



Creative Game Approach and Academic Achievements in the Teaching of SS1 Geometry in Port Harcourt Local Government Area

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This study examines the effect of Creative Game Approach on Academic Achievement in the teaching of SS1 Geometry in Port Harcourt Local Government Area of River state. A sample size of 160 SS1 students was used for the study. Three research questions were asked while three hypotheses were formulated and tested. Geometry Achievement Test (GAT), a 40-item instrument was developed by the researcher. The instrument was validated by experts in Mathematics education, and measurement and evaluation department of University of Port Harcourt, while the reliability was established using test-retest and co-efficient index of 0.86 was determined using Pearson product moment correlation. Mean and Standard deviation was used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses formulated at 0.05 level of significance. The result revealed a significant difference in the achievement mean scores of students taught geometry using creative game approach and those taught using conventional method. It equally showed a significant difference in the Mathematics ability of students taught using creative game approach, also showed no significant difference in the achievement mean scores of male and female students. Based on the findings, it was

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recommended among others that Mathematics teachers be effectively trained to use different educational creative activities, like games and so on when teaching Mathematics concepts for problem-solving, communication, reasoning and connection skills which are necessary for the attainment of better academic achievement in the subject.

Keywords: Creative game approach; academic achievements; teaching of SS1 geometry.

1. INTRODUCTION

The pertinent virtue of mathematics as well as its contributions to the development of mankind has earned the subject the prominence it enjoys among other science subjects.

Over the years, the performance of senior secondary school students in Mathematics calls for concern. However, in spite of the importance and efforts made by teachers to bring about improvement in students' achievement or performance in Mathematics, students still exhibit poor performance in the subject. This constant poor performance in Mathematics has been attributed to so many factors which include among others; the nature of the subject, the design of the curriculum involving teaching methods and approaches, the quality of teachers and learners' characteristics. Awodeyi [1], respectively maintained that the poor performance of students in Mathematics is due to teachers' inability to introduce life experience or examples from the environment of the learners in teaching Mathematics.

Ogunkunle, (2007) argued that most teaching is usually devoid of life experiences. It is usually characterized by memorization of formula, reasoning in abstract terms without reference to happenings in the immediate environment. Teachers often teach Mathematics without adopting approaches, methods and strategies that stimulate students' interest, bring in full participation that allows them to critically think out ideas and solutions to Mathematical problems. The students also come into class with an already biased conception of Mathematics as a very difficult subject, very abstract and therefore hard to understand. This makes the weaker students feel anxiety towards Mathematics and this anxiety affects their achievement in the subject. The idea of using a teacher-centered strategy in teaching Mathematics has been widely condemned. The instructional method is didactic in approach and results in low retention of concepts, memorization of rules, theorems and lack of application into problem-solving. According to

Adenuga [2], students learn, explore Mathematical concepts, and verify Mathematical facts and theorems through a variety of activities using different materials. The creative approach of teaching is all about the teaching of Mathematics with variations and innovations. Creative approach can be in different dimensions, like games, play, drama, use of modern technology and stories.

1.1 Statement of the Problem

The teaching of Mathematics to secondary school students faces the problem of poor application of instructional materials and right teaching methods or approaches. Odili [3], Ogunkunle and Adaramola, [4] respectively pointed out that teaching as being practiced today in Mathematics has been found ineffective. This results in a noticeable poor achievement both in internal and external exams. Hence this study looked into geometry as a branch of senior secondary school Mathematics where students' faces more problems in understanding.

1.2 Objectives of the Study

The objectives of the study are;

1. To find out if difference exists in the achievement mean scores of students taught Mathematics using creative game approach and those taught using the conventional approach
2. To determine the achievement, mean scores of students with different Mathematics abilities taught using creative game approach.
3. To determine the achievement, mean scores of male and female students taught Mathematics using creative approach.

1.3 Research Questions

To achieve the objectives of the study, the following research questions were addressed;

1. What is the effect of creative game approach on students' achievement in Mathematics?
2. How does creative game approach affect students Mathematics abilities?
3. What is the achievement level of male and female students taught using creative game approach?

1.4 Research Hypotheses

The following hypotheses guided the study:

Ho₁: There is no significant difference in the achievement mean scores of students taught mathematics with creative game approach and those taught with conventional approach.

Ho₂: There is no significant difference in the achievement mean scores of students with different mathematics abilities taught using creative game approach.

Ho₃: There is no significant difference in the achievement mean scores of male and female students taught mathematics using creative game approach.

2. METHODOLOGY

The study is quasi-experimental design. The population of this study consists of 4075 SS1 students in Port Harcourt Local Govt. The sample size was 160 SS1 students including boys and girls in their intact classes. The instrument was Geometry Achievement Test (GAT) with distinctly designed lesson package on creative game teaching approach and conventional teaching approach. The test consists of 40 items on geometrical concept taught in responses to the two teaching approaches; which are creative game and traditional approaches. The instrument was for both pretest and posttest. The Reliability coefficient of the instrument was determined using the test-re-test and Pearson product moment correlation was used to calculate the coefficient of 0.86. The instrument was validated by two experts of measurement and evaluation from the Department of Psychology, Guidance and Counselling in the faculty of Education, University of Port Harcourt.

The students used for the study were grouped into the experimental group and control group. a pretest was administered to them. The result of

the pretest was used to classify the students into three groups; those that scored within 0-49 were grouped as Low Mathematics Ability (LMA) students, while those that scored within 50-69 were grouped as Average Mathematics Ability (AMA) students and those that scored 70 and above were grouped as High Mathematics Ability (HMA) students. The experimental group were taught using game approach while the control group were taught using conventional approach.

To the experimental group, identification matico game was used for the game approach. At the end of the lessons, students were given a geometry achievement test (GAT) as a posttest and the result was used for analysis. Data Analysis; research questions were answered using mean and standard deviation, while the null hypotheses formulated were tested using analysis of covariance (ANCOVA) at 0.05 alpha significant level.

3. RESULT PRESENTATION

3.1 Research Question One

RQ 1: What is the effect of creative game approach on students' achievement in Mathematics?

The result of Table 1 shows that the pretest mean achievement scores of the control group was (43.6) with standard deviation of (14.9). After the treatment, the use of conventional approach in teaching, the control group mean GAT score for posttest was (48.7) with SD of (17.4) while the pretest mean GAT score of experimental group was (43.9) with SD of (14.5), after the administration of treatment which was the use of creative game approach in teaching, the posttest mean GAT score increased to (69.7) with SD of (12.6). The result indicated that the experimental group outperformed the control group with an achievement mean gain of (21.0).

3.2 Research Question Two

RQ 2: How does creative game approach affect students Mathematics abilities?

The result of Table 2 shows the pretest GAT mean score of LMA to be (34.3) with SD of (9.0) while AMA has a mean score of (57.1) with SD of (5.2) and HMA has a mean score of (72.8) with SD of (1.0). The posttest result of LMA mean score was (48.6) with SD of (1.2) while AMA has a mean score of (62.3) with SD of (5.4) and HMA

has mean score of (79.0) with SD of (7.1). The result showed an increase in achievement mean scores of the three levels of mathematics ability. There was an increase in the number of students in AMA and HMA with a reduction in the number of students in LMA when the pretest and posttest number and mean scores are compared. This means that there is an improvement in the Mathematics abilities of students taught with creative game approach.

3.3 Research Question Three

RQ 3: What is the achievement level of male and female students taught using creative game approach?

The findings of Table 3 shows that the pretest GAT mean score of male students was (43.8) with SD of (14.5), while that of female was (44.1) with SD of (14.8). The posttest GAT mean score for male students was (68.0) while that of female was (71.3) with SD of (13.9). There was a slight mean difference of (3.3) between the female and male when compared but both showed an increase in their posttest which proved that

creative game approach increases academic achievement of both male and female mathematics students.

3.4 Research Hypothesis One

H0₁: There is no significant difference in the achievement mean scores of students taught Mathematics with creative game approach and those taught with conventional approach.

From Table 4, the ANCOVA result analysis of GAT shows that the calculated significant value is (.000) which is less than the 0.05 accepted sig. value, therefore we reject the null hypothesis and accept the alternative proving that there is a significant difference between students taught geometry using creative game approach and those taught with the conventional approach.

3.5 Research Hypothesis Two

H0₂: There is no significant difference in the achievement mean scores of students with different Mathematics abilities taught using creative game approach.

Table 1. Mean and standard deviation (SD) of pre-posttest scores of Experimental (EG) and Control (CG) groups as measured by GAT

Group	N	Pretest		Posttest	
		Mean	SD	Mean	SD
EG	82	43.9	14.5	69.7	12.6
CG	78	43.6	14.9	48.7	17.4
Mean diff.	-	0.3	-	21.0	-

Table 2. Mean and SD of pre-post GAT scores of students of low Mathematics ability (LMA), Average Mathematics Ability (AMA) and High Mathematics ability (HMA) of experimental group

Group	N	Pretest		N	Posttest		Mean Diff.
		Mean	SD		Mean	SD	
LMA	50	34.8	9.0	8	46.6	1.2	11.8
AMA	26	57.1	5.2	29	62.3	5.4	5.2
HMA	6	72.8	1.0	45	79.0	7.1	6.2
Total	82	164.7	15.2	82	187.9	13.7	23.2

Table 3. The mean and SD of pre-post GAT scores of male and female students of experimental group

Group	N	Pretest		Posttest	
		Mean	SD	Mean	SD
Male	43	43.8	14.5	68.0	11.5
Female	39	44.1	14.8	71.3	13.9

Table 4. ANCOVA pre-post GAT result of experimental and control group

Test of Between Subjects Effects

Dependent Variable: Achievement

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	52561.782 ^a	2	26280.891	2908.586	.000	.974
Intercept	3605.272	1	3605.272	399.006	.000	.718
VAR00001	34837.682	1	34837.682	3855.593	.000	.961
VAR00003	17110.568	1	17110.568	1893.679	.000	.923
Error	1418.593	157	9.036			
Total	614486.000	160				
Corrected Total	53980.375	159				

*a. R Squared = .974 (Adjusted R Squared = .973)***Table 5. ANCOVA result of mathematics abilities of students in the Experimental group**

Tests of Between-Subjects Effects

Dependent Variable: Mathematics Abilities

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2470.810 ^a	3	823.603	335.758	.000	.967
Intercept	47.214	1	47.214	19.248	.000	.361
VAR00001	592.820	1	592.820	241.675	.000	.877
VAR00003	158.005	2	79.002	32.207	.000	.655
Error	83.401	34	2.453			
Total	136252.000	38				
Corrected Total	2554.211	37				

a. R Squared = .967 (Adjusted R Squared = .964)

The result of the analysis shows that the computed sig. value of (.000) is less than 0.05 alpha significant. This follows rejection of the null hypothesis and acceptance of alternative. Therefore, there is a significant difference between student's Mathematics ability and creative game approach.

3.6 Research Hypothesis Three

H0₃: There is no significant difference in the achievement mean scores of male and female students taught Mathematics using creative game approach.

Table 6. ANCOVA result of male and female achievement in pre-post GAT

Tests of Between-Subjects Effects

Dependent Variable: Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	219.779 ^a	1	219.779	1.373	.245	.017
Intercept	386041.579	1	386041.579	2411.966	.000	.969
VAR00002	219.779	1	219.779	1.373	.245	.017
Error	12484.108	78	160.053			
Total	399541.000	80				
Corrected Total	12703.887	79				

a. R Squared = .017 (Adjusted R Squared = .005)

The table result shows that the calculated sig. value of (.245) is greater than 0.05 alpha significant. This follows acceptance of the null hypothesis indicating that there is no significant difference in the achievement mean scores of male and female students taught Mathematics using creative game approach.

4. DISCUSSION OF FINDINGS

The first finding of the study revealed that the use of creative Mathematics games helps students to improve in their academic achievement when it comes to learning of difficult Mathematics concepts in geometry. The findings portray the situation in our secondary schools, where the Mathematics teacher does not use effective teaching approach and method, rather, they cling to the use of talk chalk approach in teaching mathematics. Jonah- Eteli [5] in his study portrayed this when he notes that “there has over the years been a decay of the traditional approach to the teaching of Mathematics which encourages rote memorization”. Jonah- Eteli, explained further that the use of traditional approach for mathematics teaching results to less internalization of concepts taught and its application in problem solving. Mathematics teacher communicates difficult concepts in geometry without using the appropriate approach that will help the students attain academic achievement. The findings agree with the study of Ugwuanyi and Uche [6] which concluded that the use of algebraic substitution game approach has a positive influence on students’ both male and female achievement in algebra. The findings support the work of Hong and Aqui [7] on academically gifted Mathematics students and students with creative talent in Mathematics and found significant differences in cognitive strategies with the creatively talented group being more cognitive resourceful. It also agrees with the study of Ogunkunle and Adaramola [4] on teaching Mathematics through Mathematical games and was concluded that the use of Mathematical games improves the performance of students in the subject. This result also agrees with the work of Achor, Imoko and Ajai [8] who in their findings concluded that the use of instructional materials (manipulatives) such as games have a positive effect on students’ academic achievement. This means that the use of any of the dimensions of creativity in teaching enhances the achievement of students in Mathematics, as teachers can use them to eliminate the abstractness in learning

Mathematics especially in geometry and facilitate understanding.

The second findings of the study proved that there was an improvement in students Mathematics ability with a reduction in the number of Low Mathematics Ability students (LMA) and increase in the number of Average Mathematics Ability (AMA) and High Mathematics Ability (HMA) students. This proved that the creative game approach has a positive influence on the student’s level of Mathematics ability. The results confirmed the creative game approach as a means for improvement of students with low ability. The immediate feedback for error correction provided in the creative game may be the element that makes students attains higher improvement. This is consistent with the results of previous studies of McDaniel, Roediger, and Mc Dermoltt [9], which proved that immediate feedback learning results into more learning and better retention of knowledge.

This is also supported by Ku, O., Chen, S.Y., Wu, D.H., Lao, A.C.C., & Chan, T.W. [10], in their study which concluded that game-based learning (GBL) is regarded as a potential means in improving students’ level of Mathematics ability. As in the study, the students with high and low levels of ability in the GBL group gained significant improvement in confidence towards Mathematics. It also showed that low ability students in GBL group attained better Mathematics performance than those in the paper-based setting.

The third findings of this study showed improvement in the achievement of male and female students in geometry using creative game approach. Mathematics is not gender sensitive provided the appropriate teaching approach is used; students both male and female performs better. This confirms Hyde, Fennema, and Lamon [11], that gender is insignificant of students’ achievement in Mathematics. This finding disagrees with the study of Akakabota [12] which reported that boys do better in Mathematics than girls.

5. CONCLUSION

It was concluded based on the findings that creative game approach improves students’ achievement and ability in geometry. Also that the use of the creative game approach in the teaching of geometry is not gendered biased.

6. RECOMMENDATION

Following the conclusion of this study, the following recommendations were made.

1. Mathematics teachers should be encouraged and effectively trained on how to use appropriate mathematics creative activities including different games and so on, in teaching mathematics topics/ concepts in order to link learners past experiences and daily activities with classroom instructions. This is believed will enhance problem-solving, communications, reasoning and the needed connections, not just better achievement in mathematics but also reliance.
2. Game approach can also be applied to other Mathematical concepts/topics to stimulate interest and make available many simple ways of engaging learners.
3. Authors of Mathematics textbooks are encouraged to simplify more their textbooks by involving game approach in most of the topics.
4. Stakeholders in Mathematics education should endeavour to organize workshops/ seminars where in-service mathematics teachers could be trained on the use of mathematics games in teaching students.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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