

EFFECTS OF GAME AND POEM ENHANCED INSTRUCTION ON PUPILS' ACHIEVEMENT IN MATHEMATICS

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ABSTRACT

The study investigated the effects of game and poem enhanced instruction on pupils' achievement in mathematics. A total of 344 pupils from twelve (12) public primary schools of Ogbia and Yenagoa Local Government Areas of Bayelsa State, Nigeria were involved in the study. A pretest-posttest control group quasi-experimental design was adopted in the research. The moderating effects of gender were also examined on the independent and dependent variables. Using ANCOVA statistics, the results revealed that pupils exposed to game and poem enhanced instruction have better mean achievement score than the control groups. Game was found to be more effective in improving pupils' achievement in mathematics than poem and a significant difference existed between the mean achievement scores of male and female pupils in mathematics. The male pupils performed significantly better than the female pupils. There was no significant interaction effect of gender on pupils' achievement in mathematics. The implication of the findings was discussed and appropriate recommendations were made.

Key Words: Game, Poem, Pupils, Mathematics Achievement

INTRODUCTION

Primary school education as referred to in the National Policy on Education [1] is the education given in institutions for children aged six to eleven plus. The Federal Government of Nigeria stated and clarified the objectives of primary education in the National Policy on Education [1] as:

1. Inculcating permanent literacy and numeracy, and the ability to communicate effectively;
2. Laying a sound basis for scientific and reflective thinking;
3. Giving citizenship education as a basis for effective participation in and contribution to the life of the society.

The first of these objectives is the inculcation of permanent numeracy which stresses the need for every child to be mathematically literate at the primary school level [2]. The National Policy on Education [1] states that, the mathematical development of the child cannot be ignored at the primary school level. In line with this recognition, if Mathematics is properly taught at the primary school level, the result will be improved achievement in other levels of education [3]. [4] gives a more clear reason to this position by stating that the mathematics curricula is sequential and spiral in nature. This implies that understanding mathematics at the primary school level will enhance improved achievement in other levels of education.

A study carried out by [5] finds that primary education has significant impact on the Nigeria social, economic and political development. The study also finds that, primary education is perceived as having significant impact on the attainment of the Nigeria vision 20:2020. The study also concludes that the lingering problems of under achievement in secondary and tertiary institutions in the country are traceable to the poor and shaky foundation laid at the primary school level. Thus, improving the teaching and learning of Mathematics at the primary school level becomes imperative. This is the major reason why the researcher is motivated to carry out this study at the primary school level.

Mathematics plays a vital role to the achievement of the primary school objectives; to science and technology and science related disciplines; for it is the language used in expressing them. Ukeje in [6] states that, without Mathematics there is no science, without science there is no modern technology and without modern technology there is no modern society. Also, Mathematics is a core and compulsory school subject in the curricula from Primary through the Junior Secondary to the Senior Secondary School levels of the Nigeria Educational System [7, 6, 8].

Mathematics is an important school subject and in every activity of man. It is expected that students' achievement at all levels would be good. However, [9] describes the state of mathematics education in Nigeria as depressed; implying that students' achievement in mathematics both at the primary, junior and senior secondary and tertiary levels are poor. Also, [10] note that academic achievement of students in mathematics education is still deplorably low, both in certificate and non-certificate examinations. For example, poor achievement of pupils in Mathematics in both internal and external examinations was reported by [11]. Also, [8] express dismay in marking the pupils' scripts during Common Entrance Examination and Primary School Mathematics Olympiad because of the poor achievement of pupils' in mathematics in these examinations.

Recent research findings in Nigeria have shown that the performance of pupils in primary mathematics is below average and also that the problem solving skills of the pupils is poor. In the report of Nigeria Education Sector Analysis [12], the national mean percent scores of primary four and six pupils in numeracy are 33.7 and 35.7 respectively. Table 1.1 below presents the detailed information about the performance of the pupils across the nation.

Table 1: Performance in Numeracy Test by States (Including Abuja) and Class

S/N	STATE	PRY IV	PRY VI	S/N	STATE	PRY IV	PRY VI
1	ABIA	27.63	-	20	KANO	36.51	35.71
2	ABUJA	28.33	37.67	21	KASTINA	29.85	27.64
3	ADAMAWA	22.93	27.32	22	KEBBI	41.43	45.54
4	AKIWABOM	28.29	27.7	23	KOGI	32.2	36.55
5	ANAMBRA	31.04	39.24	24	KWARA	32.59	-
6	BAUCHI	45.5	35.33	25	LAGOS	32.54	37.76
7	BAYELSA	22.61	43.12	26	NASARAWA	25.4	25.39
8	BENUE	40.78	54.82	27	NIGER	32.65	31.57
9	BORNO	19.32	20.85	28	OGUN	49.27	46.51
10	C/RIVER	34.4	31.42	29	ONDO	35.03	33.09
11	DELTA	30.46	22.48	30	OSUN	32.4	28.96
12	EBONYI	20.21	22.48	31	OYO	36.41	41.65
13	EDO	33.64	28.64	32	PLATEAU	29.11	29.24
14	EKITI	35.63	39.67	33	RIVERS	-	27.78
15	ENUGU	48.8	38.72	34	SOKOTO	27.77	30.91
16	GOMBE	36.71	34.68	35	TARABA	45.15	44.73
17	IMO	26.32	30.58	36	YOBE	39.28	40.67
18	JIGAWA	46.35	45.07	37	ZAMFARA	33.17	34.35
19	KADUNA	47.75	48.31				

SOURCE: Nigeria Education Sector Analysis (ESA, 2004)

Table 1.1 shows that primary 4 pupils in Ogun State had the highest mean percent score of 49.27 while pupils in Borno State had the lowest mean percent score of 19.32, primary 6 pupils in Benue State had the highest mean percent score of 54.82 while primary 6 pupils in Delta and Ebonyi States had the lowest mean percent score of 22.48. Again, the final report by the National Assessment of Universal Basic Education Programme [13] shows that the national mean score for primary six pupils in mathematics is 42.87. Also in Bayelsa State, primary 4 and 6 pupils had 22.61 and 43.12 mean percent score respectively which clearly shows that neither State nor the national mean score is up to credit level in primary mathematics.

The problems of students' poor achievement in mathematics in both internal and external examinations have been reported by mathematics educators, mathematicians and associations. For example, students have great difficulty in understanding, comprehending, and assimilating mathematics taught to them in the classroom [14]. So they resort to learning by rote memorization, resulting to consistent mass failure of students. Uwadia in [15] reports of inadequate coverage of syllabus, inadequate facilities for teaching, students' poor attitude to study, heavy workload on teachers as causes of poor achievement in mathematics. The comment on the results of 2006 Common Entrance Examination, the Chief Examiner noted in [16] that majority of public primary school pupils did not do well because they could not simply make out anything from what teachers teach because of their inability to understand the language of instruction. Alio in [3] reports teachers' strategy of presenting problem solving as contributing factor to high failure rate in Mathematics. Many studies have identified the teaching problem mainly on the teachers' strategy of teaching as the major factor contributing to poor achievement of students in Mathematics [17, 18, 19, 20, 21, 22, 23, 24, and 25]

As an example, the lecture strategy pays more attention to teachers, is boring for students and diminishes students' interest in mathematics because the students' only job in the classroom is to passively sit and watch the teacher work mathematics problems on the board and then copy what the teacher did [26]. It then, becomes fitting to describe the traditional strategy of teaching mathematics as one that does not sustain the development of pupils' interest in mathematics [27] and poorly develops learners' cognitive, psychomotor and affective structures [4].

Effective activities recommended for the primary school level include the use of games to enhance greater understanding of concepts [28, 29], creating a creative corner for less capable pupils in Mathematics who may be good in art or writing which include activities such as poetry or stories about mathematical situations and geometric drawings [30, 31]. Also, [32] recommends to teachers to exhibit poems at the primary school level. Ohuche [33] suggests providing adequate opportunities for manipulation of materials accompanied by verbalization of materials as well as conceptualization by means of discovery. Hence, the study determines the effects of poems and games enhanced mathematics instruction at the primary school level.

Poetry has vital roles to play in children learning. It is used an advance organizer which is based on Ausubel verbal meaningful learning (34). The use of poems involves the construction of images for appreciating mathematics. Again, the poems are verbal presentation of the mathematics concepts to be learned. Furthermore, verbal meaningful learning involves speech, reading and writing (Cooper, 35). The use of poetry in teaching involves these key aspects of learning.

Poetry offer mathematics students new means to explore the recondite realm of abstract mathematical concepts, improving cognitive understanding and confidence [36]. Mathematics is not just all about calculations; it is beyond calculation [37]. 'There is a great and growing body of linguistic and visual metaphors that constitute a healthy understanding of mathematics in which things called fields, rings, bundles and flows play dominant roles; mastery of these concepts often involves creativity more readily expected of a poet than of a scientist' [36, p.76]. Bahls [36] also states that students' cognitive understanding of mathematical terminology and symbolism, and confidence in carrying out computation and other mathematical task are key coordinates of success in learning mathematics [36]. He went further to say that by using poetical metaphors students become more aware of these and other mathematical metaphors and thereby gain deeper understanding to mathematical concepts those metaphors describe. This new form of mathematical cognition is made possible through poetry.

The other activity that can be used to enhance mathematics instruction is the use of games based on operant conditioning theory which examines the stimulus, the response to the stimulus (a behavior) and the behavior's consequence (Skinner,38). The games played are guided by rules. Whenever a pupil plays the game correctly or wrongly, that child is immediately rewarded or punished depending on the rule of the game like the rat in Skinner's box. This leads to behavior modification.

A game is a type of play that follows a set of rules, aims at a definite goal or outcome and involves competition against other players or against barriers imposed by nature of the game [29]. Game plays vital roles in mathematics instruction. The use of games in teaching mathematics makes students to be actively involved in the daily lessons since they are interested in learning mathematics as game [7]. Games relaxes tension, clear boredom and foster environment where teaching and learning are pleasant, interesting, exciting, stimulating, motivating and at the same time academically rewarding [4]. Azuka [39] also opines that games provide unique opportunity for integrating the cognitive, affective, and social aspects of learning.

*The effect of gender on learning outcomes of mathematics and science related subjects are still a major controversy among educators. This may be as a result of conflicting results from such gender- related studies. Some research results find significant differences in favour of boys, while a few in favour of girls and others are neutral [40]; [41]; [42]; [44] and [45] respectively. This inconsistency in the test achievement of boys and girls need to be further investigated in the use of poems and games to enhance mathematics instruction at the primary school level in this study.

Statement of the Problem

Mathematics plays a significant role virtually in all activities of man, especially in this modern age of science and technology. Its demand is therefore at a premium position. Yet students' achievement in mathematics at all levels of education is poor. Available literature shows that students' poor achievement in mathematics is due to a number of factors, especially on the strategies used for teaching mathematics. The lecture strategy which is predominantly used by the teachers may have contributed too many problems and under achievement in mathematics at various levels of education. Thus, the use of appropriate instructional activities to enhance mathematics instruction in the classroom and promote achievement in mathematics in the primary school level becomes necessary. Therefore, this study determines the effects of poems and games enhanced mathematics instruction on pupils' achievement in mathematics. The study further seeks to determine the moderating effects of gender on the dependent variable

Hypotheses

The following three null hypotheses were tested at 0.05 significant levels.

H₀₁ There is no significant main effect of treatment on pupils' achievement in mathematics

H₀₂ There is no significant main effect of gender on pupils' achievement in mathematics

H₀₃ There is no significant interaction effect of treatment and gender on pupils' achievement in mathematics

Scope of the Study

The study covers primary six pupils in twelve primary schools from Ogbia and Yenagoa Local Government Areas of Bayelsa State. The study investigates the effects of poem and game enhanced mathematics instruction on pupils' interest in Mathematics. It also determines the moderating effects of gender on the dependent variable. The concepts selected for the experiment includes fraction and decimal (Addition, subtraction, multiplication and division), volume, capacity, weight, 2 and 3- dimensional geometry and word problems. These are perceived difficult topics and areas in the primary mathematics curriculum and listed for primary six pupils in the curriculum.

METHODOLOGY

Research Design

This study adopted a pretest-posttest, control group quasi-experimental design. The design is schematically represented as:

E ₁ :	0 ₁	X ₁	0 ₂
E ₂ :	0 ₃	X ₂	0 ₄
C:	0 ₅	X ₃	0 ₆

Where:

0₁, 0₃, 0₅ represents pretest observations for both experimental and control groups.

0₂, 0₄, 0₆ represents posttest observations for both experimental and control groups.

X₁ represents treatment 1; poems enhanced instruction.

X₂ represents treatment 2; games enhanced instruction.

X₃ represents the modified lecture instruction.

Selection of Participants

Two Local Government Areas in Bayelsa State and six schools in each Local Government Areas were purposively selected and assigned for treatment and control groups in this study. The selection of the Local Government Areas was based on the following criteria:

- (i) The Local Government Areas must have roadways because of the State's terrain (rivers)
- (ii) The Local Government Areas must have at least six (6) public primary schools that have roadways.

The selection of the schools were based on the following criteria: (i) the schools must be public schools (ii) the schools must have experienced teachers who possess teaching qualification and have been teaching mathematics for not less than five years (iii) the teachers must be willing to be involved in the experiment.

Six (6) schools were randomly selected from each Local Government Area; that is a total of twelve (12) schools were used for the study. One intact class of primary six (6) pupils was randomly selected and four (4) schools were assigned to treatment while two (2) schools for control groups for the study. A total of 344 pupils (males=164, females=180) were used.

Research Instruments

Four instruments were used in the study. They are:

1. Instructional Guide on Poems Enhanced Instruction (IGPEI).
2. Instructional Guide on Games Enhanced Instruction (IGGEI).
3. Instructional Guide on Modified Lecture Instruction (IGMLI).
4. Pupils' Mathematics Achievement Test (PMAT).

Teachers' Instructional Guides

Instructional Guide on Poems Enhanced Instruction (IGPEI).

The main features of the guide are general information which consists of subject, topic, and class. It also consists of the procedure, general objectives, teacher's activities, pupils' activities, materials (poems' manuals), pupils' evaluation guide and contents to be taught for eight weeks.

The instructional guide (IGPEI) was given to experienced mathematics teachers teaching primary six (6) classes, University lecturers in Teacher Education, Science/Mathematics unit and English language unit, University of Ibadan to examine its content and face validity. The appropriateness of the language used and images created in the poems to the age of the learners were also examined. The recommendations given were used to reconstruct the guide.

Instructional Guide on Games Enhanced Instruction (IGGEI).

The main features of the guide are general information which consists of subject, topic, and class. It also consists of the procedure, general objectives, teacher's activities, pupils' activities, and materials for the games, pupils' evaluation guide and title, objectives of the game, procedure, rules, and follow-up activities.

The instructional guide on IGGEI was given to experienced mathematics teachers in primary school that are teaching primary six (6), University lecturers in Teacher Education, Science/ Mathematics unit, University of Ibadan to examine its content and face validity. The validity of IGGEI was further ensured according to Pulos and Sneider, [46] model for game development and validation in terms of suitability, appropriateness, clarity of ideas, class level, scope and relevance to the study through two experts in the area of Educational Technology, Faculty of Education, University of Ibadan and Niger Delta University, Nigeria respectively for scrutiny and amendments. The games also passed through the supervisor of this study for necessary corrections.

Table 2: Guidelines for Games Model Validation

Contents	4	3	2	1	0
Relevant to learner's needs and ability					
Relevance of the objectives of the game					
Appropriateness of materials used					
Relevance of the game for the task to be learnt					
Attractive and sturdy					
Clarity of game					
Image familiar with the learner					
Balance ease, enjoyable with challenge					
Appropriate to the age of learners					
Learner's skill development					
Total					

Instructional Guide on Modified Lecture Instruction (IGMLI)

This guide allowed some measure of interaction of pupils with teacher and materials without the poems and games. The main features of the guide are general information which consists of subject, topic, procedure, general objectives, teacher's activities, and pupils' activities, contents for each week and pupils evaluation guide. The instructional guide (IGMLI) was given to experienced mathematics teachers that are teaching primary six (6) for review and all their suggestions were considered in the guide.

Pupils' Mathematics Achievement Test (PMAT)

The PMAT is a twenty five item multiple choice test with four options A- D adapted from various primary six pupils' mathematics texts to measure pupils' cognitive achievement in mathematics. Section A contained the demographic data of the pupils and section B consists of twenty five multiple choice items. The test items focused on the first three levels of cognitive domain: knowledge, understanding, and thinking as categorized by Okpala, Onocha and Oyedeji in [28]. The table of specification for the construction of PMAT is shown below.

Table 3: Table of Specification of Pupils' Mathematics Achievement Test (PMAT)

Topic	Knowledge	Understanding	Thinking	Total
Fraction and Decimal (Addition, subtraction, multiplication and division)	1	2, 3, 4	16, 17,18	7
Volume(cylinder, triangular prism and sphere		10, 11, 20, 21	22	5
Capacity		5	9, 19	3

Weight	7	8	6	3
2and3 dimensional geometry	12,13,14,23,24,25	15		7
Total	8	10	7	25

The initial 50 items were reduced to 39 items by experts and were administered to one hundred (100) primary six (6) pupils that were not involved in the real study to determine the discriminating indices for each item and difficulty levels were computed manually by the researcher. The result of the analysis was used to pick twenty five (25) items that were neither too difficult nor too easy and this was between 0.4 and 0.6. The twenty five (25) items were then re-administered to fifty (50) pupils and a reliability coefficient of 0.72 was obtained using Kuder – Richardson formula 21 (KR-21)

Research procedure

The first week was used for the selection of eligible schools, permission from the school authorities and random assignment of schools into experimental and control groups. Two weeks for training of teachers with the instructional guides (IGPEI, IGGEI and IGMLI). A week was used for the administration of the pretest. Eight weeks were used for the treatment of experimental and control groups PEI, GEI and MLI respectively. A week was used for the administration of posttest by the researcher and research assistants. Lesson plans were provided for each experimental and control groups.

Method of Data Analysis

Data collected was analyzed using Analysis of Covariance (ANCOVA). This was used to test the hypotheses using pre-test scores as covariates. Also, the Multiple Classification Analysis (MCA) aspect of the ANCOVA was used to determine the magnitude of performance of the various groups. Scheffe's post-hoc test was also used when significant differences were observed to show the pairs of groups that were significantly different.

RESULTS

HO₁: There is no significant main effect of treatment on pupils' achievement in mathematics.

Table 4: One way analysis of covariance (ANCOVA) of post-test scores of pupils' achievement in mathematics with treatment using pre-test scores as covariates.

Source of variation	Sum of squares	Df	Mean square	F	Sig.	Decision at p < .05
Covariate pre-test	3672.575	1	3672.575	1573.807	0.000	
Main effects	1388.654	2	697.327	297.540	0.000	*
Model	5061.229	3	1687.076	722.962	0.000	
Residual	793.411	340	2.334			
Total	5854.640	343	17.069			

* = Significant at 0.05 alpha level; critical F_{2, 340} = 3.04, N = 344.

The data presented in Table 4 indicates that the main effect is significant at F_{2, 340} = 297.540; p < 0.05. Therefore, the null hypothesis which states that there is no significant main effect of treatment on pupils' achievement in mathematics is rejected.

Consequent upon the observed main effect, multiple classification analysis (MCA) was carried out to determine the index of relationship and also to determine the variance of the dependent variable (Pupils' achievement in mathematics) that is attributable to the influence of the independent variable (treatment) as shows in Table 5.

Table 5: Multiple classification analysis (MCA) of the post-test scores of pupils' achievement in mathematics by treatment (instructional strategies).

Grand mean = 15.60	N	Unadjusted	Adjusted for independent variables and covariates		
Variables + Category		Dev'n	Eta	Dev'n	Beta
Treatment (instructional methods)			0.399		0.490
Game enhanced instruction (GEI)	116	1.566		1.872	
Poem enhanced instruction (PEI)	128	0.526		0.694	
Modified lecture instruction (MLI)	100	-2.479		-3.060	
Multiple R = .930					
Multiple R-squared = .864					

The data in Table 5 also shows that the deviation of the adjusted post-test scores from the grand mean of 15.60 is 1.872 for pupils' exposed to (GEI). The deviation of the adjusted post-tests scores from the grand mean of 15.60 is 0.694 for pupils' exposed to (PEI), while the deviation of the adjusted post-tests scores from the grand mean of 15.60 is -3.060 for pupils' exposed to (MLI). This implies that pupils' exposed to (GEI) were significantly better than those exposed to both (PEI) and (MLI) in their achievement in mathematics. To determine the order of effectiveness of treatment and the direction of significance, the post-test scores were subjected to scheffe's multiple comparison test for post hoc analysis as observes in Table 6.

Table 6: Scheffe's post hoc pairwise comparison analysis of treatment and pupils' achievement in mathematics.

Treatment	N	Mean	GEI	PEI	MLI
GEI	116	17.16			*
PEI	128	16.12			*
MLI	100	13.12	*	*	

Data in Table 6 shows that pupils' exposed to GEI performed significantly better with a mean score of (17.16) than pupils' exposed to MLI with a mean score of (13.12). Also pupils' exposed to PEI were better than those exposed to MLI. However, there was no significant difference between those exposed to GEI and PEI. This further indicates that the significant difference shown by the ANCOVA analysis was as a result of the difference between GEI and MLI as well as that of PEI and MLI.

HO₂: There is no significant main effect of gender on pupils' achievement in mathematics.

Table 7: One way analysis of covariance (ANCOVA) of post-test scores of pupils' achievement in mathematics with gender using pre-test scores as covariates

Source of variation	Sum of squares	df	Mean square	F	Sig.	Decision at p < .05
Covariate pre-test	3672.575	1	3672.575	573.940	0.000	
Main effects	0.046	1	0.046	0.007	0.933	NS
Model	3672.620	2	1836.310	286.974	0.000	
Residual	2182.019	341	6.399			
Total	5854.640	343	17.069			

NS=Not Significant at 0.05 alpha level; critical F_{1, 341}=3.89, N=344

The data presented in Table 7 reveals that the main effect is not significant at F_{1, 341} = 0.007; p > 0.005. Hence, the null hypothesis which states that there is no significant main effect of gender on pupils' achievement in mathematics is retained. This implies that gender does not have main effect on the pupils' achievement in mathematics.

HO₃: There is no significant interaction effect of treatment and gender on pupils' achievement in mathematics.

Table 8: Two way analysis of covariance (ANCOVA) of post-test scores of pupils' achievement in mathematics with treatment and gender using pre-test scores as covariates

Source of variation	Sum of squares	df	Mean square	F	Sig.	Decision at p < .05
Covariate pre-test	3672.575	1	3672.575	1585.880	0.000	
Main effects(combined)	1390.990	3	463.663	200.218	0.000	
Treatment	1388.654	2	694.327	299.822	0.000	
Gender	2.336	1	2.336	1.009	0.316	
2-Way interactions treatment * gender	10.651	2	5.326	2.300	0.102	NS
Model	5074.216	6	845.703	365.189	0.000	
Residual	780.423	337	2.316			
Total	5854.640	343	17.069			

NS = Not Significant at 0.05 alpha level; critical F_{2, 337} = 3.04, N = 344.

The data presented in Table 8 indicates that the interaction effect is not significant at $F_{2, 337} = 2.300$; $p > 0.05$. Therefore, the null hypothesis which states that there is no significant interaction effect of treatment and gender on pupils' achievement in mathematics is retained. This implies that treatment and gender has no interaction effect on the pupils' achievement in mathematics.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

Discussion

Effect of Treatment on Pupils' Achievement in Mathematics

The findings from the study revealed that there is a significant main effect of treatment on pupils' achievement, knowledge of mathematics concepts and interest in mathematics. Pupils exposed to Game Enhanced Instruction (GEI) obtained the highest mean score, followed by pupils exposed to Poem Enhanced Instruction (PEI) while the pupils exposed to Modified Lecture Instruction (MLI) had the least mean achievement score. This shows that the GEI and PEI were found to have facilitated achievement in mathematics more than the MLI.

The findings of the study are consistent with many previous studies on the effectiveness of the use of game in mathematics instruction [28; Ezeamenyi in 47; 48, 49 and 50] that students who are exposed to Game strategies achieved significantly better in mathematics than the lecture strategies. On the use of PEI, findings agrees with the views and findings of [51], [36] and [31] that poems and poetic aspects of learning mathematics increase achievement in mathematics.

The superiority of the GEI over the PEI in achievement could be as a result of the fact that pupils exposed to GEI have the opportunity to solve whole mathematics problems while pupils in PEI solve a part or step in mathematics problems because it was a role play. Again the writing activity of PEI also failed which may have enhanced pupils' achievement in mathematics. Also, GEI has advantage over MLI with an improved mean score could be due to the fact that pupils exposed to GEI were all actively involved in solving series of mathematics problems through games. This finding confirms the assertion of [7] and [4] that the use of game makes students to be actively involved and academically rewarding. The pupils exposed to PEI also had an edge over the MLI group. This is because the pupils in PEI were exposed to reading or reciting the poems, dramatizing or role play and writing which makes them to be actively involved in parts of the lesson. This agrees with the studies established by the National Institute for Literacy [52] that reading and writing skills improves students' capacity to learn. Urquhart [53] and Burns [54] explained that writing enhances the meta-cognitive aspect of learning mathematics, problem solving, invention, increase reading and improve content understanding. However, the pupils exposed to MLI were not exposed to group work which promotes pupils-pupils interaction and did not demonstrate any skill. This explains why their performance is not as good as the other groups [55].

Effect of Gender on Pupils Achievement in Mathematics.

The findings showed that male pupils have an adjusted mean achievement score better than their female counterparts. The implication is that male and female pupils differ in their achievement in mathematics. This finding supports the reports of [56], [40] and [41] that males achieved significantly better than females in mathematics. The males and females obtained a similar mean achievement score. The little difference could be due to the fact that more male teachers were involved in the experiment. This may have led to gender bias during teacher-pupils classroom interaction and in follow-up activities. Again, the female pupils may not have enough time to read and practice at home because they normally help out in household chores or other factors not considered in this study must have contributed to the gender difference in achievement. Thus, it could be concluded that, the result does not show any gender superiority [56]. A contrary report was made by [42], [43] that the females achieved significantly better than the male students in mathematics. Also, some studies find no significant difference in the achievement of male and female students in mathematics [44, 45].

Interaction Effect of Treatment and Gender on Pupils' Achievement in Mathematics

The results of the study showed that, there is no significant interaction effect of treatment and gender on pupils' achievement in mathematics. This implies that treatment is gender insensitive; in other words, the effect of treatment on pupils' achievement in mathematics does not vary from male to female. This result gives credence to the findings of [28], [57], [58], [45] and [50]. It therefore follows that teachers of mathematics should apply game and poem to enhance mathematics instruction irrespective of their gender in order to improve their achievement in mathematics.

Educational Implications of the Study

The study has the following implications for classroom practices. Teachers of mathematics should be encouraged to use game and poem to enhance their mathematics instruction. These are effective in improving the achievement of pupils' in mathematics. However, the use of game is more effective in improving the achievement of pupils in mathematics at the primary school level. Therefore, games and poems should be constantly used in the mathematics classroom. Also, if more attention could be given to the females in solving mathematical problems, they will perform as good as the males.

Conclusion

On the basis of the findings in this study, it could be concluded that:

Game enhanced instruction is most effective in improving pupils' achievement in mathematics. Therefore, the GEI and PEI are better activities to improve pupils' achievement in mathematics than the modified lecture instruction (MLI).

Gender difference in achievement in mathematics was also significant in favour of boys but with a minimal mean difference. Thus, females can perform as good as the males in mathematics. Therefore, teachers should give equal attention to the two groups.

Recommendations

Based on the findings of this study, the following recommendations are made. Mathematics teachers should use games and poems to enhance pupils' achievement in mathematics. Teachers should give both male and female equal opportunity in the classroom for this will raise female students feeling of competence in mathematics. The National Mathematical Centre (NMC) and the Government should embark on in-service training for mathematics teachers to equip them with new skills such as game and poem needed for effective teaching.

Nigeria Educational Research and Development Council (NERDC) should emphasize that teachers embrace innovative strategies like the use of game and poem while implementing the mathematics curriculum.

Curriculum designers should look for the means of including the use of game and poem as activities in the curriculum to enhance mathematics instruction. Authors of mathematics text books should write books on mathematical poems as they have done on mathematical game for easy access and use.

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