

Performance in General Mathematics of Grade 11 Students of Sta. Cruz South High School Using Modular Learning Approach

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Abstract: - The goal of this research is to describe Grade 11 students' performance in General Mathematics during the first quarter of the school year 2020-2021 utilizing a modular learning strategy. This study also looked at the effectiveness of a modular learning method. This study used an experimental approach using a one-group pre- and post-test design. With a total of 16 pupils, there were seven male and nine female respondents. The information was taken from Sta. Cruz South High School in the province of Zambales used a questionnaire created by the researcher. The questionnaire consists of 50 items divided into five core topics based on the Department of Education's Most Essential Learning Competencies (MELC) (DepEd). Functions, rational functions, inverse functions, and inverse functions are the five basic ideas.

Keywords:- Modular Learning Approach, Functions, Mathematical Competence, MELC, DepEd.

I. INTRODUCTION

Corona Virus 2019 (COVID19) is affecting the entire world. Nations, businesses, economy, education and more are drowning from this virus. This virus is an infectious disease attacking the respiratory system specifically its tracks. COVID19 is a kind of common virus that causes an infection in your nose, sinuses, or upper throat (Smith, 2020). Because of this virus all educational institution is adjusting on how learning deliveries will adopt the situation.

According to the European Centre for Disease Prevention and Control's website, Asia has 1 375 372 cases as of June 9, 2020; the five countries reporting the most cases are India (266 598), Iran (173 832), Turkey (171 121), Pakistan (108 317), and Saudi Arabia (105 283). World Health Organization (WHO) (2020) reported on June 4, 2020 that out of the total 20,382 confirmed cases reported in the Philippines, 55 percent are male, with the most affected age group 30-39 years (22.2 percent) followed by 20-29 years (19.1 percent) - 57.9% of cases reported from National Capital Region (NCR), followed by Central Visayas (14.3 percent), CALABARZON (8.9%), and Central Luzon (3.3 percent). The Department of Education

(DepEd) planned too much with this emerging virus in the entire nation. As stipulated on Republic Act No. 7977, also known as "An Act to Lengthen the School Calendar from Two Hundred (200) days to not more than Two Hundred Twenty (220) Class Days," the "school year shall start on the first Monday of June but not later than the last day of August." Thus, the government agency announced that the first day of school year will be on August 24, 2020 and will end in April 2021.

Recently, the department announced that there will be no face-to-face classes as first claimed by the President. Thus, the educational agency is preparing every unit for the Learning Continuity Plan (LCP) like modular, blended, and online learning. Malaluan (2020) reported that the LCP has five major components: data analytics; learning modalities, which should be aligned with the curriculum, delivery of education, learning resources needed, and assessment; teacher up-skilling and re-skilling, since not all teachers may be well-versed in the learning methods to be implemented; operational plan, such as enrollment procedures, and the need for strong communication plans and strategies; and bridging the plan for long- and medium-term initiatives of the department for quality education, especially under its "Sulong Edukalidad" campaign.

Teachers are the distributors of knowledge to form the world and to change society for the better. In order to do this amid COVID19 pandemic, DepEd decided that teachers should use modular learning approach. Modular learning is an approach where teachers prepare the module of the competencies provided by the educational agency and being picked up by the parent from the school. Parents will guide their children in order to accomplish the module. Student's performance and quarter examination will also be conducted. But a big question argues the learning process, will the performance of the students in the modular learning approach be enhance?

This study was conducted to test the effectivity of modular learning approach in enhancing the performance of the Grade 11 Humanities and Social Science (HUMSS) students in General Mathematics.

II. RESEARCH METHODOLOGY

A. Research Design

According to some studies the performance of students was influenced by different variables. To determine whether the Modular Learning Approach enhances the students’ performance and academic achievement, experimental method of research will be used.

Experimental research is a scientific approach to research, where one or more independent variables are manipulated and applied to one or more dependent variables to measure their effect on the latter. The effect of the independent variables on the dependent variables is usually observed and recorded over some time, to aid researchers in drawing a reasonable conclusion regarding the relationship between these 2 variable types (Formplus Blog, 2020).

One-Group Pretest-Posttest was the design of the experimental method. Using this design, the subject in the experimental group was measured before and after the treatment, Modular Learning Approach, is administered. Thus, the performance and academic achievement of Grade 11 students of Sta. Cruz South High School was measured before and after the implementation of the Modular Learning Approach. There is no controlled group. This offers comparison of the same individuals before and after the treatment.

B. Respondents and Location

The respondents of the study were the Grade 11 students of Sta. Cruz South High School in the district of Sta. Cruz, Zambales for the school year 2020 - 2021. The margin of error to be used in this study is 0.05 and used universal sampling.

Table 1:- Number of Grade 11 Students of Sta. Cruz South High School Classified into Sex

Strand/Grade	Sex	Population Size	Proportion
Humanities and Social Sciences 11	M	16	57.14
	F	12	42.86
TOTAL		28	100

Sta. Cruz, Zambales is the northern most district of the province. The place locates the boundary Pangasinan of Region I and Zambales of Region III. According to PhilAtlas (2020) Sta. Cruz is situated at approximately 15° 46’ North, 119° 55’ East, in the island of Luzon. The municipality has a land area of 438.46 square kilometer or 169.29 square miles which constitutes the 12.03% of Zambales’ total area. From the 2015 Census the population of the district was 58,151 or 9.84% to the province’s total population.

Sta. Cruz South High School is one of the High Schools of the district located at Barangay Lipay, Sta. Cruz, Zambales and was established in 2009. At present the school offers Grade 7 to 10 and Grade 11 to 12, thus being classified as integrated high school. It has 19 teachers with 2 master teachers and having an enrollment number of 451 students.

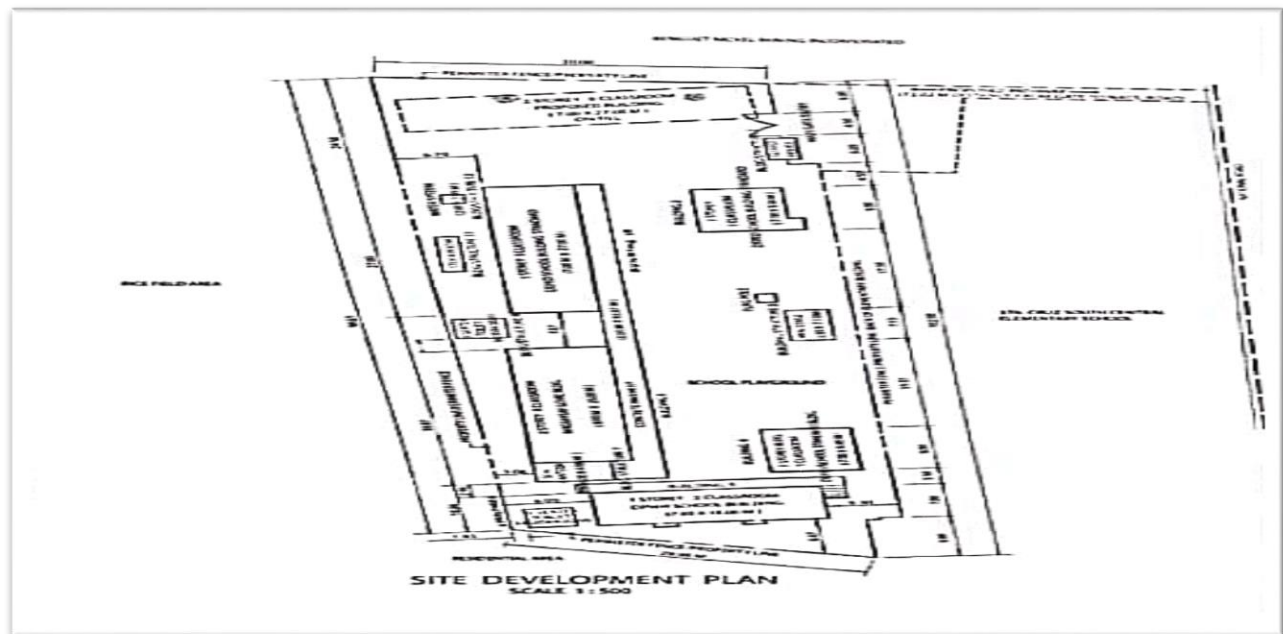


Fig 3:- Vicinity of Sta. Cruz South High School, Sta. Cruz, Zambales

C. The Instrument

The data were collected using multiple-choice questionnaire anchored from the first quarter curriculum guides of General Mathematics provided by DepEd as the Most Essential Learning Competencies (MELC) of Senior High School program amid the COVID19 pandemic. The 50-item multiple-choice questionnaire covers 5 key concepts of General Mathematics which are as follows: key concepts of functions, key concepts of rational functions, key concepts of inverse functions, key concepts of exponential functions, and key concepts of logarithmic functions. Each key concept will be having 10 multiple-choice questions.

Key Concept of Functions mainly focused on the nature of function and piece-wise functions while the Key Concepts of Rational functions centered on the solutions and its graphical representations. The Key Concepts of Inverse Function focused on the inverse of the rational function with its graphical representation with the use of asymptotes and intercepts. However, the Key Concepts of Exponential and Logarithmic Functions centered on the basic discussions and real-life applications. All key concepts adhere the performance standard of the most essential learning competency in terms of real-life applications.

D. Validation of the Instrument

The researcher validated the instrument of the study. The purpose of the pretesting was to measure the effectivity, validity, and reliability of the questionnaire. This also determined the length and clarity of the items, the difficulty of answering the questions, the proper length of time answering, ease in tabulating response, and other problem (Calderon & Gonzales, 1993).

The researcher also focused on the initial questionnaire by addressing the directions or instructions, vague questions, spaces for replies, number of options and choices, length of the questionnaire, and other difficulties of answering researchers instrument. Suggestions and recommendations by these respondents were noted to help the researcher in improving the questionnaire.

E. Data Collection

The researcher sought the permission of the school's division Superintendent to conduct the study. After the approval of the permission, the researcher communicated with the school principal regarding the date and time of data gathering. The confidentiality of the results were assured after the date and time were set; the researcher talked to the target respondents regarding the gathering of data.

During the conduct of the study, the researcher explained the goals of the research and carefully discussed

how the questions were answered. Questions coming from the respondents were entertained and answered.

Data were consolidated, analyzed, and treated using statistical tools and methods.

F. Data Analysis

The following statistical tools were used in the analysis of data:

1. **Percentage.** Rate, number, or amount in each hundred, it is any proportion or share in relation to a whole (Google Dictionary, n.d.).
2. **Average or Mean.** An average is the result obtained by adding two or more amounts together and dividing the total by the number of amounts or by another total. Mean will be used to describe the level of performance and academic achievement of the students.
3. **Paired T-test.** The paired t-test, also referred to as the paired-samples t-test or dependent t-test, is used to determine whether the mean of a dependent variable (e.g., weight, anxiety level, salary, reaction time, etc.) is the same in two related groups (e.g., two groups of participants that are measured at two different "time points" or who undergo two different "conditions"). This statistical treatment will be used to test the difference of the students' performance before and after the implementation of the Modular Learning Approach.

In deciding whether to accept or to reject the null hypothesis, follow the following rules:

1. If the significant (Sig.) value is greater than the alpha level of significance of 0.05, the null hypothesis is accepted. Thus, it can be interpreted as Not Significant or there is no significant difference.
2. If the significant (Sig.) value is lesser than the alpha level of significance of 0.05, the null hypothesis is rejected. Thus, it can be interpreted as Significant or there is a significant difference.
3. **Pearson r.** The Pearson product-moment correlation coefficient (Pearson's correlation, for short) is a measure of the strength and direction of association that exists between two variables measured on at least an interval scale. This statistical treatment will be used to determine the level of association of the academic achievement and performance after the implementation of the Modular Learning Approach.
4. **DepEd Order No. 8, s. 2015.** This DepEd Order refers to the Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program. It provides the multiple ways of measuring the students varying abilities and learning potentials, and the role of learners as co-participants in the assessment process. The DepEd order also provides on how students' performance must be described using 5 different grading scales which is in Table 2 below:

Descriptors, Grading Scale, and Remarks of DepEd Order No.8, s. 2015

DESCRIPTORS	GRADING SCALE	REMARKS
Outstanding	90 - 100	Passed
Very Satisfactory	85 – 89	Passed
Satisfactory	80 – 84	Passed
Fairly Satisfactory	75 – 79	Passed
Did Not Meet Expectation	Below 75	Failed

Transmutation Table of Initial/ Percentile Grade and the Equivalent Transmuted Final Grade

Initial Grade/ Percentile Grade	Transmuted Grade	Initial Grade/ Percentile Grade	Transmuted Grade
100	100		
98.40 – 99.99	99	66.40 – 67.99	79
96.80 – 98.39	98	64.80 – 66.39	78
95.20 – 96.79	97	63.20 – 64.79	77
93.60 – 95.19	96	61.60 – 63.19	76
92.00 - 93.59	95	60.00 – 61.59	75
90.40 – 91.99	94	56.00 – 59.99	74
88.80 – 90.39	93	52.00 – 55.99	73
87.20 – 88.79	92	48.00 – 51.99	72
85.60 – 87.19	91	44.00 – 47.99	71
84.00 – 85.59	90	40.00 – 43.99	70
82.40 – 83.99	89	36.00 – 39.99	69
80.80 – 82.39	88	32.00 – 35.99	68
79.20 – 80.79	87	28.00 – 31.99	67
77.60 – 79.19	86	24.00 – 27.99	66
76.00 – 77.59	85	20.00 – 23.99	65
74.40 – 75.99	84	16.00 – 19.99	64
72.80 – 74.39	83	12.00 – 15.99	63
71.20 – 72.79	82	8.00 – 11.99	62
69.60 – 71.19	81	4.00 – 7.99	61
68.00 - 69.59	80	0 – 3.99	60

Note: This is the Appendix B attachment of DepEd Order 8 Series of 2015

Table 2:- Descriptors, 10 – Point Score Scale, and Remarks

Descriptive Rating	Scale	Score
Outstanding	9.00 - 10.00	9 - 10
Very Satisfactory	8.00 - 8.99	8
Satisfactory	7.00 - 7.99	7
Fairly Satisfactory	6.00 - 6.99	6
Did Not Meet Expectations	0.00 - 5.99	0 - 5

* Based on DepEd K to 12 Grading System

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Table 3:- Transmutation Table of 10-Point Score Scale

Score	Computed Initial Grade	Initial Grade	Transmuted Grade
10	100.00	100	100
9	90.00	88.80 - 90.39	93
8	80.00	79.20 - 80.79	87
7	70.00	69.60 - 71.19	81
6	60.00	60.00 - 61.59	75
5	50.00	48.00 - 51.99	72
4	40.00	40.00 - 43.99	70

3	30.00	28.00 - 31.99	67
2	20.00	20.00 - 23.99	65
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III. MATHEMATICAL MODEL

This chapter presents the research design and methods, the research locale, respondents and sampling technique, the instrument and its validation, the data distribution and gathering procedure and the statistical treatment of the data.

A. Research Design

According to some studies the performance of students was influenced by different variables. To determine whether the Modular Learning Approach enhances the students' performance and academic achievement, experimental method of research will be used.

Experimental research is a scientific approach to research, where one or more independent variables are manipulated and applied to one or more dependent variables to measure their effect on the latter. The effect of the independent variables on the dependent variables is usually observed and recorded over some time, to aid

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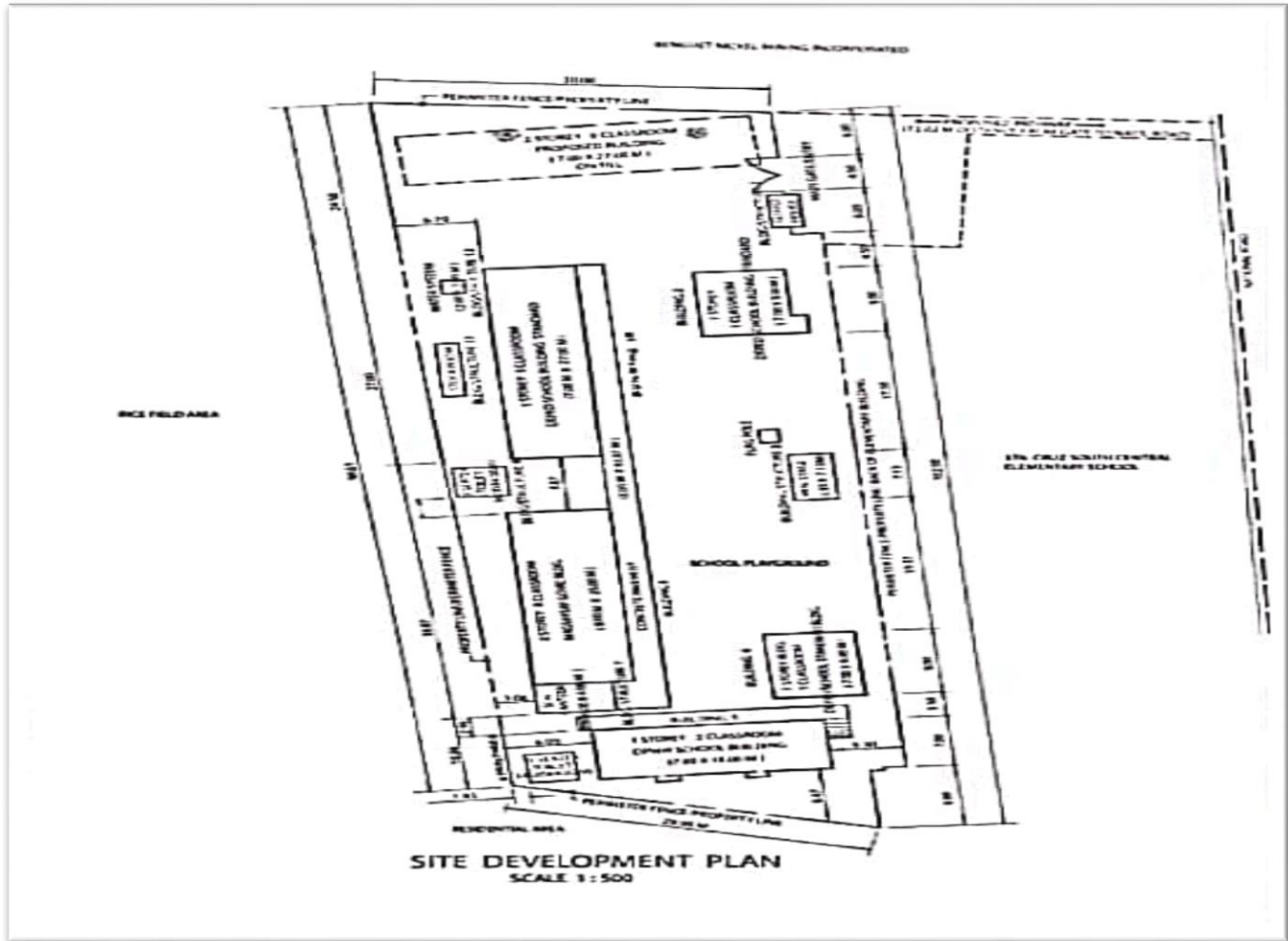


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77.60 – 79.19	86	24.00 – 27.99	66
76.00 – 77.59	85	20.00 – 23.99	65
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IV. RESULTS AND DISCUSSION

This chapter presents the results and interpretation of the findings based on collected data, related literature and studies, and the researcher’s observations and actual experience.

A. Performance Level of the Students before and after the Implementation of Modular Learning Approach in General Mathematics

➤ Function

Table 4 Performance Level in General Mathematics Before and After the Implementation of Modular Learning Approach Using Pre-test and Post-test Scores in Function

Descriptive Rating	Score	Pre - Test		Post – Test	
		Frequency	Percent	Frequency	Percent

Outstanding	9 - 10	1	3.57	20	71.43
Very Satisfactory	8	3	10.71	4	14.29
Satisfactory	7	2	7.14	1	3.57
Fairly Satisfactory	6	3	10.71	2	7.14
Did not meet expectation	0 - 5	19	67.86	1	3.57
Total		28	100.00	28	100.00
Mean		4.38		8.71	
		Did not meet expectation		Very Satisfactory	
* Based on DeoEd K to 12 Grading System					
*DepEd Order No. 8, s. 2015					

Table 4 shows the performance level in General Mathematics before and after the implementation of modular learning approach using pre-test and post-test scores in terms of functions. There were 19 students or 67.86 percent who attained the did not meet expectation level in the pre-test while there is only one student or 3.57 percent who achieved an outstanding level. However, there were 20 students or 71.43 percent who achieved the outstanding level in the post-test while one student or 3.57 percent to both satisfactory and did not meet expectation levels. Pre-test has a mean of 4.38 which is under the did not meet expectation level in terms of function while post-test has a mean of 8.71 which described as very satisfactory.

Study showed that students who perceive that they are skillful in a particular subject would likely to perform well in that field than those who perceive to have low skills (Correll, 2001; Hannover & Kessels, 2004). Additionally, a study revealed the presence of statistically significant at $\alpha \leq 0.05$ among means of student scores who learned the module strategy over those who studied the traditional way in direct achievement. These differences are in favor of student of module strategy. (Alelaimat & Ghoneem, 2012). Modules also provide for active participation by the learner. The modular approach finds solid philosophical rationale in

the idea that learning is most meaningful and lasting when the learners are fully engaged in the learning process (Naboya, 2019). Guido (2014) in his study entitled Evaluation of a Modular Teaching Approach in Materials Science and Engineering found out that the instructional module in materials science and engineering are effective for students' knowledge adaptation and shows suitability to the level of the students and acceptability to the faculty evaluators.

Vinner and Dreyfus (1989) concluded that a lack of conceptual understanding of the definition of a function corresponding to images was present and that several students did not recognize a piecewise graph to be a function with restrictions in the domain. Students learn about patterns and relationships between sets and then transition to work on simple functions and solving equations with missing parts (Powell, Gilbert, & Fuchs, 2019). However, Froelich, Bartkovic, and Foerrestter (1991) believed that the concept of functions is one of the most important concepts in mathematics.

➤ *Rational Function*

Table 5 Performance Level in General Mathematics Before and After the Implementation of Modular Learning Approach Using Pre-test and Post-test Scores in Rational

Descriptive Rating	Score	Pre – Test		Post - Test	
		Frequency	Percent	Frequency	Percent
Outstanding	9 - 10	2	7.14	5	17.86
Very Satisfactory	8	2	7.14	2	7.14
Satisfactory	7	1	3.57	8	28.57
Fairly Satisfactory	6	0	0.00	4	14.29
Did not meet expectation	0 - 5	23	82.14	9	32.14
Total		28	100.00	28	100.00
Mean		3.96		6.09	
		Did not meet expectation		Fairly Satisfactory	
* Based on DeoEd K to 12 Grading System					
*DepEd Order No. 8, s. 2015					

Table 5 shows the performance level in General Mathematics before and after the implementation of modular learning approach using pre-test ad post-test scores in terms of rational function. There were 23 students or 82.14 percent who attained the did not meet expectation level in the pre-test while there is only one student or 3.57 percent who achieved a satisfactory level. However, there were nine students or 32.14 percent who attained the did not meet expectation level in the post-test while two students or 7.14 percent achieved the very satisfactory level. Pre-test has a mean of 3.96 which is under the did not meet expectation level in terms of rational function while post-test has a mean of 6.09 which described as fairly satisfactory.

The concept of a function is fundamental for undergraduate mathematics and is essential in related areas of the sciences (Okur, 2013). A clear understanding of the

function concept is also crucial for any student to better understand calculus - a critical direction for the rise of future scientists, engineers, and mathematicians (Carlson and Oehrtman, 2005).

Research studies (Cangelosi et al., 2013; Yee & Lam, 2008; Nair, 2010; Dotson, 2009; Bardini et al., 2014 etc.) indicated that student have a hard time dealing with rational functions. Consecutively, Nair (2010) pointed out that some high school and college students have an incomplete conception of rational functions, asymptotes, limits and continuity which often becomes a challenge for their understanding of other mathematical concepts. Nair also indicated that some students think that rational functions are rational numbers and some think that a rational function has a number in the denominator instead of a variable.

➤ *Inverse Function*

Table 6 Performance Level in General Mathematics Before and After the Implementation of Modular Learning Approach Using Pre-test and Post-test Scores in Inverse

Descriptive Rating	Score	Pre - Test		Post - Test	
		Frequency	Percent	Frequency	Percent
Outstanding	9 - 10	2	7.14	3	10.71
Very Satisfactory	8	2	7.14	8	28.57
Satisfactory	7	0	0.00	5	17.86
Fairly Satisfactory	6	2	7.14	5	17.86
Did not meet expectation	0 - 5	22	78.57	7	25.00
Total		28	100.00	28	100.00
Mean		4.04		6.38	
		Did not meet expectation		Fairly Satisfactory	
* Based on DeoEd K to 12 Grading System					
*DepEd Order No. 8, s. 2015					

Table 6 shows the performance level in General Mathematics before and after the implementation of modular learning approach using pre-test ad post-test scores in terms of inverse function. There were 22 students or 78.57 percent who attained the did not meet expectation level in the pre-test while none of the students or zero percent who achieved the satisfactory level. However, there were eight students or 28.57 percent who attained the very satisfactory level in the post-test while three students or 10.71 percent achieved the outstanding level. Pre-test has a mean of 4.04 which is under the did not meet expectation level in terms of inverse function while post-test has a mean of 6.38 which described as fairly satisfactory.

A study concluded that students have difficulty in attaining a meaningful understanding of inverse functions without experiencing it through conceptually focused and cognitively challenging tasks using a variety of representations (Bayazit & Gray, 2004). According to previous studies, students experience learning difficulties with the concept of an inverse function or have

misconceptions (Carlson et al., 2005; Ural, 2006). The essential reason for such difficulties and misconceptions is the fact that the concept of an inverse function is generally taught based on memorization and routine rules (Wilson et al., 2011). In a study conducted in Ireland by Breen, Larson, O’Shea, and Pettersson (2016), some of the students gave straightforward answers in an open-ended questionnaire by using “undoing” operations. The results of the study showed that several students did not draw on their conceptual knowledge of the inverse property of undoing known as inverting. The concepts of function and inverses are essential for representing and interpreting the changing nature of a wide array of situations (Breen et al., 2016, p. 2228).

➤ *Exponential Function*

Table 7 shows the performance level in General Mathematics before and after the implementation of modular learning approach using pre-test ad post-test scores in terms of exponential function. There were 28 students or 100 percent who attained the did not meet expectation level

in the pre-test. However, there were eight students or 28.57 percent who attained the fairly satisfactory level in the post-test while three students or 10.71 percent achieved the outstanding level. Pre-test has a mean of 3.00 which is

under the did not meet expectation level in terms of exponential function while post-test has a mean of 6.13 which described as fairly satisfactory.

Table 7 Performance Level in General Mathematics Before and After the Implementation of Modular Learning Approach Using Pre-test and Post-test Scores in Exponent

Descriptive Rating	Score	Pre – Test		Post - Test	
		Frequency	Percent	Frequency	Percent
Outstanding	9 – 10	0	0.00	3	10.71
Very Satisfactory	8	0	0.00	4	14.29
Satisfactory	7	0	0.00	6	21.43
Fairly Satisfactory	6	0	0.00	8	28.57
Did not meet expectation	0 – 5	28	100.00	7	25.00
Total		28	100.00	28	100.00
Mean		3.00		6.13	
		Did not meet expectation		Fairly Satisfactory	
* Based on DeoEd K to 12 Grading System					
*DepEd Order No. 8, s. 2015					

However, Kirschner, Sweller, and Clark (2006) claimed that a main property of the problem-solving approach is that it challenges students to solve “authentic” problems or acquire complex knowledge in information-rich settings based on the assumption that having learners construct their own solutions leads to the most effective learning experience. Imm and Lorber (2013) pointed out that understanding the problem context in the modeling

process is crucial to connecting mathematical knowledge to the real-world knowledge. Connected Math (Lappan, Fey, Fitzgerald, Friel, & Phillips, 1998) was the only curriculum that dedicates a chapter to construct students’ conceptual knowledge of exponential functions.

➤ *Logarithmic Function*

Table 8 Performance Level in General Mathematics Before and After the Implementation of Modular Learning Approach Using Pre-test and Post-test Scores in Logarithm

Descriptive Rating	Score	Pre - Test		Post - Test	
		Frequency	Percent	Frequency	Percent
Outstanding	9 - 10	0	0.00	0	0.00
Very Satisfactory	8	0	0.00	1	3.57
Satisfactory	7	0	0.00	0	0.00
Fairly Satisfactory	6	0	0.00	3	10.71
Did not meet expectation	0 - 5	28	100.00	24	85.71
Total		28	100.00	28	100.00
Mean		3.00		3.50	
		Did not meet expectation		Did not meet expectation	
* Based on DeoEd K to 12 Grading System					
*DepEd Order No. 8, s. 2015					

Table 8 shows the performance level in General Mathematics before and after the implementation of modular learning approach using pre-test ad post-test scores in terms of logarithmic function. There were 28 students or 100 percent who attained the did not meet expectation level

in the pre-test. However, there were 24 students or 85.71 percent who attained the did not meet expectation level in the post-test while none of the students or zero percent attained the outstanding and satisfactory levels. Pre-test has a mean of 3.00 which is under the did not meet expectation

level in terms of logarithmic function while post-test has a mean of 3.50 which is also described as did not meet expectation.

Furthermore, Webber (2002) indicated that learners understand exponential and logarithmic functions through exponentiation as an action and process, exponential expressions are the results of the process and generalization. Webber (2002) asserted that exponential and logarithmic functions are important concepts that play

a fundamental role in mathematical courses, including calculus, differential equations, and complex analysis. Learners appear to experience difficulties in understanding the two types of functions used in the study. Some of the learners struggled to express the exponential equation $y = ax$ into a logarithmic equation, $y = \log ax$. As a result, learners couldn't master a skill of distinguishing them as the rate of growth which is proportional to their values (Bogley & Robson, 1999).

Table 9 Summary of Performance Level in General Mathematics Before and After the Implementation of Modular Learning Approach Using Pre-test and Post-test Scores

	Pre – Test			Post - Test		
	Mean	Descriptive Rating	Rank	Mean	Descriptive Rating	Rank
Function	4.38	Did not meet expectation	1	8.71	Very Satisfactory	1
Rational	3.96	Did not meet expectation	3	6.09	Fairly Satisfactory	4
Inverse	4.04	Did not meet expectation	2	6.38	Fairly Satisfactory	2
Exponent	3.00	Did not meet expectation	4.5	6.13	Fairly Satisfactory	3
Logarithm	3.00	Did not meet expectation	4.5	3.50	Did not meet expectation	5
Overall Weighted Mean	3.68	Did not meet expectation		6.16	Fairly Satisfactory	

Table 9 shows the summary of performance level in General Mathematics before and after the implementation of the modular learning approach using pre-test and post-test scores. Key concept of function has the greatest mean in the pre-test which is 4.38 and being described as did not meet expectation while exponential and logarithmic functions have a mean of 3.00 and both described as did not meet expectation. The overall mean of the pre-test is 3.68 which is described as did not meet expectation. However, the key concept of function has a mean of 8.71 and described as very satisfactory in the post-test while the key concept of logarithmic function has the lowest mean which is 3.50 and described as did not meet expectation. In totality, post-test has a mean of 6.16 and described as fairly satisfactory.

According to Capuno et al. (2019), Filipino students' performance in Math needs to be improved as reflected in the 2016-2017 Global Competitiveness Report; in this, the Philippines ranked 79th out of the 138 participating countries in terms of the quality of Science and Math education. However, a study about the factors affecting the

mathematics performance of junior high school students revealed that 97 or 53.01 percent of the respondents had reasonably satisfactory performance in mathematics, which is followed by 52 or 28.42 percent of the respondents who had satisfactory performance in the subject (Peters, Gamboa, Etcuban, Dinauanao, Sitoy, & Arcadio, 2020).

Studies revealed that learning the function concept is concept with many high performing undergraduates possessing weak function understandings (Carlson, 1998; Oerhtman et al. 2008). Learners' understanding of transformation of graphs is very limited (Smith, 2009). A study emphasized that a mathematically proficient student needs to learn more than the procedures in mathematics; he/she need to deeply understand the concept and that the common core is calling to prepare students to reason mathematically and use their knowledge as a tool to solve problems (Sawalha, 2018).

B. Level of the Academic Achievement of the Students after the First Quarter of General Mathematics

Table 10 Level of Students' Academic Achievement after the First Quarter of General Mathematics

Descriptive Rating	Grades	Frequency	Percent
Outstanding	90 - 100	0	0.00
Very Satisfactory	85 - 89	2	7.14
Satisfactory	80 - 84	26	92.86

Fairly Satisfactory	75 - 79	0	0.00
Did not meet expectation	below 75	0	0.00
Total		28	100.00
Mean		82.36	
		Satisfactory	

Table 10 shows the students' level of academic achievement after the first quarter in General Mathematics. There were 26 students or 92.86 percent who attained a satisfactory level while two students or 7.14 percent achieved the very satisfactory level. However, none of the students attained the outstanding, fairly satisfactory, and did not meet expectation level. The mean of the academic achievement of 28 students is 82.36 which described as satisfactory.

This implies that students performed satisfactory in General Mathematics of the first quarter of academic year. This result contradicts a study about the level of student's achievement at the end of elementary in Yemen which

revealed that there was an underachievement of the students in mathematics due to the lack of used of varieties of teaching methods (Khair, Khairani, & Elrofai, 2012). Modular approach was used for the first quarter and succeeding quarters of the academic year. Thus, this satisfactory achievement of the students was under modular learning approach. The goal of the modules is to provide resources to teachers that will allow them to transform the classrooms into active, student-centered learning environments (Stewart & Wilkerson, 1999).

C. Paired Sample t-test on the Difference of the Performance of the Students Before and After the Implementation of the Modular Learning Approach

Table 11 Difference in the Performance of the Students Before and After the Implementation of the Modular Learning Approach

	t	Df	Sig. (2-tailed)	Decision/ Interpretation
Function	-9.350	27	0.00	Reject Ho Significant
Rational	-3.813	27	0.00	Reject Ho Significant
Inverse	-4.072	27	0.00	Reject Ho Significant
Exponent	-4.882	27	0.00	Reject Ho Significant
Logarithm	-1.800	27	0.08	Accept Ho Not Significant

Table 11 shows the difference in the performance of students before and after the implementation of the modular learning approach. The computed significant value of 0.08 is greater than the alpha level of significance of 0.05, thus the null hypothesis is accepted. There is no significant difference between the performance before and after the implementation of the modular learning approach in terms of logarithmic functions. On the other hand, the computed significant value of 0.00 is less than the alpha level of significance of 0.05, thus the null hypothesis is rejected. Therefore, there is a significant difference between the performance of the students before and after the implementation of the modular learning approach in the key concepts of function, rational function, inverse function, and exponential function.

Lim (2016) showed that there is a significant difference between the mean gain scores of the two groups of respondents – experimental and control groups. The experimental group who was taught using the modules performed significantly better than the control group who were taught using the traditional lecture method. Sadiq and Zamir (2014) stated that modular teaching is more effective in teaching learning process as compared to ordinary teaching methods. Because in this modular approach the students learn at their own pace. Modular approach helps to maximize the chances of student participation in classroom in respect to fulfill the given tasks at the spot.

Table 12 Relationship Between the Students' Academic Achievement and the Performance after the Implementation of the Modular Learning Approach

Source of Correlations		Grade	Posttest	Decision/ Interpretation
Grade	Pearson Correlation	1	0.595**	Moderate Relationship Reject Ho Significant
	Sig. (2-tailed)		0.01	
	N	28	28	
Posttest	Pearson Correlation	0.595**	1	
	Sig. (2-tailed)	0.01		
	N	28	28	

** . Correlation is significant at the 0.01 level (2-tailed).

Table 12 shows the relationship between the students' academic achievement and the performance after the implementation of the modular learning approach. The computed significant value of 0.01 is less than the alpha level of significance of 0.05, thus the null hypothesis is rejected. Moreover, the computed correlation coefficient of 0.595** shows moderate relationship. Therefore, there is a significant relationship between the academic achievement and the students' performance after the implementation of the modular learning approach.

Nizoloman (2013) stated that there is a positive and significant relationship between the students' mathematical ability and achievement in mathematics and that students' mathematical ability can predict achievement in mathematics. Furthermore, on the relationship of modular learning approach, a study revealed that there was a significant relationship between self-concept and academic performance of the respondents in Mathematics (Peteros, Gamboa, Etcuban, Dinauanao, Sitoy, & Arcadio, 2020). With this positive direct relationship, it is clear that self-learning devices like modules help students learn or acquire skills, knowledge and information in the absence of a teacher. These materials provide sufficient reinforcement, enrichment, and source materials. They also allow the learner to work at a rate style and level situated to his capacity (Lim, 2016).

V. CONCLUSION

This chapter presents the summary of findings from the analyzed collected data, conclusions, and recommendations of the study.

❖ Summary of Findings

A. Performance Level of the Students before and after the Implementation of Modular Learning Approach in General Mathematics

➤ Function

There were 19 students or 67.86 percent who attained the did not meet expectation level in the pre-test while there is only one student or 3.57 percent who achieved an

outstanding level. However, there were 20 students or 71.43 percent who achieved the outstanding level in the post-test while one student or 3.57 percent to both satisfactory and did not meet expectation levels. Pre-test has a mean of 4.38 which is under the did not meet expectation level in terms of function while post-test has a mean of 8.71 which described as very satisfactory.

➤ Rational Function

There were 23 students or 82.14 percent who attained the did not meet expectation level in the pre-test while there is only one student or 3.57 percent who achieved a satisfactory level. However, there were nine students or 32.14 percent who attained the did not meet expectation level in the post-test while two students or 7.14 percent achieved the very satisfactory level. Pre-test has a mean of 3.96 which is under the did not meet expectation level in terms of rational function while post-test has a mean of 6.09 which described as fairly satisfactory.

➤ Inverse Function

There were 22 students or 78.57 percent who attained the did not meet expectation level in the pre-test while none of the students or zero percent who achieved the satisfactory level. However, there were eight students or 28.57 percent who attained the very satisfactory level in the post-test while three students or 10.71 percent achieved the outstanding level. Pre-test has a mean of 4.04 which is under the did not meet expectation level in terms of inverse function while post-test has a mean of 6.38 which described as fairly satisfactory.

➤ Exponential Function

There were 28 students or 100 percent who attained the did not meet expectation level in the pre-test. However, there were eight students or 28.57 percent who attained the fairly satisfactory level in the post-test while three students or 10.71 percent achieved the outstanding level. Pre-test has a mean of 3.00 which is under the did not meet expectation level in terms of exponential function while post-test has a mean of 6.13 which described as fairly satisfactory.

➤ *Logarithmic Function*

There were 28 students or 100 percent who attained the did not meet expectation level in the pre-test. However, there were 24 students or 85.71 percent who attained the did not meet expectation level in the post-test while none of the students or zero percent attained the outstanding and satisfactory levels. Pre-test has a mean of 3.00 which is under the did not meet expectation level in terms of logarithmic function while post-test has a mean of 3.50 which is also described as did not meet expectation.

Key concept of function has the greatest mean in the pre-test which is 4.38 and being described as did not meet expectation while exponential and logarithmic functions have a mean of 3.00 and both described as did not meet expectation. The overall mean of the pre-test is 3.68 which is described as did not meet expectation. However, the key concept of function has a mean of 8.71 and described as very satisfactory in the post-test while the key concept of logarithmic function has the lowest mean which is 3.50 and described as did not meet expectation. In totality, post-test has a mean of 6.16 and described as fairly satisfactory.

B. Level of the Academic Achievement of the Students after the First Quarter of General Mathematics

There were 26 students or 92.86 percent who attained a satisfactory level while two students or 7.14 percent achieved the very satisfactory level. However, none of the students attained the outstanding, fairly satisfactory, and did not meet expectation level. The mean of the academic achievement of 28 students is 82.36 which described as satisfactory.

C. Paired Sample t-test on the Difference on the Performance of the Students Before and After the Implementation of the Modular Learning Approach

The computed significant value of 0.08 is greater than the alpha level of significance of 0.05, thus the null hypothesis is accepted. There is no significant difference between the performance before and after the implementation of the modular learning approach in terms of logarithmic functions. On the other hand, the computed significant value of 0.00 is less than the alpha level of significance of 0.05, thus the null hypothesis is rejected. Therefore, there is a significant difference between the performance of the students before and after the implementation of the modular learning approach in the key concepts of function, rational function, inverse function, and exponential function.

D. Test of Significance of the Association between the Students' Academic Achievement and the Performance after the Implementation of the Modular Learning Approach

The computed significant value of 0.01 is less than the alpha level of significance of 0.05, thus the null hypothesis is rejected. Moreover, the computed correlation coefficient of 0.595** shows moderate relationship. Therefore, there is a significant relationship between the academic achievement and the students' performance after the implementation of the modular learning approach.

❖ *Conclusions*

- Grade 11 students of Sta. Cruz South High School did not meet the expectation on the key concepts of function, rational function, inverse function, exponential function, and logarithmic function before the implementation of the modular learning approach. On the other hand, students performed very satisfactory in function, fairly satisfactory in rational function, inverse function, and exponential function, and did not meet expectation in logarithmic function after the implementation of the modular learning approach. Overall, students did not meet the expectation before the modular learning approach while fairly satisfactory after.
- The level of academic achievement of Grade 11 students of Sta. Cruz South High School in General Mathematics after the first quarter was Satisfactory.
- There is a significant difference between the performance of the students in General Mathematics before and after the implementation of the modular learning approach in terms of functions, rational function, inverse function, and exponential function but not significant to logarithmic function.
- There is a significant relationship between the academic achievement and the students' performance after the implementation of the modular learning approach in General Mathematics.

RECOMMENDATIONS

- Teachers may consider continuing the use of modules created by the Department of Education.
- Teachers may consider the ability of every student to easily understand the key concepts of General Mathematics.
- Teachers may consider attending trainings about how to design and implement modular learning.
- Teacher may consider making sure that the activities written in the module are appropriate to the learners based on the provided learning competencies.
- The Department of Education may consider simplifying or lessening the activities provided in the module.

- Future researchers may consider conducting the same study.

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