International Journal of Recent Research in Thesis and Dissertation (IJRRTD)
Vol. 3, Issue 1, pp: (33-45), Month: January - June 2022, Available at: www.paperpublications.org

EFFECTIVENESS OF SELF LEARNING MODULES (SLM) IN TEACHING MATHEMATICS 3

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DOI: https://doi.org/10.5281/zenodo.6497186

Published Date: 27-April-2022

Abstract: **This study aimed to find out whether the use of self-learning modules was effective in improving the academic performance among learners of grade 3. The subjects of the study were thirty-four (35) learners of Mamangos Maulana Kandog Elementary school for the school year 2020-2021 at Kiamba, Sarangani Province, Philippines. The study used the experimental design. Utilizing the frequency counts, and t-test for correlation of big size sample. The findings of the study revealed that the most of the grade 3 learners improved after the use of learners in Mathematics subject.**

Keywords: **educational management, effectiveness, self-learning module, Mathematics 3, Philippines.**

1. INTRODUCTION

The world of self-learning can be seemingly difficult to deal with in anticipation. However, suppose we desire to successfully bring about or reach our aspirations and stay closely connected to what is being done or considered in an ever-changing world. In that case, self-learning is expressively of great significance to meet the demands of the 21st century. Consequently, the purpose of education needs a radical shift in providing the primary education that fits the insistence of the 21st century. It suggests that DepEd or any related organizations that are ideally concerned with education, instead of trying to provide young generations with the knowledge they need, the role of education needs to train people with the tools and skills to acquire knowledge themselves. With that, learners must be self-reliant and adapt to the rapid change around them (Cangelosi, 2015; Rao, 2016; Reader, 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 find out whether the use of Self-Learning Modules (SLMs) effectively improved the academic performance of the Grade III pupils in Mamangos Maulana Kandog Elementary School of Kiamba 1 District, Nalus Kiamba Sarangani Province during the school year 2020-2021.

More specifically, it sought to answer the following questions:

1. What are the pre-test scores in Mathematics among grade 3 pupils?
2. What are the post-test scores in Mathematics among grade 3 pupils?
3. Is there a significance between the pre-test and post-test scores of grade 3 pupils in Mathematics using self-learning?

1.2 Theoretical Framework

Dhamija, et al. (2014) highlighted that the Self Learning Modules (SLM) are more effective than the conventional mode of teaching. It showed that Self-Learning Modules helped to increase the retention of students. In India, the development of Self-learning Modules is in its infancy stage. Most of the researchers developed Self-learning Modules and found the effectiveness of the Self-learning Module for school students. Significantly few researchers developed SLMs for the Higher Education level. In determining the effectiveness of SLMs in higher education, took up the present venture. The students may excel in their related fields if the teachers provided them with Self-Learning Modules for self-study purposes.

The Theory of the Constructivist Approach also supported this study by Jean Piaget (1967) as cited by Steffe and Gale (2015). It was based on genetic epistemologies that developed. This approach has piqued the interest of Western educators, notably in the domains of mathematics and science instruction. There are three types of constructivism introduced in psychology; one of the types is the radical constructivist approach.

1.3 Conceptual Framework

The schematic diagram in figure 1 illustrates two boxes. The first is the independent variable, the Pre-test Scores, and the second box shows the dependent variable, the Post-test Scores. They are presented to demonstrate whether using a self-learning module effectively improves the academic performance of grade 3 learners in mathematics.

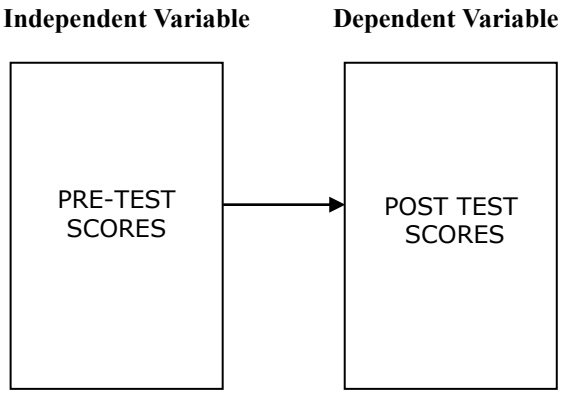

Figure 1: Conceptual Framework

2. METHOD

This study used the single group, pre-test, post-test experimental design. In Education Research, this involves the experimental group.

The crafted Self-Learning Modules (SLMs) would be the basis for determining the performance level among grade 3 pupils. They underwent the Pre-test and Post-test.

The Self-Learning Modules (SLMs) were designed, and media choices make in the design phase. In the development phase, supplementary materials produced according to decisions made during the design phase. The implementation phase included testing additional tools with the targeted audience, putting the product in total production, and orienting learners and teachers on how to use these tools. Both formative and summative evaluations were included in the evaluation process, allowing users to submit input (Heramil, 2016; Strickland, 2016).

The research and development method produced a particular product and tests its effectiveness. Research development is defined as a purpose to result in the effects and ended with an evaluation process.

This study employed the pre-test and post-test experimental design because it used one group. It had been used in educational research that involves an experimental group. Figure 1 shows the design.

Experimental Group $O_1 - x\ O_2$

where:

O_1 refers to the pre-test result in Math of the experimental group

O_2 refers to the post-test result in Math of the experimental group

X refers to Self-Learning Modules as treatment

The researcher considered Mamangos Maulana Kandog Elementary School, the Kiamba 1 District. The school has ten (10) teachers, including the School Head, the Alive Teacher for Muslim learners, and a floating teacher currently the ICT in the school, and they have 1 section in every grade level from Kinder to grades 6. The total population of the pupils enrolled was 295. The learners are Maguindanaon, Ilocano, T'boli, Bisaya and Ilocanos. The learners were residing in 6 Puroks near the school. The subjects live in six puroks, under Purok Masagana (Falls). It has eight subjects, Masagana and Crismus Highway has eleven (11) subjects, Bougainvilla has seven (7), Narra has two (2) subjects, Crismus (Proper) has three (3), and Purok Crismus Boundary has four (4) a total of 35 grade three subjects. The school is a flood prone area, the buildings were dilapidated, but it was not a hindrance to the teachers to impart their knowledge to the learners.

The subjects were thirty-five (35) Grade III pupils in Mamangos Maulana Kandog Elementary School, for the school year 2020-2021. This study was conducted using a single group design among Grade III pupils of Mamangos Maulana Kandog Elementary School. The researcher employed Census or Total enumeration in the survey (Lieberman and Singh, 2017).

The table shows equally distributed according to their purok, residing in six (6) Puroks of Brgy. Nalus, Kiamba Sarangani Province, involved eight (8) learners from Prk. Masagana (Falls), eleven (11) pupils from Prk. Masagana&Crismus (Highway), seven (7) pupils from Prk. Bougainvilla, one (2) pupil from Prk. Narra, three (3) pupils from Prk. Crismus (Proper) and four (4) pupils from Prk. Crismus (Boundary).

Table 1: Distribution of Respondents

Respondents	Total
Prk. Masagana(Falls)	8
Prk.Masagana&Crismus Highway	11
Prk. Bougainvilla	7
Prk. Narra	2
Prk. Crismus (Proper)	3
Prk. Crismus (Boundary)	4
Total	35

This study used a researcher's made questionnaire. The researcher constructed a questionnaire based on the MELCs for the 2nd quarter of Grade 3 Mathematics. It had a Table of Specification and followed the Blooms Taxonomy of percentage in making the questions which were 60% of easy questions, 30% of average questions, and 10% of difficult questions. Different learning competencies covered the questionnaire. The constructed questions in the teacher's questionnaire were related to the Self-Learning Modules (SLMs) of learners that they were using during this time of the pandemic. The questionnaire underwent thorough validation by the experts, especially in the Mathematics subject. The researcher used this questionnaire in the actual conduct of her study.

The questionnaire used in this research was a researcher's made questionnaire. The researcher made sixty (60) questions with the Table of Specification (TOS). This researcher's completed questionnaire underwent validation with the experts, five doctorates. After the experts finished checking and validating each question, they gave a suggestion that the researcher needed to follow the Blooms Taxonomy of percentage in making the questionnaire and arrange it into three levels which are 60% of easy questions, 30% of average queries, and 10% of difficult questions. The experts validated the final number of questions being used by the researcher in her study, thirty (30) questions with the Table of Specifications. After the experts validated the questionnaire, the researcher submitted it to her adviser for correction and suggestion and ensured the reliability of the instruments.

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

$$\int xx = \left[\frac{N}{N-1}\right]\left[\frac{SD^2 - \sum piqi}{SD^2}\right.$$

Where N is the number of items, SD^2 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 $\frac{\sum(x-\bar{x})^2}{n-1}$ denotes the proportion of individuals passing item I, and the proportion failing by qi, where $qi = 1 - pi$. The proponent strictly observed the steps in applying the Kuder-Richard Formula 20:

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

After that, the researcher computed it to find out if the 60-item Test Instrument piloted was reliable or not.

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

First, she arranged the test scores from the highest to the lowest.

Second, she got one-third of the papers from the highest and one-third from the lowest scores. The middle one-third was set aside.

Next, she counted the number of students in the upper and lower groups, respectively, who chose the options.

Then, she recorded the frequency from step 3, and

Furthermore, she estimated the index of difficulty hence she. She used the formula:

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

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 refers to the percentage of getting the correct answer to each item. The smaller the ratio, the more complex the item 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 difficult it is.

Finally, the researcher estimated the item discriminating power. In assessing the item discriminating power, she compared the correct responses from the upper and lower groups. Using this formula, one could compute the index of discrimination quickly:

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

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

According to Calmorin (2014), the discriminating power of an item was not more than 1.00. A maximum of positive discriminating power revealed by an index of 1.00. It obtained when all upper group pupils choose the correct answer and not the lower group. Negative discriminating power obtained when more pupils in the lower group got 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 correct 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 retained the items that passed the difficulty and discrimination index in the item analysis. Other items that marked revise or improve were carried out. The 60-item test undergoes 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 indicators, 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, they suggested to revise the items to be valid and reliable. The instrument obtained an overall mean.

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

The following were the procedures followed in conducting the research study.

The researcher proceeded to ask permission and approval from the principal and the barangay to conduct the study since it is COVID- 19 pandemics. The acceptance of IATF from the barangay was needed after the approval. The pre-test was conducted on the 35 grade 3 pupils residing in the different Puroks. It was monitored adequately after the conduct of the pre-test. The researcher immediately collected the test papers for analysis and interpretation. The test was conducted in every purok following the proper protocol with face masks, social distancing, and alcohol use. In the following week, the researcher taught the lesson based on the coverage of the study for the second quarter by observing proper protocol again. The scope of the study lasted for two months. It was a weekly activity using the SLM in which the researcher taught the lesson in every purok. Proper reorientation for the parents to guide their children in the different coverage lessons under SLMs. After two months of experiments, a post-test was conducted to analyze the data and compare the pre-test results and to determine whether the use of SMLs was effective in improving the academic performance of grade 3 pupils in mathematics. The t-Test of uncorrelated data was used because the respondents of 35 belonged to a large population**.**

Having found the instrument valid and reliable, the researcher administered the questionnaire. The learners were given modules by Purok for them to answer. But she needed to follow the protocol in distributing and retrieving the Self-Learning Modules to ensure the health and safety of each individual. The validated questionnaire was conducted aligned with the MELCs for Grade III Mathematics for the 2nd quarter, and it has a Table of Specification. The researcher did the preparation of instructional materials. A pre-test was conducted in each Purok, with the proper guidance of the teacher. They followed the schedules, protocols to ensure the safety of the pupils and teachers during this pandemic. The validity and comparison were done after conducting of the post-test. The data were recorded and computed appropriately.

The study used the appropriate tools to analyze and interpret the gathered data. To treat the data properly, appropriate statistical tools were used for each subproblem. For sub-problems 1 and 2, to determine the mean score of the pre-test and post-test, frequency count, and percentage distribution were utilized. Subproblem, number three was treated using the t-Test for correlated sample. It is used because the sample size was big.

$$t = \frac{D}{\sqrt{\frac{\sum D^2 - \frac{(\sum D)^2}{n}}{n(n-1)}}}$$

3. RESULTS AND DISCUSSION

3.1 Pre-test scores of Grade 3 Learners in Mathematics

The Table below presents the Pre-test Scores of Grade Three learners in Mathematics before the treatment.

It can be gleaned that of the thirty-five (35) respondents, learner numbers 12, 23, 28, and 33 with obtained scores of 26, 25, 25, and 26, respectively got a very high score during the pre-test. As shown, there were only four learners who got very high scores during the pre-test, while learner numbers 4, 10, 11, 14, 16, 20, 21, 22, 24, 25, 26, 29, and 30 with obtained scores of 24, 21, 23, 20, 29, 20, 21, 24, 18, 21, 22, 20, 22, and 21, respectively got higher scores during pre-test.

On the other hand, learner numbers 5, 6, 7, 8, 15, 17, and 35 with obtained scores of 8, 7, 10, 11, 8, and 9, respectively got low scores or 7 out 35 learners had low scores during the pre-test. It could be noticed that some learners got lower scores on the pre-test. They were learner numbers 5, 6, 7, 8, 15, 17 and 35 or 7 out of 35 got a very low score during the pre-test.

Generally, the mean of the 35 learners for the pre-test was 16.8 or 56.46 percent which was average.

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

Pupil	Frequency	Percentage	Description
1	14	47	Average
2	12	40	Low
3	15	50	Average
4	24	80	High
5	8	27	Low
6	7	23	Low
7	10	33	Low
8	8	27	Low
9	5	17	Very Low
10	21	70	High
11	23	77	High
12	26	87	Very High
13	11	37	Low
14	20	67	High
15	11	37	Low
16	19	67	High
17	8	27	Low
18	17	57	Average
19	13	43	Average
20	20	67	High
21	21	70	High
22	24	80	High
23	25	83	Very High
24	18	60	High
25	21	70	High
26	22	73	High
27	14	47	Average
28	25	83	Very High
29	20	67	High
30	22	73	High
31	18	60	Average
32	13	43	Average
33	26	87	Very High
34	21	70	High
35	9	30	Low
Total	591	1,976	
Mean Score	16.8	56.46	Average

3.2 Post-Test Scores of Grade 3 Learners in Mathematics

Table 4 on page 48 presents the post-test scores of Grade 3 learners in Mathematics after the treatment. The frequency counts and percentage distribution were used in analyzing the data.

It can be observed that an improvement was reflected, and it was found out that out of 35 respondents, fifteen learners got very high scores. This were learner numbers 4, 10, 11, 12, 12, 14, 21, 22, 24, 25, 26, 28, 29, 30, and 33 with obtained scores of 28, 25, 27, 29, 25, 25, 28, 29, 25, 25, 30, 27, 26, and 30, respectively. Compared to the pre-test only four learners got very high scores.

On the other hand, ten learners got higher scores. They were learner numbers 3, 16, 17, 18, 19, 20, 27, 31, and 34 with obtained scores of 28, 21, 19, 22, 22, 21, 22, 19, 21, and 23, respectively. They met the needed requirements to pass the test.

As shown, there were learners who got average scores. They were learner numbers 1, 2, 7, 8, 13, 22, and 33,

While four learners got lower scores in the post-test. They were learner numbers 6, 7, 9, and 35 with obtained scores of 12, 12, 11, and 10 respectively.

Generally, the mean score for the post-test of 35 learners was 21.3 or 70.02 percent interpreted as average.

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

Pupil	frequency	Percentage	Description
1	18	60	Average
2	15	40	Average
3	19	63	High
4	28	93	Very High
5	12	27	Low
6	12	27	Low
7	14	47	Average
8	15	50	Average
9	11	37	Low
10	25	83	Very High
11	27	90	Very High
12	29	97	Very High
13	16	53	Average
14	25	83	Very High
15	18	60	Average
16	21	70	High
17	19	63	High
18	22	73	High
19	21	70	High
20	22	73	High
21	25	83	Very High
22	28	93	Very High
23	22	73	Average
24	29	97	Very High
25	25	83	Very High
26	25	83	Very High
27	19	63	High
28	30	100	Very High
29	27	90	Very High
30	26	87	Very High
31	21	70	High

32	18	60	Average
33	30	100	Very High
34	23	77	High
35	10	33	Low
Total	747	2,451	
Mean Score	21.3	70.02	Very High

Table 4 shows the effectiveness of self-learning modules in improving the academic performance of Grade 3 learners in Mathematics. The t-Test with uncorrelated data was utilized since the population was big. The result revealed that the computed t-value was 10.37 which was greater than the tabular value of 1.645. As a result, the null hypothesis was rejected. It would mean that Supplementary Materials was effective in improving the Academic Performance of Grade Three learners in Mathematics.

The researcher reinforced the results with the existing research about developing Mathematics learning strategies' module based on journal review that the module has effectively improved the learners' performance. The modules were authentic and dependable, and they could use them to supplement concept learning. The modular approach to teaching Basic Mathematics was an effective method for improving Mathematics learning. The module was recommended as a reference for Mathematics learning strategies. Further, the study needed to develop a module based on international journals (Kusumawati and Nayazik, 2018).

Furthermore, Self-learning Modules undoubtedly made the learners active, interactive, and independent learners during learning. In this situation, they were answering effectively by applying what they learned based on their reading. The learners could remember specific subject matter, receive tutoring, track their progress toward their goals, comprehend how their knowledge connects to the subject matter in a larger context, and to earn badges they had mastered. They followed the instructions and processes in the modules. In most cases, modularization allowed learners to learn at their own pace (Maliya and Sukestiyarno, 2019).

In addition, Self-Learning Modules increased achievement and helped retain the content for a longer time. It is because of the interaction of students with the Self-learning Modules. Modules were helpful for students' knowledge adaptation, appropriate for their level, and acceptable to faculty assessors. Learners can use prior knowledge to analyze what they already know and complete modules relevant to areas where they still need to learn more. To progress, students must demonstrate mastery of essential goals and competencies within each module, which shifts responsibility to the student as their learning becomes self-directed, self-paced, and self-monitored. It is indicated that the assessors thought the module was highly beneficial to the course and accelerated learners' learning (Aquino, 2020; Guido, 2014; Asgar and Satyanarayana, 2021).

Furthermore, students performed higher in the Self-Learning Modules according to the study entitled Study on the Efficacy of Learning in the Usage of Learning Modules versus Students Learning Outcomes. Researchers found out that the learners who utilized modules had better average Mathematical learning outcomes than learners who did not use the modules (Rahmawati, Lestari, and Umam 2019).

Finally, the use of Self-learning Modules undoubtedly reduced the teaching burden of teachers. It allowed the learners to learn the content at their own pace because their outcomes were more personalized and adaptable. The education's results were more personalized and versatile. For this reason, some parents came returning to the notion that a child's education began at home family. The family offered a safe and nurturing environment for children to develop and grow. Children could realize their full potential and accept their limitations, advantages, and disadvantages. The administrators should also arrange training courses for teachers during summer and winter vacations (Asgar and Satyanarayana, 2021; Chamberlin, Payne, and Kettler 2020).

Table 5: Effectiveness of Self-learning Modules among Grade Three Learners

Variable	**df**	**t-value**		**Description**	**Decision a = 0.05**
		Computed	Tabular		
Pretest Score versus **Post-test Score**	n-1 34	10.37	1.645	significant	Reject H_{03}

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