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# EFFECTS OF LANGUAGE OF INSTRUCTION ON JUNIOR SECONDARY STUDENTS' PERFORMANCE IN MATHEMATICS

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**ABSTRACT**: *This study investigated the Effects of Language of Instruction on Junior Secondary Students' Performance and Terminology Achievement in Mathematics. A case study of Adavi Local Government Area of Kogi State, Nigeria. A total of eighty (80) students were drawn from two (2) schools. The study was guided by two (2) research questions and two (2) hypotheses. Mathematics Achievement Test (MAT) and Mathematics Terms Achievement Test (MTAT) were used as instruments for data collection. The students were taught the concepts of Algebra, Word Problem and Fraction for two weeks. The PRE-MAT and POST-MAT were administered to the students. Mathematics Terms Achievement Test (MTAT) was administered one week after the administration of POST-MAT. The students' scripts were scored and the resulting data were subjected to data analysis. Research questions were answered using mean and standard deviation. Hypotheses were tested using Analysis of Variance (ANOVA). Major findings of the study showed that the experimental group achieved higher and retained more mathematical concepts than their counterparts in the control group. It is therefore recommended that teaching mathematics strictly in English should be de-emphasis to enable the mathematics teachers to explain in the mother tongue whenever they are teaching. Also, curriculum developers should take into consideration the language interference between English and the language of the environment in their planning for junior secondary school students.*

**KEYWORDS**: Mathematics Achievements Test (MAT), Mathematics Term Achievements Test (MTAT), Algebra, Communication, Language.



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## INTRODUCTION

In every culture, there has always been the need for mathematics in the aspect of counting and record-keeping which varied from tribe to tribe and country to country. All societies have developed mathematical concepts and practices to serve their needs and interest. Charles, (2012) stated that mathematics could be said to be as old as humankind. Ngoma, (2013) added that proficiency in basic numeracy is essential for everyday functioning and it is a foundation for other aspects of human endeavour.

Research in mathematics education has also focused on the role of language in mathematics because language is the means by which mathematics concepts (as all ideas) are communicated between the teacher and the learner, either through oral or written materials, Kaphesi, (2002) argue that language of is not merely a vehicle of expression, it is also the driver and that what we perceive, and therefore can learn, is a function of our language processes. He also stated that "Communication breaks down when people do not have certain concepts". When pupils do not understand what the teacher is trying to say, then he/she is not communicating. Hence, the language of instruments has a large space in mathematics education and also as a subject in junior secondary school.

Mathematics language or terminology in mathematics is the collection of signs or symbols, abbreviations, axioms, lemma, methods, formulae, and units that are necessary for mathematics teaching and learning (Oginni, 2013). Understanding its usage is imperative and cannot be underestimated. Kolawole, (2013) affirmed that the failure of the learners to master the mathematical language leads to poor performance in the subject. Oginni, (2013) remarked that mathematics has often been described as arithmetic with letters, however, notations used in mathematics such as +, -, x, and ÷ are symbols while other mathematicians believed that mathematics language is a special emblem that guided the learners on the step to take. The uniqueness of mathematics terminology has distinguished mathematics from other subjects. Moreover, proper consideration is not given to this in Nigeria. Mathematics is viewed as every other subject whose terms are not technical. Particularly in Adavi Local Government Area, children who have acquired their mother tongue (Ebira) and even communicate in them before enrolling in schools are then taught mathematics in the language they don't understand. The likelihood of language interference occurring is high when students learn in a language other than their mother tongue.

### Communication

Kaphesi, (2002) conceives communication as consisting of the transmission of a message from the source to the receiver through a medium and that the receiver must integrate the message into the mind. Figure 2.1 is the theoretical map showing the relationship between teacher, content, medium and pupils.

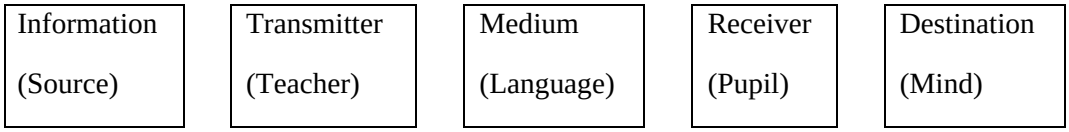


**Figure 2.1: The relationship between the teacher, medium, language, content and pupils.**


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To use this model in explaining classroom communication implies that in any teaching and learning process, the teacher is one of the many transmitters of the messages (content) which is contained in a medium (language) (figure 2.1). Other transmitters are such materials as printed matter. The model suggests that:

1. The most common source of the content in classroom communication is the teacher (and the target group is the pupils) who initiates, facilitates and organizes the content in a medium that conveys it to the pupils. The teacher has to have the content in the form of mathematical symbols, concepts, principles and relationships. The teacher processes this in an appropriate language that is meaningful to the pupils.

2. The major component of any communication is the medium because it has to allow the content to flow freely from the source to the target group. Naturally, in classroom communication, pupils receive the content through language. For the pupils to be active learners of the content, they must be competent enough to use the medium to share and discuss the content. As a result, teachers must recognize pupils' need for knowledge of, attitude to and practices in the language of instruction. Failure of pupils to comprehend either the language used or the content being taught may lead to ineffective learning of mathematics.

3. The destination of the learning content is the mental (cognitive) domain. A child has to make sense of or process the context in the medium and store it in the memory. This is what constitutes meaningful learning. ( Kaphesi, 2002) also argues that children may fail to solve a problem being set by an adult or misunderstand something being taught or explained to them not because they lack certain intellectual abilities but because they don't understand the language being used.

This problem of communication breakdown can be more pronounced where the local language in mathematics involves simply replacing a refined mathematical language, as Kaphesi, (2002) argue, with a crude one without considering that different languages carry to the child different mathematical meanings. The effective use of a language as a medium of instruction in mathematics should take into consideration the differences in knowledge of attitude to and practice of language between teachers and their pupils (see, Kaphesi, 2002). In the case of this study, I am concerned with exploring if either the language of instruction – Ebira/English or English only – will carry the intended message to the learner who will in turn, correctly interpret the message.

Kaphesi, (2002) was a Russian psychologist whose pioneering work focused on child development, and the connections between language development, social learning and cognition. He is one of the prominent proposers of constructivism. According to the Educational Broadcasting Corporation (2004) in Kaphesi, (2002), constructivism is basically a theory – based on observation and scientific study – about how people learn. It says that people construct their own understanding and knowledge of the world through experiences. When we encounter something new, we have to reconcile what we believe, or maybe discard the new information as irrelevant. In any case, we are active creators of our own knowledge. To do this, we ask questions, explore, and assess what we know.

In Baiju, (2010) Piaget emphasized the importance of social interaction to intellectual development. Piaget saw interaction as the key to how we overcome the instability of the


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symbols we individually construct. Piaget tied the role of social interaction to the importance of language. Piaget tied the role of language in the development of conceptual and logical understandings. He made language an integral part of his ideas on intellectual development. Piaget linked the role of social interaction in intellectual development to the role of language.

According to Piaget, language is inherently a social factor partly because of the conventional nature of words and this conventional nature of words is crucial for conceptual development. Piaget offers an avenue for extending Vygotsky's approach to the interplay of conceptual and semiotic aspects in intellectual development. Piaget argued that the formation of mental structures underlying feelings of logical necessity requires social interaction using a conventional sign system.

Piaget theorized that language was simply one of the children's ways of representing their familiar worlds, a reflection of thought, and that language did not contribute to the development of thinking. Cognitive development, he argued, proceeded with that of language.

In view of the above problems, this study is ready to answer the following questions; what are the effects of language of instruction on junior secondary students' performance and terminology achievement in mathematics?

**Purpose of the Study**

The purpose of this study is to investigate the effect of language of instruction on junior secondary students' performance and terminology achievement in mathematics. To achieve the above purpose, the following objectives are outlined, to:

1. Investigate the effect of English/Ebira as the language of instruction on JSS 2 performance in mathematics;
2. Investigate the effect of English/Ebira as the language of instruction on JSS2 terminology achievement in mathematics;
3. Comparing any significant effect on the mathematical achievement test of the students;
4. Comparing any significant effects on the mathematics terms achievement test of the students.

**Significance of the Study**

The research will be valuable to scholars, educationists and other researchers who will use it for further studies. Also, provide information for parents, educators and the general public on how effective and efficient Nigeria's native languages can be in the mathematical performance of the students, especially in junior secondary classes. It is crucial for teachers to realize how mathematics learning is linked to language, social interaction and cultural context. Mathematics has been taught using language as if the language itself bore little relation to the acquisition of mathematical concepts. The study will educate the general public on the fact that mathematics can be easier if communicated in a familiar language. The learners will not have to misinterpret the communicated idea, as a result of lexical ambiguity.


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**Research Questions**

The following research questions guided the study;

1. What is the difference in the mean achievement scores of students taught mathematics in English/Ebira language and those taught in English language only?
2. What is the difference in the mean terminology achievement scores of students taught mathematics in English/Ebira language and those taught in English language only?

**Research Hypotheses**

The following research hypotheses were tested at a 0.05 level of significance.

1. There is no significant difference between the mean mathematics achievement scores of the students in the experimental group and the control group.
2. There is no significant difference between the mean terminology achievement scores of the students in the experimental group and the control group.

## METHODOLOGY

This study adopted a quasi-experimental design. Quasi-experimental design involves the PRE-TEST, POST-TEST non-equivalent control group design. This design was adopted because it was not possible for the researcher to randomly sample the subjects and assign them to groups without disrupting the academic programs of the schools involved in this study. The researcher randomly assigned intact classes of one school to the experimental (E) group and intact classes of one other school to the control (C) group. This did not disrupt the school timetable and lessons. The research design is symbolically represented as shown below;

$$\frac{E:=M_B X_1 X M_A}{C:=M_B X_2 M}$$

Where E -- Experimental group

C -- Control group

$M_B$ ---- Measurement before treatment

$M_A$ ---- Measurement after treatment

$X_1$---- English/Ebira as the language of instruction

$X_2$ ---- English only, as the language of instruction

_____ ____ indicates that there are two groups (experimental and control) which are not equivalent before treatment.


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The research instruments for this study were of two types. The first instrument, the mathematics achievement test (MAT), was a twenty (20) multiple-choice objective question on algebra, word problems and fractions. The second instrument, the mathematics terms achievement test (MTAT), was also a twenty (20) multiple-choice test. There are four response options A, B, C, and D in the instruments. The answers were distributed among the alphabets to make sure the answers do not have the same letters. The first instrument was administered to the entire student prior to the treatment (PRE-TEST). Thereafter, the item in the PRE-TEST was reshuffled to make them appear new at a glance. The reshuffled POST-TEST was administered to all the students concerned at the end of the treatment. The second instrument, MTAT, was administered a week after the POST-TEST.

Bamikole, (2019) sees the validity of the research instrument as an evaluative judgment about an assessment and defined the validity of an instrument as the degree to which the measuring instruments used in the data collection actually serve the purpose intended. To ensure the validity of the instruments, a copy of the MAT and also of the MTAT was given to the project supervisor for moderation, correction and validation.

The MAT was first administered to the entire research group prior to the treatment (PRE-TEST). This exercise provided baseline data that was used to compare the subjects in both groups. The experimental group was then taught using both English and Ebira as the language of instruction. Also, the control group was taught using only English as the language of instruction. This treatment lasted for two weeks. Thereafter, the items in the PRE-TEST were reshuffled to make them appear different at a glance. The reshuffled POST-TEST was administered to all the students at the end of the treatment. Two classes (JSS2A and JSS2B) were used in one school as the control group while two classes (JSS2A and JSS2B) were also used in the other school as the experimental group. After the second week, the POST-TEST was administered to the two groups. A week after the treatment, the MTAT was administered to the two groups. The MTAT has different content.

The data generated from the study were analyzed using various statistics such as mean and standard deviation. The research questions were answered using a mean and standard deviation of test scores. The hypotheses were tested at a 0.05% level of significance using ANOVA.

## RESULTS AND DISCUSSION

**Research Question One.** What is the difference in the mean achievement scores of students taught mathematics in English/Ebira language and those taught in English language only?

**Table 1: Mean Achievement Scores Of Experimental Group And Control Group In Pre-Test And Post-Test**

| Group | | Pre-Test Scores | | Post-Test Scores | |
|---|---|---|---|---|---|
| | Number of Students | Mean | Standard Deviation | Mean | Standard Deviation |
| Experimental | 40 | 8.55 | 2.28 | 11.05 | 2.66 |
| Control | 40 | 8.13 | 2.38 | 9.53 | 2.84 |


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From Table 1, the PRE-TEST mean score of the experimental group was 8.55 and standard deviation of 2.28, while that of the control group was 8.13 and 2.38 respectively. This implies that both groups were almost of equal ability at the beginning of the experiment. However, in the POST-TEST, the experimental group had a mean of 11.05 and a standard deviation of 2.66 while the control group had a mean of 9.53 and a standard deviation of 2.84. This implies that the language of instruction has an effect on the experimental group.

**Hypothesis One.** There is no significant difference between the mean mathematics achievement scores of the students in the experimental group and the control group.

**Table 2: Anova Analyses Of The Students' Achievement Scores.**

| Source Of Variance | Sum Of Squares | Df | Mean Square | F | $F^{cv}$ |
|---|---|---|---|---|---|
| Between | 46.51 | 1 | 46.51 | 6.001 | 3.962 |
| Within | 604.88 | 78 | 7.75 | | |
| Total | 651.39 | 79 | | | |

Table 2 shows that the F-value is 6.001. Since the F-value is greater than the $F^{CV}$(Critical value) (i.e. F-value $>F^{CV}= 6.001>3.962$), the hypothesis is therefore rejected. This implies that there is statistically significant evidence at 0.05 significant levels that there is a difference between the mean achievement scores of the experimental and control groups. Similarly, the sum of squares from between (46.51) when compared with the sum of squares arising from within (604.88) indicates that the observed difference in the achievement of the experimental and control group is due to the treatment administered in this experiment.

**Research Question Two.** What is the difference in the terminology achievement scores of students taught mathematics in English/Ebira language and those taught in English language only?

**Table 3: Students' Mean Terminology Achievement Scores And Standard Deviation Scores In Mathematics Of Experimental And Control Groups**

| Group | | Pre-Test Scores | | Post-Test Scores | |
|---|---|---|---|---|---|
| | Number of Students | Mean | Standard Deviation | Mean | Standard Deviation |
| Experimental | 40 | 8.55 | 2.28 | 12.1 | 2.79 |
| Control | 40 | 8.13 | 2.38 | 10.33 | 4.15 |

Table 3, shows that the experimental group had a mean score of 8.55 and a standard deviation of 2.28 in the PRE-TEST while the control group had a mean score of 8.13 and standard deviation of 2.38. The experimental group had a mean score of 12.1 and a standard deviation of 2.79, while the group had a mean score of 10.33 and a standard deviation of 4.15 in the mathematical terms achievement test. This implies that the experimental group gained higher than the control group in the MTAT. It is, therefore, profitable that students taught using both English and Ebira language achieve more terms in mathematics than those taught using the


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English language only. A higher MTAT score and a low standard deviation by the experimental group show that most members of the experimental group gain more mastery in mathematical terms by the use of both English and Ebira as the language of instruction.

**Hypothesis Two.** There is no significant difference between the mean terminology achievement scores of the students in the experimental group and the control group.

**Table 4: Anova Analysis Of Students' Terminology Achievement Scores**

| Source of Variance | Sum of squares | Df | Mean square | F | $F^{cv}$ |
|---|---|---|---|---|---|
| Between | 63.01 | 1 | 63.01 | 4.91 | 3.962 |
| Within | 1001.38 | 78 | 12.84 | | |
| Total | 1064.39 | 79 | | | |

From table 4, the ANOVA analyses terminology achievement score shows that the F-value is 4.91. Since the F-value is greater than the $F^{CV}$(Critical value) (i.e. F-value $>F^{CV} = 4.91 > 3.962$), the hypothesis is, therefore, rejected. This implies that there is statistically significant evidence of 0.05 significant levels to show that there is a difference between the mean terminology achievement scores of the experimental and control groups. Similarly, the sum of squares arising from between (63.01) when compared with the sum of squares arising from within (1001.38) indicates that the observed difference in the terminology achievement of the experimental and control groups is due to the treatment administered in the experiment.

## DISCUSSION

The Analysis of Variance (ANOVA) presented in Table 1, confirmed that there is a significant difference between the mean achievement scores of students taught using both English and Ebira language and those taught using the English language only. The significant difference is attributed to the treatment. This finding indicates that using both English and Ebira as the language of instruction has positive effects on students' performance in mathematics. Both groups (control and experimental) were taught the same concepts and tested with the same test items but the experimental group significantly performed better than the control group. This result is in conformity with the findings of Dauda, (2015). They found that language is crucial not only for the purpose of communication but for the role it plays in the thinking process. Table 2 showed that the experimental group had higher mean scores than the control group. Table 3, confirms that there are significant differences in the terminology achievement scores of students taught mathematics using both English and Ebira language and those taught using English language only. This indicates that English/Ebira as a language of instruction is more effective than using English only as a language of instruction. This result shows that the students in the experimental group performed better in MAT due to their understanding of mathematics terminology.


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## CONCLUSION

Students understand better if teachers teach mathematical concepts in both the English language and the language of the environment. Presently, the Nigerian policy is in line with the finding of this study. However, from our experience in the school system, most of the teachers are still complying with the old policy which states that the language of the environment should be used only for the first three years of primary, after which English should be used. It is most probable that some of the teachers are not aware of the change in policy, which now allows the use of both English and the language of the environment for teaching right from the fourth year of primary school.

## RECOMMENDATIONS

1. Teachers should be encouraged to teach in both English and the language of the environment as it facilitates understanding of mathematical concepts and hence improve students' performance. The implication of this is that teachers should be able to teach mathematics in the language of the environment better.

2. Curriculum developers should take into consideration the language interference between English and the language of the environment in their planning for junior secondary school students.

3. Textbook writers should include materials in Mother Tongue or both mother tongue and English in texts since the policy says the language of the environment should be used in teaching mathematical concepts at the JSS level. Terms used in mathematics should be explained as much as possible to help students understand the concept better.

4. Indigenous language should be taught properly at all levels of the educational ladder both by utilizing the outcome of research with these languages and by ensuring adequate and suitable training for the teachers concerned.

5. Teaching mathematics strictly in English should be de-emphasis to enable the mathematics teachers to explain in the mother tongue whenever they are teaching.

## REFERENCES

Baiju, K. N. (2015). Theories of Language in Learning of Mathematics: Major Language Theorists influencing Learning of Mathematics.

Bamikole, G. I. (2019). Effect of Computer Animation Package (CAP) on the Performance of Senior Secondary School Students in Geometry in Ado-Ekiti Local Government Area, Ekiti State. . Unpublished Project, F.C.E. Okene, Kogi State, Nigeria.

Kaphesi, E. S. (2002). The use of language in mathematics teaching in primary schools in Malawi: bringing language to the surface as an explicit feature in the teaching of mathematics. PhD thesis, University of Nottingham.

Kolawole, E. B. (2013). Effect of Mother Tongue and Mathematical Language on Primary School Pupils Performance in Mathematics. *Abacus*, 38(1): 56 – 63.


Article DOI: 10.52589/BJCE-B4XQL7JV
DOI URL: https://doi.org/10.52589/BJCE-B4XQL7JV

Ngoma, H. N. (2013). Effect of Static and Non-static CAIs on Students' Achievement in Mathematics. *Maths Research Journal*, 3(16): 81 – 93. http://www.Africanquarters.org/journal.

Oginni, O. I. (2013). Effect of Mother Tongue and Mathematical Language on Primary School Pupils Performance in Mathematics. . *Abacus*, 38(1): 56 – 63.


Article DOI: 10.52589/BJCE-B4XQL7JV
DOI URL: https://doi.org/10.52589/BJCE-B4XQL7JV