EFFECTIVENESS OF FLIPPED-BLENDED CLASSROOM STRATEGY IN TEACHING MATHEMATICS

Francisco, Mark Andrew G.

Completed 2021

Effectiveness of Flipped-Blended Classroom Strategy in Teaching Mathematics

Francisco, Mark Andrew G.
Teacher III
Pangulayan Elementary School
Department of Education, Division of Zamboanga City
markandrew.franciso01@deped.gov.ph
09774274079

Abstract

This study aimed to determine the effectiveness of Flipped-blended classroom strategy in teaching Grades 4 and 5 Mathematics in Pangulayan Elementary School, SY 2019-2020. The researcher adopted a quasi-experimental design using pretest and posttest. It used a 50–item multiple-choice test in Mathematics which was answered by the 30 Grade IV Pupils (control group) and 30 Grade V Pupils (experimental group). The pupils' pretest results of the control and experimental groups had very poor performance in Mathematics, and they did not meet the expectations to pass the subject. The posttest result of the control group was fairly satisfactory performance in mathematics when the teacher used the traditional method and satisfactory in the experimental group performance in mathematics when the teacher used Flipped- Blended Classroom Teaching Strategy. There is a significant difference in the posttest results of the control and experimental group. This outcome suggests that the flipped-blended classroom teaching strategy is effective in teaching mathematics because the pupils improved their math performance after the teacher used the strategy. Thus, the study recommends using a flipped-blended classroom teaching strategy as an alternative measure to address the poor performance of the pupils in mathematics. Mathematics teachers are encouraged to continue the study by using the flipped-blended classroom strategy to other subject areas. Moreover, they can continue the research study to include other subjects in the grade level.

Keywords: *flipped-blended classroom teaching strategy; mathematics performance; skill acquisition; traditional learning*

Acknowledgment

Above all, to the **Almighty God**, for His goodness, without whose Grace and Blessings it would have been difficult for the researcher to complete this action research. I thank him for the good health He granted me during the completion of this research.

The researcher wishes to extend his sincere gratitude to several individuals who have left their marks on this study's conceptualization and completion. Hence, the author expresses heartfelt gratitude to the following who have been generously shared their time, effort, and expertise:

Members of the Schools Division Research Committee for the Basic Education Research Fund, which provided continuous financial support to all the researchers in the Department of Education.

Roy C. Tuballa, EMD, JD, CESO VI, Schools Division Superintendent of Zamboanga City, for his approval and support for the completion of the research.

Alhadzmar Lantaka, Ed.D., SPES-Planning and Research, for his tremendous mentoring and encouragement throughout this study, whose expertise and advice had contributed much to the improvement of the study.

Janekin V. Hamoc for her support, encouragement, and persistence in critiquing the researcher's manuscript to examine every part of the text.

Rowena F. Barcelona, ESHT IV, for her support and technical assistance in gathering the data.

Teachers of Pangulayan Elementary School, for their cooperation and positive responses during data gathering.

The researcher is forever grateful to his **father, Mr. Macario D. Francisco**, his late mother, **Mrs. Marissa G. Francisco**, and his four brothers and one sister for their unconditional love, prayers, moral, and emotional support.

Context and Rationale

New forms of education reflect digital changes surrounding us. Blended learning becomes the essential part of the education process. Flipped classroom is a recently emerged hybrid classroom model, which engenders tremendous interest from teachers all over the world. It demonstrates the original education approach, which combine existing components in an innovative design (Shnai 2017, 11).

The flipped classroom is considered as one of the latest and alternative e-learning models that have made its way into the classroom worldwide. The pedagogical approach highlights the reversal of teaching roles with homework. This process allows learners to digest and develop content knowledge outside the four corners of the classroom (Martin et al. 2015). As a consequence, the teachers can optimize the teaching-learning process by using their classroom sessions as a venue for learners to apply the information and learning through a series of practical assignments (Baepler, Walker and Drieses 2014, 11).

The flipped classroom, otherwise recognized as flipped learning, was formally introduced by Bergmann and Sams in 2014. Now, it is widely utilized in the academe as evidenced by the appealing adoption rate by educators and academic institutions worldwide. The implementation of flipped classroom reduces the burden of teachers in making the students understand the concepts and improves student's digital knowledge, creative thinking and learning performance (Alalmai, Arun and Aarif 2020, 9425).

Flipped Classroom learning reverses the delivery method in traditional learning. Traditional delivery of learning is reading, watching, and absorbing learning material in class and being tasked with work to complete at home. In a flipped learning classroom, teachers prepare audio or video lectures for learners to watch at home, on their own time. The time in class is spent working through the concepts being delivered with the guidance of an instructor (Lo and Hew 2017, 11). Complementary to all of this is an online platform where learners and the instructor can discuss with one another (Honeycutt and Garette 2013, 15).

Moreover, the flipped classroom provides the teachers a different role. "In a flipped classroom, teachers do not give direct instruction. Their role becomes one of the facilitators who sets up the content, maps out homework, and provides a welcoming learning space that students can explore in" (Roles in a Flipped Classroom: Teachers & Students 2017).

On the other hand, Kim et al. (2016) considered Blended Learning as a combination of online learning and face-to-face learning (often referred to as "traditional learning"). Blended learning involves both online and offline learning. Both online and traditional teaching methods are employed to provide students with a more effective learning experience. Teachers would commonly utilize online learning components such as educational videos, games, online learning materials, and podcasts. Blended learning is a pedagogical approach in which a student learns at least in part through the delivery of content and instruction via digital and online media with some element of student control over time, place, path, or pace. This mode allows students to create a customized and integrated approach to their learning. Blended learning is proven effective when combined with the flipped-classroom approach to teaching (Purba 2021).

Sometimes, it is difficult to distinguish the difference between Blended Learning and Flipped Classroom because they have much in common. Blended learning is characterized by the combination of the in class or face-to-face education with online activities which could be applied in a flipped classroom. The role of the teachers in the flipped classroom is to create contents of the lesson so that students can study the material first. Thus, students who accessed the learning material before going to school can engage creatively and interact actively (Capone, De Caterina and Mazza 2019, 108). In this context, the teacher becomes a support and facilitator and helps students in the transition process from knowledge to acquisition of skills and competencies (Lou et al. 2012, 107).

In Zamboanga City, particularly in Pangulayan Elementary School, Mercedes District, since the school is located far- in upper high land areas, it is a big problem for the learners to access online teaching. One implementation of flipped-blended classroom learning is using technology in the classroom. In the traditional learning environment, students attend a lecture and then do assignments on their own. The idea behind the flipped-blended is to have students do passive learning activities (like watching a recorded lecture) at home, reserving classroom time for active learning. This process allows students to apply new knowledge in the presence of an instructor and will enable them to collaborate with their peers. This model increases student-instructor and student-student engagement. As observed by the teacher, Grades IV and V pupils of Pangulayan Elementary School, Mercedes District.

Another dilemma the teacher faces is the result of the Mathematics in 2018 Programme for International Student Assessment (PISA), wherein from a 489 OECD average, the Filipino students ranked very low in Mathematics and Science subjects, with 353 points and 357 points, respectively. Moreover, the Philippines ranked in the low 70s in the 2018 Programme for International Student Assessment (PISA), a student Assessment of 15-years-old learners across 79 countries done by the Organization for Economic Co-operation and Development (OECD).

The result of PISA urged the researcher to do an innovative way of teaching mathematics to grade school pupils. Hence, flipped learning, also known as the flipped classroom, is used as the teaching strategy in presenting mathematics lectures to Grade IV and V pupils. This strategy will decide between the technology and face-to-face elements of the learning experience. A learner is asked to watch an e-learning video or participate in another online learning exercise before coming to class. In the classroom, the new materials are explored at length. In most cases, the knowledge learned online is applied in the classroom.

For this reason, the researcher embarked on this study to determine the effectiveness of Flipped-blended classroom strategy in teaching mathematics for grade IV and V pupils.

Innovation, Intervention, and Strategy

The intervention utilized in this study is the Flipped-Blended Strategy. The Flipped-blended strategy is vital because it is designed to address the active and maximum participation of pupils in learning mathematical concepts. It is interesting to dig into this teaching strategy because it is expected to improve the performance level of pupils in Mathematics by allowing them to learn at their own pace and encouraging them to engage with lecture material actively.

Based on the study by Nouri (2016) on the influence of flipped classroom especially for low achievers, it was found that majority of the students had a positive attitude towards the use of flipped classroom. And this positive attitude was strongly correlated to perceptions of increased motivation, increased learning, effective learning, and engagement. Flipped learning strategy was more effective than the conventional teaching method in terms of developing students' research skills (SRS) (Mahasneh 2020).

There may be a lot of circumstances that create difficulty for pupils to improve performance in mathematics, such as lack of interest in the subject, laziness to study, and even parents' support at home. All of these things may lead to one factor, the strategy to use in the classroom. With this notion, this research topic greatly impacted researchers with a greater understanding of the processes involved in establishing an environment that would enhance student performance using the flipped-blended learning approach.

Pangulayan Elementary School, as a non-central school, has been sending pupils to the mathematics competition and sometimes reached the division level. It is expected that the school caters to pupils with good performance, especially in Mathematics. However, it is found that 80% of the pupils perform poorly in solving mathematical problems. It is therefore recommended that research must be conducted among the target respondents of the study.

Circumstances significantly affect the school, especially in the National Achievement Test (NAT). It was therefore decided that teachers should act and look for solutions that will improve the performance of pupils in Mathematics. After identifying factors that play a significant role in this problem, the Flipped-Blended strategy will be employed in the teaching-learning activities of Grade IV and V pupils.

The flipped-blended strategy was conducted during the mathematics classes of Grade IV and V to see the effectiveness between the control and experimental groups as described: (1.) The control group with a traditional discussion of the lesson during the mathematics period and the experimental group watched videos related to the lesson; (2.) Activities were given to both groups after the discussions by solving drills and mathematical problems; (3.) Provided homework videos to pupils in the flipped-blended strategy and written work for the control group; and (4) Activity was recorded and documented for one month. After the fourth quarter of this activity, the flipped-blended was given if there were no changes in the data.

Action Research Questions

This study aimed to determine the effectiveness of Flipped- blended classroom strategy in teaching mathematics for Grade IV and V pupils.

Specifically, this study sought to answer the following problems:

1. What is the pretest result of the control and experimental groups in mathematics?
2. What is the posttest result of the control group in mathematics?
3. What is the posttest result of the experimental group in mathematics after the flipped-blended classroom teaching strategy was used?
4. Is there a significant difference in the pretest of the control and experimental groups in mathematics?

5. Is there a significant difference in the posttest of the control and experimental group?

Action Research Methods

Research Design

In this study, the researcher utilized a quasi-experimental design of research that determined the effectiveness of flipped-blended classroom strategy in teaching mathematics for Grade IV and V pupils for a period of one quarter of the school year 2019 -2020. The pupils answered the 50 items questions about mathematics for Grade IV and V before and after the duration of the experiment. After answering the pretest, the teacher used the flipped-blended classroom strategy in teaching mathematics to the experimental group. The result of the posttest was taken from the experimental group.

Specifically, the two-group pretest-post-test design was used to measure the before and after the treatment (Price et al., 2017).

Participants and/or Other Sources of Data Information

The participants of this study were sixty (60) Grade IV and V pupils of Pangulayan Elementary School, Mercedes District, Division of Zamboanga City. The purposive sampling technique was used in choosing the respondents of this study. These two intact sections of Grade IV and V comprise of thirty (30) learners for each grade level. These participants answered a 50-mulitple choice test in Mathematics to determine their level of competence in the subject for pre-test and post.

Research Instrument

The researcher had formulated a 50–item multiple-choice test in Mathematics. It was pilot tested on the non-respondents for item analysis. This was referred to the school head and master teacher at the school for validity. After all suggestions and recommendations were done properly in the test, the instrument was subjected to a reliability test.

Data Gathering Procedure

Data gathering was conducted after the approval of the research proposal. The researcher secured permission from the Schools Division Superintendent through a letter to gather data from the Grade IV and V pupils of the school. The data gathering started after the approval of the study by presenting the permission letter to the District Supervisor and school principal of the said school. The researcher explained the approved letter to the principal.

The researcher conducted a series of conditioning activities on the resumption of classes for the fourth quarter. The respondents were oriented that they were part of an educational experiment to be conducted by the researcher. Consent was given by the parents/guardian for the inclusion of the participants in the study. The researcher administered a 50-item multiple-choice test to control and experimental groups during

the next meeting with the respondents. The respondents gave approximately an hour to answer after administering the pretest materials. The researcher performed routine activities by using a flipped-blended teaching strategy. This strategy served as the treatment. After the intervention, posttest materials were administered and collected personally by the researcher. Afterward, the researcher submitted the tabulated data to the statistician for statistical treatment. Lastly, the researcher did the discussion and interpretation of data.

In compliance with Research Ethics Protocol, the researcher obtained informed assent through the parents/guardian of the participants. This ethical consideration ensured that the survey respondents, with the consent of their parents/guardian, signify their awareness and understanding of the study objectives, their agreement to participate as survey respondents, their freedom to disclose or not to disclose information, their freedom to stop their participation anytime if they do not feel comfortable, their right to the confidentiality of information and anonymity of their identity as respondents of the researchers, their right to understand that the study is about testing the effectiveness of flipped-blended classroom in mathematics and have the opportunity ask questions, their right to know its benefits and the activities expected of them in the study.

Data Analysis

The researcher used the percentage mean to determine the pretest and posttest of the control and experimental groups in mathematics. Moreover, an independent t-test was used to determine the significant difference in the pretest of the control and experimental groups. It is also employed to test the significant difference in the results of the posttest of the control and experimental groups after the flipped-blended classroom teaching strategy was used.

Results and Discussion

Table 1: **Pretest of the Control and Experimental Groups in Mathematics**

Group	Mean	Equivalent Rating	Description
Controlled Group	13.87	64	Did Not Meet Expectations
Experimental Group	15.77	66	Did not Meet Expectations

Legend (DO No. 8, s. 2015): 90-100 =Outstanding 85-89= Very satisfactory
80-84= Satisfactory 75-79= Fairly satisfactory
Below 75 = Did not meet expectations

Table 1 shows the Pretest of the control and experimental groups in Mathematics for the Grade 1V and Grade V pupils. It is evident in the table that the pretest result of the control group has a mean of 13.87, which had an equivalent rating of 64% that was verbally described as did not meet expectations. This means that the pupils in the control group did not meet the expectations to pass the mathematics quiz.

Moreover, the table also revealed that the pretest result of the pupils from the experimental group had a mean of 15.77, which had an equivalent rating of 66% that was verbally described as did not meet expectations. This means that the pupils in the experimental group did not meet the expectations to pass the mathematics quiz.

This outcome implies that the pupils from both groups had very poor performance in Mathematics. Several factors such as learners' interest, attitude towards mathematics, and insufficient mathematical practice possibly contributed to the pupils' poor performance in mathematics. This finding is supported by Hossain (2018), who stated that the Math achievement of American students in 2015 fell again for the second time on a significant international benchmark, as stated in the Program for International Student Assessment (PISA). American students stagnated in reading and science proficiency, while their Math performance declined. Additionally, according to the study of Casinillo (2019) on Factors Affecting the Failure Rate in Mathematics: The Case of Visayas State University (VSU) revealed that there were five main factors affecting the failure rate in mathematics that does not follow a uniform distribution namely: poor study habits, negative learning attitudes, social environment, emotional problem, and financial problem.

Table 2: **Posttest of Control Group in Mathematics**

Mean	**Equivalent Rating**	**Description**
25.13	75	Fairly satisfactory

Legend (DO No. 8, s. 2015): 90-100 =Outstanding; 85-89= Very satisfactory; 80-84= Satisfactory; 75-79= Fairly satisfactory; Below 75 = Did not meet expectations

Table 2 shows the posttest of the control group in mathematics with a mean of 25.13 with the equivalent rating of 75% that was verbally described as fairly satisfactory. This means that the pupils in the control group had fairly satisfactory performance in mathematics when the teacher used the traditional method.

The pupils in the control group had improved a little in their performance in mathematics by 11%. This implies the traditional method is effective in teaching where learners sit silently and passively inside the classrooms and the teacher actively performs the lecturing. Thus, the pupils inactively attend in the learning process. They talk and engage in the learning process when approached and required to perform as they are instructed, while in a conventional classroom setting, the learning abilities of the majority of the learners are restricted only to duplicating the writings on the board. Hence, the learners are not empowered to effectively handle the data through thoughts, evaluation, and investigation. Because of this constrained intellectual capability, learners lose interest in learning.

Table 3: **Posttest Result of the Experimental Group in Mathematics after the Flipped-Blended Classroom Teaching Strategy**

Mean	**Equivalent**	**Description**
30.70	80	Satisfactory

Legend (DO No. 8, s. 2015): 90-100 =Outstanding; 85-89= Very satisfactory; 80-84= Satisfactory; 75-79= Fairly satisfactory; Below 75 = Did not meet expectations

Table 3 shows the posttest of the experimental group in mathematics with a mean of 28.70 with the equivalent rating of 80% that was verbally described as satisfactory.

This means that the pupils in the experimental group had satisfactory performance in mathematics when the teacher used Flipped- Blended Classroom Teaching Strategy.

Activity-based teaching is a strategy focused on the idea that learners should be included through activities. It is adopted by a teacher to emphasize his or her teaching technique through activities in which the learners are motivated and empowered to learn. This learning approach enables the learner to learn through effective inclusion physically and rationally. Activity-based learning is characterized by meaningful school learning settings in which the learner creates Mathematical ideas through dynamic contribution. This procedure may include controlling physical materials, using games, or participating in experimentations with physical items.

Multiple data collection methods were employed including observation, written journals and tests. The data were then analysed both quantitatively and qualitatively. The findings showed that flipped classroom promotes independent learning, with the type of classroom encouraging students to work together with other peers and improved learning awareness. However, some challenges were highlighted in flipped classroom application such as technical issues, editing recording skills, and it was time consuming. Recommendations are offered in reference with the findings.

The findings are supported by Umam et al. (2019) who pointed out that flipped classrooms promote independent learning, with the type of classroom encouraging students to collaborate with peers. They found out that performance of the students became better because the students showed interest in learning; likewise, they were motivated to deal with problems and numbers. However, their study highlighted some difficulties in flipped classroom application, such as technical issues and editing recording skills, which were time-consuming.

Table 4: **Significant Difference in the Pretest of the Control and Experimental Groups in Mathematics**

Variables	**Mean**	**t-value**	**p-value**	**Interpretatio**
Control group	13.87	1.876	0.071	Not Significant
Experimental group	15.77			

**Significant level at @ = 0.05*

Table 4 shows the significant difference in the Pretest of the control and Experimental Groups in mathematics. The table revealed that the Pretest of the control and experimental groups' t-value = 1.876 with a p-value of 0.071, which is greater than the significant alpha value of 0.05, indicated that the significant difference does not exist. Hence the posited null hypothesis is accepted because there is no significant difference in the Pretest of the control and experimental groups in mathematics.

This means that the pupils from the control and experimental groups did not meet the expectations of passing the mathematics quiz given in the pretest. These outcomes are similar with the results of 2021 Regional Achievement Test of DepEd RO-IX which posted the low Mathematics proficiency level of 55.40% of Grade 6 learners (DepEd Regional Office IX BE-LCP, 2021).

Haw, King and Trinidad (2021) pointed out that the PISA report of 2018 showed that the Philippines ranked 353 in Mathematics which was recorded as very low. Over 80% of students in the Philippines did not reach a minimum level of proficiency in mathematics, which is one of the most significant shares of low performers amongst all PISA-participating countries and economies.

Table 5: **Significant Difference in the Post-test of Control and Experimental Groups**

Variables	Mean	t-value	p-value	Interpretation
Control group	25.13	0.135	0.003*	Significant
Experimental group	28.70			

**Significant level at @ = 0.05*

Table 5 shows the significant difference in the post-test of control and experimental groups after the flipped-blended classroom teaching strategy was used. The post-test of control and experimental groups' t-value = 0.135 with a p-value of 0.003, which is less than the significant value of @ = 0.05, indicated that a significant difference exists. Hence the posited null hypothesis is rejected because there is a considerable difference in the posttest of control and experimental groups after the flipped-blended classroom teaching strategy was used.

This means that the pupils from the control group had fairly satisfactory performance in mathematics, whereas the pupils from the experimental group had a satisfactory performance. This means that the flipped-blended classroom teaching strategy is effective in teaching mathematics because the pupils improve their math performance after the teacher uses the technique.

These findings are supported by Karabak and Polat (2019). They concluded that the academic achievement levels of the students in the flipped classroom model using ARCS (attention, relevance, confidence, and satisfaction) motivation strategies were significantly higher than those of the students in the distance education classroom model and the traditional classroom model. In addition, the training process did not lead to a significant change in the motivation of the students in the traditional classroom model and distance education classroom model. Still, it did lead to a substantial difference in the students' motivation in the flipped classroom model.

Another study by Talan and Gulsecen (2019) proved that a flipped classroom strategy is effective. The learners in Experiment-I discovered the theoretical aspect of the course through the materials in the online learning environment, which were prepared before the class study time in context with the "flipped classroom." The students in Experiment-II unraveled the theoretical aspect of the course in the classroom using the blended learning model. They performed active learning activities outside of the class study time. The students in the control group discovered the theoretical aspect of the subject in the classroom in consonance to the current curriculum and conducted active learning activities in their homes. They found that the scores for the students in the experimental groups concerning academic achievement and engagement were substantially higher than the performance for those in the control group. There was a statistically significant the difference between the groups. It was further disclosed that the students were also generally satisfied with the flipped classroom.

Conclusions and Recommendations

The study seeks to determine the effectiveness of flipped-blended classroom strategy in teaching mathematics. In sum, the flipped-blended classroom strategy had

consistently showed a satisfactory performance to pupils in mathematics and teachers in teaching the subject. This means that the flipped-blended classroom teaching strategy is effective in teaching mathematics because the pupils have improved their performance after the intervention was used.

The researcher resolved that the flipped blended teaching strategy amidst the peril of the COVID-19 pandemic call for the collaboration of DepEd officials that they may recommend teachers for seminars and training on using the flipped-blended teaching strategy to enhance teaching performance, Public-School Division Supervisors can initiate the monitoring plan to address the low math performance of the students. They must recommend the utilization of a flipped-blended classroom teaching strategy as alternative measures to address the poor performance of the pupils in mathematics, school heads should encourage teachers to use the flipped-blended classroom teaching strategy in teaching mathematics, teachers may suggest that the school heads provide technology and classroom materials. They may ask the school heads to provide internet connectivity so they can help abreast themselves with the new trends in education and embolden pupils to learn mathematics effectively by using the flipped-blended classroom. They may study mathematics independently to be motivated to understand and appreciate mathematics.

Action Plan

Rationale

The flipped classroom, also considered commonly as flipped learning, was introduced by Bergmann and Sams in 2014 which was adopted by teachers and academic institutions at an alluring adoption rate. The flipped classroom was launched and pioneered to represent and capture a new modern educational system that focuses on how to get out of students by adhering to their social habits. The primary objective of the flipped-blended learning program was to stimulate higher levels of pupils' performance.

Objectives

Based on the findings of the study, the intervention aims to address the following challenges:

1. Learner's interest in Mathematics.
2. Academic performance of pupils in Mathematics.
3. Insufficient mathematical practice by the pupils.
4. Inadequate teaching and learning of mathematical materials.

Strategy

The researcher used a Flipped-blended classroom strategy in teaching mathematics for Grade IV and V pupils. The activity was recorded and documented for one month. After the fourth quarter of this activity, the flipped-blended was given if

there were no changes in the data. The researcher proposed to use a Flipped-blended classroom strategy in teaching mathematics generally to grade school pupils so that attention and retention level can still be managed. The Flipped- blended classroom has become popular in several different subjects. Significant advantages are the increased level of lecturer and student interaction, which can strongly impact students' motivation, engagement, satisfaction, and performance.

References

Alalmai, Ali A., A. Arun and Mohd Aarif. 2020. "Implementing Possibilities and Perspectives of Flipped Learning in Hotel Management Institutions." *Test Engineering and Management* 83: 9421-9427.

Baepler, Paul, Jay Walker and Michelle Driesses. 2014. “It’s not about seat time: Blending, flipping, and efficiency in active learning”.

Bergmann, Jonathan and Aaron Sams. 2014. “Flipped learning: Gateway to student engagement.” *International Society for Technology in Education*. http://webcasts.astd.org/uploads/assets/264/document/TDFlippedLearning.pdf

Capone, Robert, Patrizia De Caterina and Giustina Anna Gerarda Mazza. 2017. Blended Learning, Flipped Classroom and Virtual Environment: Challenges and Opportunities for the 21st Century Students. *9th International Conference on Education and New Learning Technologies*, (pp. 1-110). Barcelona. doi:10.21125/edulearn.2017.0985

Casinillo, Leomarich. 2019. “Factors affecting the failure rate in mathematics: the case of Visayas State University (VSU).” *Review of Socio-Economic Research and Development Studies* 3.1: 1-18.

Haw, Joseph Y., Ronnel B. King and Jose Eos R. Trinidad. 2021. "Need supportive teaching is associated with greater reading achievement: What the Philippines can learn from PISA 2018." *International Journal of Educational Research* 110: 101864.

Honeycutt, Sarah C. and Patrick I. Garette. 2013. The flipped approach to a learner-centered class. (whitepaper). *Magna Publications*.

Hossain, Anowar. 2018. "The Implementation of Learning Together in Improving Students' Mathematical Performance." *International Journal of instruction* 11.2: 483-496.

Karabatak, Songül and Hakan Polat. 2019. "The effects of the flipped classroom model designed according to the ARCS motivation strategies on the students' motivation and academic achievement levels."

Kelly, Dana, Christine Winquist Nord, Frank Jenkins, Jessica Ying Chan and David Kastberg. 2013. Performance of US 15-Year-Old Students in Mathematics, Science, and Reading Literacy in an International Context. First Look at PISA 2012. NCES 2014-024. National Bureau of Economic Research.

Kim, Min Kyu, So Mi Kim, Otto Khera and Joan Getman. 2014. "The experience of three flipped classrooms in an urban university: An exploratory of design principles." *The Internet and Higher Education,* 22, 37-50. doi: 10.1016/j.iheduc.2014.04.003.

Lo, Chong, K and Khe F. Hew. 2017. "A critical review of flipped classroom challenges in K-12 education: possible solutions and recommendations for future research." *Research and Practice in Technology Enhanced Learning* , pp. 1-50.

Lou, Shi J, Nai C. Chen, Huei H. Tsai, Kou H. Tseng and Ru C. Shih. 2012. "Using Blended Creative Teaching: Improving a Teacher Education Course on Designing Materials for Young Children." *Australasian Journal Of Educational, Technology*, 28 (5), 776-792.

Mahasneh, Omar M. 2020. "The effectiveness of flipped learning strategy in the development of scientific research skills in procedural research course among higher education diploma students." *Research in Learning Technology* 28.

Martín, Cesar T., Christian Acal, Mohammed E. Homrani and Angel C. Estrada . 2015. Implementation of the flipped classroom and its longitudinal impact on improving academic performance. *Educational technology research and development*, pp. 1-44.

Nouri, Jalal. 2016. "The flipped classroom: for active, effective and increased learning–especially for low achievers." *International Journal of Educational Technology in Higher Education* 13.1: 1-10.

Price, Paul C., Rajiv S. Jhangiani, I-Chant A. Chiang, Dana C. Leighton and Carrie C. Cuttler. 2017. 10.3 The Single-Subject Versus Group "Debate". *Research Methods in Psychology*.

Purba, Ramen Antonov. 2021. "The Effectiveness Combination of Blended Learning and Flipped Classroom with Edmodo as a Digital Media Innovation for Learning From Home." *Journal of Education Technology* 5, No. 3. https://doi.org/10.23887/jet.v5i3.36210

Roles in a Flipped Classroom: Teachers & Students. Study.com. September 4, 2017. https://study.com/academy/lesson/roles-in-a-flipped-classroom-teachers-students.html

Shnai, Iuliia. 2017. Systematic Review of Challenges and Gaps in Flipped Classroom Implementation: Toward Future Model Enhancement. 16th European Conference on eLearning, (pp. 1-50).

Talan, Tarik T. and Servinc S. Gulsecen. 2019. "The Effect of A Flipped Classroom on Students' Achievements, Academic Engagement and Satisfaction Levels."

Umam, Khoerul, Toto Nusantara, I Nengah Parta, Erry Hidayanto and Herri Mulyono. 2019. "An application of flipped classroom in mathematics teacher education programme." 68-80.

Financial Report

A. Supplies and Materials					
ITEMS	QTY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL AMOUNT
1	2	Reams	A4 size s20 Bond Paper	200.00	400.00
2	1	Set	Cannon Computer Ink	400.00	400.00
4			Binding Expenses		500.00
5	10	Pcs.	Folders	20.00	200.00
6			Miscellaneous		1000.00
Total					2,500.00
7			Contingency Expenses (5%)		125.00
Grand Total					2,625.00

Research Work Plan and Timelines

Calendar of Activities	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Conceptualization of the Research						
Identification of the Problem in School						
Writing the Research Proposal						
Application & Submission of Research Proposal						
Data Gathering						
Data Analysis						
Wrap-Up & Basic Research Completion						
Submission of Full-blown Basic Research						

Appendix A

Pretest and Post-Test in Mathematics
Department of Education
Region IX, Zamboanga Peninsula
Division of Zamboanga City
Mercedes District
PANGULAYAN ELEMENTARY SCHOOL
Zamboanga City
2019-2020

Name of Pupil: _____*Gr. & Section:* _____

Directions: Read each question/problem carefully, compute if necessary and encircle the letter of the correct answer.

I. What number describes "1 millions, 5 hundred thousands, 2 ten thousands, 2 thousands, 9 hundreds, 5 tens and 3 ones?
b. 1 502 593 b. 1 525 953 c. 1 522 593 d. 1 522 953

2. What is twelve million three hundred seventy-two thousand fifty-six written in figures?

a. 12 372 056 b. 12 327 056 c. 12 372 556 d. 12 327 556

3. What is 8 678 284 rounded to the nearest hundred thousands?
   a. 8 6900 000 c. 8 700 000
   b. 8 600 000 d . 8 600 000
4. Round off the underlined digit in 9 7<u>8</u>5 215
   a. 9 700 000 b. 9 750 000 c. 9 790 000 d. 9 000 000
5. What is the greatest common factor of 72 and 40
   a. 8 b. 9 c. 10 d. 11
6. A number is divisible by 5 if_____.
   a. ones digit is 0 or 5 c. the number ends with 0, 2, 4, 6, 8
   b. the number ends with 0d. ones digit is only 5
7. What word problem involving multiples can you make using the data below?
   Given : 10 mangoes / day
   Asked: total number of mangoes in 2 weeks
   1. Ram can eat 10 mangoes a day. How many mangoes can he eat in 2 months?
   2. Alan can harvest 10 mangoes per day in his mango tree. How many mangoes can he harvest in 2 weeks?
   3. There are 10 mangoes in each mango tree. How many mangoes are there in 2 mango trees?
   4. Each mango tree has 10 mango fruits. How many mango fruits are there in 2 mango trees?

8. Evaluate: 6 x 20 + (27÷ 9).
   a. 120 b. 123 c. 23 d. 138
9.. What is the GCF of 30 and 45?
   a. 5 b. 6 c. 15 d. 30
10. Write 0.0004 in words.
   a. four tenths
   b. four hundredths
   c. four thousandths
   d. four ten thousandths

11. What is $1\frac{1}{2}+2\frac{3}{4}$?

a. 4 b. 4 ¾ c. $4\frac{1}{4}$ d. 1

12. Subtract: $5\frac{2}{3}-2\frac{1}{2}$

a. $3\frac{1}{6}$ b. 2 ¾ c. 4 ¾ d .6

13. What is the product of $4\frac{1}{3}$ multiplied by $\frac{2}{5}$?

a. $1\frac{12}{15}$ b. $1\frac{11}{15}$ c. $2\frac{12}{15}$ d. $2\frac{11}{15}$

14. Jessie took a 50-item test in Mathematics. He answered 4/5 of it correctly. How many items did he answer correctly?
   a. 35 b. 40 c. 45 d. 46

15. What is $\frac{6}{7} \times \frac{2}{4}$

a. 1/2 b. 1½ c.2 d. $\frac{3}{7}$

16 Give the place value of the underlined digit 0.82<u>7</u>

a.tenths b. hundredths c. thousandths d. ten thousandths

17. Round 16.982 to the nearest hundredths

1. 16.10 B. 16.98 C. 16.20 D. 16.97

18. Which of the following order numbers from greatest to least?

1. 3.756 37.56 375.6 0.3756
2. 0.2468 0.2486 0.2648 0.2846
3. 11.010 11.011 11.0110 1.1101
4. 2.86 2.75 2.68 2.56

19. Which of the following numbers is arranged in increasing order?

a. 3.756 37.56 375.6 0.3756
b. 0.2468 0.2486 0.2648 0.2846
c. 11.010 11.001 11.0110 1.1101
d. 2.86 2.75 2.68 2.56

20. Danny traveled 61.3 kilometers on Monday and 43.75 kilometers on Tuesday. How many kilometers did he travel in two days?

a. 105.05km b. 104.87km c. 103.635km d. 9.505km

21. Using the rounding-off technique, find the estimated sum of 3.45 + 8.63 + 2.75

a. 13 b. 23 c. 15 d. 3

22. Create a problem using the given data.

Given : ₱2 900.00 - cost of mountain bike, ₱1 575.00 - down payments 5months - equal installment

Asked: pay for each installment

a. Jess buy a mountain bike cost ₱2 900.00. He gave a down payment of ₱1 575.00. He will pay the remaining balance for 5 months installment. How much can he pay for each installment?
b. Jess buy a bike that cost ₱2 900.00. he paid 1 575.00 - down payments; how much change did he get?
c. How much is the monthly installment?
d. Jess paid ₱2 900.00 - the cost of a mountain bike, ₱1 575.00 - down payments 5 months - equal installment.

23. $\square$: 7= 24 : 56

a. 2 b. 3 c. 4 d. 5

24. Reduce ratios to lowest terms. 10 : 5

a. 2:2 b. 2:1 c. 1:1 d. 1:2

25. Solve for the missing term. $\frac{a}{32} = \frac{3}{4}$

a. 12 b. 16 c. 24 d. 28

26. The school garden is about 35% of the total land area of the school. How will you write 35% in decimals.

a. 3.5 b. 0.35 c. 3.50 d. 0 .35%

27. Express 0.56 in percent.

a. 0.56% b. 56% c. 56% d. 5.6%

28. In elements of percentage, what do you call the whole number?

a. Rate b. percentage c. base d. percent

29. 25% of 900 = 225; 25% is called____

a. Rate b. percentage c. base d. percent

30. 35% of 90 is N: what is N?

a. 31.5 b. 21.5 c. 3.7 d. 13.7

31. On their family budget, Santos family allotted 45% for the education of their children. If the family has a monthly income of P 13, 540.00, how much is allotted for the education of their children?

a. 0963 b. 6093 c. 9063 d. 3063

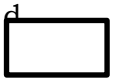
32. Kris has a monthly allowance of P 4, 800.00. She allotted 60% of it for his studies. From this 60%, she allotted 25% for his books. How much is allotted for books?

l. 72 b. 702 c. 720 d. 270

33. A polygon with eight sides is called____

a. Pentagon b. hexagon c. heptagon d. octagon

34. What figure shows a polygon?

a.  b.  c.  d. 

35. Which of these are congruent polygons?

a.  b.  c.  d. 

36. r = 7.1 yd. Calculate the diameter of the circle.

a. 14 yd b. 14.5 yd c. 14.05 yd d. 14.2yd

37. The line that is half of the diameter.

a. secant b. tangent c. radius d. diameter

38. . The diameter of the water tank is 412dm; what is its radius?

a. 220 b. 206 c. 260 d. 620

39. Spatial figure which has an equidistant from its center.

a. cone b. cylinder c. prism d. sphere

40. Which of these objects is an example of rectangular prism?

a. shoe box b. dice c. ball d. funnel

41. After finishing her shopping, Chelsea wants to have Php25 left. She plans to buy sandals for Php45 and a purse for Php20. How much money does she need?

a. P100.00 b. P95.00 c. P90.00 d. P85.00

42. Gian recorded the time as 3:45 A.M; what is it in 24-hour system?

a. 3:45 A.M b. 5:45 A.M c. 13:45 PM d. 15:45PM

43. The radius of a circle is 5.6m; find its area.

a. $89.4704m^2$ b. $98.4740m^2$ c. $98.4704m^2$ d. $89.4740m^2$

44. Find the volume of a cube with sides that measures 7.5m.

a. 412.875 m^3 b. 421.875 m^3 c. 418.227 m^3 d. 412.27 21.

45. A rectangular prism has a length of 4.2cm, width of 3cm, and height of 10cm. Find its volume.

a. 12.6c m^3 b. 126.00c m^3 c. 12.600c m^3 d. 1260cm^3

46. Jan's sewing box is 3 dm long, 2.5 dm wide, and 4.3 dm high. What is its estimated volume?

a. 12dm^3 b. 32d m^3 c. 33d m^3 d. 34dm^3

47. A flower box is 5.3 m long, 1.6 wide, and 0.23 m high. How many cubic meters of soil will fill the box?

a. 1.9504m^3 b. 19.504 m^3 c. 195.04 m^3 d.195

48. A freezer is set at 0◦C. Corina reset it to 8.5◦C. Did the temperature in the freezer rise or drop? By how many degrees?

a. rise by 8.5 ℃b. drop by 8.5 ℃ c. no d. maybe

49. Carlo boils water after a few minutes he found out it decreases by 17℃. What is the temperature of the water?

a. 92 ℃b. 85 ℃ c. 83 ℃ d. 80 ℃

50. A Box contains 15 red balls, 12 blue balls, and 13 green marbles.
Find the experimental probability of not getting a green ball?

a. $\frac{10}{16}$ b. . $\frac{15}{16}$ c. . $\frac{12}{16}$ d. . $\frac{13}{16}$

Appendix B
Informed Consent

I, the undersigned, confirm that (please tick the box as appropriate):

1.	I have read and understood the information about the research, as provided in the Information Sheet dated _____.	☐
2.	I have been allowed to ask questions about the research and the participation of my son/daughter.	☐

3.	I voluntarily agree to allow my son/daughter to participate in the research.	☐
4.	I understand I can withdraw at any time without giving reasons and that I will not be penalized for withdrawing, nor will I be questioned on why I have withdrawn.	☐
5.	The procedures regarding confidentiality have been clearly explained (e.g., use of names, pseudonyms, anonymization of data, etc.) to me.	☐
6.	If applicable, separate consent terms for interviews, audio, video, or other data collection forms have been explained and provided to me.	☐
7.	The use of the data in research, publications, sharing, and archiving has been explained to me.	☐
8.	I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of the data and if they agree to the terms I have specified in this form.	☐
9.	Select only **one** of the following: • I would like my son/daughter's name used and understand what I have said or written as part of this study will be used in reports, publications, and other research outputs so that anything I have contributed to this project can be recognized. • I do not want my son/daughter's name used in this project.	☐ ☐
10.	Along with the Researcher, I agree to sign and date this informed consent form.	☐

Participant:

_____ _____ _____

Name of Parent/Guardian Signature Date

Researcher:

_____ _____ _____

Name of Researcher Signature Date