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SHONA INDIGENOUS LANGUAGE: CAN IT BE A SOLUTION TO MATHEMATICS VOCABULARY INSTRUCTION FOR PRIMARY SCHOOL LEARNERS IN ZIMBABWE?

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ABSTRACT: Language in mathematics has become an interesting concept for the past decades (Halliday, 1978; Pimm 1987). Mathematics is taught in English, which is a second language for most learners in Zimbabwe. Therefore, for students to perform well in the subject, they have to master English, the language used to explain and define mathematical vocabulary. This then means that the learner has two challenges, learning English and then the mathematics vocabulary. It then implies that the language can provide a formidable barrier to both the understanding of mathematics concepts and to providing students access to assessment items that would assist in mathematical understanding (National Numeracy Review Report, 2008). This shows that the challenge is not only faced during the teaching and learning of mathematics but also on assessments (King, 2016). After noting that mathematics vocabulary has some words specific to mathematics and others which are ambiguous because of the difference in meaning between mathematics classroom and English context outside the school, it has become necessary to analyse if Shona, one of the Zimbabwean indigenous languages can assist in reducing the confusion. The purpose of the study is to explore the possibilities of using Shona to explain primary school mathematics vocabulary in Zimbabwe. Qualitative data was collected from 4 primary schools in 4 classes in the upper primary school grades where mathematics lessons were observed and analysed. Findings indicate that teachers would code switch between English and Shona to explain mathematics vocabulary and also further use indigenous everyday examples and games to clarify misunderstandings. Also teachers used more than one word to explain a mathematical concept rather than translating the mathematical word. In this paper, the challenges in the learning of mathematics vocabulary are analysed highlighting the possibility of using Shona language to enhance mathematics understanding with reference to primary school mathematics. The article offers a review of research supporting the importance of mathematics vocabulary and

then describes the Shona language as a strategy for effective teaching of mathematics vocabulary. The researcher argues that Shona can be used to reduce ambiguity and in future, lessons can even be done using the Shona language.

KEYWORDS: Mathematics and Language, Mathematics Vocabulary, Shona language, Instruction, Learning.

Introduction

In Zimbabwe most people are bilingual. Over 80% of the population (Chivhanga and Chimhenga, 2013) have Shona as their first language (L1) and yet English language is used as the language of instruction for all subjects, mathematics included. Teachers and learners communicate verbally during the teaching and learning of mathematics using English because this is also the language used for assessment. There is therefore need to develop a conducive environment for mathematics learning that would be easy for the learner allowing full understanding of the concepts. The mathematics concepts can only be understood if the mathematics vocabulary is clearly articulated. Learners often find mathematics to be difficult or boring because they have not understood the formula, principle and mathematics vocabulary. They take mathematics as a foreign language. If students do not know the words they read, it means they will fail to understand what they read (Nilsen and Nilsen, 2003). Therefore it is important to teach mathematics vocabulary.

While Zimbabwe recognises three national languages, English, Shona and Ndebele, English has remained a language of instruction and an official language during the teaching and learning. This is because schools inherited a colonial education system where English was imposed (Viriri and Rubaya, 2013). This resulted in all mathematics vocabulary being in English and yet the Zimbabwean new constitution recognises 16 languages, Shona included. The Zimbabwe Education Act of 1987, amended in 2006 also indicate that indigenous languages can be used as language of instruction for all subjects prior to Form One. This has not been implemented and yet complex concepts are mastered more easily if learned in languages familiar to the learner (Mcllwraith, 2013). Meaningful learning takes place if cognitive mathematical concepts are learned in the indigenous language.

The Mathematics Language and Vocabulary

The language of mathematics is a challenge to both English-only speakers and English language learners (Duston and Tyminski, 2013). The reason is that words used in mathematics have unique

and specific meanings. An example of such words is ‘table’ meaning where people sit and eat in English while it is referred to as a list of formulae or figures in a specific order in mathematics. There are also words such as average which have precise mathematical definitions. Some words are unique to mathematics such as integer and coefficient. There are also mathematical words that can be expressed in mathematical symbols. For example, ‘less than’ can be expressed as (<). Therefore mathematical learners need to grasp all these mathematical vocabulary without using complex language or complicated sentence structure (Dunston and Tyminski, 2013). This article will explore the possibility of using Shona language options to assist students better understand mathematical vocabulary and symbols to allow for better understanding of the mathematical concepts.

Mathematics vocabulary is difficult to teach students since they have to know and understand terms and concepts from their previous years (Shields, Findlan and Portman, 2005). Teachers cannot avoid teaching mathematics language because they have to read, understand and discuss mathematical ideas. Mathematics can be taken as a foreign language by some learners because it contains symbols, numbers and figures in addition to vocabulary words (Flanagan, 2009). In addition some of the vocabulary words are not used in everyday life. Mathematics is a language that has its own vocabulary and syntax. Therefore mathematics vocabulary becomes hard to teach to learners because the ordinary Zimbabwean would have to learn English and Mathematics which are not familiar.

Understanding of mathematics and ability to communicate mathematics increases as learners learn and understand mathematics vocabulary (Flanagan, 2009). If mathematics vocabulary is not taught well, then there is bound to be confusion hence the interest to look at the strategies to be used when teaching mathematics vocabulary. For a person to understand mathematics, it requires more than knowledge of numerals and symbols (Powell and Nelson, 2017). During the teaching and learning of mathematics, language comes into play whether in oral or written form and this language is filled with vocabulary. Mathematics vocabulary learned during the teaching and learning of mathematics is important for mathematical proficiency and yet according to NiRiordain and ‘O’ Donoghue (2009), mathematics register is more than just vocabulary and technical terms. It borrows words from natural, English and at times redefines them for logical purposes. According to Monroe and Panchyshyn (1995), vocabulary belongs to one of these categories: technical, sub technical, general or symbolic. Technical terms have one meaning specific to mathematics. Examples include quadrilateral, integer, isosceles triangle. Sub technical

vocabulary terms have two meanings with one of the meanings specific to mathematics. Such a term is volume where one meaning refers to sound while the other mathematical meaning refers to quantity. General vocabulary includes vocabulary from everyday language with universal meanings. Mathematics can also be expressed verbally or symbolically. Symbolic refers to non-alphabetic symbols that include numerals, signs, abbreviations and notations and this makes it more complicated for the learner. This then justifies why it becomes necessary to find out if it is not simpler for the leaner if a language familiar is used for the efficient mastery of mathematics vocabulary without compromising the grasping of mathematical concepts.

Challenges in Learning Mathematics Vocabulary

Mathematics vocabulary and the language of mathematics present challenges to most learners whether they are speakers of English or not. This shows that if mathematics language is difficult for speakers of English then it is more challenging for the English L2 speakers. The challenge is not only in the classroom but also on assessment (King, 2016). The major reason is that Mathematics has unique and specific meanings. Since the desire of most educators or teachers is to make mathematics meaningful to learners, the first step educators should take is to be aware of the challenges learners come across when learning mathematics vocabulary. These challenges can be categorised and they do hinder mathematical communication, learning and achievement (Ramsey, 2013).

The first challenge is that of double meanings of some of the words during the learning. Such words, especially those used more in writing have different meanings in other subjects and depending on the context in which they are used. They have comparable meanings though distinct in mathematics. Examples of such words are angle, degree, difference, point, power, even, right, volume, times, table, square, odd, factor and prime. These words have same spellings as everyday words but meanings differ when it becomes a mathematical term.

A similar challenge can also arise when speaking mathematics. There are words that sound the same when speaking (homophones). Such words are:

Mathematical Term	**Homophonic Partner**
arc	ark
chord	cord
mode	mowed
pi	pie
plane	plain
serial	cereal
sine	sign
sum	some

Adapted from Adams, Thanagata and King (2005)

The other challenge is the use of non-alphabetic symbols with different meanings. Learners are used to alphabetic symbols but the following have other mathematical meanings:

< : less than > :greater than ≥ : greater or equal

= : equal % : percentage + : plus

Some of the symbols have different meanings depending on the context. For example '-'means minus or a negative value.

Vocabulary in word problems also pose challenges to learners because the words are not common and this becomes another challenge. Some words are complicated and dictionaries give at least two to three definitions. The opportunity to use these words in mathematics is limited because mathematics vocabulary is only used in mathematics (Monroe and Orme, 2002). Some words have more than one mathematical meaning. For example the word 'square' meaning to share and square with the meaning multiple. There are also mathematical concepts verbalised in more than one way. An example is ¼ or a quarter. Some mathematical words are learned in pairs and can confuse learners. Such examples include multiple and factor, denominator and numerator, hundreds and hundredth.

Method

A qualitative method was adopted for this study since according to Bogdan and Biklen (1998), qualitative research assist to understand human behaviour and experience better. Non-participant

observation exercise was done so as to identify different explanations of mathematical vocabulary used during the teaching and learning of mathematics at primary school level in a Shona speaking area of Masvingo in Zimbabwe. Four teachers teaching Grades 4 to 6 and their classes from four different primary schools in Masvingo were randomly selected. The classes had an average of 40 learners of mixed ability who were observed learning mathematics over a period of 12 weeks. The focus was on primary schools only because the amended Zimbabwe Education act of 2006 authorises the se of indigenous language for primary level. The schools were randomly selected while the primary school teachers were purposively selected so as to make sure they had a minimum of two years' experience with minimum qualification of a Diploma in Education.

Findings and Discussion

Teachers who participated were referred to as A to D with their clasees also A to A respectively. Teachers A and B taught Grade 4, teacher C Grade 5and teacher D, Grade 6. Teacher D used English only when explaining the mathematical vocabulary. This is because Grade 6 is just a year before the national examinations, Grade 7 which are in English only and therefore the teacher wanted learners to be familiar with the vocabulary. The other three teachers A to C switched between English and Shona. For example when failed to get the correct answer when asked to 'add two numbers', the teacher switched to Shona 'batanidza kana sanganisa nhamba mbiri'. In this explanation 'nhamba' is a word to word equivalence that was used as cited by Gondo, Nyota and Mapara (2005). If such borrowing strategy is used, no learner wold be confused because there is no Shona everyday use of the word. It shows that some of the mathematical vocabulary is difficult to explain in Shona. This is similar to what the Malawi Institute of Education did. They took terms from mathematical English and spell them in Chichewa (Kazima, 2008). An example is 'set' taken as 'seti' and this word does not mean anything in Chichewa. This has been supported by UNESCO Position Paper (2003) that indicated that sometimes the indigenous language has an unwritten language words. From this, it shows that African languages lack appropriate Science and mathematics terminology. The observed lessons showed that each time the teachers explained in Shona, learners showed complete understanding of the concepts.

The same teachers also sometimes translated the mathematical vocabulary by explaining the concepts in Shona rather than translating the mathematical word. An example that was observed was the concept 'area' that was given as 'nzvimbo yakagarwa'. Zimbabwe is not the first country to do this form of translation because Tanzania also applied the strategy focusing on mathematical concept of a term and not literal translation into Kiswahili (Kazima, 2008). Once in a while some

vocabularies were found to have one Shona word translations. An example was “length’ which was referred to as ‘hurebu’.

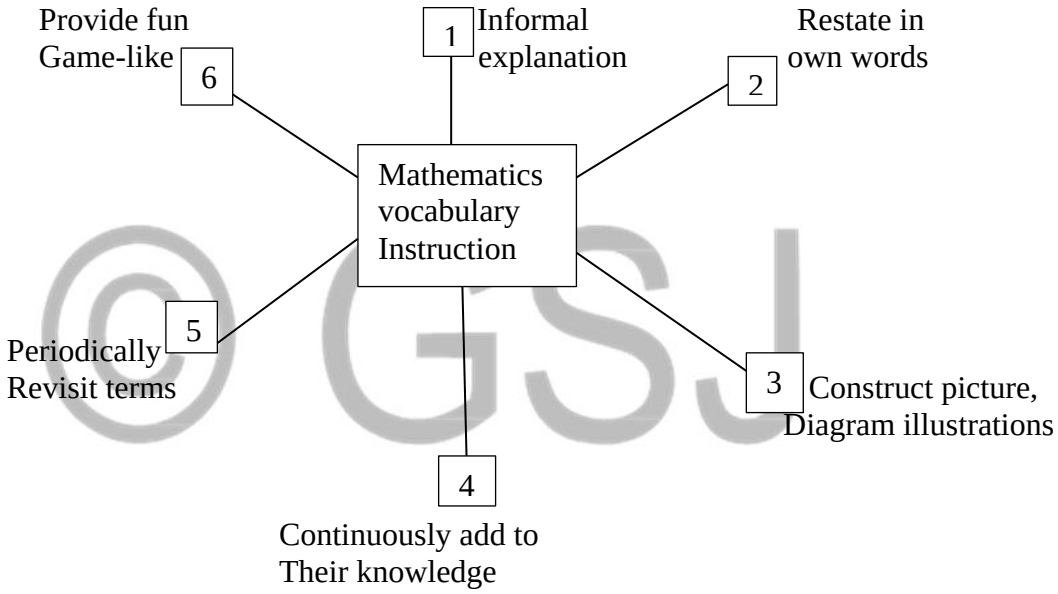
The information from this study shows that it is possible to use Shona language to explain mathematical vocabulary. As observed, when mathematics Shona vocabulary was used, there was high participation and engagement of learners during mathematic lessons. All these Shona responses to mathematical vocabulary were mainly verbal. The written responses were in English or symbols. This shows that while use of Shona can be a solution to mathematics vocabulary, there is still more work needed to come up with the appropriate Shona registers.

From the class observations it was noted that one can use a variety of strategies to teach mathematical vocabulary. The first strategy is that of using more than one instructional strategy. This is when the teachers code switched between Shona and English to explain the vocabulary. The second one is to engage the learner so as to allow deep comprehension. This is only possible if in the process the learner is allowed to use their first language (L1) and indigenous examples familiar to them. The learners were given a chance to use the language they are comfortable with when discussing mathematical concepts either in groups or as a class. Thirdly the learners should be able to communicate mathematically and this is only possible if they do practice more by interacting with the vocabulary (Flanagan, 2009). Lastly and most importantly is that learners should relate to knowledge they already have or know. It was also observed that teachers used indigenous games to explain mathematical concepts and vocabulary. Games can be used as a strategy to teaching vocabulary because there is repetition of words, visual and interactive experiences which can result in vocabulary acquisition. Therefore Shona indigenous games can be used to teach mathematical vocabulary.

Vocabulary Instruction Strategies and Shona Language

The challenges and misconceptions resulting from mathematics vocabulary can be addressed by the use of various vocabulary instructional strategies. In Chikodzi (2018) thesis on the teaching of mathematics in the Shona language in Zimbabwe: Possibilities and constraints, it was noted that it is possible to teach mathematics in Shona though there are no texts and relevant material available. There is also a lot of code switching between Shona and English to clarify issues in mathematics. Therefore Shona can as well assist in the teaching of mathematics vocabulary.

The other strategy is that of bridging some words pictorial. It becomes easy for learners to remember pictures or physical objects. These physical objects can be from the Shona environment. For example circle can be linked to the hut. The other way is the use of a concept map based on the six recommendations by Marzano (2004) indicated in figure 1 below:



The first and second steps of informal explanation and restating in own words respectively can be done using the Shona language which is the first language for the majority of the Zimbabwean learners. The mathematical vocabulary can be represented in one's own language without compromising the learning of basic mathematical concepts (Chazon and Ball, 1999). This shows that the second step of restating in one's own words can as well be done is one's own language. Learners find it easy to discuss in their first language (Chikodzi, 2018).

When learners create diagram representations as per step 3, usually they use the items familiar to them and obviously these can be Shona related. Step 6 involves providing funny activities. Something becomes funny when it is related to the games familiar to them using their L1 language. According to Chikodzi's (2018) research, teachers and parents are aware of Shona games and cultural examples such as 'nhodo' that can be used in the teaching and learning of mathematics.

When developing a concept, it is necessary to know properties an object includes and does not include. The Frayer model caters for this. This model is a graphic organizer that allows students to use inquiry so as to learn new science and mathematical concepts. (Frayer, Frederick and

Klausmeier, 1969). Learners identify examples and non-examples of a concept and they also differentiate essential characteristics from non-essential ones. As the learners think of examples and non-examples, it is clear that they do think of examples from their environment. According to Ogutu (2006), learning takes place more easily when communication and examples are from the learner's L1 language. An example is when learners are taught shapes and are asked to give examples of circles and non-examples. Examples can be huts.

The challenge of words with double meanings can be solved by using Shona. For example the word 'even' can be clearly explained using Shona as 'nhamba inopinda mune imwe isingasiyi imwe kunze' for mathematical meaning and then "zvakaenzana" for English meaning. Even the words that sound the same such as 'sum' and 'some' can also be defined clearly using Shona. The first one translated to 'kubatanidza' and the second one 'zvimwe".

Conclusion

If it is possible to teach Mathematics in Shona, therefore vocabulary instruction can also be effectively done in Shona. Also if code switching is inevitable then the strategy of using Shona during vocabulary instruction becomes an effective way to assist learners master concepts in mathematics. For it to be effective there is need for acceptance by the Zimbabwean community. The strategies highlighted in this paper require teachers and educators to think through all new mathematical concepts and vocabulary and come up with the Shona mathematical register similar to that done for Kiswahili in Tanzania. This would remove challenges and dilemma policy makers make face.

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