WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Utilisation of Mathematics Vocabulary Knowledge in Problem-Solving Among Junior Secondary School Students in Egor Local Government Area of Edo State, Nigeria

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ABSTRACT

This study was conducted to investigate the utilization of mathematics vocabulary in problem-solving among Junior Secondary School students in Egor Local Government Area of Edo state. The study population was all public junior secondary school students in Egor Local Government Area of Edo State. The sample for the study consisted of 175 mathematics students. Random sampling using toss of the coin was used to select seven schools from the thirteen public schools and random number generator software was used to select twenty-five mathematics students from junior secondary school I class from the seven schools. The instrument used for the study was a questionnaire divided into two sections A and B with twenty-three items. Three (3) research questions were raised to guide the study. Data collected were analysed using simple percentage for research question one with benchmark of 50%. Statistical mean and standard deviation were used to answer research questions two and three. The results showed that more than 50% of junior secondary school students agree to the use of mathematical vocabulary in solving problems in mathematics. It was also observed that there was a high agreement for positive attitude of junior secondary school students in use of mathematical vocabulary in solving problems in mathematics. Also, students acknowledged complications in meaning, difficulty in reading symbols, interference of indigenous language and pictorial representation of mathematical vocabulary as constraints to the effective use of mathematical vocabulary. Based on the results, it was recommended that mathematical vocabulary should be deliberately taught as a topic by organizing workshops and seminar by professionals, participation of students in group discussion, games and dialogues, students should be encouraged, spoken language should be taught as rehearsals for recording, library with colourful and interesting pictorial representation of mathematical vocabulary should be provided to allow students develop and extend their mathematical vocabulary accurately

Keywords: Utilization, mathematics vocabulary, solving, problem

INTRODUCTION

Mathematics is the science of quantity and space and of the relationship that exist between them. It is a unique area of inquiry which seeks to understand quantities and shapes in their diversities. Mathematics as a discipline involves practical steps that propel human activity from day-to-day living. It is the significant position that mathematics occupies that has made it a compulsory discipline for all levels of formal education, which is in line with the National Policy on Education. The federal government of Nigeria has recognised the valuable contribution of Mathematics to advancement in science, technology and more recently information technology. Hence, in her National Policy on Education (FRN, 2013) advocated the need for a functional education that is geared towards attaining the general objectives in the teaching of Mathematics at the secondary school level. The new National Mathematics Curriculum for Primary and Junior Secondary School in Nigeria is therefore focused on giving children the opportunity to acquire mathematical literacy to function in an information age and cultivate understanding of the skills necessary for evolving technical world. Therefore, the general objectives of teaching mathematics in the Junior Secondary School level are as follows:

- to generate interest in mathematics and to provide solid foundation for everyday living.
- to develop computational and problem-solving skills
- to develop precise, logical and abstract thinking
- to develop ability to recognise problems and to solve them with related mathematical knowledge
- to provide necessary mathematical background for further education
- to stimulate and encourage creativity (BMC, p.4).

The universe cannot be read until we have learned the language it is written in and the language is mathematics. The main reason for studying mathematics is to solve problems. Without the ability to solve problems, the usefulness and practice of mathematics ideas, skills and application can be limited. Chakpo and Buchko (2004) are of the view that learning and teaching mathematics concepts form the integral parts of the daily activities of

students, since these activities involve exploration, qualitative and quantitative reasoning and problem-solving. These tools equip the students to think logically during mathematics learning experience. It goes a long way to enhance students' interaction with learning experiences and vocabulary in mathematics. According to Liabor (2013), vocabulary can be defined as a list of words used by people in a subject matter. Vocabulary plays an important role in learning to read. Learners must use the words they learn orally to make sense of the words they see in print. It will be difficult to understand concepts without knowing what most of the words and symbols mean in solving problems in mathematics.

Mathematics as a subject matter is a visual language of concepts, symbols and numbers. It is also expressed and explained through written and spoken words. This can be presented as mathematics vocabulary. It is important in understanding the overall comprehension of contents in mathematics which can help in language development and ultimately mathematics proficiency during problem-solving.

Effective mathematics problem-solving often depend on understanding of key concepts without which the students can be totally lost as to how to carry out a mathematical learning task. Martinez and Martinez (2001) were of the view that students learn to use language to focus and work through problem-solving, to communicate ideas coherently and clearly, to organise ideas and structure arguments, to extend their thinking and knowledge, to encompass other perspective and experiences, to understand their own problem-solving and thinking processes as well as those of others and to develop flexibility in presenting and interpreting ideas. At the same time, they begin to see mathematics, not as an isolated school subject, but as a life subject – an integral part of the greater world, with corrections to concepts and knowledge encountered across the curriculum.

Mathematics vocabulary is essential to learning mathematics in problem-solving as it pertains to learning how to read and comprehend meaning to words read. In language arts, mathematical words conjure up graphic representations of the objects they label but when it comes to abstract mathematical concepts, words describes activities or relationship that often lack a concrete item. Thus, the knowledge of vocabulary in problem-solving is critical to helping the students develop the means to solving mathematical problems. A good mathematics programme should involve the use of relevant examples to illustrate mathematics vocabulary in problem-solving as mathematics is a creative discipline which can effectively be used to communicate ideas and become familiar with the characters in which it is written. It is written in mathematical language and the letters are triangles, circles and other geometrical figures without which it is humanly impossible to comprehend a single word (Odu, 2017). This shows that communication is a key factor in everyday interaction of the people. Hence, understanding the meaning of the vocabulary is essential to learning mathematics.

Mathematics Vocabulary is a medium of thought and expression which helps to organise and shape human understanding of concepts. This involves the ability to comprehend the idiomatic express, figurative usage and interpreting correctly the verbal and non-verbal signs that make up the totality of that language (Olaoye, 2007). This communication plays an important role in helping students construct links between their informal notions and the abstract language and symbolism of mathematics. It plays a key role in helping students make important connections among physical, pictorial, graphics, symbolic, verbal and mental representation of mathematical ideas (National Council of Teachers of Mathematics, 2000).

Knowing and understanding mathematics vocabulary can help students explain their thinking in precise mathematical terms to move on to deeper understanding and discussion of problem-solving. Problem-solving according to Polya (1957) is the process used to solve a problem that does not have an obvious solution. It is the teaching of strategies or heuristics in order to solve problems. It is the highest form of knowledge which occurs as a result of assembling already known rules for the purpose of creating a new superior rule which is learned and also allows appropriate solution to the problem. This implies that, it is a process that requires the student to navigate through prior knowledge and select an idea plan in solving the problem task at hand.Thus, engaging in problem-solving provide an opportunity for mathematics students to engage in extensive learning experiences either individually or collectively to solving a wide variety of problems and reflecting on their performance through presentation and discussion. The new Juniour Secondary School mathematics curriculum is unique in the sense that it also specifies objectives to be attained. Grade placement and activities associated with these contents. It lays emphasis on computational skills and problem solving skills. It is summarized under four broad themes;

- Number and numeration: Number system, fractions, decimal, fractionation, proportion and approximation.
- Algebraic process: Mathematical statements, simple equation, line equation and variation.
- Geometry and mensuration: Basic properties and simple mensuration, 2D and 3D shapes, properties of angles, scales and elementary trigonometric ratios.
- Everyday statistics: Data collection, techniques and graphs, frequency tables, measure of central tendencies, elementary ideas of probability, mean, median, mode.

The ability to solve mathematics problems develop overtime because it requires much more than merely the direct application of some mathematical content knowledge but through verbal and written words by questioning, expressing views, conjecturing and explaining findings to solutions of mathematics problems. Learners' prior knowledge influences the information which they perceive and how it is interpreted verbally depends largely on problem-solving skills imbibed. According to a research carried out by Swan (2005), achievement in Mathematics is far more successful if learners are actively engaged and encouraged to think and talk mathematically and to see links and connections in solving mathematics problems.

The ability to understand and communicate with Junior Secondary School mathematics students is a key to effective teaching. The mathematics teacher may have adequate knowledge of content, possesses the necessary skills for instructional delivery and yet may not have the vocabulary ability to impact learning. This can hinder the successful transfer of knowledge as students may not be able to engage in solving problems effectively. However, if the teacher's mode of communication and presentation of pictorial, charts and symbols are clearly unambiguous, simple and easy to comprehend, students will perform successfully in Mathematics. For instance, when students have understanding of mathematics vocabulary, it is easy to represent learning experience in mathematics logically.

Statement of the Problem

To many teachers, Mathematics is simply a matter of giving out procedures for students, who then perform by using the procedure to solve problems. Mathematics teachers try to help students read and interpret mathematics text and discuss problem-solving strategies which are basically procedural rather than assisting them to read for understanding of the mathematical learning task. A lot of mathematics teachers do not see vocabulary knowledge as part of the professional teaching skills, which they ought to train for. They do not understand that reading and discussing a mathematical text for problem-solving is quite different from other types of reading and discussion. Cunningham and Stanovich (1998) were of the view that once a learner has the ability to read and comprehend what he or she is reading, he or she can do well in subjects and tasks required. Since Mathematics is often conveyed in symbols, shapes, numeric and graphs, oral and written communication is not always considered as an important part of Mathematics. Many students suffer low self-esteem and inability to communicate mathematically. Often times, they are unable to recognise, comprehend and recall mathematical terms as their vocabulary knowledge in problem-solving is not effective. This observable decline has been blamed on a number of factors, including reading culture, lack of mathematics library, lack of instructional materials, teaching method, parental background and school environment. Aremu and Oluwole (2001) observed that poor performance in mathematics is attributable to non-use of verbal reinforcement of Mathematical concepts and terms.

In school, students who cannot communicate, read and comprehend mathematics vocabulary are likely to face challenges and drop out of school through frustration. This is obvious with the trend of fluctuating performance in mathematics examinations. This has created problems of failure, negative attitude and poor performance at classroom exercises, homework, quiz and external assessment in mathematics like West Africa Senior Secondary Certificate Examination (WASSCE), National Examination Council (NECO), Joint Admission and Matriculation Board (JAMB) and National Board for Technical (NABTEB). This therefore calls for an urgent step to provide solution to the problem. Hence, the crux of this study is to assess Mathematics vocabulary on problem-solving among Junior Secondary School Mathematics students in Egor Local Government Area, Edo State.

Purpose of the Study

The main purpose of the study was to assess the utilisation of mathematics vocabulary knowledge in solving problems in Mathematics in Junior secondary schools in Egor Local Government Area of Edo State. Specifically, the study seeks to:

1. find out the percentage of students who use mathematics vocabulary in solving problems in Mathematics?
2. ascertain the students' attitude towards the use of mathematics vocabulary knowledge in problem-solving in Mathematics?
3. identify perceived constraints to effective use of mathematical vocabulary knowledge in problem-solving in mathematics among Junior Secondary School students in Egor Local Government Area?

Research Questions

To guide this study, the following research questions were raised;

1. What is the percentage of students who use mathematical vocabulary knowledge in solving problems in Mathematics?
2. What is students' attitude towards the use of mathematical vocabulary knowledge in solving problems in Mathematics?
3. What are the perceived constraints to the use of mathematics vocabulary in solving problems in mathematics among Junior Secondary School students in Egor Local Government Area?

Population and Sample Size of the Study

The population for the study is all junior secondary school students in public schools with a population of 7800. Seven out of the thirteen public schools in Egor Local Government Area of Edo State were randomly selected for the study. In each school, 25 students were randomly picked by balloting for the study. In all, the sample size consisted of 175 mathematics students in junior secondary schools in Egor Local Government Area of Edo State.

METHODOLOGY

The study adopted a descriptive survey design which employed the perceptive approach to find out what students perceived about the concept of mathematics vocabulary on solving problems in Mathematics.The instrument used in gathering information for this study was questionnaire. It consisted of two sections: Section A was designed to elicit personal data from the respondents like gender, age range of mathematics students and class. Section B had twenty-three (23) items with 20 positive oriented items and three negative-oriented items. One mark was awarded for positive response and zero was allotted for the negative response, indicating disagreement after scoring, total marks obtained were classified into categories indicated on table in accordance with raw scores. The instrument was subjected to validation by three experts in the departments of Curriculum and Instructional Technology (CIT) and Educational Evaluation and Counselling Psychology (EECP) respectively in the University of Benin, Benin City. It was scrutinized and valuable corrections were made. As a result of the scrutiny, necessary clarification and modifications of items were made. The reliability of the instrument was established using Cronbach Alpha reliability statistics with a pilot test. This was done by administering the draft instrument to 20 mathematics students who were not part of the respondents in the main study. Data was analysed and a value of 0.78 was obtained which proved the instrument to be reliable.

The researchers administered the questionnaire personally to the respondents after seeking permission from the various school principals. A brief summary of the essence of the study was explained to the respondents before administration and questionnaires were collected immediately after responses were filled.

Data collected was scored, coded and analysed using simple percentages, statistical means and standard deviations. Research question one was answered using simple percentage with a benchmark of 50%. Research questions two and three were answered using means and standard deviation. Item with mean values of 2.50 and above were considered as agreed as the case may be while items with mean values less than 2.50 were considered disagreed.

PRESENTATION AND ANALYSIS OF RESULTS

Research Question 1

What percentage of students use mathematical vocabulary in Mathematics problem-solving?

Table 1

Students' responses on their use of mathematical vocabulary in mathematics problem-solving

S/N	Items	Yes (%)	No (%)
1.	I use mathematics symbols to identify symbols in simple inequalities	125 (71.4%)	50 (28.6%)
2.	I use mathematics vocabulary during graph presentation.	138 (78.8%)	37 (21.2%)
3.	I use symbols in solving problems in mathematics when mathematics vocabulary is written out in fractions.	127 (72.6%)	48 (27.4%)
4.	I use mathematics vocabulary during problem-solving in numbers and numeration	136 (77.7%)	39 (22.3%)
5.	I use mathematics vocabulary during probability problem-solving in Mathematics.	128 (73.1%)	47 (26.9%)
6.	I use mathematics vocabulary during statistics problem-solving in Mathematics.	151 (86.3%)	24 (13.7%)
7.	I do not use mathematics vocabulary because it is not necessary.	25 (14.3%)	150 (85.7%)

Table 1 above shows all the items for percentage of Junior Secondary School students who use mathematics vocabulary. For item 1, a total of 125 students, representing 71.4% responded yes to the use of mathematics vocabulary, while 50 students, representing 28.6% responded no. Item 2 had 138 students with a percentage 78.8 as yes while 37 students, representing 21.2% as a no. Item 3 had 127 students, representing 72.6% as a yes, while 48 students with a percentage of 27.4 as no. Item 4 had 136 students, representing 77.7% as respondent to yes, while 39 students, representing 22.3% responded no. Item 5 had 128 students; representing 73.1% responding yes while 47 representing 26.9% responding no. Item 6 had 151 students, representing 86.3% responding yes, while 24 students, representing 13.7% responded no. For item 7 which was negatively-oriented, 25 students which represent 14.3% responded negatively to non-usage of mathematics vocabulary, while 150 students, representing 85.7% responded yes to usage. From the table analysis, it can be observed thata high parentage that is more than 50% was recorded for all the items on usage of mathematics vocabulary in problem solving in Mathematics. Hence, it can be deduced that more than 50% of Juniour Secondary School students use mathematics vocabulary during problem-solving in mathematics.

Research Question 2

What is students' attitude towards the use of Mathematics vocabulary in problem-solving?

Table 2

Students' responses on their attitude towards the use of mathematics vocabulary in problem-solving

S/N	Items	Mean	S.D	Remark
1.	Understanding mathematics vocabulary increase problem-solving skills in Mathematics.	2.80	1.08	Agreed
2.	Mathematics vocabulary is not important in problem-solving skills in Mathematics.	2.20	1.35	Disagreed
3.	I do not have interest in reading mathematics textbooks because of the mathematics vocabulary used during problem-solving.	2.65	1.16	Agreed
4.	Mathematics vocabulary makes solving problem in mathematics difficult for me.	2.54	1.11	Agreed
5.	Mathematics vocabulary helps me to think and make good mathematical representation during problem-solving in mathematics.	2.78	1.32	Agreed

Table 2 reveals that Junior Secondary School students agreed to having positive attitude towards mathematics vocabulary during problem-solving on items 1and 5 with a mean of 2.80and 2.78 respectively, which is above the stated mean value of 2.50. This shows that there is positive attitude with standard deviations of 1.08and 1.32 respectively. Item 2 which has a mean value of 2.20 which is less than the stated mean value of 2.50 is also positive because it is negatively-oriented. This implies that students were of the view that mathematics vocabulary is important for their mathematical problem-solving.The Table also shows that the use of mathematics vocabulary in textbooks make students to be less interested in reading such mathematics texts

with a mean value of 2.65 and that mathematics vocabulary makes solving problems in mathematics difficult for them with a mean value of 2.54.

Research Question 3

What are the constraints of mathematical vocabulary in solving problems in Mathematics?

Table 3

Constraints of mathematical vocabulary in solving problems in mathematics

S/N	Items	Mean	S.D	Remark
1.	Mathematics vocabulary is complicated in meaning and difficult to learn.	2.55	1.12	Agreed
2.	The mathematics vocabulary differs from the everyday English language in the classroom.	3.14	1.50	Agreed
3.	Understanding the place of mathematics vocabulary in solving problems in mathematics is difficult.	2.77	1.36	Agreed
4.	Indigenous language improves mathematics vocabulary in solving problems in Mathematics.	2.31	1.10	Disagreed
5.	Symbols in mathematics vocabulary are difficult to read.	2.74	1.21	Agreed
6.	Pictorial representation of mathematics vocabulary can be a constraint in solving problems in Mathematics.	2.58	1.52	Agreed

Table 3 shows that everyday English language differs from mathematical vocabulary with a mean of 3.14. Understanding the place of mathematical vocabulary in problem-solving with a mean of 2.77, use of symbols with a mean of 2.74 and use of pictorial representation in mathematical vocabulary with a mean of 2.58 were agreed by students to be constraints to use of mathematics vocabulary. Also, the use of indigenous language to improve mathematical vocabulary with a mean of 2.31 was disagreed by the respondents as it was a negatively-oriented item. From the analysis, all items were considered as constraints to use of mathematics vocabulary in problem solving in mathematics.

DISCUSSION OF FINDINGS

From the above analysis, the study revealed that a high percentage of Junior Secondary School students use mathematics vocabulary during mathematics tasks. This finding corroborates the study of Martinez and Martinez (2001) that students learn to use language to focus and work through problem-solving to communicate idea coherently and structure arguments to extend their thinking. Similarly, the findings of Chakpo and Buchko (2004) was in agreement as they observed that learning and teaching mathematics form the integral parts of the daily activities of students in class. Since these activities involves exploration, problem-solving, qualitative and quantitative reasoning, it goes a long way to enhance students' interaction with the learning experiences and in mathematical vocabulary. However, the finding of Olaoye (2007) is not in consonance with the result of this study as it emphasizes the important role of communication in helping students construct links between their informal notions and abstract language and symbolism in Mathematics. But the result of the study found out that students did not agree that their informal notion of everyday English language and their indigenous language can help in mathematics vocabulary in solving problems in mathematics. They considered these to be constraints to effective use of mathematics vocabulary. The work of Swan (2005) was in consonance with the findings of this study as it reported that achievement in Mathematics is far more successful if learners are actively engaged and encouraged to think and talk mathematically and to see links and connections in solving mathematics problems. The result of the study showed that students had positive attitude towards mathematics vocabulary during solving problems in mathematics as they are actively involved.

CONCLUSION

Based on the analysis of this study, it was found out that a high percentage of Junior secondary school students use mathematical vocabulary during solving problems in Mathematics. The students had positive attitudes towards the use of mathematical vocabulary in solving problems in Mathematics. It was also found out that the students perceived constraints were interference of mother tongue medium and mathematics vocabulary, mathematics textbooks without pictorial, charts and symbolic representation of mathematics vocabulary and the difference between everyday English language and mathematics vocabulary.

RECOMMENDATION

Based on the findings of the study, it is recommended that

1. More students can be encouraged to use mathematics vocabulary by engaging them to use space-themed, pictorial problem-solving activities. This can help students gain confidence.
2. Publishers should be sensitized and motivated to produce textbooks in Mathematics with good pictorial representation of mathematics vocabulary.

3. Library should be provided where students interact daily for discussion in Mathematics.
4. Mathematics laboratory should be provided to assist students identify symbols, theorems and formulas and their vocabulary meaning.
5. Opportunities should be created for students to use mathematics vocabulary frequently. For example, by participating in paired activities, group discussions and games as well as other dialogues.
6. Spoken language in Mathematics can be taught as a rehearsal for recording. This will allow Juniour School students extend and develop their mathematics vocabulary accurately and express new ideas and new thinking.

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