ISSN No:-2456-2165

Mathematics Vocabulary and Mathematical Ability of Grade 7 Students

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Abstract:- **Vocabulary understanding is vital to comprehend in many facets and this includes Mathematics. Employing and learning the dialect of Mathematics is critical for the development of Mathematics ability. Mathematics vocabulary have an important part on students' Mathematical comprehension and ability. These could serve as foundation for the teachers to design and model pedagogies in teaching Mathematics. This survey-correlational type of research aimed to determine the Mathematical Ability in relation to the Mathematics Vocabulary of Grade 7 students of Dulangan National High School for the school year 2019 – 2020. Data were gathered using researcher-made Mathematics Vocabulary and Mathematical Ability Tests. The independent variable of the study was Mathematics Vocabulary and the dependent variable was Mathematical Ability. The findings revealed that the level of Mathematics Vocabulary and Mathematical Ability of Grade 7 students was "average". There was no significant difference in the mathematical ability of students when grouped in terms of the level of their Mathematics Vocabulary. There was no significant relationship between the Mathematics Vocabulary and Mathematical ability of the students.**

Keywords:- *Mathematics Vocabulary, Mathematical Ability*.

I. INTRODUCTION

Vocabulary understanding is the important factor to comprehend in many aspects and this includes Mathematics. Employing and learning the dialect of Mathematics is critical for the development of Mathematics ability. Mathematics vocabulary have a significant portion on students' mathematical development, mathematical understanding and ability.

As reported, Mathematics performance of students in the Philippines was very low as compared to International Average Performance based on Trends in International Mathematics and Science Study (TIMSS) in 2003. It was being noted that the country ranked near the bottom among the countries who participated. This result speaks of a need to identify specific determinants of students' poor performance in Mathematics (Philippine Daily Inquirer, May 23, 2010). On the other hand, it was reported that the National Achievement Test (NAT) mean percentage score (MPS) for high school in the school year 2012 – 2013 was 46.83 percent in Mathematics while the standard set by the department is 75 percent to be conclude that the national standard for Mathematics have been met? Moreover, based on the recent conclusion, Schools Division of Capiz Mathematics posttest for the school year 2018 – 2019, DNHS harvested an overall mean percentage score of 51.90 percent that did not met standard. Based from these observations and results, some interventions are needed to improve the performance of the students in Mathematics. Furthermore, the 2013 NAT results revealed that Schools Division of Capiz secondary level garnered 54.09 percent in Mathematics while the Dulangan National High School (DNHS) score of 39.27 percent that is very far from the National Standard which is 75 percent mean percentage score**.** [3]

Mathematics can seem like a strange language to some students. It is not like any other language that students are accustomed to because Mathematics contains symbol, number, and figures in addition to vocabulary words. The vocabulary words that are used in mathematics are often not used in everyday life. So, usually the students are exposed to these words only in their mathematics class, Burns in [5].

Moreover, there are many challenges for students in their learning of the language of Mathematics. The ability to effectively communicate through the language of Mathematics requires Mathematical understanding; a robust vocabulary knowledge base; flexibility; fluency and proficiency in numbers, symbols, words, and diagrams; and comprehension skills. Many students struggle with some or all of the important mathematical concepts. [14]

On the study of Reference [15] concluded that there was a positive relationship between students' level of mathematical vocabulary and level of mathematical achievement. This implies that students' performance in mathematics can be accounted for by their understanding mathematical vocabulary. Mathematics students should be taught mathematical vocabulary using appropriate strategies.

Mathematical ability is a cognitive ability, the skill to perform calculations in the formal language of mathematics. It can be regarded as a non-verbal ability [8]. Mathematical ability involves effective thinking with conceptual learning, students need to be taught to think logically along with practicing the numerical problems but on the contrary they do practice a problem, and then repeatedly do the same kind of problems until that is hard-wired in their brains [12].

Reflective ability in mathematics and its relations with other mathematical abilities helps improve students' long term mathematical and creative capacities [16].

A study published by Reference [7], examined relationships among interest, achievement motivation, mathematical ability, the quality of experience when doing mathematics, and mathematics achievement. The results showed that quality of experience when doing mathematics was mainly related to interest. Grades and course level were most strongly predicted by level of ability. Interest was found to contribute significantly to the prediction of grades for the second year and to the prediction of course level. Quality of experience was significantly correlated with grades but not course level.

Students are experiencing difficulties in the Mathematics vocabulary to evaluate and to understand the given Mathematical problems. Students did not know the definition of the various Mathematical terms that contain method or instruction to solve Mathematical problems. Majority of the students have difficulties in finding the right answers or solutions to the exercises given to them, and to conclude a Mathematical calculation based on the given Mathematical terms.

This study is anchored on the theory of Bruner (1986) the constructivist and Piaget's Cognitive Theory, believed that every learner is a constructor. This theory explains that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. When learners encounter something new, they reconcile it with previous knowledge and experience. They may change what they believe, or they may discard the new information as irrelevant. To be active creators of their knowledge however, they must be able to ask questions, explore and assess what they know. In the classroom, the constructivist view of learning means encouraging students to use active techniques such as experiments and real- world problem solving using authentic data if possible, and to create knowledge and reflect on their understanding.

This study also connects to Richard's (1976) Vocabulary Knowledge Framework, which states knowing a word does not mean knowing its meaning, rather, word knowledge is by nature a multi-dimensional construct, which entails semantic, syntactic and pragmatic features of the word. [4].

This study focuses on students' Mathematics Vocabulary as the independent variable and Mathematical Ability as the dependent variable as shown by the conceptual framework below.

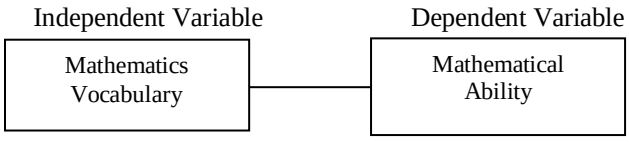

Figure 1. Mathematical Ability of Grade 7 Students as Influenced by their Mathematics Vocabulary

This study was to determine the mathematics vocabulary and mathematical ability of Grade 7 Students of Dulangan National High School for the school year 2019 – 2020.

Specifically, this study sought to answer the following questions:

1. What is the level of mathematics vocabulary of Grade 7 students?
2. What is the level of mathematical ability of Grade 7 students?
3. Is there a significant difference in the mathematical ability of Grade 7 students when classified according to their mathematics vocabulary?
4. Is there a significant relationship between the mathematics vocabulary and mathematical ability of Grade 7 students?

Based on the aforementioned problems, the following hypotheses were formulated that there no significant difference and no significant relationship between mathematical ability and mathematics vocabulary of Grade 7 students.

II. RESEARCH DESIGN AND METHODOLOGY

A. Method

This study utilized the survey – correlational research design. This method obtains data to determine specific characteristics of a group. This method uses to investigate the possible relationships among variables. The use of the survey approach is appropriate for most descriptive and correlational study.

The data in this study were gathered using the researcher-made Mathematics Vocabulary and Mathematical Ability Tests. The independent variable was the mathematical vocabulary while the dependent variable was the mathematical ability of students.

The descriptive statistics used in the study were the mean, and standard deviation. The inferential statistics were One-way Analysis of Variance (ANOVA), and Pearson r. The alpha level of significance was set at 0.05.

B. Participants

The participants of this study were the one hundred thirty-eight (138) randomly selected from a population of two hundred nine (209) Grade 7 students of Dulangan National High School for the school year 2019–2020. The participants were chosen using the stratified random sampling. The required numbers of participants were determined using the formula of Slovin's.

Table 1. Proportional allocation of the respondents

Section	Population	Sample Size
Cattleya	52	34
Daffodil	53	35
Sampaguita	54	36
Sunflower	50	33
Total	209	138

ISSN No:-2456-2165

C. Data - Gathering Instruments

A researcher-made Mathematics Vocabulary and Mathematical Ability Test were used to collect the needed data. The instruments were undergone content validation and item analysis so that the difficulty and discrimination indices of every item in the instruments were established.

Mathematics Vocabulary and Mathematical Ability Test. A 58 – item Researcher-Made Mathematics Vocabulary and Mathematical Ability Test were used to measure the mathematics vocabulary and mathematical ability of the Grade 7 students respectively. The instruments were formulated based on lessons to be taught in Grade 7 Mathematics subjects for two quarters including the following topics; Module 1: number and number sense that includes set theory, fundamental operations of integers, rational numbers, principal root, irrational numbers and absolute of the number. Module 2: measurement and unit conversion. Module 3: constant, variable and algebraic expressions, verbal phrases and mathematical phrases, law of exponent, polynomials, linear equations and inequality in one variable.

The Mathematics Vocabulary and Mathematics Ability of the Grade 7 students were interpreted using the scales of means given below:

Mean	*Description*
46.41 – 58.00	Very High
34.81 – 46.40	High
23.21 – 34.80	Average
11.61 – 23.20	Low
0.00 – 11.60	Very Low

D. Statistical Data Analysis Procedures

The following statistical tools employed in the analyses of the data gathered.

Frequency Count and Percentage. Frequency and percentage used to determine the number of respondents in every section.

Mean. This employed in determining the level of Mathematics vocabulary and mathematical abilities of the Grade 7 students.

Standard Deviation. This test was used to determine the homogeneity and heterogeneity of responses of students in terms of Mathematic vocabulary and mathematical abilities.

Analysis of Variance (ANOVA). This test was used to determine the significant differences in the mathematical ability of students when they were grouped according to their Mathematics vocabulary.

Pearson r. This was used to determine the relationships between the Mathematics vocabulary and mathematical ability of the Grade 7 students.

III. RESULT AND DISCUSSION

A. Mathematics Vocabulary of Grade 7 Students

Table 2 revealed that the level of mathematics vocabulary of Grade 7 students is "average" (M = 25.04, SD = 7.28).

Table 2. Mean, Standard Deviation and Description of the Mathematics Vocabulary of Grade 7 Students

Variable	Mean	Description	SD
Mathematics Vocabulary	25.04	Average	7.28

Scale	Description
46.41-58.00	Very high
34.81-46.40	High
23.21-34.80	Average
11.61-23.20	Low
0.00-11.60	Very Low

The average Mathematics vocabulary of students implies that students have average capacity in recalling information pertaining to denotation of words, variables, symbols, letters, and terminologies in mathematics. This further implies that students do not possess very concrete understanding on mathematical language presented to them because they are not always expose to different activities that can enhance to high level of Mathematics vocabulary. There are no follow up activities at home, to oblige students reviewing the different definition and mathematical terms that are useful in learning Mathematics. The teachers maybe sometimes expose students to situations or learning tasks that need involvement of mathematical vocabulary and terminologies using the strategies of unlocking difficulties by defining and explaining the mathematical terminologies need for the specific objective and subject matters. In addition, the concern department provided learning materials and textbooks are insufficient for the ideal one is to one ratio target in order for students to have their books to study at home.

Furthermore, students are not actively participating in class discussions and class activities or learning tasks that need involvement of Mathematics language, definition and representation. Students are not so much attentive during the class discussions and not observant in their classes making them easily forget the information and concepts taught to them by their teachers.

Finding of this study supports to the study of Reference [1], found that the level of Mathematics vocabulary of students in general was average or approaching to proficiency and in terms of word language in mathematics word problem and overall conceptual understanding. Furthermore, this study supports to the study conducted by Reference [13] found that the performance accuracy of Mathematics vocabulary of fourth graders was average.

B. Mathematical Ability of Grade 7 Students

Table 3 data revealed that the level of mathematical ability of Grade 7 students is "average" (M = 24.17, SD = 4.24).

Table 3. Mean, Standard Deviation and Description of the Mathematical Ability of Grade 7 Students

Variable	Mean	Description	SD
Mathematical Ability	24.17	Average	4.24

Scale	Description
46.41-58.00	Very high
34.81-46.40	High
23.21-34.80	Average
11.61-23.20	Low
0.00-11.60	Very Low

The average mathematical ability of Grade 7 students implies that students only perform average in numbers sense, measurements, algebraic expressions, and properties of rational numbers as applied in linear equation and inequalities in one variable. Students can solve easy mathematics questions but have difficulty to manipulate and solve complex questions. This also implies that students have average arithmetic background, interference of much deeper learning, not well mastered to deal with direction and operation signs. It also implies that students still having problems with algebraic notation and misapplication of rules. Teachers seldom expose their students to various drills and activities involving the number sense, measurement, algebraic expressions and linear equality and inequality in one variable. Also, teachers are giving minimal practice sets, exercises or worksheets for the students during their class in Mathematics. Learning materials and worksheets necessary for the development of students' mathematical ability are not fully available. Students who have an average sense of mathematical ability may attempt to avoid difficult tasks and would not be interested to participate more eagerly in more complex and higher mathematical tests.

The results of this study support to the study of Reference [10] found that the level of mathematical ability of students was "average". However, the results of this study contradict to the study Reference [9] found that the level of mathematical ability of students was "low". Furthermore, results of this study also contradict to the study of Reference [2], found that the level of mathematical ability of students was "high".

C. Differences in the Mathematical Ability of Students when Classified According to their Mathematics Vocabulary

Table 4 shows the Analysis of Variance on the difference in the mathematical ability of students when classified according their level of mathematics vocabulary. Data show that there is no significant difference in the mathematical ability of students when they are grouped according to their level of mathematics vocabulary, F (43, 134) = 0.237, p >.05.

Table 4. ANOVA results on the difference in Mathematical Ability of Students in terms of their level of Mathematics Vocabulary

Category	Sum of Square	df	Mean Square	F	Sig.
Between Groups	13	3	4.33	.237*	0.871
Within Groups	2452.83	134	18.31		
Total	2465.83	137			

* p > .05 - not significant at .05 alpha level

The no significant difference in the mathematical ability of students in terms of their level of Mathematics vocabulary implies that the mathematical ability of the students is not influence by their mathematics vocabulary. Whatever is the level of mathematics vocabulary of the students, their level of mathematical ability remains the same. This further implies that students can improve their mathematical abilities not only on the Mathematics vocabulary but also on other factors that contribute on the students' ability like student's study habits, learning styles, motivation, comprehension ability, and teaching strategies of teachers. In addition, the result implies that the students' different capacity to understand Mathematics words or language does not contribute to the improvement of students' mathematical ability.

This finding contradicts to the study of Reference [6], that there was a significant difference in the mathematical skills of students when grouped in terms of memory problems experienced. Furthermore, the results of this study disagree to the study of Reference [2], found that the mathematical ability of the students varies when they are classified based on their mastery of the mathematical rules.

Thus, the null hypothesis that states that there is no significant difference on the level of mathematical ability of Grade 7 students when they are classified according to their mathematics vocabulary is hereby accepted.

D. Relationships between Mathematics Vocabulary and Mathematical Ability of Grade 7 Students

Table 5 results reveal that there is no significant relationship, between mathematics vocabulary, r = 0.047, p >.05, and mathematical ability of students.

Table 5. Pearson r between Mathematics Vocabulary and Mathematical Ability of Grade 7 Students

Variables	R	Sig. (2-tailed)
Mathematics Vocabulary and Mathematical Ability	0.047*	0.580

* p > .05 – not significant at .05 level

The no significant relationships exist between the Mathematics vocabulary and mathematics ability implies that mathematics vocabulary of the students is not related to their mathematical ability or vice versa. The result further implies that if students have high mathematics vocabulary

level this could not improve the students' level of mathematics ability or vice versa. The more students are exposed to activity that enhance their mathematical ability have no effect to their Mathematics vocabulary. Maybe there are other factors that are related to the mathematical ability of the students.

The result is parallel to the study of Reference [9], found that there is no significant relationship between retention skills and mathematical ability. But the result of this study supports to the study of Reference [15] found that that there is a positive relationship between students' level of mathematical vocabulary and level of mathematical achievement. Also, the result of this study disagree to the study of Reference [11], found that the mathematical ability skills of college students are significantly related to verbal comprehension.

Thus, the null hypothesis that states that there is no significant relationship between Mathematics vocabulary and mathematical ability is hereby accepted.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

In the light of the aforementioned findings of the study, the following conclusions are drawn:

1. The average level of Mathematics vocabulary of students indicates that students still have difficulty to communicate better using the information pertaining to denotation of words, variables, symbol, letters and terminologies in Mathematics and have struggles to think more critically. Students can solve easy to average problems in Mathematics that involves easy Mathematics vocabulary. This further indicates that students have difficulty in understanding higher Mathematics vocabulary that can help students explain their ideas and thinking about Mathematics. Furthermore, students cannot fully grasp the difficult meaning of unfamiliar words of the given data in a Mathematics problem and have difficulty in evaluating information that could lead them to a right answer or conclusion. This concludes that students need much help in dealing with situation that needs analysis and interpretations.
2. The average level of mathematical ability of the students indicates that they can perform an easy to average problems in numbers sense, measurements, algebraic expressions and properties of rational numbers as applied in linear equation and inequalities in one variable. Students can solve easy Mathematics questions but have difficulty to manipulate and solve complex questions. Students could only exhibit average level of mathematical ability and could averagely discern what are the right steps or procedures in finding out solutions or making conclusions based on the given information or data. This further indicates that the students have not developed the fundamental knowledge and skills and core understandings and needs guidance from the teacher. This further indicates that students have average skills and competency which they need to analyze difficult mathematics problems. Furthermore, the average level of Mathematics ability would hinder them from attaining a very good score or ratings in any assessment or learning tasks that require them to use their mathematical abilities. Students may also find some difficulty in arriving at the right solution or conclusion easily. They are having average arithmetic background, interference of much deeper learning, not well mastered to deal with direction and operation signs.
3. There is no significant difference found in the mathematical ability of students when grouped in terms of their level of mathematics vocabulary. This indicates that the mathematical ability of the students is not affected by their Mathematics vocabulary. Whatever is the level of mathematics vocabulary of the students, their level of mathematical ability remains the same. Students can improve their mathematical abilities not only on the mathematics vocabulary but also on other factors that contribute on the students' ability. In addition, students' different capacity to understand mathematics words or language does not contribute to the improvement of students' mathematical ability.
4. There is no significant relationship found between mathematical ability and mathematics vocabulary. This indicates that mathematics vocabulary is not related to the Mathematics ability or vice versa. The result further indicates that if students have high mathematics vocabulary level this could not improve the students' level of mathematics ability or vice versa. This concludes that there are other factors that relates to the mathematical ability of the students.

B. Recommendations

Based on the findings and conclusions, the following recommendations are hereby endorsed:

1. Students are encouraged to participate in different activities and learning experiences to increase their level of Mathematics vocabulary from average to high. Students may use the dictionary when they encounter unfamiliar words or ask help from their teachers to define it. They may involve themselves in collaborative activities that promote enhancement of their vocabulary. Students are encouraged to study their lesson at home and understand the conceptual definition of mathematical terms that could enhance their Mathematics vocabulary. They may always be attentive and participative in their classes to promote better chance of storing and retrieving information. They are encouraged to be involved in interactive and online games and applications that promote enhancement of their vocabulary and memorization skills.

Mathematics teachers need to provide students with Mathematics vocabulary chart or word list that may improve their Mathematics vocabulary. Math teachers have to integrate the development of students' good Mathematics vocabulary in the conduct of their lessons by engaging the learners in performance tasks that promote good vocabulary comprehension. They may extend personal assistance to those students who have low and average Mathematics vocabulary through remediation classes and enrichment

activities. Math teachers have to continue attending to seminars and trainings on delivering content and varied teaching styles and techniques that promote the development of the Mathematics vocabulary needed by students to succeed in their daily tasks.

Principals and Math supervisors have to conduct close monitoring of classes to ensure that classroom activities integrate the development of good Mathematics vocabulary skills among students. They may initiate school-based activities and programs for improving and enhancing students' Mathematics vocabulary skills to secure academic success among them. In addition, principal and Math supervisor may secure the completion of learning materials and textbooks that is very crucial for learning references and follow-up review at home.

Parents have to be aware of the status of their children's Mathematics vocabulary so that they could extend the needed support for the benefit of their children. They have closely monitors their children's progress not only in school but also in doing their assigned tasks at home. They may purchase a Mathematics dictionary booklet that is useful for improving the Mathematics vocabulary of their children even at home.

2. Students need to master the properties and rules in mathematics such as arithmetic, numbers sense, measurements, algebraic expressions and rational numbers by engaging themselves in different worthwhile activities such as interactive games, drills and hands-on activities to increase their mathematical ability from average to high. Students have to always memorize and understand the properties and rules of specific lesson in Mathematics. Students may equip with appropriate habits by having a constant practice on solving basic arithmetic, numbers sense, measurements, algebraic expressions and properties of rational numbers as applied in linear equation and inequalities in one variable problems during their independent cooperative learning time. They may seek the help of their teachers or peers if they feel they have problems in performing numbers sense, measurements, algebraic expressions and properties of rational numbers as applied in linear equation and inequalities in one variable so that they can enhance their mathematical ability as early as possible.

Math teachers may engage students in varied activities and performance tasks that would promote high mathematical ability among students. They may provide students with different activities such as games, manipulative activities, and drills using flash cards, window cards, practice sets, exercises or worksheets to enhance students' mathematical ability. Students may involve themselves in worthwhile activities that promote analytical thought such as solving riddles, puzzles, damath and soduko. They may utilize teaching techniques and strategies that could help enhance their mathematical ability. They may also provide differentiated instruction to cater students' individual needs. They may teach their lessons in an interesting manner and integrate real-life situations so that students would be attentive and participative during teaching-learning process.

Principals and Math supervisors may develop an enhancement program that could cater students' mathematical ability. For the principals, they may allot specified time for the teachers to enrich students' mathematical ability. For the Math supervisor they may design programs and activities that would enhance the students' mathematical ability. In addition, principal and Math supervisor may secure the completion of learning materials and textbooks that are very crucial for learning references and follow-up review at home.

Parents may follow up their children at home by giving them extended activities like drills using flash cards and window cards to enhance and to enrich their children's mathematical ability. Parents are encouraged to enroll their children in enrichment programs or interactive activities that can help improve their mathematical ability during summer vacation. Parents may provide their children's needs that would enhance their mathematical ability.

3. Since there is no significant difference in the mathematical ability of students when grouped in terms of their mathematics vocabulary, it is recommended that students need to avoid or minimize their absences for them to focus and participate during the teaching-learning process that could strengthen their mathematics vocabulary and mathematical ability. They may provide with diverse learning opportunities that can develop students' vocabulary that can support in improving their mathematical ability. They have to engage themselves with activities that need the utilization of mathematics vocabulary and mathematical abilities. Students may develop a positive learning attitude, good study habits, good reading comprehension, and high level of interest in their studies.

Teachers have to employ different teaching styles that match students' needs and must carefully support students' mathematical ability to help them use their mathematics vocabulary in applying what they have learned beforehand to any mathematical task. They must have a constant feed backing with the parents to have a follow up on students' progress.

Principals may encourage teachers to plan or conduct an intervention as home visitation and remediation to continue monitor the level of mathematics performance of students and use the result in planning how to improve their mathematical ability and in determining the factors that greatly influence it. Constant feed backing may be done to ensure that this aspect of mathematics learning given full attention.

Parents are encouraged to attend Quarterly Parents-Teachers meeting to be well informed about their students' mathematics performance so they can provide the needed guidance and support.

4. The relationship Mathematics vocabulary and mathematical ability does not exist. Students may engage themselves in activities that could develop their mathematics vocabulary and mathematical abilities through the application of higher order thinking skills (HOTS). This could enhance their ability to recall concepts or information that could use to perform numbers sense, measurements, algebraic expressions and properties of rational numbers as applied in linear equation and inequalities in one variable in order to solve much complex mathematical problems. They may attend to remedial class and related programs which made use of their mathematics vocabulary to complete a task.

Math teachers are encouraged to use various approaches in teaching mathematics they may provide differentiated activities to cater students' need. They need to update themselves with the 21st century skills of teaching. Teachers need to develop a plan of action for enhancement of students' mathematics vocabulary and mathematical ability through enrichment activities during independent and cooperative learning. They may employ the integration of technology within and across the discipline in which the development of abilities supported.

Parents may be diligent in monitoring the progress of their children in school. Parents may also follow up their children at home and provide the needed support that can help students increase their mathematics vocabulary and mathematical ability.

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