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IMPROVING JUNIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN ALGEBRAIC WORD PROBLEMS USING IGBO LANGUAGE AS A MEDIUM OF INSTRUCTION IN ABIA STATE, NIGERIA

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Abstract

This study investigated,improving junior secondary School students' achievement in algebraic word problems using Igbo language as a medium of instruction in Abia State. Quasi- experimental design of pretest posttest control group type was adopted. Population of the study was 2,114 with sample size of 212 Junior Secondary One Students from four Secondary Schools, in Umuahia metropolis, Abia State. Two Secondary Schools were randomly assigned to the experimental and control groups, respectively. Two research questions and two null hypotheses guided this study. Instrument of the study, Algebraic Word Problem Achievement Test (AWPAT) was validated by experts and trial-tested usingKuder-Richardson formula K-$R_{20}$with a reliability coefficient of 0.81. Descriptive statistic of mean and standard deviation was used to answer all the research questions and inferential statistic (ANCOVA) was used to test all the research hypotheses. It was found that Junior Secondary one Students' interestin algebraic word problems improved when taught using Igbo language as medium of instruction. Also, there was no significant gender difference. Hence, the use of Igbo language as medium of instruction enhanced Junior Secondary One Students'Achievement in Algebrai c Word Problems irrespective of their gender. Recommendations such as school authorities should encourage their mathematics teachers to use students' first language as medium of instruction in teaching school mathematics at the lower level of education was made among others. Also, suggestion such asother researchers should be encouraged to replicate this research with other indigenous language of the learners was made.

Key words*: Achievement, Algebraic word problem, Igbo Language, Junior secondary school*

Introduction

Among the several branches of mathematics, the one that is mostly used for developing such as mathematics process skills namely, problems solving, communication, reasoning and making connections that are needed in the human daily living is algebra (NCTM, 2000). According to National Council of Teachers of Mathematics (NCTM, 1989) algebra is the language through which most of mathematics is communicated. It also provides a means of operating with concepts at an abstract level and then applying them, a process that often fosters generalizations and insights beyond the original context.

In recognition of the importance of algebra, the Nigerian government in 1984 selected some algebra topics that formed the further mathematics curriculum. This was aimed among others reasons to close the gap that was observed between General Mathematics and the mathematics taught at the tertiary institutions. Recently in 2007, algebraic processes have been enshrined in the Junior Secondary School level mathematics curriculum as a theme, while in the Senior Secondary School level mathematics curriculum introductory calculus, modular arithmetic, and logic among others were enshrined.

The reasons, for introducing these algebraic topics apart from pursuit of academic excellence, may also be for preparing the citizenry for today's scientific and technological

advancement which has become so demanding for people in problems-solving on daily basis. These reasons were supported by Erbas (2004) who stated that, without algebra, advancement into most areas of mathematics, and the study of otherdisciplines requiring mathematical abstraction and modeling are limited, if not impossible. Also, Education Alliance (2006) posits that, regardless of mathematics skills before high school, taking algebra in the middle school is strongly related to achievement gains in high school mathematics. Thus, knowledge of algebraic concepts and skills are considered as providing a foundation for developing higher-order thinking and problems solvingabilities in real life situations.

Despite the importance and effort on the teaching and learning of mathematics, it has not achieved the desired success yet. Furthermore, reports of students' achievement in secondary school mathematics especially at West African Examinations Council (WAEC) and General Certificate in Education (GCE) examinations results in the subject, in recent times, are not encouraging. Also, it has been observed over the past decade, students' achievement in mathematics has not been impressive (Obodo, 2004).

The low achievement of students in mathematics may be due to the abstract symbolism and the nature of mathematics language. Therefore, Haylock and Cockburn (2003) emphasizes that the following particular language difficulties inherent in mathematics are vocabulary, syntax, abstract and natural language, miscues in word problems, and the predominance of structure over content. The importance of language in learning mathematics cannot be overstated. One understands mathematical ideas by making connections between language, symbols, pictures and real-life situations. Mathematical concepts to be understood and used have to be associated with a word or a phrase.

In the same vein Perry and Dockett (2002)reported that without sufficient language to communicate the ideas being developed, children were at a loss to interact with their peers and teachers and eventually have their mathematical development seriously curtailed. As a result of the significance of language in learning mathematics, it is important that mathematics teachers be aware of the particular difficulties and complexities of the way language is used in this subject. This is to enable the mathematics teachers to develop different skills in teaching and learning, in order to enhance students' interest and greater achievement in mathematics.

Language and Students' Achievement in Algebra

Achievement refers to the students' present academic skills in Mathematics. Good (2003), define achievement as something important that you succeed in doing by your own efforts. To Central New Mexico (CNM, 2009), academic achievement is all about what students do when they have finished a course of study.

Zahn and Elliot (2008) define achievement motive as a disposition of individuals towards success or failure possibilities. This definition has identified two primary achievements which represent a desire to approach success, and fear of failure, which represent a desire to avoid failure. Hence, Lara-Cinisomo, Pebley, Vaiana, Maggio, Berends, and Lucas, (2004) have found that the most important factors associated with the educational achievement of children are not race, ethnicity, or immigrant status, instead, the most critical factors appear to be socio economic ones. These factors include parental education levels, neighbourhood poverty, parental occupational status, and family incomes. In the study of Mathematics achievement, the same Lara-Cinisomo et al, (2004) who did their study among national sample of high school students in 65 Los Angeles neighbourhoods found that

improved socio-economic conditions among blacks and Latinos correspond strongly to decrease in the mathematics test score-gaps – both between blacks and whites and between Latinos. They recommended that socio- income families and communities should be recognized also as educational policies on behalf of the children in their families and communities (Alfmio, 2007).

In the study conducted by Wushishi, Yusha'u, and Usman, (2013) on the effects of Computer Assisted Instruction in Nupe Language on Pupils' Achievement in Mathematics in Bida Metropolis of Niger State. Two research questions were asked and two research hypotheses were formulated.The researcher adopted quasi experimental design for the study. Primary two pupils of all the 53 primary schools in 14 wards of Bida Local Government Area constitute the population of the study with total population of 4,430 pupils. Hence, sample size of 202 primary two pupils were used for the study. This comprised 125 male and 77 female students sampled from four primary schools. Therefore, four separate intact classes were used; two for experimental groups and two for control groups. Also, two research instruments, the Primary School Mathematics Achievement Test (PSMAT) and Computer Assisted Instruction Package in Nupe Language (CAIPNL) were developed by the researchers with the assistance of a professional programme developer with mathematics orientation were used for the study. The PSMAT and CAIPNL were validated by a team of four experts two each from Federal University of Technology (FUT) Minna and UsmanuDanfodiyo University, Sokoto respectively. The reliability coefficient for the PSMAT was found to be 0.84 after using test retest method.

The results of Analysis of Variance (ANOVA) on the achievement of students taught Mathematics using computer assisted instruction in Nupe language indicates that there is no significant difference between the achievement of the experimental and control groups on pre-test. This showed that the pupils in the two groups had equivalent mathematics background as entry behavior. However, the finding indicated that there is significant difference in the academic achievement of pupils taught using Computer Assisted Instruction Package in Nupe Language and those taught using English Language. In other words there is significant difference in favour of those taught with CAIPNL.The findings of the study showed that Pupils taught mathematics with computer assisted instruction package in Nupe language performed better than those taught with conventional teaching method and also gender has effect on their mathematics achievement scores.

Umuahia is the capital of Abia State and also serve as headquarters of Umuahia Metropolis of Abia State. Umuahia was chosen because it is one of the Igbo speaking town. Umuahia Local Government Area is bounded in North East with Ibeku- UgbalaNkata, in the North West with Uzuakoli, in the West with Obowo and in the South with Awow.

Research Questions

1. What are the mean achievement scores ofJSS1 students taught algebraic word problems using Igbo language as medium of instruction and those taught using English language?
2. What are the mean achievement scores of male and female JSS1students taught Algebraic word problems using Igbo language as medium of instruction?
3.

Research Hypotheses

1. There is no significant difference between the mean achievement scores of JSS1 students taught algebraic word problems using IL as medium of instruction and those taught using English language.
2. There is no significant difference between the mean achievement scores of male and female students taught algebraic word problems using Igbo Language (IL) as medium of instruction.

Methodology

The study adopted a quasi – experimental design Precisely this study used non – randomized, pre-test, post-test control group design. Cohen and Manion (1989) described this type of research as non-equivalent control group design as both the experimental and control groups may not necessarily be equal in size and treatment.The subjects in the study were randomized into experimental and control groups but was left intact in order to avoid disrupting the school programmes, hence this type of design is called "compromise" design. The population of this study was 2,114 Junior Secondary One Students in 25 Secondary Schools in Umuahia Metropolis of Abia State. The sample size for this study was 212 students out of a total of 2,114 JSS1 students' in the Metropolis. This sample was obtained from four schools out of a total of 25 secondary schools in the study area through a multi-stage sampling technique. Among the four schools selected, two schools were further selected each and assigned to experimental (E=102) and control (C=110) groups respectively. By this arrangement, four classes from four schools were used for both experimental and control groups. Thus, the total for experimental group was102 students (male =65, female =37) and that of the control group was 110 students (male=60, female=50).The instrument used for the study was Algebraic Word Problems Achievement Test (AWPAT).AWPAT was a self structured test, the test items covered Algebraic Word Problems topics that was taught during the period of this study.

The Algebraic word problems test was administered twice, before (pre) and after (post) the experiment. Therefore, there was pre- Algebraic word problems test and post-Algebraic word problems test. The pre- Algebraic word problems test was used to ascertain the level of Algebraic word problems Achievement at which the students were, before the treatment. While the post-Algebraic word problems test was used to ascertain the level of Algebraic word problems Achievement in the students after the experiment. The Algebraic word Problems Achievement Test has four options in which students choose one: A, B, C or D.

The Algebraic Word Problems Achievement Test consists of thirty items comprising of twenty lower order questions (questions that test students' ability on knowledge, comprehension and application) and ten higher order questions (questions that test students' ability on analysis, synthesis and evaluation). These items were developed in accordance with the instructional objectives as contained in the JSS one textbook written by the Mathematics Association of Nigeria (2012). Algebraic Word Problems Achievement Test covered the units that were taught during the experiment. This reflects the six level of cognitive domain Bloom, Englehart, Furst, Hill and Krathwohl (1956).

Data collected was subjected to both descriptive and inferential statistics. Research questions were answered using mean and standard deviation. Research hypotheses were tested using Analysis of Covariance (ANCOVA) at 0.05 level ofsignificance.

Results

The results are presented according to research questions asked and hypotheses formulated.

Table 1: Mean Achievement Scores and Standard Deviations of Jss1 Students Taught Algebraic Word Problems Using Igbo Language and English Language

Group	Number of students	Pre-test Mean	SD	Post-test Mean	SD
Experiment	102	22.40	2.21	42.30	3.04
Control	110	22.73	3.18	32.20	4.30
Mean Diff		**0.33**		**10.10**	
Total	**212**				

Table 1 indicates that the JSS1 students taught algebraic word problems using Igbo language as treatment grouphad a pre-test achievement mean scores of 22.40 with a standard deviation of 2.21 and post – test achievement mean scores of 42.30 with a standard deviation of 3.04, while the JSS1 students taught algebraic word problems using English language as control group had a pretest achievement mean scores of 22.73 with a standard deviation of 3.18 and post-test achievement mean score of 32.20 with a standard deviation of 4.30. Their mean differences are 0.33 and 10.10 for pre and post in the experimented and control groups respectively.

Table 2: Mean Achievement Scores and Standard Deviations of Male and Female Jss1 Students Taught Algebraic Word Problems Using Igbo Language

Group	**Number of students**	**Pre-test Mean**	**SD**	**Post-test Mean**	**SD**
Experiment M	65	27.72	4.30	41.09	1.39
Experiment F	37	28.07	2.72	39.29	3.22
Mean Diff		**0.35**		**1.80**	
Total	**102**				

From Table 2 it could be observed that JSS1 male students taught algebraic word problems using Igbo language as treatment grouphad a pre-test mean achievement score of 27.72 with a standard deviation of 4.30 and post – test mean achievement score of 41.09 with a standard deviation of 1.39, while the JSS1 female students taught algebraic word problems using Igbo language had a pretest mean achievement score of 28.04 with a standard deviation of 2.72 and post-test mean achievement score of 39.29 with a standard deviation of 3.22. Table 4 also shows that in pre-AWPAT, the difference in the mean achievement scores of the male and female students was 0.35, while that of post-AWPAT was 1.80.

Hypothesis 1

Table 3: Analysis of Covariance (ANCOVA) Result of Jss1 Students Achievement Score Taught Algebraic Word Problems (AWP) Using Igbo Language Approach and English Language

Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Corrected Model	172.527[a]	4	43.132	10.890	.000
Intercept	469.830	1	469.830	118.614	.000
Pretest achievement	46.214	1	46.214	11.667	.000
Igbo Language	128.970	1	128.970	32.560	.000
Error	827.909	209	3.961		
Total	14636.000	212			
Corrected Total	1000.436	211			

From Table 3, the test shows that F(1,209) = 32.560 at 0.05, level of significance P= 0.000, P<0.05. Thus the difference in mean achievement scores of students taught algebraic word problems using Igbo language and those taught using English language is statistically significant. The result is an indication that students taught algebraic word problems using Igbo language improved in their achievement score more than those taught algebraic word problems using English language. Thus, the null hypothesis of no significant differenceis rejected.

Hypothesis 2

Table 4: Analysis of Covariance (ANCOVA) Result of Male And Female Jss1 Students Achievement Score Taught (AWP) Using Igbo Language Approach

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	274.000[a]	2	24.909	11.500	.126
Intercept	69.363	1	69.363	32.024	.037
Pretest achievement	11.447	1	11.447	5.285	.369
Gender	269.221	1	269.221	124.294	.103
Error	214.428	99	2.166		
Total	6260.000	102			
Corrected Total	488.429	101			

From Table 4, the test shows that F(1,99) = 124.294 at 0.05, level of significance P= 0.103, P>0.05.Therefore, the null hypothesis of no significance is not rejected. Thus, there is no statistically significant difference between mean achievement scores of male and female students taught algebraic word problems using Igbo language approach as measured in algebraic word problems achievement test.It implies that both male and female students improved in their achievement during the study.

Recommendations

Based on the findings of the study the following recommendations were made:

1. Mathematics teachers should be exposed to workshop /seminars on how to indigenous language to effectively and efficiently teach Mathematics pupils.
2. The Federal Ministry of Education and stakeholders in education should organize workshops; seminars and conferences where mathematics teachers could fully explore the use of mother tongue and integrate it into the teaching/learning process at the basic education.

Conclusion

It could be concluded in this study that Igbo language as medium of instruction in teaching/learning approach significantly enhanced students' achievement in algebraic word problems irrespective of gender. This implies that if mathematics teachers' use students' indigenous language as medium of instruction in teaching approach, which is found to have enhanced students' achievement, the problem of low achievement in mathematics at the lower, middle, upper basic and eventually the senior secondary school level may become a thing of the past. Similarly, the gender gap created by continued use of unfavourable teaching

strategy in algebraic word problems could also be bridged withindigenous language approach.

References

Alfmio, F. (2007). Examining Disparities in Mathematics Education: Achievement Gap or Opportunity Gap.*The High School Journal*, 29-42

Central New Mexico (2009).*http://catalog.cnm.edu/mime/media/12/1285/CNM+Course+Catalog+2009-11.pdf*

Cohen, L. and Manion, L. (1989) Research Methods in Education.3rd ..edn. London: Routledge

Education Alliance (2006).Closing the achievment gap: best practices in teachingmathematics.Retrieved on Jan. 5th, 2014. From www.educationalliance.org

Erbas, A. K. (2004). Teachers' knowledge of student thinking and their instructional practices in algebra. Retrieved on january,5th 2014: Fromhttp://jwilson.coe.uga.edu/pers/erbas_ayhan_k_200408_phd.pdf

Good, N. (2003). Sputnick and science education.A paper presentation at a symposium hosted by the Center for Science, Mathematics and Engineering Education.

Haylock, D. & Cockburn A. D. (2003).Understanding Mathematics in the Lower Primary Years*: A Guide for Teachers of Children*SAGE Publisher,pp. 3 – 8

Lara-Cinisomo, S., Pebley, A.R. Vaiana, M.E., Maggio, E. Berends, M. & Lucas, S. (2004). A Matter of Class: Educational Achievement Reflects Family Background more than Ethnicity or Immigration. RAND Corporation: Santa Monica, Ca.

National Council of Teachers of Mathematics (1989).*Curriculum and Evaluation Standards for School Mathematics*

NCTM (National Council of Teachers of Mathematics).(2000). Principles and standards for school mathematics. Reston, VA: NCTM.

Obodo, G.C. (2004). Principles and Practice of mathematics education in Nigeria. Enugu: Floxtone Press

Perry, Bob, &Dockett, Sue.(2002). Young children's access to powerful mathematical ideas. In Lyn D. English (Ed.), ***Handbook of international research in mathematics education: Directions for the 21st century***(pp. 81-111). Mahwah, NJ: Erlbaum.

Wushishi1., D. I, Yusha'u, M. A &Usman, H (2013). Effects of Computer Assisted Instruction in Nupe Language on Pupils' Achievement in Mathematics in Bida Local Government Area of Niger State, Nigeria: Journal of Research & Method in Education. Pp 23-29 *www.iosrjournals.org*

Zahn, I., & Elliot, A. (2008). Implicit theories and IQ Test performance: A sequential mediational analysis. *Journal of Experimental Social Psychology*, 44, 783 – 791.