



EFFECT OF GAME TEACHING METHOD ON STUDENTS' ACADEMIC PERFORMANCE IN GEOMETRY CONCEPT OF MATHEMATICS IN AJAOKUTA LOCAL GOVERNMENT AREA, KOGI STATE, NIGERIA

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Abstract:

This study investigated the effect of game teaching method on students' academic performance in Geometry concept of Mathematics in Ajaokuta Local Government Area, Kogi State. Quasi-experimental research design was employed in the study. The target population of the study was 1,215 comprised all the senior secondary school two (SSS11) students in Ajaokuta Local Government Area, Kogi State. The study sample size was 120 students consisted of 70 males and 50 females from five schools in Ajaokuta Kogi State through purposive sampling procedure. An instrument titled "Geometry Performance Test (GPT)" was used for data collection. The reliability index of 0.83 for the instrument was determined using Pearson's product moment correlation coefficient (PPMCC). The study was guided by two research questions with corresponding null hypotheses. Data collected were analyzed using Means, Standard deviations and ANCOVA. The findings of the study revealed that students taught the concept of Geometry using game teaching method performed better than their counterparts who were taught using conventional method. Based on the findings therein, the study recommended that Mathematics teachers should always adopt game teaching method in teaching the concept of Geometry in secondary schools. Conclusively, game teaching method as an instructional strategy facilitates or enhances students' academic Performance on Geometry better than the use of conventional method.

Keywords: Mathematics; Geometry; Students' academic performance; Game teaching method

Introduction

Mathematics as a core subject remains very vital on which any true science can rest and no true science can succeed without going through mathematical expression and any nation that wants to survive and develop economically, technologically begins by

developing her mathematical arts right from the classroom (Odili, 2006). In other words, Mathematics and science are very significant in the development of every individual and nations as a whole. It is this significance of Mathematics that allowed Ukeje in Onah (2004) to stress that without Mathematics, there is no science; without science, there is no modern technology, and without modern technology, there is no modern society. The implication of this statement is that there could be no actual development, economically and technologically without a corresponding development in Mathematics. Nevertheless, the recognition given to Mathematics globally cannot be overemphasized. This is from the reality that Mathematics provides the basic laws/rules, formulas and the theorem that allow the scientific and technological developments (Odili, 2006).

In the context of this study, Geometry is seen as one of the concepts of Mathematics which deals with the study of different shapes or figures and their properties (Salman, 2009). To Salman, Geometry could be a plane or solid shape and their properties. The plane shape is a geometrical object with length and width/breadth or base and height/altitude. Plane shapes are also called 2-dimensional shapes such as square, rectangle, circle, polygon, triangle, and so on. A solid shape is a geometrical object with length, breadth and height or base area and height. Solid shapes are also called 3-dimensional shapes such as a cone, pyramid, sphere, cylinder, prism, cube and cuboid. Geometry is a concept of pure Mathematics that requires students to demonstrate their understanding by justifying their answers using mathematical jargon or theories. The Geometry classroom also involves integrating students' number sense skills in terms of calculation, estimation, measurements, and use of correct mathematical symbols. Students' algebra skills are also integrated into the Geometry classroom via substitution into formulas or changing formulas to solve for the unknown values. For students to develop solid Geometry skills, teachers must be able to demonstrate a solid understanding of both number sense and algebra (Tutak & Adams, 2017).

The role Geometry plays in development of science, technology and art as well as humanity is greatly essential as the correct application of knowledge and skills in solving Geometry helps both individual and nations as a whole to solve daily problems or tasks and equally be familiar with many geometric shape and properties in their domains /environments.

In spite of the roles Geometry played in development of science, technology and Mathematics generally, the students' academic performance is consistently very poor. West Africa Examination Council (WAEC) Chief Examiners Reports of 2016, 2017, 2018, 2019, 2020 and 2021 revealed that the students' poor achievement in Mathematics is due to their poor understanding of the Geometry concept observing that student themselves lack fundamental knowledge and skills in Geometry. For instance, students could not make additional construction to the given diagram, prove that the angle which an arc of a circle subtends at the centre is twice the angle subtends at the circumference. This has proven that students have poor knowledge in construction and proofing of

circle theorem. From the researcher's point of view, this could lead to their poor academic performance in Mathematics and consequently contributes to their poor performance in science and technology based courses at the higher institution of learning.

In the context of this research, mathematical games are those in which the structure and rules/laws of the game are built on mathematical ideas and where winning the game is directly related to understanding the Mathematics. A game is a type of play that follows a set of rules/laws, targets at a definite objective or outcome and involves competition against other players or against barriers imposed by nature of the game itself. A game refers to a contest/ play between adversaries (players) operating under constraints (rules/laws) in order to achieve an objective (winning or payoff). Games could be referred to competitive interactions among participants to achieve pre-specified goals. These interactions may improve co-operation among individuals or group. Mathematical games can be in form of fallacies, puzzles, or any form of Mathematics which provides interest. Such games provide enjoyment and recreation. They also motivate mathematical thinking and equally create excitement and spirit of competition. Mathematical games provide reinforcement to both losers and winners. For the winners, for instance, they will endeavor to maintain their lead while the losers will try to overcome their defeats. Games help in releasing tension, clearing boredom and providing an environment where the student can develop his/her skills and acquire more knowledge. Games and Mathematics are linked because each has rules/laws which involve drills, practical applications and experiences.

Several research evidences have proven teaching method as a main determinant factor of students' academic performance in Mathematics (Iqbal, 2004). Therefore, the need to search for better methods and newer innovations is enormous task confronting science educators. Omeodu and Fredrick (2019) researched on the effect of game teaching method on students' Mathematics academic performance using the concept of algebra (quadratic equation and the study revealed that students taught the concept of quadratic equation using game teaching method achieved better than their counterparts who were taught using expository method. Akinsola and Animasahun (2008) conducted a study on the effect of game environment on student's academic performance and attitude to Mathematics in schools and the result indicated that the use of games environment led to improved performance towards Mathematics. The findings also revealed that there is a significance difference between the experimental and control groups in relation to the academic performance of individuals and behavior toward Mathematics. Ifamuyiwa (2004) reported that pupils are inadequately exposed to mathematical experiences in the early formative stages of life. In consequence, children get to the secondary school discouraged rather than encouraged in mathematics learning. The overall effect of this is unattractive learning situation, lack of understanding of mathematical concepts, and hatred for the subject among students.

Several studies carried out on gender factor showed that male students achieved significantly better their female counterparts in Mathematics and Science related courses (Egwasi, 1980; Galadima, 2003; Ekeh, 2004; Ifamuyiwa, 2004; Tylor, 2010; Onasanya, 2008). Nevertheless, other studies found no significant difference in Mathematics achievement between male and female students (Abiam & Odok, 2006; Adaramola, 2012; Musa, 2014; Adeleke, 2007).

Based on the forgoing prior studies, the effect of game teaching method on students' academic performance in Mathematics has not been stable and this calls for continuous investigation per time. Therefore, there is a need to embark on this study to find out the effect of game teaching method on students' academic performance in Geometry concept of Mathematics in relation to gender.

Purpose of the Study

The purpose of this study was to find out the effect of game teaching method on students' academic performance in Geometry concept of Mathematics. Specifically, the study sought to find out:

1. the performance mean scores of students in Geometry concept of Mathematics when taught using game and conventional method.
2. the performance mean scores of male and female students in Geometry concept of Mathematics when taught using game and conventional method.

Research Questions

The following research questions guided the study and were answered.

1. What are the performance mean scores of students in Geometry concept of Mathematics when taught using game and conventional method?
2. What are the performance mean scores of male and female students in Geometry concept of Mathematics when taught using game and conventional method?

Research Hypotheses

The following null hypotheses were formulated to guide the study. These hypotheses were tested at $\alpha = 0.05$ level of significance.

- Ho₁:** There is no significant difference between the performance mean scores of students in Geometry concept of Mathematics when taught using game and conventional method.
- Ho₂:** There is no significant difference between the performance mean scores of male and female students in Geometry concept of Mathematics when taught using game and conventional method.

Methodology

This study employed quasi-experimental research design that involves intact classes in non-randomized pre-test, post-test control group. The study participants comprised 1, 215 senior secondary two (SS11) students in Ajaokuta Local Government Area, Kogi

State. Four senior secondary schools were drawn from seven senior secondary schools through simple random sampling techniques in Ajaokuta Local Government Area, Kogi State, Nigeria while two intact SS11 classes in each of the sampled schools were used for the study. The sample size consisted of one hundred and twenty (120) senior secondary two (SS11) male and female students who registered for 2021/2022 academic year. The experimental group comprised fifty (50) students with thirty (30) males and twenty (20) females. The control group comprised seventy (70) students. One instrument titled "Geometry performance Test (GPT)" was used for data collection. The GPT consisted of 25 multiple choice items (questions). Each item had five (5) options A, B, C, D and E with only one possible correct answer for the participants to choose. The questions were extracted from the previous WASSCE and NECO Examination question papers. Each correct answer scored carries four (4) marks and incorrect answer carries zero (0) mark. This resulted to the highest score of 100% and the lowest score of 0%. The researcher designed the Lesson Notes used in the teaching of Geometry concept based on the two (2) instructional strategies used. The Lesson Notes contained the similar concepts, but with different instructional methods with respect to experimental group. GPT was administered to both groups to obtain their level of academic performance before treatment was given to both groups and instrument was re-administered. The initial copy of the instrument was subjected to validation by two (2) experts in the field of science education (Mathematics Unit) and one in measurement and evaluation. In order to determine the reliability coefficient of the instrument, Pearson's product moment correlation coefficient (PPMCC) was used which yielded 0.83. The data collected from the participants were analyzed using descriptive statistics of means and standard deviations, while the null hypotheses formulated were tested using inferential statistics of Analysis of Covariance (ANCOVA) at $\alpha = 0.05$ level of significance.

Results

The analysis of this study was done and presented according to the research questions with the corresponding null hypotheses.

Research Question One

What are the performance mean scores of students in Geometry concept of Mathematics when taught using game and conventional method? The data used to answer this question is presented in Table.

Table 1: Means and Standard Deviations of Students' Pre-test and post-test Scores taught Geometry Concept using Game and conventional method

Teaching Method	Type of Test	No. of students	Mean Gain	SD	Mean
Game	Pretest	50	30.37	12.20	22.93
	Posttest	50	53.30	13.76	
conventional Method	Pretest	70	25.10	8.95	18.21

	Posttest	70	43.31	10.88
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As seen in Table 1, the performance mean scores of students taught with game strategy was 53.30 and SD of 13.76. While those students taught with conventional method had the academic performance mean scores of 43.31 and SD of 10.88 in that order. The mean gain (pre-test and post-test) for game and the conventional method were 22.93 and 18.21 respectively.

Research Question Two

What are the performance mean scores of male and female students in Geometry concept of Mathematics when taught using game and conventional method? The data used to answer this question is presented in Table 2.

Table 2. Means and Standard Deviations of Students' Pre-test and post-test Scores taught Geometry Concept with respect to Gender and Treatment.

Teaching Method	Gender	Type of Test	N	Mean	SD	Mean Gain
Game	Male	Pre-test	30	19.80	14.86	43.45
		Post-test	30	63.50	16.26	
	Female	Pre-test	20	20.09	10.12	43.16
		Post-test	20	63.25	12.57	
Conventional Method	Male	Pre-test	32	19.09	11.12	23.93
		Post-test	32	43.02	10.45	
	Female	Pre-test	38	19.69	8.60	12.69
		Post-test	38	42.27	16.23	

As can be seen in Table 2, the performance mean score of male students taught with game was 63.50 and SD of 16.26 obtained in the performance test. Also, female students who were taught with game method obtained 63.25 and SD of 12.57. The mean gain of post-test-pre-test difference of male students taught with game was 43.45 while the mean gain of female students in the same group stood at 43.16. Similarly, in conventional method, it was seen that male students obtained the performance mean score of 43.02 and SD of 10.45 while the female students obtained the performance mean score of 42.27 and SD of 16.23. The mean gain score of post-test - pre-test difference of male students taught with conventional method was 23.93 while the mean gain of female students in the same group stood at 12.69 in that order.

For the present researcher to establish the significant or non-significant in the differences that exist between the performance mean scores in the forgoing Tables 1 and 2, the corresponding null hypotheses were tested as shown in Tables 3 and 4.

Hypothesis One

There is no significant difference between the performance mean scores of students in Geometry concept of Mathematics when taught using game and conventional method.

Tables 3. Results of ANCOVA on Students' Post-test and Pre-test scores in GPT Classified According to Teaching Methods

Source of Variance	Df	Sum of Square	Mean Squares	F.Cal	F.crit	Sig
Between Groups	1	2921.14	2921.14	7.96	3.95	S
Within Groups	118	4317.18	367.94			
Total	119	46338.32	32289.08			

As can be seen in Table 3, the computed F-ratio (F cal) is greater than the F-critical at $\alpha = 0.05$ level of significance or decision rule. Therefore, the null hypothesis one was rejected. This signifies that there is significant difference between the performance mean scores of students in Geometry concept of Mathematics when taught using game and conventional. Therefore, the inference drawn is that the teaching methods used to teach Geometry concept of Mathematics have significant effect on students' academic performance.

Hypothesis Two

There is no significant difference between the performance mean scores of male and female students in Geometry concept of Mathematics when taught using game and conventional method.

Table 4. Results of ANCOVA on Male and Female Students' Post-test and Pre-test Classified According to Teaching Methods

Source of Variance	Df	Sum of Square	Mean Squares	F.Cal	F.crit	Sig
Between Groups	3	2870.47	956.84	2.55	2.67	NS
Within Groups	116	43417.87	374.28			

Total	119	46288.34	1331.12	
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As can be seen in Table 4, the computed F-ratio (Cal) is less than the F-critical at $\alpha = 0.05$ level of significance. Hence, the null hypothesis of no significant was retained. This shows that there is no significant difference between the performance mean scores of male and female students in Geometry concept of Mathematics when taught using game and conventional method. The inference drawn is that the teaching methods (instructional strategies) used have no significant difference in students' performance based on gender.

Discussions of the Results

The results of the study showed that there was a significant difference between the academic performance of students in Geometry concept of Mathematics when taught using game and conventional methods, the students taught using game had higher mean gain than those taught using conventional method. The significant difference between the academic performance of those taught using game in the study is in line with the following researchers (Akinsola & Animasahun, 2008); (Omeodu & Fredrick, 2019) who indicated in their various researches that students taught using game performed significantly better than those taught using conventional method in both Algebra and Quadratic equation. From the researcher's point of view, the implication of this finding is that, if students are exposed to both teaching methods and equal classroom instructions, there might not be much difference in the academic performance of students.

Results of the study also showed that there is no significant difference in the academic performance of male and female students taught the concept of Geometry using game and conventional method. This finding agrees with Abiam & Odok (2006); Adaramola (2012); Musa (2014); Adeleke (2007) who found no significant difference in Mathematics academic performance between male and female students but disagrees with Egwasi (1980); Galadima (2003); Ekeh (2004); Ifamuyiwa (2004); Tylor (2010) and Onasanya (2008) who observed that male students performed significantly better than their female counterparts in Mathematics and science related courses. . However, the implication of this finding is that, both male and female students might have been exposed to both teaching methods (game and convention method) and equal classroom instructions by Mathematics teacher.

Conclusion

This paper critically found out the effect of game teaching method on students' academic performance in Geometry concept of Mathematics in Ajaokuta Local Government Area, Kogi State and in accordance with the results of this study, it is hereby concluded that

game teaching method enhances students' academic performance in Geometry concept of Mathematics better than the use of conventional method.

Recommendations

Based on the forgoing findings and conclusion of this study, the following recommendations are made by the researchers:

1. From the fact that game method of teaching enhances the students' level of critical and reflexive thinking to solve mathematical problems, teachers are encouraged to adopt game teaching method in teaching Mathematical concepts.
2. Workshop, Seminars, and conferences should be organized more regularly for Mathematics teachers to update their knowledge on the use of games
3. Since the world is highly digitalized, Mathematics teachers should Google, download and learn some mathematical games applications from the internet website and encourage the students to do same since majority of the students have gadgets that have access to internet per time.

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