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Effects of the Three Teaching Strategies on the Performance in Mathematics of Grade V Pupils of Ampayon Central Elementary School, Butuan City Division

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ABSTRACT

This study examined the effects of three teaching strategies—multisensory, think-pair-share, and lecture method—on the mathematics performance of Grade V pupils at Ampayon Central Elementary School, Butuan City Division. Employing a quasi-experimental design with three groups of 40 pupils each, the research utilized pretests and posttests based on the K–12 Basic Education Curriculum in Mathematics. Data were analyzed using Analysis of Covariance (ANCOVA). Findings revealed significant differences in performance across the strategies, with the multisensory approach producing the highest mean scores, followed by think-pair-share, while the lecture method yielded the lowest. Pupils exposed to multisensory and think-pair-share strategies demonstrated greater interest, higher engagement, and more substantial learning gains compared to the traditional lecture-discussion group. The study concludes that the multisensory approach is the most effective strategy for enhancing mathematics learning outcomes. It recommends that teachers and school leaders adopt varied pedagogical approaches to foster improved student performance and to align with the goals of the Department of Education in promoting quality instruction.

KEYWORDS

Mathematics performance; teaching strategies; multisensory learning; think-pair-share; lecture method; quasi-experimental research; Grade V pupils; Butuan City Division

INTRODUCTION

Teaching and learning have long emphasized the important role of teachers in supporting students' development in areas beyond their core academic skills. For example, in their conceptualization of high-quality teaching as cited in the study of Sabbagh (2019), a set of emotional supports and organizational techniques that are equally important to learners were described as teachers' instructional methods. He posits that by providing "emotional support and a predictable, consistent and safe environment", teachers can help students become more self-reliant, motivated to learn, and willing to take risks. Furthermore, by modeling strong organizational and management structures, teachers can help build students' own ability to self-regulate. Content-specific views of teaching also highlight the importance of teacher behaviors that develop students' attitudes and behaviors in ways that may not directly impact test scores.

In mathematics, researchers and professional organizations have advocated for teaching practices that emphasize critical thinking and problem solving around authentic tasks

(Thompson, 2011). Others have pointed to teachers' important role of developing students' self-efficacy and decreasing their anxiety in math.

One of the common ideas concerning the learning of mathematics is that it consists of a set of indisputable rules and knowledge which has a fixed structure and can be acquired by frequent repetitions and memorizations (Reber, 2013). It is often seen as a school subject concerned exclusively with abstract and formal knowledge. According to Skovsmose (2020), the subject of Mathematics is itself an essential element in thinking through didactical considerations in mathematics instructions. Mathematics has long been considered as "absolutist" science. It is seen as an "epitome" of certainty, vimutable truths and irrefutable methods".

Because of this idea, mathematics learning has been generally perceived as a challenging and difficult process. This difficulty is especially true for learners who have to struggle yet with basic facts and skills. This makes it imperative for teachers to introduce effective learning strategies that will help the learners to visualize mathematical concepts, which are eventually applied in problem solving situations.

Learning strategies are used by students to help them understand information and solve problems. Students who do not know or use good learning strategies often learn passively and ultimately fail in school. Learning strategy focuses on making the students more active learners enabling them to learn to use what they have learned to solve problems and be successful (English & Kitsantas, 2013).

All strategies are essential for a well-integrated program. It is necessary to help students figure out and comprehend the idea presented. The strategies are usually tied to the needs and interests of students to enhance learning and are based on many types of learning styles (Law, 2011).

In order to achieve meaningful learning, students must interpret, relate, and incorporate new information with existing knowledge and experiences (Fink, 2013). Students must actively process information in order to learn (Bada & Olusegun, 2015).

Bandura's social cognitive theory is rooted in the idea that there is a triarchic reciprocal causality between behaviors, personal factors, and environmental factors (Bjorklund & Causey, 2017). Behaviors, personal factors like cognition, goals, and self-efficacy; and environmental factors like models, instruction, and feedback given to a student all affect one another (Akkuzu, 2014). In other words, if students are paired together, they will be able to discuss each student's thought process. It allows them to gain mastery experiences and vicarious experiences that help to build self-efficacy, or a student's belief in their ability to bring about a desired effect (Kaddoura, 2013).

Teachers are given the task to instill upon the growing minds of the learners the zest for learning and provide them a firm foundation for lifelong learning (Stronge, 2018). The role of teachers on the quality of student learning outcomes is very indispensable. For this reason, the Division of Butuan City gives much attention to teachers who are in the field of mathematics. Different trainings have been conducted to refresh them with different strategies and even introduce innovations to be used in the classrooms in order to really develop the students' love for learning mathematics.

But the different training programs seem not to have been successful in achieving their goals. Pupils are still grappling with multiplication facts and problem solving as shown in the quarterly examinations and even in the achievement test conducted at the end of the school year. This is the glaring evidence of the pupils' low mastery level of the skills being taught. Per item analysis of the test given revealed that the pupils were not able to attain the mastery level desired in the curriculum.

The Division of Butuan City has been known to produce achievers in the regional and even in national contests. Being one of the top performers for the whole Caraga Region is a big prestige for all the teachers in school. However, in the last three years, the record has been put to test when the Division garnered a low rank during the MTAP-DEP-ED assessment. One of the possible reasons for this decline of performance could be that the pupils were not able to master the mathematical concepts that would help them in demonstrating the different skills expected of the subject.

Through the years of being one of the mathematics teachers in the said division, the researcher recognized the need of coupling teachers' teaching competence with student-centered pedagogies. To date, the availability of appropriate teaching strategies particularly in mathematics remains an issue in every classroom. It is for these reasons that the researcher was motivated to undertake this study. The ultimate goal is to introduce more effective teaching strategies in teaching Grade V mathematics that will significantly improve pupils' multiplication skills.

Objective of the study

The study aimed to determine the efficacy of the multi-sensory strategy, lecture discussion and think pair share strategy of learning mathematics among the Grade 5 pupils of Ampayon Central Elementary School, Butuan City Division.

RESEARCH METHODS

Research Design

The study employed the pretest-posttest experimental design. It involved three intact groups of Grade V pupils in Mathematics. One group was exposed to the multi-sensory strategy, the other group was exposed to the think pair share strategy, and the third group was exposed to lecture-discussion. Pre-test was given to the three groups before the treatment. After the treatment period, a post test was administered to determine any significance of difference in their performance as influenced by the exposure to the learning strategies.

Research Locale

The study was conducted at Ampayon Central Elementary School, Ampayon, Butuan City. It is located east of Butuan City and has a distance of 7 kilometres from Butuan City proper. With a total land area of 2 hectares, Ampayon Central Elementary School has 1,700 pupils and 60 teachers administered by a Principal IV. The vast land which was donated generously by the Manuel Santos family is surrounded by coconut and banana trees, which made the school environment conducive for learning. Different trees inside the school premises made the eighteen buildings with sixty-five classrooms more attractive for those who want to enroll. For sixty-five years of existence, Ampayon Central Elementary School produced successful citizens who served the community.

Research Respondents

The study involved three sections of Grade 5 pupils of Ampayon Central Elementary School with 7 sections. The process involved the following steps. First, the three Grade 5 sections were gathered in one setting. Secondly, pupils were administered with the pretest. The third group was exposed to Multi-sensory. The other group was exposed to think pair share strategy. Meanwhile, the other group was exposed to the control group which is the Lecture-discussion. Each section consists of forty (40) pupils.

Research Instrument

The K-12 Basic Education Curriculum in Mathematics covering the 4th grading period for Grade 5 mathematics was used as basis for the 50 item content validated test for pre-test and posttest, in the study. The performance of the pupils in the pre-test determined their scores in the 50-item test in Math 5. The test is composed of 30 skills focusing two areas: visualization of the area of concepts and multiplication skills.

There were eight (8) items for visualization of the area of a circle concept and finding the area of a circle including solving routine and non-routine. For the area of a circle, there were 11 items in visualizing and finding the volume of a cube and rectangular prism, reading temperature throughout problem solving has six items, on collecting data for line graphs to problem solving has 15 items and probability has 10 items

The 8 items for the visualization of area of the circle concepts used chart, ruler, real circle objects, pencil and compass in showing radius and diameter of a circle, and it is included in the 50 item test of which 5 items are for remembering and 13 for the understanding level of which has weighted 36 percent for the whole test. There were 13 items for understanding with 26 percent for the whole test ,12 items for applying, 10 items for analyzing with the percentage of 44 percent, 5 for evaluating with ten percent and 5 for creating with ten percent, weighted 100 percent. The test was based on the 30 skills with 45 days sessions in the learning competencies desired to be attained for the said group as spelled out in the K-12 Basic Education Curriculum Guide. Another instrument used was the attitude and anxiety scale.

Data Gathering Procedure

For the purpose of the study, the researcher wrote a letter, endorsed by the District Supervisor, asking permission from the Schools Division Superintendent of Division of Butuan City through channel to conduct a study to the three sections of Ampayon Central Elementary School of East Butuan District, Butuan City Division. An experimental activity was conducted using the simple randomization technique. Prior to the actual experiment, all groups were administered a pretest using the validated test questionnaire. After the conduct of the pretest, the experiment started. A lesson was introduced to the three groups but different learning strategies were used among the groups. Pupils in Group1 were exposed to the multisensory learning strategy. In this group, students were exposed to manipulatives wherein they were given different materials intended for the lessons and they were given time to work in groups cooperatively according to the instructions given to them. For Group 2, think-pair-share learning strategy was used. In this group, students were grouped by pair who worked on math related tasks together. The other group was exposed to the traditional approach where teachers discussed and students listened. After the experimental period, all groups had a posttest. To avoid possible contamination effect, all groups took the test at the same time. The researcher invited one assistant who facilitated the smooth administration of the test. After retrieving, collecting and recording the data, it was analyzed according to the purpose of the study. The collection of different observations from the pupils and teachers after the experiment was also collected.

Ethical Considerations

The researcher prepared a consent letter for the permission of the respondents to be part of the current study. The participants were informed about the study in detail. The purpose of the study, together with details about the data collection process was explained to the participants. The participants were informed that they could withdraw from the study at any

time without questions being asked. Participation in the said survey was completely voluntary. In administering the questionnaire, the privacy statement was written promising that the answers are purely confidential and will only be solely used for the study. The confidentiality of the respondents was assured by the researcher. are standardized and figure out the feeling of a student towards mathematics.

Scoring and Quantification of Data

Statistical analysis was facilitated the scores of the test were given descriptive ratings to treat the variables.

Statistical Treatme

The data gathered in the study was analyzed with the use of the following statistical tools. **Statistical analysis, arithmetic mean and frequency** were used to determine the pretest and posttest scores of the pupils before and after the treatment. **ANOVA or Analysis of Variance** was used to test if significant difference is seen when comparing the scores of the pupils across three teaching strategies. **ANCOVA or Analysis of Covariance** was used to determine the interaction effect of pre-test scores towards math performance (post-test) of pupils.

RESULTS AND DISCUSSION

Table 1. Pre-test scores of pupils in the visualization of concepts and multiplication skills across teaching strategies

Score Range	Descriptive Rating	Think Pair Share		Multi sensory		Lecture Discussions	
		F	%	f	%	f	%
41-50	Outstanding	0	0	0	0	0	0
31-40	Very Satisfactory	0	0	0	0	0	0
21-30	Satisfactory	0	0	0	0	0	0
11-20	Poor	4	10	8	20	1	2
1-10	Very Poor	35	90	32	80	44	98
Total		**39**	**100**	**40**	**100**	**45**	**100**

Note: f and % denote frequency and %, respectively

Table 1 shows the distribution of pupils with respect to their pre-test scores considering the three teaching strategies. Under the Think Pair Share strategy, 90% (35 out of 39) pupils posit very poor performance and 10% (4 out of 39) poor. Almost similar trend of pre-test scores is found in other strategies of teaching. For instance, using the multisensory, 80% (32 out of 40) and 20% (8 out of 40) perform very poor and poor, respectively. Noticeably, lecture discussion yields the highest percentage of very poor performing pupils by around 98% (44 out of 45) and 2% (1 out of 45) show poor descriptive rating.

The distribution of pupils exposed to the three learning strategies is a technique used similar to Cortright et al. (2005) wherein they divided the class into heterogeneous groups, groups A and B before the exposure of the class discussion. The experiment of Cortright was used as guide in the distribution of pupils as experimental units in the study. All students are in the first place screened before being distributed to three learning strategies.

Table 2. ANOVA results on pupils' pre-test score difference across teaching strategies

Teaching Strategies	Mean	Sd	P-value	Remarks	Decision
Think Pair Share	6.59	2.78	0.01	Significant	Reject H_0
Multisensory	8.48	3.95			
Lecture Discussions	4.02	3.41			

Note: Sd denotes standard deviation

Table 2 exposes the ANOVA test results on the pupils' pre-test score difference across teaching strategies. Think Pair Share, Multisensory, and Lecture discussion, respectively obtain mean scores of 6.59, 8.48, and 4.02. These mean scores are significantly different as supported by the p-value of 0.01. Hence, it can be construed that students under the multiSensory have better mathematics ability than those who are treated under Think Pair Share and Lecture discussion. These findings further lead to the rejection of the study null hypothesis.

The exposure relates the efficiency of achievement of students through manipulative according to De Asis (2001) in his study on "Realms of Knowledge: Academic Achievement". Multi-Sensory approaches allow children to receive the information in a variety of ways and links symbols to the ideas they represent. Furthermore, the difference on the mean scores prior to the administration of the different teaching strategies signifies for the need to perform Analysis of Covariance (ANCOVA) in the post-test to account the co varying effect of pre-test results.

Table 3. Post-test scores of pupils in the visualization of concepts and multiplication skills across teaching strategies

Score Range	Descriptive Rating	Think Pair Share		Multi sensory		Lecture Discussion	
		F	%	f	%	f	%
41-50	Outstanding	0	0	2	5	0	0
31-40	Very Satisfactory	7	18	8	20	4	9
21-30	Satisfactory	29	74	29	73	15	33
11-20	Poor	3	8	1	3	22	49
1-10	Very Poor	0	0	0	0	4	9
Total		**39**	**100**	**40**	**100**	**45**	**100**

Note: f and % denote frequency and %, respectively

Table 3 presents the post-test scores of pupils in the visualization of concepts and multiplication skills across learning strategies. The distribution of pupils is seemingly different than the findings in the pre-test. Under the Think Pair Share, 18% (7 out of 39) of the pupils perform very satisfactory, 74% (29 out of 39) are satisfactory, and only 8% (3 out of 39) are poor. It can be gleaned from the same table that 20% (8 out of 40) and 73% (29 out of 40) pupils under multisensory method perform very satisfactorily and satisfactorily, respectively. Remarkably, with the application of multisensory, 5% (2 out of 40) show an outstanding descriptive rating. Although, 9% (4 out of 45) and 33% (15 out of 45) demonstrate very satisfactory and satisfactory descriptive ratings, pupils who are taught with lecture discussion remain to perform poor (49%) and very poor (9%).

The post test scores of the pupils reveal differently from the pretest scores. It is believed that using multisensory strategy in teaching mathematics is responsible that the pupils perform very satisfactorily among the two strategies. According to Sarudin et. al., (2019), the effects of using a multi-sensory approach is used as a treatment. It was concluded that

using the multi-sensory approach was effective with the control group, the lecture and discussion strategy.

Table 4. ANOVA results on pupils' post test score difference across teaching strategies

Teaching Strategies	Mean	Sd	P-value	Remarks	Decision
Think Pair Share	26.62[b]	5.57	P<0.01	Significant	Reject H_0
Multisensory	28.60[a]	6.59			
Lecture Discussions	20.04[c]	6.96			

Note: Superscripts on mean scores reflect post-hoc analysis using LSD.

Table 4 exposes the ANOVA results on the pupils' post test score difference across teaching strategies. It can be observed that pupils under multisensory posit the largest mean score of 28.60, followed by pupils under Think Pair Share with mean rating of 26.62. The least mean score of 20.04 is obtained by students under the lecture discussion method. The differences on the mean scores across teaching strategies are significant as evidenced by the p-value of 0.01. Thus, the null hypothesis is rejected.

The differences on the mean scores across teaching strategies clearly favored the multisensory strategy as per ANOVA result evidenced by the p-value of 0.01. Furthermore, the post-hoc analysis using LSD reveals that the three mean scores are significantly different from one another. Table 5 exposes the ANCOVA result which substantiate the results shown using ANOVA.

Table 5. ANCOVA results with post hoc for multiple comparisons

Source	Mean Square	F-value	P-value	Remarks
Pre-test	4049.591	215.792	0.01	Significant
Strategy	217.339	5.791	0.01	Significant

(I) Strategy	Mean Score	Pairwise Comparison	Mean Difference (I-J)	Std. Error	P-Value
Multisensory	27.4	Think Pair Share	2.05	1.18	0.04
		Lecture	3.6	1.09	
Think Pair Share	25.35	Multisensory	2.05	1.18	0.03
		Lecture	1.55	0.9	
Lecture	23.8	Multisensory	3.6	1.09	0.01
		Think Pair Share	1.55	0.9	

The ANCOVA results with the coupling of post hoc analysis using the least significant difference test (LSD) posits that the mean scores of students in the post-test are significantly different. As shown in Table 5, teaching strategy is associated with a p-value that is lesser than 0.01 after getting the co-varying effect of the pre-test scores. This only shows that multi-sensory has significantly improved pupils' mathematics performance with the adjusted mean score of 27.40. Table 5 further exposes that Think Pair Share and lecture strategies yield respective mean scores of 25.35 and 23.80. On the other note, the post hoc analysis supports that the three mean scores are significantly different from one another.

The use of multisensory has indeed contributed more improvement to the mathematics performance of the students. This is something to be expected when this study primarily subscribed on the constructivism theory besides the bulk of literature supports. The use of multisensory tied to the needs and interests of students to enhance learning is based on the types of learning styles (Ekwinsi et. al., 2006). Muir (2014) also emphasized that when

applying multi-sensory strategies teachers can engage and sustain the attention of all students thus, reinforcing strong preferences and strengthen weaker ones.

Table 6. ANOVA results on the mean gain difference across teaching strategies

Teaching Strategies	Mean Gain	Sd	P-value	Remarks	Decision
Think Pair Share	20.03 [b]	3.67	0.01	Significant	Reject H_0
Multi-Sensory	21.13 [a]	3.75			
Lecture Discussions	16.02 [c]	5.72			

Note: Superscripts on mean scores reflect post-hoc analysis using LSD.

Table 6 presents the ANOVA results on the mean gain difference across teaching strategies. It unfolds multi-sensory as the strategy garnering the highest mean score of 21.13, followed by the Think pair share method with 20.03. Lecture discussion however, yields a mean score of 16.02 as shown in Table 6. The p-value=0.01 supports that there is a significant difference on the mean scores across teaching strategies at 5% level of significance. Hence, the null hypothesis is rejected.

The least significant difference (LSD) multiple comparisons test further exposes that the three mean scores are pairwise, significantly different. The findings in Table 6 are consequent to the discussion on ANCOVA results. Rummelsburg (2008) stressed that multi-sensory teaching technique should be included across a variety of classrooms instructions. It is important that teachers help students understand the material, since they have different learning styles. Multiple methods of presentation can alleviate their comprehension of new concepts to enhance their understanding. Furthermore, it provides a high interest for children to explore math problems, alleviates expectations and provides concrete resources to help students understand intangible math concepts and assist teachers in keeping students attention and make math fun.

The several factors that teachers perceive as obstacles -based practices contributed much to the teaching learning process because teachers cannot reach out the targeted time allotted for the skills (Rahman et. al., 2011; Remesh (2013); Richland et. al., 2012).

Issues:

1. Time involved in learning about new strategies and redesigning courses
2. Concerns about ensuring that students are taught important content

Challenges:

1. Concerns about students' reactions to an unfamiliar teaching method and the impact on student course evaluations
2. Concerns that a different strategy will not work as well, especially if it impacts

Facilitating Experience:

1. Length of the experiment- not be too long. They may become bored and lose interest in the task and in performing well.
2. Stress and discomfort levels for participants

The 6 points exposed above are derived from the actual experiences of teachers in classrooms. There is always an issue of teaching strategies due to the recent culture where teachers are hooked to the commands from the national levels. The good thing is- teachers in the modern times start to exercise initiatives to find ways in finding the best pedagogies that would fit to the learning styles of the

CONCLUSION

Based on the findings of the study, the following conclusions were made.

1. The three groups were not comparable at the beginning of the experiment.
2. The posttest performance of the students exposed to multi-sensory gained the highest mean.
3. Pupils who were given the multisensory and think pair share strategies have the same mean gain compared to the control group.
4. Multisensory strategy is the most effective teaching strategy relative to think pair share and lecture method.
5. The multisensory strategy has the highest mean gain score.
6. The experiences of teachers highlighted the need for discovering varied pedagogies in teaching mathematics in the classroom setting.

Recommendations

In the light of the conclusions made, this study recommends the following;

DepEd. The Department of Education can also make use of the key points and findings that are generated by this study. Adopting appropriate teaching strategies for mathematics, the DepEd may be able to promote the culture of better learning outcomes among schools.

School Heads. They shall consider the strict implementation and monitoring of the appropriate teaching strategies applied in the classrooms particularly in the teaching of mathematics where instructional techniques are very necessary.

Teachers. They may use the findings of this study to better understand the instructional needs of the mathematics learners. These group of professionals will be guided by the results of the study in a way that appropriate and effective teaching strategies are provided.

Future Researchers. It is further recommended that future researchers may also consider the effect of other relevant variables that are not considered in the study. These variables may include parental involvement, self-efficacy towards math, and others.

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