

Mathematical Language: Its Issues in Learning Process

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Abstract:

It is well known to all that in sharing information and thoughts, language is a key component. Every subject has simple language. In these subject, language of mathematics is unique from other languages that can be understood by any one even high skilled person in mathematics field also faces difficulties to talk in mathematical language. The learning of mathematics in schools is very important for high skill and education and learning the language of mathematics is significant for the improvement of mathematical expertise. The problems also come in the teaching and learning of mathematics. There are many factors that affects the learning of mathematics such as vocabulary and use of prepositions. In mathematical language, the prepositions play a vital role for explaining the problems of mathematics. This article represents the relation between mathematics and language and the problems in learning the language of mathematics which have different categories. It also explain the role of culture in the understanding the concepts, terms and ideas of mathematics.

Keywords: Prepositions, Culture, Vocabulary

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Introduction

Like other subjects, for teaching and learning of mathematics there is a need of effective communication between teacher and learner. The mathematical language defined in the term of how to create and share meaning of mathematics by the help of language. The concept of mathematics is quite simple until the teacher and learner use a common language. Difficulty is generated where two different languages are used. For understanding the objectives of mathematics instruction, it is necessary to use the language by the author in their book and also by teachers whose meaning, structure, symbolism, and technical vocabulary can be understood by the pupils of a specific class level. As many individual and sociological factors have impact on the mathematical learning. In the same way, linguistic (language) also has an impact on the mathematical learning. For understanding the number and arithmetic competence, the language plays a role for accounting the children from different culture. If language is used for the representation of calculations of large quantities and algorithms, it is essential to use the discrete linguistic features that could result into distinction arithmetical productivity and computational understanding (Mulwa, 2014).

Role of Language in Mathematics Instruction

For sharing the mathematical knowledge, the chief role is played by the language between teacher and learners. There is a need of language used by the teacher that is suitable for the intellectual advancement of students. In the establishment of ideas, achievement of specific viewpoint capabilities and transference or message exchanged between these notions, language is a powerful instrument. Three important functions are served by language as follows:

1. People are allowed to communicate with each other by the help of language.
2. It enables the thinking process.
3. By the use of language, people can recollect data despite the bounds of recollection.

This last point displays that language is not solely for communication but it also simplifies thoughtfulness. Language that is used in thinking generally first language. Therefore, mathematical concept is transferred in one language. There might be chances to convert it into some other language that allows being thoughtful and then converted back in order to

communicate with the teacher. Misunderstanding and error can be generate at any step of this two- way inward conversion procedure.

Language Categories

Roughly, language is categorized into two groups: oral and literacy methods. Among which oral language skill contains grammatical, vocabulary and phonological capabilities that are the requirement of attaining the knowledge that have writing and reading skill. The performance of mathematics are affected by the linguistic abilities. In spite of it, the mathematics is a special and unique language in itself. So, the leaners should build the semiotic representation for the arithmetical theories, symbols, and philosophies by which it would be possible to generate a connection between new knowledge and previous mental representation. However, from our everyday language, mathematical language is very different and with the grade levels, the struggle and complication of arithmetical language are also increased. In the understanding of problems and strategies are affected by the intricacy of the verbal languages and semantic construction of word issues in the case of beginners of mathematics.

The strong relation is seen between mathematical development and phonological processing. Three components are consisted by the phonological processing. These are as follows: phonological retrieval, phonological awareness and phonological memory. For the development skill in mathematics, each of them has been evidenced.

In these, phonological memory contain temporary storage of speech and encoding. The mathematical issues are converted into oral depictions by encoding. While temporary maintenance works for preventing the verbal information from decaying for further processing. Another is phonological processing which is called as phonological awareness. It is defined as the ability of manipulating the sound structure of languages. The phonological awareness is a noteworthy associate of specific alterations in arithmetical aptitudes. There are two probable motives that associate between arithmetical capabilities and phonological awareness.

1. By the number word learning, the phonological awareness can be connected with arithmetical services.
2. Considerable sustenance of fundamental management regulate and phonological memory

are required by both phonological consciousness and arithmetical problem solving.

Mathematics Categories

As language is divided into two categories. In the same way, arithmetical assistances can be divided into two chief constituents: Formal math and Informal math.

Formal Math: It is refers to as the skills and concepts that are trained in school. It includes elementary mathematic like subtraction, addition and more such complex calculations.

Informal Math: it is defined as the logic and elementary notions of number, which are attained by students before the learning of writing skill about the mathematics in school. It is the process of developing the understanding into children about the degrees of series of symbols or of objects, comparison and estimation of degrees of small sets, interconnect the arithmetical value with the amount of the set, etc. According to Purpura and Ganley, the informal math development can has the three phases.

- In first phase, comparison of degrees of two sets or objects and counting chronologically are learned by children.
- In second phase, they are familiar with the link phenomenon, how to associate numbers with their equivalent amounts and number words.
- In third phase, lucid procedures of number words are learned by children like sum and which number is large/greater or which number is smaller?

Informal math works as a basis for the formal math because the learning mathematics is an accumulative process. And as we know, the prior knowledge is a keystones of new knowledge (Zhang et al., 2017).

According to Donaldson (1978) the interpretation of child is influenced by three things; his language knowledge, his valuation according to our intention which can be showed by non-linguistic conduct and the way in which he present the physical condition to himself. Some symbols and words that are used to communicate the arithmetical concepts may be the reason of misinterpretation which is done by learners during the imitation of their teachers. The report was given 1992 by Pimm that with the determination of

pattern of communication in the classroom, role model of native speaker of mathematics should be played by the teachers. Regarding the mathematical language, another report was given by Orton in 1987 as an instance learning tendency can change the meaning of mathematical words into their own thinking as the thought that teacher intended to say that. With the end, in 1998, a mechanical co-operation plan called as SMASSE in Kenya was developed by the Government through the Ministry of Education Science and Technology (MoEST) and the Government of Japan. The main purpose of it was for the consciousness that the feature of classroom activities is serious for the operative teaching and learning of mathematics.

Many researches has been agreed out with the learner for whom has English as a native language and the result show that the learners face difficulties in the use of mathematical terms. According to Pimm (1992) perceived that: *It is common place to hear a teacher ... asking pupils if they have understood the meaning of a certain word, and possibly trying to test their understanding of it by requesting either a formal definition or a paraphrase of its meaning!*

Mulwa (2014) analyzed the status of language of mathematics in students in the term of understanding the concept of number and stated that difficulties in the learning and use of arithmetical language are faced by the learner because some terms in the mathematics cannot be uttered in normal language. However, the student's great complications narrate with the development of procedural term which appears as these are avoided at the time of mathematical instructions and they do not link these terms with the ordinary English language. They also explained the concept of 'factor' term used in mathematics. The concept of factor in the term of divisor is used in the text book as the factor and divisor have the same meaning. For example

20 can be divided by 5; hence it is proved that 5 is a factor of 20

5 is a factor of 40 when we divide 40 by 5 we get 8 as an answer.

The term factor can be used in the term of multiplication as for example:

5 can be 'multiplied exactly' to give 15; hence we say 5 is a factor of 15.

5 is a 'factor' of 15; when we 'multiply' 5 by 3, we get 15

The concept of factor is generally used to perform the divisibility tests that leads to the concept of prime number. Prime number a term, is described as a number which is not divided except itself and '1'.

Implication for Learning Mathematics

Preposition

In the mathematics, preposition play an important role. It is used to study the space strand as relation of one object with respect to others. The reader requires to pay attention on the term 'preposition' that makes the sense. The lexical density of arithmetic is defined as every single word is used for a purpose. So, instance reading of the sentence can generate problems. Prepositions are the tiny words that are generally overlooked by readers or learner. A range of preposition is used within the school mathematics. Some preposition have higher value in mathematics classes compare to others. Without the use of preposition, it is difficult to think of teaching.

Table: Some Prepositions used in the Mathematical Classroom

Across	After	Against	Around	Among	Along
beneath	between	before	by	beside	below
during	down	on	into	like	near
from	for	through	off	over	of
past	toward	through	under	up	with
underneath	without	Within			

These are the preposition which are commonly used in mathematics classroom (Robyn, 2011).

Mathematical Vocabulary

In the learning of mathematical language, there are many trials for students. The communication in the mathematical linguistic is very complicated task even for most of the arithmetically progressive pupil. There is a need of mathematical understanding for effective communication in the language of

mathematics. There are some essential components which are required: a vigorous terminology skill base, fluency, proficiency and flexibility with symbols, numbers, words, comprehension skills and diagrams.

A number of pupils face problems in the concepts of mathematics especially those students who have learning disabilities. In the mathematical classrooms, text-centered instructional setting is encountered by students by which unintentional barrier is created in the learning process. By Rubenstein and Thompson in 2002, eleven categories were given that shows the difficulties in learning the language and mathematical vocabulary. These categories are as follows:

1. Meanings are context dependent (e.g., foot as in 12 inches vs. the foot of the bed).
2. Arithmetical senses are more precise (e.g., product as the solution to a multiplication problem vs. the product of a company).
3. Terminologies are particular to arithmetical backgrounds (e.g., polygon, parallelogram, imaginary number).
4. Multiple meanings (e.g., side of a triangle vs. side of a cube).
5. Discipline-specific technical meanings (e.g., cone as in the shape vs. cone as in what one eats).
6. Homonyms with everyday words (e.g., pi vs. pie).
7. Related but different words (e.g., circumference vs. perimeter).
8. Specific challenges with translated words (e.g., mesa vs. table).
9. Irregularities in spelling (e.g., obelus vs. obeli).
10. Concepts may be verbalized in more than one way (e.g., 15 minutes past vs. quarter after).
11. Students and teachers adopt informal terms instead of mathematical terms (e.g., diamond vs. rhombus, origin the house vs. in the division bracket) (Riccomini et al., 2015).

In 2015, Yushau and Omar studied about the performance in mathematics and its relation with English language. They investigate the effects of

student aptitude levels of bilingual Arab students in English on their performance in mathematics. They noticed that the lack of proficiency in English have the effects in the understanding and performance in mathematics. Because the mathematic performance is connected to the English Aptitude level of pupils. From their study, they reported as the top performance is seen in mathematics for those students who have high proficiency in English compare to others. The student are not aware from the disadvantages due to the lack of proficiency that give an effect on mathematical performance.

The role of phonological in the arithmetical skill advancement was examined by Landerl Bevan and Butterworth (2004). They compared the children that have deficiency in the reading and arithmetic or dual deficit group. The performance on the elementary number handling chores was designated that pattern of extensive-ranging and significant damage was similar in both arithmetic only and dual deficit groups, not only in reading group. In mathematical development, theoretical understanding is a dominant matter. The language, central medium of teaching should move the concepts of mathematics. Specific Language Impairments (SLI) can play an important role on the language in mathematics developments. The progress of calculation skills, and number sequences are inhibited in the children by the use of specific language impairments (SLI). The development of conventional calculation skills and understanding of number notation is affected by the linguistic constraints which regulate children's developing ability to produce the spoken number sequence. Knowledge of arithmetic principle may be developed by the support of separable system.

Regional Language and Mathematics

The mathematical language is considered a specific social linguistic that is categorized as white, middle class. Let's take an example, the comparison by the use of binary opposites 'less and more'. Walkerdine and Lucey (1989) mention in their report that both words 'more and less' are used by the middle-class mothers with their children during interaction while working-class mother use only the term 'more'. The mathematics is accessed greatly or less by some students that depends on their home language. The region language become a tool for the communication and concepts to the students. Those students who have classroom language they have better access to the mathematical ideas and knowledge and vise-versa. For teaching the

mathematics, the language is adopted. Now it becomes important for recognizing the specific language of mathematics. Mathematics has its unique features like any other language. At the time of standard Australian English (SAE) language, this is noticed that home language and school language have a great difference in which difficulty come in the learning of school mathematics. Across the social background and non-English speakers, this phenomenon has been well documented. Indigenous speakers have the same issue with the language.

The culture and social background are also very important factors in the learning process of mathematical language. Benson and Effiong (2005) reported that when home language is used for teaching the students, they are more understood with the concept. Matang (2003) also highlighted the importance of home language as for gaining the concentration in mathematics and make sense out of what kids are learning. There is a need of culture for the learning of mathematics. They suggested that the material from their culture background should use in the teaching for making the concepts and ideas of mathematics easy. Same thing was said by Israel and Thomas in 2014 that by the use of mother tounge, the mathematics can be understood in better way. The leaning through the mother tongue, the mathematical vocabularies can be developed which could be easily understandable and remember. Before Israel, in 2009, Niesche has discussed about the use of mother tongue and children's culture in the teaching of mathematics.

By incorporating the knowledge of cultural background, the concepts and ideas of mathematics are easily grasped by students, evident in the form of scores and activities. When the children is taught without using their local language and culture, they lost their interest in learning because of the difficult vocabulary of mathematics. Due to this reason, they give poor performance in mathematics (**Hafiz and Farik, 2016**).

Conclusion

This article discussed about the language of mathematic this is unique in itself. It can be defined as the using of words and terms for defining the mathematics. According to many researchers, the students and teachers have difficulty in learning and teaching the mathematics respectively. Many factors affect the language of mathematics. Preposition and Vocabulary are the factors which are discussed in

this article. From the reviews and studies of other researchers, this article concludes that the cultural and local language are very helpful for learning the mathematical language. The use of children culture

and their local language, students are able to learn the concept of mathematics. And they can remember the concepts of mathematics for long times.



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