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EFFECTIVENESS OF SUPPLEMENTARY MATERIALS IN MATHEMATICS 3 IN SAN VICENTE ELEMENTARY SCHOOL

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Abstract: **The purpose of this study was to determine if the use of supplementary materials was effective in improving the academic performance of Grade 3 struggling learners in Mathematics 3 at San Vicente Elementary School, Glan 2 Division of Sarangani Province for the school year 2021-2022. This study used the pre-experimental design. Specifically, the researcher utilized the single group pre-test-posttest design. The respondents were the 30 grade 3 struggling learners in Mathematics of San Vicente Elementary School Glan 2 District, Division of Sarangani composed of 15 boys and 15 girls, respectively. The statistical tools used to analyze and interpret the data gathered were the frequency counts, mean, and t-test to treat the relationship of the two variables under study. Based on the findings, it was found out that the supplementary materials were effective and had improved the performance of Grade 3 struggling learners in Mathematics.**

Keywords: **Supplementary materials, Mathematics 3, pre-experimental design, education, Philippines.**

1. INTRODUCTION

Mathematics has continually been given special the attention in school, related to many other fields and disciplines. Some learners struggled with Mathematics because of dyscalculia. A learning difficulty causes learners to work with formulas, shapes, and number-related concepts. It made it difficult for them to understand and manage Math problems. These learners usually fell far behind their colleagues in Math and had trouble with a number-related problem that did not improve with ongoing practices. The learners struggled with Mathematics because they did not have the proper foundation to succeed. These learners had fallen behind in a unit or moved on to advanced material before they were ready, leading to failing grades (The National Council of Mathematics, 2020; Wilkey, Pollack, and Price, 2020; Lee, 2019; Ganor-Stern, 2017).

On the other hand, Mathematics effectively built mental discipline and encouraged logical reasoning and mental rigors among young people. It consisted of numeracy, the decimal system, arithmetic operations, and the capacity to solve elementary arithmetic problems such as proportionality, knowledge of magnitudes, and knowledge of common two-and three-dimensional geometric forms. Numeracy among early graders was a critical literacy skill. It played an essential role in early development. The child could only access the power of education first through a numerical he was familiar with where the learner developed his self-confidence, pride, and full potential. Mathematical literacy needed to function in life. This involved skills not taught in the classroom, like using numbers and solving problems in real life. The early mathematical achievement of children had constituted an infrastructure for their academic success in the future (Morsanyi, et al., 2018; Nirit, Hadad Bat-Sheva, and Orly, 2021; Freeman, 2018).

A self-learning module is an orderly set of instructions designed to facilitate learners' mastery of a body of knowledge or a procedure. When combined with other modules, learners can master a vast body of knowledge or a complex process. Moreover, self-learning modules are also defined as its name implies - modules, which are available for students to use by them for learning on their own and usually do not require any teacher for help. Given that the use of these modules entirely relies on the hands of students, and these are self-learning materials will aid students to learn and do at their own pace and interest (Maile and Cooper, 2014).

On July 1, 2020, the Philippines Department of Education released a new normal press statement. As the Department is committed to preparing for the opening of the School Year 2020-2021, DepEd will provide Self-Learning Modules (SLMs) and alternative learning delivery modalities for the majority types of learners across the entire Philippines. Meanwhile, the integration of SLMs with alternative learning delivery modalities such as modular, television-based, radio-based teaching, blended, and online will assist DepEd in ensuring that all students have access to high-quality primary education for this school year. At the same time, face-to-face classes were still strictly prohibited due to the public current health situation (Agaton and Cueto, 2021; Guimalon, 2021).

Correspondingly with the above statements, the effectiveness of the SLMs was significant. Moreover, this quantitative study tried to gain a better understanding of its effectiveness. Therefore, the researcher in this study wanted to find out whether the Self- Learning Modules were effective in teaching and could these significantly improve the performance of pupils in Mathematics.

1.1. Research Questions

The purpose of this study was to determine if the use of supplementary materials was effective in improving the academic performance of Grade 3 struggling learners in San Vicente Elementary School, Glan 2 Division of Sarangani Province for the school year 2021-2022.

Specifically, this study answered the following subproblems:

1. What are the pretest scores of Grade 3 struggling learners before using supplementary materials in Mathematics?
2. After using the supplementary materials, what are the post-test scores of the subjects?
3. Is there a significant difference between the pretest and post-test scores of the Grade 3 struggling learners in Mathematics after the treatment?

1.2. Theoretical Framework

This study was anchored on different learning theories. First, it was based on the Transfer Theory by Fox (1983) cited by Jones (2017). It stated that Transfer Theory occurred when a teacher applied new information, strategies, and skills to which students had acquired new knowledge. The teachers who adopted this learning theory believed that knowledge could be transferred to students. It emphasized that the help of supplementary materials in delivering instruction directly impacted the learners' academic learning, needs, interests, and future endeavors.

Secondly, the Theory of Assimilation by Ausubel (1963), cited by Seel (2016), which focused on what he described as meaningful learning. It is a process where new information is related to an existing relevant aspect of the individuals' knowledge structure. This component of his theory fits with short-term and long-term memory concepts in cognitive information processing. This theory integrated the cognitive, affective, and psychomotor. It further identified two aspects of learning, namely; rote learning, and meaningful learning. Rote learning is learning for a young learner which implied recall and transferability. In this theory, the learners were given the freedom to learn and how they wanted to learn.

The study's objective was to provide and promote supplementary materials for a faster learning process of numerical skills of the young learners to address the gap and contextualize it to fit target struggling young learners John Dewey (1897), cited by Williamson (2018), a learner learns by considering popular theories.

1.3. Conceptual Framework

Figure 1 shows the conceptual framework of the study. The figure consists of two significant variables, the pretest, and the post-test scores.

The first box presents the pretest scores. The pre-test was given to the 30 struggling learners at the onset of the course to determine their initial awareness of the measures stated in the learning objectives.

The second box illustrates the post-test scores of the subjects. The administration of post-test was done after the treatment of two (2) months to determine whether the 30 Grade 3 struggling learners had improved their performance in Mathematics 3.

The results of pretest and post-test using supplementary materials wereconsidered to assess the current numeracy skills of the 30 struggling Grade 3 learners and to find out if the supplementary materials were effective.

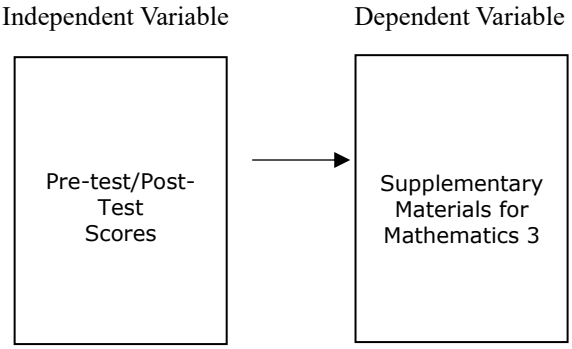

Figure 1: Conceptual Framework

2. METHOD

2.1 Research Design

This study used the pre-experimental design. Specifically, the researcher utilized the single-group pre-test-posttest design. According to Ardales (2008), as cited by Glenn (2016) the one-group pretest-post-test design is without a control group. However, it has a pretest or a baseline observation (O1), which allows the investigator to determine the effects of the treatment by comparing the pretest and post-test (O2) results. This design is subject to validity treats history, maturity, testing, instrumentation, and statistical regression. Its external validity is poor, as illustrated below.

The crafted supplementary material was the basis for determining the performance level of Grade 3 struggling learners. They underwent the Pretest and Post-test.

The supplementary materials were designed, and media choices were made in the design phase. In the development phase, supplemental materials were produced according to decisions made during the design phase. The implementation phase included testing additional tools with the target subjects, putting the product in total production, and orienting learners and teachers on how to use these tools. The evaluation stage included both the formative the and summative, which provided opportunities for feedback from the users (Strickland, 2006 cited by Johnsen, 2020).

The purpose was not to formulate and test the theory but to develop effective products for use in school. Products were designed to meet specific needs and according to detailed specifications. Once completed, outcomes were field-tested and revised until a specified level of effectiveness was achieved (Rice, and Ortiz, 2021; Das, 2017).

2.2 Research Locale

The study was conducted in San Vicente Elementary School Glan 2 District Municipality of Glan, the Department of Education, Division of Sarangani, particularly in Glan. It comprised 24 teachers, and 586 pupils enrolled from kinder to Grade 6. The school is located at Barangay San Vicente Glan Sarangani Province residents in different communities vary that in their dialects like Cebuano, Muslim, Ilongo, Ilocanos, and Blaan.

In religion, almost 80 percent of the people in the community are Christians. Only 20 percent is composed of Muslims. Their source of income is based on agriculture, with high-level production of dried coconut meat, coconuts, corn, and banana. It is an agricultural barangay.

2.3 Research Respondents

The subjects underwent experimental procedures were the 30 Grade 3 struggling learners in Mathematics of San Vicente Elementary School Glan 2 District Division of Sarangani. It was composed of 15 boys and 15 girls. Table 1 presents the distribution of the subjects.

Table 1: Distribution of the Subjects.

BOYS	GIRLS	TOTAL
15	15	30

The instruments used in this study were the Pre-test and Post-test constructed by the researcher coming from the supplementary materials. It was composed of 30 questions.

Initially, the proponent made a 60-item test instrument based on the second grading lesson. After formulating and completing the draft of the device, the researcher piloted it homogeneously to answer the chosen 30 grade 3 struggling learners in mathematics coming from a neighboring school. After the learners answered the instrument, it was immediately retrieved through Internal-Consistency Method. Using this method, one could determine if the examinee passed or failed in an item A (1) was assigned for a pass or a failure.

The process of obtaining a reliability coefficient in this method was determined using Kuder-Richardson Formula 20.

Where N is the number of items, $\frac{\sum(x-x)^2}{N-1}$ is the variance of scores on test defined as, and $piqi$ is the product of the proportion of passed and failed for item i. The symbol pi denotes the proportion of individuals giving item 1, and the proportion failing by qi, where $qi = 1 - pi$. The proponent strictly observed the steps in applying the Kuder-Richard Formula 20:

First, the researcher computed the variance SD^2 of the test scores for the whole group. Second, the researcher determined the proportion passing each item (pi) and failing each item (qi). Third, the researcher multiplied the (pi) and (qi) from each item and sum for all the things. It gave the $\sum piqi$ value. Finally, the researcher substituted the calculated values in the formula.

After that, the researcher computed the values based on the computation that revealed if the 60-item test instrument piloted was reliable or not. Upon knowing the reliability of the tools, the proponent did an item analysis to see the index of difficulty and the index of discrimination of each item. To do this, the researcher strictly followed simple but effective procedures for item analysis:

Step 1, the researcher arranged the test scores from the highest to the lowest. Step 2, she got one-third of the papers from the highest and one-third from the lowest scores. The idle one-third was set aside. Step 3, she counted the number of students in the upper and lower groups, respectively, who chose the options. Step 4, she then recorded the frequency from step 3. Step 5, the proponent estimated the index of difficulty.

Where $\sum x$ is the sum of the correct answer of the upper and lower groups, and N is the number of cases in both the upper and lower groups. Difficulty refers to the percentage of getting the correct answer to each item. The smaller the percentage, the more complex the item is. The majority criterion (50% plus one) is the basis for interpreting the index of difficulty, whether the item is difficult or easy. When the item has a 50% difficulty index, it is neither easy nor difficult; the lower the percentage, the more complex the item is.

Finally, in step 6, the researcher estimated the item discriminating power. In evaluating the item discriminatory power, the upper and lower groups were compared to the correct responses.

To discuss the formula, RU presents the proper response of the upper group, RL is the appropriate response of the lower group, and NG is the member of learners in each group.

According to Calmorin (2014), the discriminating power of an item is not more than 1.00. A maximum of positive discriminator power is revealed by an index of 1.00. It is obtained when all upper group learners chose the correct answer and not the lower group. Negative discriminating power is obtained when more learners in the lower group get the correct answers than the upper group. Moreover, a zero-discriminating power (0.00) is attained when the equal frequency of the upper and lower groups received the right answer. The items having negative and zero discriminating power should be revised or improved. Table 2 presents the discrimination index and the difficulty of the test item.

Table 2: Index of Discrimination and Difficulty of test Item

INDEX OF DISCRIMINATION	ITEM EVALUATION
0.40 or higher	Very Good Item
0.30 – 0.39	Good Item

0.20 – 0.29	Marginal Item
0.19 or below	Poor Item
INDEX OF DIFFICULTY	ITEM EVALUATION
0.70 or higher	Low Difficulty
0.31 – 0.69	Moderate Difficulty
0.30 or below	High Difficulty

The proponent retained the items that passed the difficulty and discrimination index in the item analysis. Other items that marked revised or improved were carried out. The 60-item tests underwent face validation. It was validated by three (3) experts who are Master teachers. The instrument was validated using the following criteria: 1.) clarity of direction and indicators, 2.) presentation and organization, 3.) suitability of the items, 4.) adequacy of indicators per category, 5.) congruency to the purpose, 6.) impartiality of the researcher, and 7.) appropriateness of the options and evaluation rating system. Through their expertise, revisions and improvements were made. The instrument obtained an overall mean of **4.77,** which implied an excellent descriptive rating.

Out of the 60-item Test in Mathematics 3 that went through the validation and piloting process, the researcher came up with an official 30-item Test which was used in the pretest and post-test activities. The items were coming from the supplementary materials.

2.4 Data Gathering Procedure

The following procedures were religiously followed in the actual conduct of the study.

The researcher approached the principal, the district head, and the barangay, following the proper protocol for the COVID 19 pandemics: wearing of face mask, face shield, and hand sanitizer.

To ensure the transparency and validity of the instruments, the researcher submitted the tool for validation to five expert validators for critical analyses. Their comments and suggestions were considered to come up with the official questionnaire. Tests of validity, including Item analysis were done.

The subjects came from the grade 3 learners of San Vicente Elementary School. They were identified as the struggling learners. There were only 30 subjects being part of the study.

Having found the instrument valid and reliable, the researcher administered the questionnaire by observing the proper protocol; social distancing, wearing a face mask and face shield, and hand sanitizing. After the actual administration of the test, it was retrieved immediately.

Appropriate tools were used to analyze and interpret the gathered data. Problems number one and two were treated using frequency counts. The proponent employed the t-Test for correlated samples. It was used to answer problem number three.

3. RESULTS AND DISCUSSION

3.1 Pre-test Scores of Grade 3 struggling learners in Mathematics

Table 3 below presents the data on the pretest scores of grade 3 struggling learners in mathematics before the treatment was given. It was utilized using the frequency counts and percentage distribution of the scores of the learners in the pretest.

It can be gleaned that out of the thirty (30) subjects, none of the learners got scores of 25 to 30. Learner numbers 4, 7, 9, and 16 obtained scores of 24, 19, 20, and 21, respectively. Learner numbers 1, 2, 3, 5, 11, 13, 19, 24, and 28 obtained scores of 18, 13, 15, 17, 16, 15, 13, 18, and 17, respectively. Learner numbers 8, 12, 14, 15, 17, 18, 20, 21, 22, 23, 25, 26, 27, 29, and 30 got scores of 12, 10, 11, 7, 10, 9, 8, 9, 9, 10, 9, 8, 9, 8, and 9, respectively. Out of 30 respondents, only 2 learners namely learner numbers 6 and 10 had gained scores of 6 and 1, respectively.

These results were parallel to research on pupils who lacked supplementary materials in mathematics; they struggled to learn mathematics and with low prior knowledge in learning math. In that case, they most reflected on highlighted errors within an incorrect mathematical problem. Developing number sense from supplementary materials were beneficial for enhancing learners' importance in learning mathematics. Development in understanding mathematics were exciting and significant among learners when they realized its relevance to their daily lives (Reid 2015; Ramesh, 2012; Singh et al. 2018).

Table 3: Frequency counts and Percentage Distribution of Pretest Scores of grade 3 Pupils in Mathematics

Pupil	Frequency	Percentage	Description
1	18	60	Moderate
2	13	43	Moderate
3	15	50	Moderate
4	24	80	High
5	17	57	Moderate
6	6	20	Very Low
7	19	63	High
8	12	40	Low
9	20	67	High
10	1	3	Very Low
11	16	53	Moderate
12	10	33	Low
13	15	50	Moderate
14	11	37	Low
15	7	23	Low
16	21	70	High
17	10	33	Low
18	9	30	Low
19	13	43	Moderate
20	8	27	Low
21	9	30	Low
22	9	30	Low
23	10	33	Low
24	18	60	Moderate
25	9	30	Low
26	8	27	Low
27	9	30	Low
28	17	57	Moderate
29	8	27	Low
30	9	30	Low
TOTAL	371	1,236	
MEAN SCORE	12.4	41.2	Low

3.2 Post-Test Scores of Grade 3 struggling Learners in Mathematics

Table 4 presents the post-test scores of grade 3 struggling learners in mathematics after the treatment. The proponent used frequency counts and percentage distribution in analyzing the data.

It can be observed that an improvement was reflected. It was found out that out of 30 subjects, ten learners got very high scores. These were learner numbers 1, 3, 4, 5, 7, 9, 11, 16, 24, and 28 obtained scores of 26, 25, 30, 30, 29, 25, 29, 30, 24, and 28, respectively.

On the other hand, 15 learners got higher scores and these were learner numbers 2, 8, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 25, 26, and 27 obtained scores of 19, 21, 19, 21, 20, 21, 19, 22, 19, 20, 21, 20, 22, 19, and 20, respectively. As shown, there were four learners who got moderate scores. They were learner numbers 6, 15, 29, and 30 with obtained score of 15, 14, 17, and 18 respectively, while only one learner got under low score. Learner number 10 got a score of 11.

As a result, learners' knowledge increased after exposing them to different supplementary materials. Their numeracy skills were developed through a series of activities. It explored their thinking abilities. Hence, the teachers are encouraged to continuously use supplementary materials in mathematics to improve the teaching and learning process. Numeracy skills are increasingly formal among young learners to progress in number sense and conviction using mental and written strategies to solve problems. It stated that by the age of eight, learners should read and write numbers up to 999. They have

to start using tallies to keep track of totals. However, some kids still relied on essential pictures to explain problem-solving. The learners could utilize number lines to aid mental counting skills since they already comprehended numbers on a number line (Ahl, 2016; Cui, Xiao, Ma, Yuan, Kodash, and Zhou, 2020; Smith and Shillam 2015).

Table 4: Frequency counts and Percentage Distribution of Post-test Scores Of grade 3 Pupils in Mathematics

Pupil	Frequency	Percentage	Description
1	26	87	Very High
2	19	63	High
3	25	83	Very High
4	30	100	Very High
5	30	100	Very High
6	15	50	Moderate
7	29	97	Very High
8	21	70	High
9	25	83	Very High
10	11	37	Low
11	29	97	Very High
12	19	63	High
13	24	80	High
14	20	67	High
15	14	47	Moderate
16	30	100	Very High
17	21	70	High
18	19	63	High
19	22	73	High
20	19	63	High
21	20	67	High
22	21	70	High
23	20	67	High
24	27	90	Very High
25	22	73	High
26	19	63	High
27	20	67	High
28	28	93	Very High
29	17	57	Moderate
30	18	60	Moderate
TOTAL	660	2200	
MEAN SCORE	22	73	High

3.3 Effectiveness of the Supplementary Materials

Table 5 reflects the effectiveness of the supplementary materials in improving the academic performance of grade 3 struggling learners in Mathematics. The t-test was used. The result revealed a significant difference at the .05 level with the df of 19. The required t-value of significance was 1.729. It was found that the computed t-value of 3.85 was higher than the tabular value of 1.699. This result led to the rejection of the null hypothesis. It implied that the supplementary materials effectively improved the academic performance of Grade 3 struggling learners in Mathematics.

Additionally, the teacher applied new information, strategies, and skills to acquire new knowledge. Learning occurred and improved academic performance when task was given independently. It helped motivate by creating and encouraging them to use information from the given text and beyond learners' expectations. The supplementary learning materials helped the learners understood the concept and recognize their abilities to investigate, to explore, and to solve mathematical problems that increased their school's performance (Ahl, 2016; Dodd, 2015; Jones, 2017; Langat, 2020).

Moreover, research studies revealed that effective instructional materials enhanced learners' understanding of teaching and learning processes. It was also discovered that the improvised instructional materials brought the exact meaning compared

to the produced instructional materials (Himah, Parker and Asahe, 2018; LeFevre et al., 2009; Batchelor and Gilmore, 2015; Moran, 2016).

Finally, engaging pupils in educational activities using tangible material was one of the solutions. Based on the interview made by the experts, they found out that many teachers in the United employed activities in Mathematics lessons that helped in improving the learners' engagement and arithmetic learning outcomes. Based on the survey's results, many instructors regularly employed instructional activities utilizing various resources (Kaminski and Sloutsky, 2020).

Table 5: Effectiveness of the Supplementary Materials in Improving the Academic Performance of Grade 3 Struggling Learners in Mathematics.

Variable	df	t		Description	Decision
		Computed	Tabular		
Pre-test Mean Score versus **Post test Mean Score**	n-1 29	10.89	1.699	With significant difference at .05 level	Reject H_{03}

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