RELATIONSHIP BETWEEN STUDENTS' UNDERSTANDING OF MATHEMATICAL LANGUAGE AND ACHIEVEMENT IN JUNIOR SECONDARY SCHOOL IN IKERE-EKITI, NIGERIA

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ABSTRACT

The study investigated the relationship between students' understanding of mathematical language and their achievement in mathematics. 450 senior secondary two (SS II) students (200 males and 250 females) were randomly selected from five secondary schools in Ikere Local Government Area of Ekiti State for the study. Data collection was done using Mathematical Language Reading Ability and Understanding Test (MLRAUT) and Mathematics Achievement Test (MAT). Product Moment Correlation coefficient and the corresponding t-test of significance were used in analyzing the data. Results obtained show that there is significant relationship between students' understanding of mathematical language and their academic achievement in mathematics. Consequently, it was recommended among others that government should employ more qualified mathematics teachers and send them on inservice training and development programmes. This will enable them to update their knowledge on how best they can use mathematical language to enhance the teaching and learning of junior secondary school mathematics in Ekiti State.
Keywords: *Mathematics Vocabulary, Concept, Language, Understanding, and Achievement.*

INTRODUCTION

Mathematics as a subject has a language of its own, with its signs, vocabularies, symbols and notations and plays an important role in the development of human mind and thinking. Hence, the first hurdle a student must face in learning to solve mathematical problems is the ability to understand the language in which the problems are framed (Udousoro, 2006). Language is a system of sounds and written symbols used by people to communicate with one another. For mathematics, according to Akpan (1992), it is seen in its symbolism, terms and notations which are different from that of ordinary english language. A good understanding of english language and the ability to comprehend mathematical language are very crucial skills in solving mathematical problems. Mathematical language plays the role of supplying verbal symbols, which can represent concepts and be used as stimuli for the internalized manipulation of concepts.

Udousoro (2006) also states that students who do not understand the words used in the statement of a problem will have difficulties in solving such problem. This

implies that incompetence in mathematics vocabulary and inadequate knowledge or understanding of the symbols is a constraint to students' proficiency in mathematics learning. Word and syntactical redundancies in mathematics are different from ordinary English for example, the mathematical meanings of the words such as 'factorize, evaluate and integrate are different from that of english language meanings. In english languaue, "5 *x* 2" means something different from five multiply by two in mathematics. According to Adeagbo (1995), Baiyelo (1996) and Udousoro (2006) mathematical language which involves the use of symbols, signs, rules and formulae to represent ideas and relationships existing between concepts pose a lot of problems to students in learning mathematics. Strevens (1994) has reported that simple words and expressions like 'let', 'sum' and 'for' are used in linguistic form in mathematics to bring about logical relationships.

Understanding exactly what you are asked to do is part of the solution to the problem. Thus, for a given problem in a class, those students with the ability to comprehend the language will only be left with the problem of finding ways of tackling the problem. On the other hand, those without such ability will not even know what to do. It therefore implies that the nature of mathematical language is a constraint to students' proficiency in mathematics problem solving. Oluwatusin (2010) contends that the vocabulary of a language is all the words in it. Thus, the vocabulary of a particular subject (say mathematics) is the group of words that are typically used when discussing the subject. He further contended that lack of adequate mathematics vocabularies is one of the major reasons why students perform poorly in mathematics. Akpan (1989) in his study, has reported that the middle 50% of the ability range of children who were unable to understand mathematical principles were significantly affected by lack of mathematical vocabularies. The understanding of mathematical terms, translation of mathematical terms to symbols, representation of mathematical terms in diagrams or numbers and descriptions of mathematical terms in words are important correlates of mathematics achievement (Akpan, 1989).

Similarly, Baiyelo (1996) and Ajogbeje (2008) also observed that students have difficulty in translating worded problems to diagrams and diagrams to mathematical equations and these contribute to their poor performance in mathematics. They further observed that the use of letter, characters and symbols either mixed or differently in describing and labeling diagrams tends to bring difficulty in the understanding of the problem. The manipulation of symbols through the use of learned phrases like taking out brackets, canceling, inverting/turning upside down, changing sign after equality and so on create problems for students in learning mathematics. This implies that students may know the way to tackle a given problem but because they are not familiar with the vocabulary or terms used in framing such problem, they become handicapped in the solution process.

Udousoro (2006) opined that there is a strong relationship between students' ability to text edit the statement of a problem and the actual solution of the problem. Students who possess this skill were able to identify missing irrelevant and relevant

information required for the solution of the problem and would not even waste time trying to solve problem lacking sufficient information. The language used in mathematics textbooks also affects students' performance in mathematics. Kalejaiye (1992) argued that the level of language used mathematics textbooks is often higher than the language competency of students. Hence, students find it difficult to read and understand such textbooks in order to supplement information presented by the teachers, solve problems/exercises or make references. Odilli (1990) also argues that mathematics textbooks were meant to serve as instructional materials and aside this provide a concise source of materials for tables, graphs, sample problems, theorems and proofs, and definitions. Textbooks contain ideas, information and facts needed for understanding the concepts. Odilli (1990) then suggests that a good mathematics textbook should provide exercise, experiences, directions for attaining mastery through practice, review application and that the language used should be simple, clear and free from mistakes and the style should be straightforward.

Akpan (1992) opined that language is uniquely a human activity and the development of the individual depends on its usage. Aside this, he opined further that language in its spoken form plays an important role in the teaching and learning of mathematics. Taiwo (1976) had noted that if the language in which students learn facts and concepts in school is different from the one they use and hear outside the school, he/she is deprived of natural maintenance programme of mother tongue, and his/her memory is not strengthened. Students' memory can be strengthened only when his/her experiences at school overlaps with what are obtained at home.

In mathematics, the teacher's teaching ability is enhanced when he/she teaches in a language he/she clearly understands as this will enable his/her good grasp of the concepts he/she wishes to express (Taiwo, 1976). He added that what the teacher is able to achieve will depend on what his/her command of language permits. Even with the use of instructional materials, it is the teacher's language which remains the basic model for the students. Taiwo (1976) therefore concludes that a teacher, who has difficulty in speaking the language he/she teaches with, will not succeed in giving the students the command of spoken language. Kalejaiye (1992) also argued that students learn better in the language and cultural environment, which they are familiar with. The purpose of this study therefore, is to investigate whether there is any relationship between students' understanding of mathematical language and their achievement in mathematics in Ekiti State, Nigeria. The study was designed to test the veracity of the following research propositions:

i There is no significant relationship between students' understanding of mathematical language and their achievement in mathematics.

ii There is no significant gender difference in students' understanding of mathematical language.

iii There is no significant gender difference in students' achievement in mathematics.

METHODOLOGY

A survey method was used for the investigation since the variables could not be manipulated. The targeted population for the study consists of all the senior secondary two (SS II) students for 2009 academic session in Ikere Local Government Area of Ekiti State. The sample for the study consisted of 450 SSII students (200 males and 250 females) randomly selected from five secondary schools. Two research instruments namely: Mathematical Language Reading Ability and Understanding Test (MLRAUT) and Mathematics Achievement Test (MAT) were developed, validated and used for data collection. The 20 - item MLRAUT was designed to measure students' ability to translate a statement in English Language to corresponding mathematical statement/ symbols; express mathematical symbols in English Language and solve mathematical models stated in words. The MAT consisted of 50 objective questions drawn from the following areas: Number and number line, set theory, geometry and general angles. A reliability coefficient of 0.83 using Cronbach alpha and 0.68 using split-half was obtained for MLRAUT and MAT respectively. Data collected were subjected to statistical analysis using Pearson's Product Moment Correlation Coefficient with the value of r obtained further subjected to a t-test of significance to determine if there exists any significant gender difference as regards students' scores in MLRAUT and MAT. The results are presented on tables.

RESULTS AND DISCUSSION

Table 1: t-test for the Correlation between Students' Understanding of Mathematical Language and Achievement in Mathematics

Variable	N	r_{cal}	r_{tab}	df	t_{cal}	t_{tab}	Remark
Maths. Language Understanding	450	0.32	0.14	448	5.51	1.96	Sig.
Mathematics Achievement	450						

Table 2: Independent t-test of difference between male and female Students' Understanding of Mathematical Language

Gender	N	Mean	S. D	df	t_{cal}	t_{tab}	Remark
Male	200	12.40	3.48	448	1.14	1.96	Not Sig.
Female	250	12.00	3.21				

Table 3: Independent t-test of Difference between Male and Female Students in their Mathematics achievement

Gender	N	Mean	S. D	df	t_{cal}	t_{tab}	Remark
Male	200	14.68	3.78	398	1.89	1.96	Not Sig.
Female	250	13.98	3.65				

Table 1 shows that the calculated r - value of 0.32 was greater than the critical r - value of 0.14 at 0.05 level with 448 degree of freedom. Furthermore, table 1 also showed that when calculated r - value was converted to t - value, the t - calculated value of 5.51 was greater than the critical r - value of 1.96 at 0.05 level with 448 degree of freedom. These findings indicated that there was a significant relationship

between students' understanding of mathematical language and their achievement in mathematics. Based on this, the null hypothesis that there is no significant relationship between students' understanding of mathematical language and their achievement in mathematics was rejected. This implies that students who understand mathematical languages performed well in mathematics.

From table 2, we see that the t-calculated value of 1.14 is less than the critical value of 1.96 at 0.05 levels of significance and 198 degree of freedom. The null hypothesis that there is no significant gender difference in students' understanding of mathematical language is accepted. This means that there is no significant difference between male and female students in their understanding of mathematical language. therefore, it implies that gender has no significant effect on mathematical language understanding.

Table 3 shows that the calculated t - value of 1.89 is less than the critical value of 1.96 at $p < 0.05$. The null hypothesis that there is no significant gender difference in students' achievement in mathematics is accepted. This means that there is no significant difference between male and female students in their achievement in mathematics. However, it is not out of place to say that gender has no significant effect on students' achievement in mathematics. The findings of this study revealed that there was a significant relationship between students' reading ability and understanding of mathematical language and their achievement in mathematics. This finding reinforced the notion that ability of students to understand the language of mathematics is a very crucial skill in mathematics problem solving. That is, students who do not understand the language of mathematics can hardly tackle such problems and this explains why most students perform poorly in mathematics. The findings of this study agreed with the findings of Adeagbo (1995) and Oluwatusin (2010).

The findings of this study further revealed that there was no significant difference in the achievement of male and female students who took part in the study. This result agreed with the findings of Oyediji (1992) that gender is not an identifiable factor affecting students' difficulties in learning mathematics concepts. A possible explanation for the observed result might be that at the level of students considered for this study, both male and female students might have made up their minds about mathematical concepts in their syllabus resulting in non-significant difference in their mathematical language understanding and achievement.

CONCLUSION AND RECOMMENDATIONS

The result of this study has shown that students' understanding of mathematical language was significantly related to their achievement in mathematics. Hence, mathematics teachers should endeavour to see that their students are well tutored in the language of mathematics. Again, teachers should not give preferential treatment to students but both male and female students should be encouraged to learn mathematics. It was recommended based on the findings of this study that the major

instructional focus of the mathematics contents should be on the development of appropriate vocabulary structure and mathematical contexts for the language of mathematics. Since mathematics has its own language, mathematics teachers should endeavour to introduce their students to all the symbols, terms and notations commonly used in mathematics textbooks. Finally, Government should employ more qualified mathematics teachers, provide conducive learning environment for students, and organize workshops, seminars and conferences for mathematics teachers to refresh and update their knowledge on how best they can use mathematical language to enhance the teaching and learning of Junior Secondary School Mathematics in Ekiti State.

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