

Effectiveness of Mathematical Worksheets for Grade 3 Struggling Learners

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Abstract— This study aimed to determine whether using Mathematical Game Worksheets effectively improved the academic performance of Grade 3 struggling learners in Maasim Central Elementary School, Maasim Division of Sarangani province, for the school year 2020-2021. This study employed the one-group pre-test and post-test design with the 30 struggling learners and used the frequency count and Wilcoxon Signed Rank Test to analyze and interpret the data gathered. Based on the findings, it was found that Mathematical Game Worksheet materials were effective and had improved the performance of Grade 3 struggling learners in Mathematics. Nevertheless, Mathematical Game Worksheets may be implemented in teaching Mathematics in the academe.

Keywords— Educational management, worksheet, games, struggling learners, Mathematics 3, Philippines.

I. INTRODUCTION

Many learners begin to cultivate negative attitudes about Mathematics during their first years in the elementary classroom. By the time these learners reach the higher grade, many struggles at Math simply because they do not learn best through the standard process. In modern times, worksheets have become a driving force of curriculum in some countries (Leroy & Bressoux, 2016; Martin, Mullis, Foy, & Hooper, 2016).

Additionally, teachers use worksheets to support studying, promote active learning, and raise interest in learning science and evaluation. Many studies suggest that well-created worksheets positively impact learners' learning achievement. One of the essential educational innovations in instructional design that can complement traditional face-to-face instruction is programmed instruction in module form. This approach, often called the modular system, consists of self-directed. Through this method, the teacher sheds the role of presenter, demonstrator, driller, and questioner, and now takes on the facilitator, initiator, monitor, coach, and coordinator. More importantly, it allows learners to direct their learning while constructing meaningful experiences about the concepts being taught (Sasmaz-Oren & Ormanci, 2016). Moreover, Maasim Central Elementary School is one of the mega- elementary schools in Sarangani Province. The school has been in various competitions and events such as sports, arts, and academics. The teachers are also globally competitive, skillful, talented, and dedicated to their profession. They are united and have strived harder in getting level 3 in the School-Based Management Program. The mid-year performance-based report found that among the academic subjects from grade one to grade six, Mathematics had the lowest consolidated average grade from June to October for 2018-2019. It indicated that

most learners of MCES found learning Mathematics to be challenging compared to other subjects (Filgona, Sakiyo, Gwany, & Okoronka, 2020).

Furthermore, the learners of all ages appreciate having fun games that are fun and motivating. The games allow learners to explore fundamental number concepts, such as the counting sequence, one-to-one correspondence, and computation strategies. A mathematical game is one in which the rules, tactics, and guidelines are designed to reach particular objectives dependent on talent. Math games encourage learners to search number combinations, place values, patterns, and other important mathematical concepts. The learners can gain opportunities to deepen their math understanding and reasoning (Cleveland-Innes & Garrison, 2019).

Thus, the researcher wants to develop something fun and creative that could arouse interest in learning Mathematics.

Research Questions:

The study aimed to develop Mathematical Game Worksheets for Grade 3 learners based on the DepEd K-12 Curriculum Competencies.

Specifically, this study sought answers to the following sub-problems:

1. What are the pre-test scores of the Grade 3 struggling learners before the application of Mathematical Game Worksheets?
2. What are the post-test scores after applying Mathematical Game Worksheets?
3. Is there is a significant difference between the pre-test and post-test scores of Grade 3 in Math after the treatment?

1.1. Theoretical Framework

This study was anchored on the Transfer Theory by Fox (1983). Transfer Theory occurs when a teacher applies new information, strategies, and skills to which learners have acquired new knowledge. The teachers who adopt this learning theory believe that knowledge can transfer to learners. It emphasizes that the help of mathematical game worksheets in delivering instruction will directly impact the learners' academic learning needs, interests, and future endeavors. Educational research strategies support the relationships and learning opportunities needed to promote children's well-being, healthy development, and mobile learning.

In addition, instead of making the learners learn new strategies or techniques, challenging tasks were designed for practicing skills repeatedly and the relationship between the

learners' interests and functions. As learners complete the worksheets, their cognitive processes can also make worksheets invalid to the quality issues. They noted that students use a word-matching strategy to match words in questions with the corresponding sentences in the textbook, which keeps them in a passive learning status. As learners discover new learning skills, they carry out new learning tools. Learning materials are necessary because they can increase learners' success by providing support during the learning process. For instance, the worksheet can give learners opportunities to train themselves in the new skills they obtain in the class.

Ausubel's Theory of Assimilation focuses on what he describes as meaningful learning. It is a process where new information is related to an existing relevant aspect of the learners' knowledge structure. This component of his theory fits with short- and long-term memory concepts in cognitive information processing. This theory integrates the cognitive, affective, and psychomotor. It further identifies two aspects of learning, rote learning, and meaningful learning. Rote learning is learning for a young learner implies recall and transferability. In this theory, the learners had the freedom to learn and how they wanted to learn (Abidin, 2017; Inan, Erkus, and Serder, 2017).

Moreover, according to John Dewey (1887), man learns by doing in light of popular theories. The study's objective was to provide and promote a mathematical game worksheet for a faster learning process of numerical skills of the young learners to address the gap and contextualize it to fit struggling young learners. He had the confidence and skill to use numbers and mathematical approaches in all aspects of life. For learners, this is an excellent technique to develop mental discipline and stimulate logical reasoning and mental disciplines.

1.2. Conceptual Framework

The main concern of this study was to determine the effect of the developed Mathematical Game Worksheets for Grade 3 learners. The framework shows the pre-test scores as the independent variable while the dependent variable is the post test scores of the Grade 3 learners.

The researcher administered the pre-test to assess the number of people in the low, below average and average ranges. After a week, the researcher gave the developed worksheets to the respondents. The subjects received the post-test after two weeks. From the pre-test and post-test results, the researcher was able to determine the effect of worksheets on the learners.

II. METHOD

The researcher employed the one-group pre-test and post-test design. This design measures the dependent variable at a subsequent time (Ardales, 2008). The dependent variable in this study was the subjects' post test scores, and the independent variable was the pre-test scores of the subjects. The researcher was able to examine if the Mathematical Game Worksheets impact the academic achievement of grade 3 kids in Mathematics using the design she utilized. The researcher

pre-tested the dependent variable based on the least mastered skills. It was used as a source of comparison with the post-test results. The independent variable, the application of Mathematical Game Worksheets, is expected to affect the subjects' academic performance in Mathematics. This design compares the respondents' conditions before and after the test administration to determine the influence of the independent variable on the dependent variable.

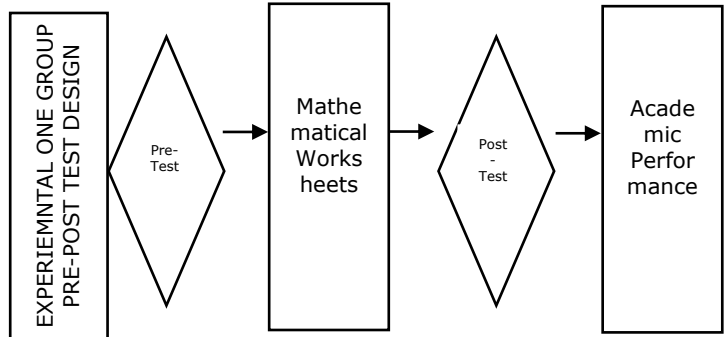


Figure 1. Conceptual Framework

The study was conducted in Maasim Central Elementary School Maasim 2 district municipality of Maasim, the Department of Education, Division of Sarangani, particularly in Maasim.

It comprises 38 teachers, and 1055 pupils enrolled from kinder to grade 6. The school is located at Barangay Poblacion Maasim, Sarangani Province residents in different communities vary in their dialects like Cebuano, Muslim, Ilongo, Ilocanos and Blaen.

In religion, almost 75 percent of the people in the community are Christians. Only 15 percent is composed of Muslims and 10 percent B'laan. Their source of income was based on the fishing industry as their livelihood.

The study's subjects were the Maasim Central Elementary School Grade 3 learners. There were 30 randomly selected learners from different sections, 12 males and 18 females, respectively. Table 1 below shows the distribution of the respondents.

TABLE 1. Distribution of Respondents

Respondents	Population	Percentage (%)
Male	12	40
Female	18	60
Total	30	100

To determine what contents/topics and skills were included in the 30-item pre-test and post-test questionnaires and worksheets, the researcher carefully studied and analyzed the existing curriculum guide with the learning competencies in Grade 3 Mathematics under the K-12 curriculum provided by the Department of Education (DepEd). Moreover, to validate the worksheets, the researcher had made the questionnaire for the evaluators based on the following criteria: goals, notions, competency, purposes, relevance, and acceptability. The research instruments are aligned and improved with

Guidelines and Process for LRMS Assessment and Evaluation of Locally Developed and Procured Materials.

Moreover, to validate the worksheets, the researcher had made the questionnaire for the evaluators based on the following criteria: goals, notions, competency, purposes, relevance, and acceptability. The researcher instruments were aligned and improved using guidelines and Processes for Learning Resources Management and Development System (LRMS) Assessment and Evaluation of locally Developed and Procured Materials. Using this method, one could determine if the examinee passed or failed in an item. A (1) was assigned for a pass for a failure. (Please refer to Appendices).

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

$$r_{xx} = \left[\frac{N}{N-1} \right] \left[\frac{SD^2 - \sum p_i q_i}{SD^2} \right]$$

Where N is the number of items, SD^2 is the variance of scores on test defined as, and $p_i q_i$ is the product of the proportion of passed and failed for item i. The proportion of individuals giving things the researcher denoted by the symbol p_i , and the proportion falling by q_i , where $q_i = 1 - p_i$. The proponent strictly observed the steps in applying the Kuder-Richard Formula 20:

First, the researcher had computed the variance SD^2 of the test scores for the whole group. Second, she had determined the proportion that passed each item (p_i) and failed each item (q_i). Third, she multiplied (p_i) and (q_i) from each item; and sum for everything. It gave the $\sum p_i q_i$ Value. Finally, she substituted the calculated values in the formula.

After that, the researcher computed the data and, based on the computation, whether the 60 Test Instrument piloted was valid and reliable.

After knowing the instrument's reliability, the proponent did the item analysis to determine the index of difficulty and discrimination of each item. To do this, she had strictly followed simple but effective procedures for item analysis:

First step, the researcher arranged the test scores from the highest to the lowest. Second, she had gotten one-third of the papers from the highest and one-third from the lowest scores. The idle one-third was set aside. Third, she had counted the number of learners in the upper and lower groups, respectively, who chose the options. Fourth, she had recorded the frequency from step 3. Fifth, she had estimated the index of difficulty. She used the following formula:

$$\text{Index of difficulty} = \frac{\sum x}{N} \times 100$$

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 implies the percentage of getting the correct answer to each item. The lower the rate, the more complex the thing is. The majority criterion (50% plus one) is the basis for interpreting the difficulty index, 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.

Step 6. The proponent had estimated the item discriminating power. In evaluating the item discriminating

power, she compared the correct responses from the upper and lower groups. The index of discrimination can be computed easily using this formula:

$$\text{Index of discrimination} = \frac{RU - RL}{NG}$$

Where RU is the proper response of the upper group, RL is the correct response of the lower group, and NG is the member of pupils in each group.

The discriminating power of an item is not more than 1.00. A maximum of positive discriminating power was revealed by an index of 1.00. It is obtained when all upper group pupils choose the correct answer and not the lower group. Negative discriminating power is obtained when more pupils in the lower group get the correct answers than the upper group. Moreover, a zero-discriminating power (0.00) attains when the equal frequency of the upper and lower groups receives the right answer. The items having negative and zero discriminating power should be revised or improved.

Table 2 presents the index of discrimination 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 had retained the items that passed the difficulty and discrimination index in the item analysis. Other things that marked revise or improve carried out. The 60-item test undergone face validation. It was validated by three (3) experts who are Master teachers. The instrument validated using the following criteria: clarity of direction and indicators, presentation and organization, suitability of indicators, adequacy of indicators per category, congruency to the purpose, impartiality of the researcher, and, appropriateness of the options and evaluation rating system. Through their expertise, they made revisions and improvements. The instrument obtained an overall mean of 4.88 and described as excellent. Then after that, the researcher would know if the test is valid and reliable.

Out of the 60-item Test in Mathematics 3 that went through validation and piloting, the researcher had developed an official 30-item Test that she had used in the pre-test and post-test activities coming from the supplementary materials.

The researcher sent a letter to the Office of the Principal and adviser to ask permission to conduct the study. The researcher provided the pre-test and post-test to two (2) Master Teachers and three (3) Grade 3 Mathematics teachers for validation. The researcher considered the constructive comments and recommendations of the evaluators to revise and come up with the final draft of the pre-test and post-test. In addition, the researcher's adviser and the panel members'

recommendations were also considered to guarantee that the test questionnaires were of high quality. The researchers scheduled the pre-test and post-test based on the accessibility of the subjects. The subjects were orientated on the nature of the test and the research in which the test results were used. The pre-test was conducted last March 29, 2021, and was retrieved after three days. The researcher had provided Mathematical Game Worksheets to the subjects after two weeks. The researcher offered a post-test to the respondents after recovering Mathematical Game Worksheets. The researchers personally distributed the pre-test, worksheets and the post-test.

The researcher evaluated the test results to determine the effects of the Mathematical Game Worksheets on the subjects' academic performance in Math 3. It then gave the results of the correct statistical treatment.

In evaluating and validating the first draft of the pre-test by the evaluators, the researcher used the five-point-scale rubric to ensure that the pre-test correctly fit the standards. The rubric's scale and description are shown below:

These ratings have the following qualitative measures:

Scale for interpretation of pre-test and post-test scores.

Grade Range %	Presentation	Interpretation
98-100	Excellent	Very effective
90-97	Very Good	Effective
80-89	Good	Moderately Effective
70-79	Satisfactory	Less Effective
60 & below	Failed	Needs Improvement

Statistical treatment was utilized to analyze the assessment and to ensure that the first draft of the pre-test is suitable to the standards,

Frequency counts. This was used to treat the data gathered in answer to sub-problem number 1 and 2.

Wilcoxon Signed Rank Test. This was used to utilized when the sample size is small, and it is the appropriate test of the difference between two groups if the distribution is not normal. It compared the means of the two independent groups in answer to sub-problem 3.

III. RESULTS AND DISCUSSION

3.1 The Pre-Test Scores of the Subjects

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, only learner number 9 obtained score of 26. Learner numbers 4, 7, and 16 obtained scores of 22, 19, and 21 respectively. Learner numbers 1, 2, 3, 5, 13, 24, and 28 obtained scores of 17, 15, 6, 8, 13, 15, 18, and 17 respectively. Learner numbers 6, 11, 12, 14, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 29, and 30 obtained scores of 12, 11, 10, 11, 10, 12, 9, 8, 8, 11, 9, 8, 10, 11, and 9 respectively. Learner number 10 obtained score of 1 which belongs to very low.

Mathematics is a subject that many learners either love or hate. Most of the learners find difficulties in Math at some point. Some of the learners complained Math subject is too hard. It is a very abstract subject. For them, knowledge acquisition usually happens best when relating it to real-life situations. As Math becomes more complex and challenging, it would be difficult for the learners to understand if it has a poor foundation of Math concepts. In Mathematics, there is no room for error in Math because there is only one exact answer, but it can come up with different solutions (Abramovich, Grinshpan & Milligan, 2019; Mazana, Suero Montero & Olifage, 2019).

TABLE 3. The Pre-Test Scores of the Subjects

Pupil	Frequency	Percentage	Description
1	17	57	Moderate
2	15	50	Moderate
3	16	53	Moderate
4	22	73	High
5	13	43	Moderate
6	12	40	Low
7	19	63	High
8	12	40	Low
9	26	87	Very High
10	1	3	Very Low
11	11	37	Low
12	10	33	Low
13	15	50	Moderate
14	11	37	Low
15	7	23	Low
16	21	70	High
17	11	37	Low
18	10	33	Low
19	12	40	Low
20	9	30	Low
21	8	27	Low
22	8	27	Low
23	11	37	Low
24	18	30	Moderate
25	9	30	Low
26	8	27	Low
27	10	33	Low
28	17	57	Moderate
29	11	37	Low
30	9	30	Low
TOTAL	379	1,263	
MEAN SCORE	12.6	42.1	Low

3.2 The Post-Test Scores of the Subjects

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, nine learners got very high scores. These were learner numbers 1, 3, 4, 5, 7, 9, 11, 16, and 29 with scores of 26, 25, 30, 30, 29, 25, 29, 20, and 28 respectively.

On the other hand, learner numbers 2, 8, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, and 27 obtained scores of 19, 21, 19, 24, 20, 21, 19, 22, 19, 20, 21, 20, 20, 22, 19, and 20 respectively. Learner number 6, 15, 29, and 30 obtained scores

of 15, 14, 17, and 18 respectively. While only learner number 10 obtained score of 11 which belongs to low.

Mathematical games are interesting scope in educational research. The learners who use math games techniques often acquire higher scores than those exposed to the traditional approach. He suggested using math games as a technique in showing and discussing topics. "I hear, and I forget, I see, and I remember, I do, and I understand" this was the statement of Confucius, which described that learners should be active rather than passive to make the best use of it. This claim is the same as the slogan of "Geometry Integrated Math Books, second edition, Mathematics is not a spectator sport." It emphasized students cannot learn more from watching other learners do it. You must cooperate and participate actively (Chis, Moldovan, Murphy, Pathak and Muntean 2018; Taclay, 2016; Zulyadaini, 2017).

TABLE 4. The Post-Test Scores of the Subjects

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	20	67	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	653	2,177	
MEAN SCORE	22	73	High

Table 5 shows the significant effect of the Mathematical Game Worksheets on performance in Mathematics 3 of Grade three learners.

As shown, the subjects obtained the t-value of ± 5.269 , higher than the critical value of 1.699 at 0.05 level of significance. Therefore, the null hypothesis was rejected, indicating the positive effect of the Mathematical Game Worksheets on the subjects.

Math worksheets based on the Multiple Intelligences Theory had aided the learners in improving their overall

academic performance. Worksheets may feature activities that need group participation. The learners can benefit from peer education in this way. Based on these findings, tailoring Math worksheets to kids' various intellectual sectors can positively impact their academic performance. It was noticed that the learner who have voiced their opinions on the Worksheet had improved their academic performance (Inan and Erkus, 2017; McCall, 2016).

Also, a Worksheet according to Fajriah and Suryaningsih, 2020 and Huang, Spector, and Yang, 2019, is a sheet of paper containing questions for learners to write their answers. In this generation, Worksheets for kids are used by the teachers for the learners to develop analytical, lingual, analytical, and problem-solving capabilities. It is a fact that the learners quickly gain faster in their formative years than at any time in their life.

TABLE 5. Effect of Mathematical Game worksheet on the learners

Score	Df	U ₁ -value		Decision	Analysis
		Computed	Tabular		
Pre-test vs Post-test	30	14	27	Reject null hypothesis	Mathematical Game Worksheets affect learners

The table shows that there was a significant difference between the pre-test and post-test scores. This difference was due to several factors that affected the independent variable, the Mathematical Game Worksheets. The researcher enumerated these factors, such as the teachers' strategies and techniques on teaching, the length of teaching time, and the teacher's attitude towards the learners and their knowledge, skills, and expertise in education.

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