
MATHEMATICAL VOCABULARY: A NECESSITY FOR MATHEMATICS ACHIEVEMENT.

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ABSTRACT

Mathematical Vocabulary is equiessential for mathematics achievement. It is an integral part of understanding mathematical concepts and developing mathematical skills. Without sufficient understanding of mathematical vocabulary, the learner will find it difficult to comprehend concepts, ideas, theorems, facts, etc in mathematics which will result in misrepresentation, misconception, misinterpretation of mathematical objects and dislike for mathematics. Hence this paper discusses the meaning of vocabulary, nature of mathematical vocabulary, Place of mathematical vocabulary in mathematics achievement with recommendations.

Keywords: Mathematics, Vocabulary, Mathematical Vocabulary, Achievement.

INTRODUCTION

National Development of a country is dependent to a very large extent by the capacity of the nation to apply technology for the exploitation of the resources of nature, such exploitation rely heavily on mathematics for the foundation of scientific and technological advancement. Mathematics is the ingredient for the effective articulation of the abstract elements of science that gives impetus to the development of technology (Ihejieta, 1989). There could be no real development technologically without a corresponding development in mathematics both as conceived and practiced (Ezeilo, 1975). Mathematics is the building block for everything in our daily lives including mobile devices, architecture (ancient and modern), art, money, engineering and even sports (Elaine, 2013). Mathematical skills are crucial for a wide array of analytical, technological, scientific, security and economic applications (Paul, 2015). The Degree of economic development stages of nations depends largely on how these nations conduct and apply technology, science and knowledge in their societies (Heiba, 2011).

Mathematics as a subject has its language. The language of mathematics has specialized meanings for words or phrases. Deficiency in the language of mathematics will result in mathematical non-achievement. Mathematical language is an essential element of learning, thinking, understanding and communicating mathematics (Riordain & O'Doroghue, 2009). The language of mathematics consists of vocabularies and symbols with unique features. Vocabulary is a core component of language proficiency and provides much of the basis for how learners speak, listen, read and write (Richards & Renandua, 2002). Students are likely to be handicapped in their effort to learn mathematics if they do not understand the vocabulary that is used in mathematics classrooms, textbooks and assessment tests (Miller, 1993). It is evident that understanding of mathematical vocabulary is central to achievement in mathematics, hence this work discusses the meaning of vocabulary, nature of mathematical vocabulary, Place of mathematical vocabulary in mathematics achievement, suggestions.

MEANING OF VOCABULARY

Vocabulary is the core component of language proficiency and provides much of the basis for how learners speak, listen, read and write (Richard & Renandya, 2002). Vocabulary is all the words that a person knows or uses, all the words in a particular language, the words that people use when they are talking, and a list of words with their meanings especially in a book for learning a foreign language (Hornby, 2006). Hatch and Brown defined vocabulary as a list of target language words for particular language or a list of words that the individual speaker might be. Thus, vocabulary is an essential part of language, there is no communication without a language and no language without vocabulary; without grammar very little can be conveyed, without vocabulary nothing can be conveyed (Harmer, 2002).

MEANING OF MATHEMATICAL VOCABULARY

Mathematical vocabulary refers to words that label mathematical concepts such as quotient, volume, vertex, dividend and hexagon (Vacca & Vacca, 1996). Mathematical vocabulary is an integral piece to understanding mathematics concepts and developing mathematical skills. Often times, when a student does not understand a vocabulary term, they are unable to process and make sense of what they are doing and this will hinder their success. If a Student does not fully develop a mathematical concept then that can and often lead to a misconception or lack of understanding of the next skills since mathematics is very much a building block process, students must have those foundational building blocks to advance to higher levels (Lora Mckillop, 2020).

NATURE OF MATHEMATICAL VOCABULARY

Mathematics as a discipline has its language which is categorized as academic language. Mathematics is a language which is concise and precise (Mutunga & Breakwell, in Wanjiru, 2015) which consists of both vocabularies and symbols. Mathematics is a system of communication with its own set of symbols, convection or special words namely mathematical vocabulary such as integral, product, matrix, homomorphism, monoid, etc.

Mathematics learning involves everyday English vocabularies. These vocabularies tend to be ambiguous due to having one meaning in the mathematics register and a different meaning in everyday usage. Also, mathematics vocabularies consist of specific words which are only encountered in mathematics environment; examples are trapezoid, acute, differentiation, monoid, topology, etc. Mathematics vocabulary also includes words that sound the same as everyday English words but have different meaning. Examples are represented in the table below:-

Table 1: Mathematical Vocabularies and Homophonic partner

S/N	Mathematical Term	Homophones
1.	Arc	Ark
2.	Chord	Cord
3.	Mode	Mowed
4.	Pi	Pie
5.	Plane	Plain
6.	Serial	Cereal
7.	Sine	Sign
8.	Sum	Some

Source: Adams, Thanagatah and King (2005).

Mathematical vocabulary includes words that have the spelling, pronunciation as everyday English vocabulary but with different meaning as Mathematical Vocabulary. Examples are; ring, field, power, concrete, change, point, real, mean, etc. Monroe and Panchyshyn (1995) categorized mathematical vocabulary into four namely; Technical vocabulary, Sub technical vocabulary, General vocabulary and Symbolic vocabulary as shown in the table below:

Table 2: Categories of Mathematical Vocabulary

S/N	Category	Definition
1.	Technical Vocabulary	Terms specific to mathematics and difficult to express in everyday words, example; integer.
2.	Sub technical Vocabulary	Terms that may have a meaning outside of mathematics but that have a meaning specific to mathematics, example; plane.
3.	General Vocabulary	Terms not specific to mathematics but that have vague, general meanings and are not considered specific enough to define for example, greater than.
4.	Symbolic Vocabulary	The many symbols used in mathematical expressions, example; =, <, >, + .

Source: Monroe and Panchyshyn (1995)

Mathematics vocabulary holds a central place in mathematics achievement. The lack of explicit explanation and understanding of mathematical vocabulary during and after mathematics instruction can impede mathematics achievement.

PLACE OF MATHEMATICAL VOCABULARY IN MATHEMATICS ACHIEVEMENT

In today's technological driven society, greater demands have been placed on individuals to interpret and use mathematics to make sense of information and complex situations; A key component in understanding mathematics is the learning of mathematical vocabulary (Wanjiru, 2015). Students are likely to be handicapped in their effort to learn mathematics if they do not understand the vocabulary that is used in mathematics classrooms, textbooks and assessment tests (Miller, 1993).

Fluency in mathematical vocabulary helps eliminate difficulties and interference in the learning of concepts learners have background knowledge of but appears unrelated to mathematics. Mathematical vocabulary is an integral part in understanding and applying mathematical skills as it is the channel through which mathematical ideas, concepts are explained, conjured and defended verbally or written.

The findings of Wanjiru (2015), in the study of Effects of Mathematical vocabulary instruction on Students' achievement in Mathematics in Secondary Schools of Murang'a County Kenya, revealed a positive association between mathematical vocabulary instructions and students' performance in mathematics.

Good mastery of mathematical vocabulary will make the learning of mathematics easier as it will help learners to understand, express mathematical ideas and also comprehend the ideas of others. Students must become confident and proficient in their mathematics vocabulary in order to succeed and advance to higher level mathematics (Monroe, 2002). One can deduce from the above assertion that without proficiency and fluency in mathematical vocabulary, learners will not progress in the course of studying mathematics; interest in mathematics will diminish and eventually result in dislike of mathematics. In-depth knowledge of mathematical vocabulary will build confidence in learners and help them solve word problem and real life problem with ease.

According to the 2021 Report of the West African Examination Council (WAEC), Chief Examiner for Mathematics listed some of the weakness of candidates as, ability to

- (1) translate word-problems into mathematical statements.
- (2) solve problems in circle theorems.
- (3) Solve problems involving angles of elevation and depression.
- (4) Solve problems involving ratio and proportions.
- (5) Show evidence of reading from a graph.

All these five areas of weakness listed above are aspects of mathematics that require vocabulary proficiency. To comprehend topics in word-problem, angles of elevation and depression, ratio and proportion, the learner must have a strong foundation in mathematical vocabulary. This is because problem in word-problem, angles of elevation and depression, ratio and proportion are in words and the learner must have sufficient mathematical

vocabulary to be able to translate the problem to a mathematical equation using appropriate mathematical symbols. For instance, the word problem

“Ivom is 10 years older than Onume. Onume is 34 years older than half Ivom’s age. Determine how old Ivom is”.

To give solution to this problem, the learner must be able to understand the problem by determining what is known and what is unknown, he/she must be able to assign variables and use the variables to translate each of the known sentences into an equation, that is the learner can say let A represent Ivom’s age and B represent Onume’s age, then translate each of the relevant sentences into equation like this:

Table 3: Translating Sentences to Mathematical Equations

Sentence	Mathematical Equation
Ivom is 10 years older than Onume	$A = 10 + B$
Half Ivom’s age	$\frac{1}{2} A = \frac{1}{2} (10 + B)$
Onume is 34 years older than half Ivom’s age	$B = 34 + \frac{1}{2} A = 34 + \frac{1}{2} (10 + B)$

The learners’ ability to give solution to the problem relies heavily on how much of mathematics vocabulary he/she has and how appropriate he/she can apply them. Thus, sufficient mathematical vocabulary is a necessity for mathematics achievement.

CONCLUSION

Mathematics Vocabulary is equiessential for mathematics achievement. Without sufficient understanding of mathematical vocabulary, the learner will find it difficult to comprehend concepts, ideas, theorems, facts, etc in mathematics which will result in misrepresentation, misconception and misinterpretation of mathematical objects.

Research have shown that there exists a strong relationship between vocabulary and mathematical comprehension, identifying vocabulary understanding as a key component in understanding mathematics.

It is of immense importance that teachers and students should develop appropriate mathematics vocabulary for achievement in mathematics.

RECOMMENDATION

The following recommendations are made based on the discussion:

1. Mathematics teachers should be sensitized on the importance of mathematics vocabulary in mathematics achievement.
2. Trainee mathematics teachers should be guided through vocabulary competence.
3. Students should be introduced to the new words they will be using in the topic to be taught.
4. Teachers should frequently remind Learners of new mathematical vocabulary with respect to the topic being taught.

5. Teachers should teach new mathematical vocabulary explicitly by giving learners different exposure to the mathematical words before the lesson.
6. Teachers should ensure that learners keep a mathematics vocabulary notebook.

REFERENCES

- Adams, T.L; Thangata, F. & King, C. (2005). “Weigh” to go! Exploring Mathematical Language. *Mathematics Teaching in the Middle School*. 10(9): 444-448.
- Kharde, U. (2016). The Symbolic Language of Mathematics. *The Explorer*. 1(1): 117-118.
- Mbugua, Z.K. (2012). Influence of Mathematical Language on Achievement in Mathematics by Secondary School Students in Kenya. *International Journal of Education and Information Studies*. 2(1): 1-7.
- Miller, D.L. (1993). Making the Connection with Language. *Arithmetic Teacher*. 40(6): 311-316.
- National Council of Teachers of Mathematics (2000). Principles and Standards for Schools. Retrieved from <http://www.nctm.org/standards>
- Nurlita, A.M (2017). Symbol Language in Learning Mathematics in School. Retrieved on 05/06/2020 from <https://www.researchgate.net/publication/327160188>
- Oguguo, O.U. (2020). Improvement of Teachers’ Proficiency in Mathematical Language for Successful Mathematics Learning Outcome. *IJAAR (Sciences, Technology and Engineering)* 6(7), 28-35. DOI:www.doi.org/10.466541/ij.24889849.96725
- Oguguo, O.U. (2020). Pre-Service Teachers Mastery of Mathematical Symbols. *International Journal of Educational Benchmark* 17(1) 121-128.
- The Chief Examiner’s for Mathematics (core) 2 and Mathematics (Elective) 2 Report.(2020). Retrieved from http://www.waecgh.org/uploads/examiners_Report/2020/maths
- Wanjiru, B.N. (2015). Effect of Mathematical Vocabulary Instruction on Students Achievement in Mathematics in Secondary Schools of Muranga County, Kenya. *Unpublished M.Ed Thesis*, Kenyatta University, Nairobi.