019) comment that to improve the quality of mathematics education, many researchers tried innovative strategies, and these strategies were proven effective to enhance student mathematics performance. The implementation of these new strategies shows favorable results in enhancing the student's mathematics performance. They also added that those innovative strategies improve students' mathematical performance and other factors that affect their academic performance, such as attitude, mathematics anxiety, and self-efficacy. Segumpan and Tan (2018) claim that, with the present generation of 21st-century learners, teaching Mathematics through the conventional classroom setup seems to be less effective or effective in improving students' mathematics learning.

In Rizal High School, students in a traditional method come to school unprepared, learn from the lesson discussed by their respective teachers, and end the class with a take-home activity that will be submitted the following day. This routine occurs every session. Another concern was time constraints in class discussions; the school's typical Math time is 1 hour per meeting for three days. Practical works and group-based activities in a traditional classroom consumed much time, excluding time for discussion before the activity was conducted. In this kind of setup, the

lesson's in-depth discussion is limited and there is less opportunity for the students to learn. Imagine this setup occurs for the whole school year; the fewer time is allotted for instructions and interaction, the more difficult it is for the Mathematics teachers to encourage them to participate in learning. In the study of Dunlap (as cited in Gumban & Tan, 2019), the student's engagement towards mathematics is influenced by how the learners recognize and deeply understand the problem. If the students did not consider math as relevant to them, they will not spend their time and interest on it. Thus, learning mathematics in a meaningful way and gaining sufficient comprehension will be difficult.

The past performance of Rizal High School in Percentage Scores (MPS) is 47.52% in Mathematics for the Third Quarterly Test is below the average rate. Based on the MPS, most students do not meet the passing rate of 75%. According to Weiss and Pasley (as cited by Clark 2015), the student's passive learning experiences inside the classroom may be rooted in Mathematics current performance and achievement. In the study, they found out that an effective mathematics instruction can lead to students' engagement in learning by injecting various strategies to help them activate their previous knowledge. It is a call for mathematics teachers to think of an alternative teaching method to cater to the 21st century students' learning process. The findings of the study will be used to plan and strategize teaching techniques to fulfill the needs of students and improve mathematics performance. Gumban et al. (2019) suggests that there is a need to improve learner engagement to improve learning outcomes.

Another concern is the current situation right now brought by Covid -19 or SARS-COV2 and other viruses which limited the face-to-face interactions among the students and teachers to shift from pure classroom-based to more flexible learning using remote, online, or digital learning. Thus, the use of technology in teaching becomes more demanding as educational tools, curriculum as well as teaching approaches are now connected with technology since it promotes a learning environment conducive for the students, developing learners' engagement and motivation in learning. The National Council of Teachers of Mathematics, as cited by Clark in 2015, comments that to suffice this, educators very highly recommend giving weight to student-centered learning strategies that will engage learners in an individual investigation of mathematical ideas to improve their academic performance. In line with this, the researcher aims to look for a teaching method that will

increase the performance of the students in mathematics. One of the student-centered approaches is the flipped classroom. Gumban and Tan (2019) suggest mathematics educators use Flipped Classroom to maximize class time for meaningful engagement and to increase students' performance in such a way that students appreciate the subject that is practical in a real-world setting. Additionally, this strategy contributes to enhancing students' active participation and results from in-class activities. Enfield (as cited in Gumban & Tan 2019) stated that a flipped classroom is one in which students use outside-of-class materials (videos lectures, podcasts, concept readings, and documents) to extend the class time for more hands-on educational activities. Tang et al. (2017) revealed a better approach in teaching that is Flipped Classroom. Flipped Classroom assisted them to improve their learning motivation, gain a better knowledge of the lesson's content, and enhance their communication and clinical thinking.

This study came to be for the reasons stated above. The research aims to determine Grade 9 learners' engagement and performance in flipped mathematics classrooms.

Research Questions

This study's objective is to assess Grade 9 Learner's Engagement and Performance in a Flipped Mathematics Classroom in Rizal High School at Pasig City. Particularly, the study sought to answer the following questions:

1. What is the performance of Flipped and Non Flipped groups in terms of
 - 1.1 Academic Performance; and
 - 1.2 Level of Engagement?
2. Is there a significant difference between the Flipped and Non Flipped students in terms of:
 - 2.1. Academic Performance; and
 - 2.2 Level of Engagement?
3. What is the correlation between the Academic performance and Level of Engagement of the students in a flipped classroom?

Literature Review

Academic Performance

Segumpan et al. 2018 note that Mathematics performance results from how learning occurs in the classroom discussion. Thus, the way learners perceive the lesson and how teachers deliver the lesson is

needed to consider since it is the by-product of the performance. According to Turner (as cited by Segumpan et al. 2018), classroom environment, teacher personality, and teachers' approaches are some of the factors that cause low performance in math among primary education students. Segumpan et al. (2018) point out that educators do not update classroom style and instead fixate on what they need to do rather than what students need to accomplish. This scenario is evident in a traditional classroom that does not suffice with the students' new learning. Generalao (as cited by Segumpan et.al, 2018) that a student's performance greatly influenced how instruction is perceived in-class instruction. The learners' performance in Mathematics depends on how the teacher makes instructions meaningful and exciting to them. This concern depends on the teacher's approach or techniques, teachings tools utilized, and the learning environment.

Ulep (as cited in Segumpan et. al. 2018), explains the mathematics teaching in Philippine settings that the teacher does the talk and asks questions to sustain the class discussion. Filipino Mathematics teachers should focus on developing and familiarizing themselves in an open-ended activity that involves real-life situations, in-class instruction, and cooperative learning to fully utilize each instruction. This is backed up by Tang et al. (2017). He discovered that flipping the classroom boosts students' learning motivation, performance on final exams, critical thinking, and communication abilities. This method requires to be modified in terms of individual subjects, student workload, and student performance evaluation. In the study led by Aji et al. (2019), assimilating in-class active learning positively impacted student engagement, self-efficacy, and content. The idea of providing a springboard for the students before the start of the class is adequate. Also, the students were engaged in learning, improved their critical thinking, cognitive skills, and reduced test anxiety, and all of this is possible if proper implementation were evident. According to Huong et.al (2018), students that used the flipped classroom technique became more vigilant with the content they studied, as it increases critical thinking and let them to take complete control of their education. As a result of expressing their point of view, they became more logical. Tan et al., (as cited by Casem 2016), described that the flipped instructions had tremendous progress in the participants' mathematics performance since flipped students could access the materials before the class discussion and have better interactions among their teachers and classmates compared to traditional. Davies et al., (as cited by Clark 2015) compared the traditional

introductory spreadsheet skills to flipped models and showed higher motivation and improved academic performance than traditional methods. Similarly, the study conducted flipping the undergraduate psychology classes revealed increased retention and engagement in classes. It shows that the increase in retention and engagement during a flipped instruction model caused improved performance on exams compared to the traditional classes. (Talley and Scherer cited by Clark 2015).

In the study conducted by Lloná and Tonga 2020, the dominant problems that affect math education were low performance, limited time of instructions, and difficulty in providing instructional needs in a diverse student. The integration of Flipped Classroom will significantly help with this difficulty that using collaboration and including the student's background reveals a positive change in their responses to the task like initiation and a higher level of interest. It deepens their understanding and shows a positive result like a boost of their interest and teaches them their study's accountability. Also, the material's availability at home and knowledgeable persons' guidance improves the student's math performance. Also, student's mathematics performance, student's achievement is the main ingredient in developing the primary education system, particularly teaching and learning. Academic performance is one of the keys to determining if the teacher's instruction emphasizes a quality education or not. (Dalan as cited by Segumpan et. al 2018). The use of technology in teaching Mathematics creates a friendly environment and covers up their interest in learning. According to Myllykoski (2016), he discovered that educational videos help students during remedial studies since it helps them recall topics, show significant improvement in exams, and those who were identified as peer learner were able to solve mathematical problems by themselves. Proper implementation of this will significantly help the student improve retention, confidence, and performance in math. A possible disadvantage is the restricted time to suffice the topic needed to cover in a time frame.

Flipped Classroom

The foundation of Flipped Learning was started by Jonathan Bergmann & Aaron Sams, two chemistry teachers from Colorado who aim to help their high school students who struggled and missed classes. Those students symbolize students who are failing academically, students who are overworked, and students who get by with a bare minimum of knowledge. Students will watch pre-recorded videos,



then answer online quizzes and activities by themselves before coming to class. By changing the lecture out of class, lesson time is used to correct misconceptions, hands-on activity, and individual assistance in the lesson. (Bergmann & Sams 2012). Bergmann and Sams (2012) list down the following advantages of Flipped Classroom: (1) flipping increases student-teacher interaction (2) Flipping communicates in the language of today's learners (3) flipping aids busy students (4) Students that struggled benefited from flipping (5) flipped supports students to excel on his / her abilities (6) flipped allows students to pause and rewind their teacher's video lesson (7) Flipping the classroom improves the connection between students and teachers (8) Teachers can get a better understanding of their students by flipping their classrooms. (9) Flipping the classroom encourages peer engagement. (10) Flipping provides for proper differentiation (11) Classroom management changes because of flipping. (12) Flipping modifies the way we communicate with parents (13) Flipping makes class visible (14) Flipping can lead to the flipped-mastery program.

Learners were preoccupied with technology for social reasons and relying on learning through integrating it into the classroom may also improve students' involvement and achievement. As students learn to progress from time to time, classroom itself suffices to upgrade by integrating technology. By integrating technology, the teachers could flip the traditional teaching and administer digital lectures outside the class that creates an active, engaging, and meaningful student-centered learning environment (Holik 2019).

Students study the lesson in a typical flipped classroom through a short video lesson presentation enclosed in a gadget readily available for them. All they need to do is watch anytime, anywhere before the class discussion, next during class hours, the learner spends time engaged in meaningful learning of the lesson through hands-on activity and like others. One instructional method that can fill in the gap between the 21st-century learner, teacher-centered approach, and digital Classroom is flipped classrooms (Holik 2019).

Freeman et al., (as cited in Zeineddine, 2018), though traditional teaching provides students with mathematical skills that are less than the expected average level of understanding, the eagerness to try other teaching methods increased the more profound understanding of the concepts and their application in a real-life situation. Using a teacher-centered lecture is not effective when it comes to teaching students with

understanding. It does not necessarily mean the lecture form is not a good idea for delivering the content but rather the time allotment for discussions and hands activity. Students' lack of understanding is caused by the time invested in the content because they must complete the curriculum within the time frame. This situation is commonly seen in different schools to ensure that the teachers could deliver the content while also ensuring that students had a thorough understanding of the lessons. According to Shyr and Chen, as cited by Segumpan et al. (2018), flipped classrooms show a positive result compared to traditional teaching. The students are prepared in learning and promoting students' performance to sustain this (Dafoe 2016) showed factors that contribute to the positive outcome such as improved student-teacher relationship and flipped classroom. Since the model granted individualized attention leading to a better student experience in a high school math classroom

Despite the potential and promise of flipped classrooms, there are things to take into consideration. Arnsten (as cited in Bautista & Fulgueras, 2020) claims that the flipped classroom is technology-heavy, which has a significant impact on students with restricted contact with technology. It was also difficult for some learners who were not tech-savvy because fully comprehending its functions takes a lot of time and effort.. Lastly, technology issues must constantly be considered, according to Quizworks (2018). One of the main reasons why flipped classrooms aren't used is because of internet connectivity concerns. Students will be able to do other things if they do not have access to the internet, which will lower their interest to study their lessons. As a result, it may result in the loss of their learning attention.

Student's Engagement

There has been an increase in interest in student engagement over the last two decades, but there have been many differences in how it has been defined and measured. Observable behaviors such as participation and time on task were used to define student engagement in early studies. (Ayçiçek & Yanpar, 2018). Emotional or emotive dimensions have also been added into researchers' conceptualizations of engagement. Researchers have recently studied the aspects of cognitive engagement such students' investment in learning, tenacity in the face of obstacles, and the adoption of deep rather than surface tactics. Self-regulation (the degree to which pupils display control over their learning actions) has also been mentioned as a factor in cognitive engagement.

The flipped classroom, according to Bishop and Verleger as cited by Ayçiçek & Yanpar (2018), is a student-centered learning strategy is made up of two parts: interactive educational activities during class and individualized computer-based lesson outside of class. The study conducted by Small horn (2017), the flipped classroom changes the teacher's space wherein the lectures were converted into pre-recorded discussion use as a springboard. Face-to-face is used to solve problems and deepen the lecture. Also, his findings reveal an improvement in student participation, as evidenced by higher attendance and submission rates, as well as a positive attitude toward the learning approach.

According to McLean, Attardi, Faden, and Goldszmidt (2016), the Flipped Classroom approach is repurposed because the focus of class time is on assessment and discussion, rather than acquiring of prerequisite knowledge and principles in the classroom. According to a study, the majority of students completed the pre-classwork in one sitting right before class. Students valued mentoring and peer relationships, as well as the ability to assess in a variety of ways. In this flipped classroom implementation, students reported developing individualized learning strategies, spending a lot of time on activity, and engaging in depth and dynamic learning, indicating that the flipped classroom has the potential to provide increased academic benefits.

According to Bergmann & Sams, as cited by Ayçiçek & Yanpar (2018), a school task is completed at home, and a home task is completed in class. Before the class, the teacher distributes the necessary materials and resources. Some tasks, such as solving problems, explanation, and concept mapping, take place in class, with the teacher acting as a facilitator. Overmyer (as cited in Segumpan et al. 2018), a dynamic and engaging learning environment is created in a flipped classroom. The learning engagement shifts from group learning to individual learning, with teacher's role is to lead and ensure that students engage in the subject. Ayçiçek & Yanpar (2018) state that in the flipped classroom, learners can participate actively in discussion and the student's level of classroom engagement may be positively affect. This could be to the fact that the students were able to perform the task with the guidance of the teacher and receive immediate feedback. In this setting, students are also encouraged to think outside and inside the classroom. (Kellinger, 2012).

Along with the pros and con's results of Flipped Classroom Model, in the focus group interview

conducted in the study of Cabi (2018) findings revealed that estimated working time of learners outside the class between one to two hours. Also, it was claimed that they viewed the videos given and assigned to learn the topic outside of class the class. They used learning strategies such as reviewing and summarizing the contents while studying. Individuals' self-learning strategies are known as learning strategies. In addition, among the beneficial characteristics of Flipped Classroom, learners are coming to class prepared and completing the assignments in class so that they do not have to do them at home. Students are also motivated when they complete their assignments in a group under the direction of the teacher.

Akgün and Atc (2017) they found out that, flipped classes improved students' academic achievement. Students' participation in the learning process enables them to develop skills such as analytical thinking, problem solving, creative thinking, and meta-cognitive thinking, all of which are necessary for academic success. The study of Smith (2015) reported that students are actively involved in a flipped classroom compared to the conventional method. He also stated that the learner admits that they were given more time to seek help from their teachers in a flipped classroom, engage in more challenging activities, and work at their own pace. In contrast, students who lack motivation may struggle with difficulty in flipped classrooms. Sun and Wu (2016) also explored the positive effects of group work on students' performance. In fact, they discovered that students' academic performance improves when they interact in the classroom (within the context of group work) (Sun & Wu, 2016). Students build self-assurance by studying independently and achieving their goals on their own.

Pagán, J. (2018) suggested that students' higher level of engagement in learning correlated to a higher performance level. In contrast, he added that students who lack essential competencies to perform the task leads to lower engagement levels since they find it difficult to understand and lack the skills needed to succeed. Higher examination outcomes that involve analysis in a unique environment are linked to the student's motivation and usage of methods. White, Naidu & Larson, (2017).

Nguyen & Ikeda, as cited by Turkii (2018) they discovered that the students who undergo flipped classrooms had higher self-regulation levels and social connectedness. In terms of self-regulation, interactions play a vital role. The students could express



themselves inside the classroom using their learning since they immediately received feedback and instructions from their teachers. The learner is motivated to ask for assistance to increase their knowledge and self-regulation skills. Hutchings and Quinney, as cited in Holik (2019), the flipped Classroom creates a more effective classroom environment. It provides students more time to apply what they've learned in class and improves the quality of their discussions. Furthermore, because they had the freedom to manage their learning with the pre-recorded video used in learning in and out of the classroom, students are responsible for their learning progress. Furthermore, peer teaching can be used to observe personal fulfillment among students who have a high level of literacy and knowledge of the topic.

J Abah, P. Anyagh, and T. Age (2017) in their study they found out that flipped learning has a positive impact on students' notions of learning and enhances the learning experience in terms of inquisitiveness, engagement, and self-paced learning. Also, educators are highly recommended at all mathematics education levels to look for teaching approaches that will engage students to learn and motivate them to maintain interest and improve academic performance like Flipped Learning. Tang et al. (2017) revealed a better approach in teaching called Flipped Classroom. Flipped Classroom assisted them to improve their learning motivation, gain a better knowledge of the lesson's content, and enhance their communication and clinical thinking.

Methodology

The research made use of the Quasi-experimental method of research: applying two group pretest and post-test designs to determine the learning outcomes of learner who were taught using flipped Mathematics classroom. Both groups took teacher's pre-test and post-test that served as the Academic Performance of the study before and after the intervention. The reliability of the Teacher's Made Test was calculated for this research and the Cronbach Alpha reliability of 0.917 and this coefficient was deemed acceptable for measuring the Academic Performance of the respondents. The Cronbach alpha was utilized to determine the research instrument's reliability. Cronbach alpha values greater than .70 are acceptable and satisfactory, according to Hair et al. (2010). In the study, the reliability coefficient is 0.917, indicating that the research instrument was reliable.

Level of Engagement Observation Form was used to

verify the learner's Level of Engagement in a Flipped Classroom. The form let the researcher to monitor and gather data to the respondents throughout the lesson. Using a five-minute interval, they observed the two groups during their respective classes in Math and coded their behavior using these three on task codes and 3 off task codes. The Level of Engagement is divided into On-Task and Off-Task. The On-Task was subdivided into code like X= listening / watching, RW= writing/ reading, H= hands on activity/interacting while Off task was subdivided into codes like P= passive/inactive, playing with object, D= disturbing others and U= Unrelated Activity. Each student was required to join the Google Meet, open their camera and rename their names as Student 1 and so on for the observers to easily identify them. At the end of the said observation, each teacher totaled the number of On-task and Off-task in their Observation Form and wrote their class observation in comments section of the form. Afterwards, the researcher tallied the results and placed them in the bar graph to assess the Level of Engagement of the respondents in synchronous classes of both groups before and after then implementation of Flipped Classroom.

Participants

The target participants were the grade 9 students at Rizal High School, Pasig City. The respondents of the study were a combination of 76 students from 2 sections that served as the subjects of this study; Grade 9 – Caramoan Beach and Grade 9- Tinago Falls in a public school in the highly urbanized city in the National Capital Region in of School year 2020-2021 whose taking up Mathematics 9: Geometry. Both groups were heterogeneously composed of both males and females. Each respondent had corresponding gadgets and means to have internet connectivity.

Instruments of the Study

Pre-test and Post-test. The researcher made pre-test and post-test was utilized to determine the performance of the respondents in Mathematics.

Construction. Researcher constructed and made a teacher's Made Test that is aligned with MELC's of the School Year 2020-2021.

Validation. The researcher sought help and supervision of 2 Master Teachers of Rizal High School in terms of Pre and post-test. In addition, the researcher asked for validation of the Teacher-Made Engagement Form from 2 Master Teachers and 2 guidance counselors.



Procedure

The questionnaire method and observation method were the mode of data gathering. Each respondent was given a structured set of questions that will be used to identify the student's performance in a Flipped and non-flipped Mathematics Classroom. Engagement Observation Form was used to determine the Level of Engagement of the student during and after the implementation of Flipped and Non-Flipped classrooms to the respondents.

In addition, the researcher used triangulation. Triangulation is a technique to analyze the result of a single study using a variety of data gathering methods. Its main purpose is to enhance the validity of the study, picture out more the problem, and investigate multiple perspectives on a research subject. Most of the time, it aids in the validation of study findings by ensuring that results from multiple methodologies or witnesses of the same event are consistent (Nightingale, 2020). The researcher interviews the students as well as the parents to validate and support the results of the research. The researcher used the following approach to collect data:

1. A letter was sent to the Schools Division Superintendent of Pasig City, Rizal High School Administrator, and Parents to ask permission the conduct the proposed study which includes the pre & post-test, observation form, utilization of Video Lesson, and interview.
2. Upon approval, the researcher adapted the observation form and constructed a Teacher-Made Pre-test and Post Test to be validated by the Experts, as well as with Cronbach alpha results of 0.917. Also, the researcher asked her co-teachers to observe her class for three days before the end of the Second Grading Period.
3. First, with the approval of parents about the study, the researcher conducted a meeting with the parents together with the students about the implementation of and what is flipped classroom to familiarize them with the learning process.
4. Next, the researcher administered the pre and post-test using Google Form before the flipped classrooms to determine the extent of their learning and after the flipped math to conclude the effect of the said study. The respondents were given 1 hour in their respective math time to answer the test. Also, they were required to join the Google Meet and open their camera to make sure that they were the ones answering it. Moreover, the scores were stored in Google Drive.
5. Then, the researcher asked her 4 co-teachers to observe her class after the implementation of the Flipped and Non-Flipped classes among the two groups for 3 observation days.

6. Lastly, the researcher conducted an interview among the respondents in the flipped classroom as well as with the parents of the respondents to solidify the results of the research. In addition, the researcher asked the respondents to write a reflection about their experience with the flipped classroom.

Ethical Considerations

The researcher sent a letter to ask permission to conduct the study from the School Division of Pasig City, the Rizal High School Administrator, parents, and students. The following were conducted in the said school: classroom observation, interviews, and answering questionnaires. Parents and learners were well informed about the conduct of the study by asking for their approval through Google Meeting and sending them a letter of consent before the study. The researcher also informed the parents of the purpose of the study and its beneficial results that will contribute to the field of education. The researcher assured the participants that their participation in the study would be voluntary. Students were asked to use their real name upon joining the classes, and the researchers verified the name and the students joining by letting open the camera to avoid intruders joining throughout the study. The same letter also stated the collected data would be treated with utmost confidentiality and would only be used for research purposes.

Results

This section presents the findings according to the study's research questions. To determine the relationship between Grade 9 Learner Engagement and Performance in a Flipped Mathematics Classroom, the Pearson Product Moment Correlation was employed. For the significant of scores in academic performance, an independent t-test was used.

Grade 9 Learner's Engagement and Performance in a Flipped Mathematics Classroom

Table 1 Academic Performance

Table 1. *Academic Performance of Flipped and Non-Flipped students in terms of (Pre-Test)*

Academic Performance	Respondents	Mean	Df	t-value
Pre-test	Experimental Group	9.29	74	-.49
	Control Group	9.68		



Critical value	P-value	Decision	Remarks
±1.9925	.63	Reject	Significant

Figure 1 Level of Engagement

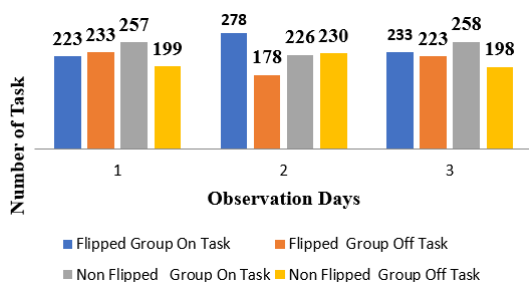


Figure 1. Flipped and Non-Flipped students in Level of Engagement

Significant Difference between the Flipped and Non-Flipped students in terms of:

Table 2 Academic Performance

Table 2. Comparison of Academic Performance of Flipped and Non-Flipped Groups

Group Academic Performance	Flipped		Non-Flipped	
	Pre-Test	Post Test	Pre-Test	Post Test
Mean	9.29	12.79	9.68	10.95
N	38	38	38	38
t-value	-5.43		-1.72	
p-value	.00004		.09	
Decision	Reject		Reject	
Remarks	Significant		Not Significant	

Table 3. Comparison of Academic Performance of Flipped and Non-Flipped Groups (Post Test)

Academic Performance	Respondents	Mean	t-value
Post Test	Experimental Group	12.79	2.34
	Control Group	10.95	

critical value	p-value	Decision	Remarks
±1.9925	0.02	Reject	Significant

Figure 2. Level of Engagement

Figure 2 illustrates the level of engagement of the respondents in both groups after the implementation of a Flipped Classroom Experimental Group. This table includes the number of on task and off task per observation.

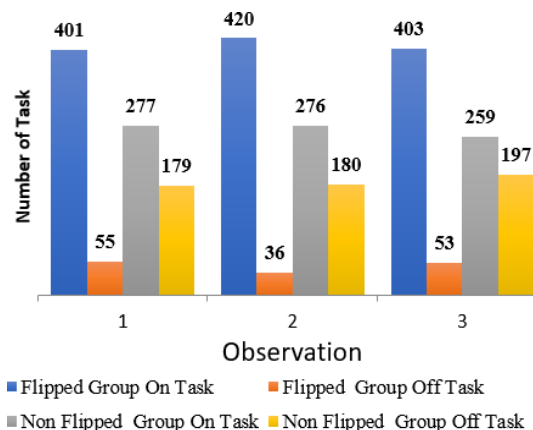


Figure 2. Flipped and Non-Flipped Group Level of Engagement after Intervention

Relationship between the Academic performance (post-test) and Level of Engagement of the students in a Flipped Classroom?

Table 4. Relationship between the Academic Performance and Level of Engagement in Flipped Classroom

	Post Test	Level of Engagement
Post Test		
Level of Engagement	.72**	

Discussion

Learner Engagement and Performance in a Flipped Mathematics Classroom

Academic Performance. The data revealed that the experimental group received mean scores of 9.29 in the Performance of Flipped and Non-Flipped Students pre-test. The control group, on the other hand, received mean scores of 9.68. The difference between the two groups' means is 0.39. As a result, students in the Control group scored higher than those in the experimental group. However, both groups lack mathematical concepts in the research's stated contents.

Level of Engagement. From the three class observations conducted, a mean of 46% or 627 out of 1368 behaviors was recorded in the Observation form in terms of on task among the non-Flipped group and mean of 54% or 741 out of 1368 behavior recorded in the Observation form in terms of off task. While for the Flipped Group got a mean of 54% or 744 out of 1368 behavior recorded in the Observation form in terms of off task among the group and a mean of 46% or 624 out of 1368 behaviors was recorded in the Observation form in terms of on task. The data shows that both groups were low in engagement this is because from the interval of 30 minutes to 45 minutes the Non-Flipped groups are off Task for and from the interval of 5 minutes to 10 minutes and 45 minutes the Flipped Group were also Off-Task. The Off-Task recorded behavior for both groups were of inactive and doing unrelated activity during class.

Significant Difference between the Flipped and Non-Flipped Academic Performance

Academic Performance. The table shows the comparison of scores in post-test of two groups after the integration of Flipped Classroom. The table shown that the Experimental groups acquired an increase of 1.84 in mean scores from the control group. It also shows that the students' means obtained from the post-test achievement Flipped and Non-Flipped Groups do make a statistically significant difference $t(74) = 2.339$, $p = .022$, $d = .79$, 95% CI [.27, 3.41]. The mean for the Experimental Group ($M = 12.79$, $SD = 3.91$) shows a significant difference from the Control Group ($M = 10.95$, $SD = 2.89$). In other words, it can be stated that the Experimental groups gain an increase of means scores after the implementation of Flipped Classroom. This implies that groups exposed in the intervention had a beneficial impact on their mathematics performance.

Level of Engagement. As presented in Figure 3 illustrates the comparison of the Level of Engagement of two groups after the implementation of intervention. From the three class observations conducted, a mean of 59% or 812 out of 1368 behavior recorded in the Observation form in terms of on task among the non-Flipped group and mean of 41% or 556 out of 1368 behavior recorded in the Observation form in terms of off task.

The data shows there is an improvement as they gain 13 % increase in the engagement level of the Non-Flipped Group compared to their previous observation. Conversely, Flipped Group gain a mean of 9% or 128 out of 1368 behavior recorded in the Observation form in terms of off task and mean of 91% or 1240 out of 1368 behavior recorded in the Observation form in terms of on task. The data shows there is also an increased gain of 45 % in the Level of Engagement compared to the previous observation as Flipped Classroom is implemented. The revealed that the Flipped Group were completely on task in the following interval of 5 minutes to 10 minutes, 35 minutes to 40 minutes, 45 minutes to 60 minutes.

Even though both groups improved in their learning engagement in respective classes, the Flipped Groups still the most improved in terms of learner's engagement in class as they gain an increase of 32 % in terms of on task compared to the Non-Flipped Group. This implies that there is a change in the behavior of the students as flipped classroom were implemented.

Correlation in Academic performance and Level of Engagement of the students in a flipped classroom

A Pearson product-moment correlation was performed to investigate the relationship of Academic Performance and Level of Engagement in terms of on-task and off the task of the students in a Flipped Classroom. Post-test was a positive high correlation related to the task Level of Engagement of the students, $r(36) = .722$, $p < 0.01$ than to off-task Level of Engagement of the students. $r(36) = -.722$, $p < 0.01$. A complete list of correlations is presented in table 9. These findings indicated that a Post Test result of the students explains engagement on-task rather than off tasks. The effect size for Level of Engagement ($r^2 = .52$) indicated that the level of Engagement that the students experience in a Flipped Classroom is accountable for the post-tests results.

Conclusion

Non-Flipped Group performs a little bit better than Flipped Group in as shown in the results of their pre-test. However, in general both groups lack mathematical concepts in the research's stated topics. Also, as observed before the implementation of Flipped Classroom, both groups showed a low level of engagement in class observation.



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