

**EFFECT OF GEO-BOARD GAME ON ACADEMIC ACHIEVEMENT OF JUNIOR
SECONDARY SCHOOL STUDENTS IN SELECTED MATHEMATICAL CONCEPTS IN
IDEATO NORTH, L.G.A., IMO STATE**

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Abstract

Games or plays are the birth right of every child. Hence, Mathematics educators inferred that the achievement of students in Mathematics can be achieved through games. In view of this, this study sought to find out the effect of using geo-board game in teaching and learning of some selected topics in Mathematics in junior secondary schools in Ideato North L. G. A., Imo State. The study adopted a posttest randomized quasi-experimental research design. The population of the study consisted of 1,496 JSS2 students in the public secondary school within the area of the study. A sample of 240 students (125 males and 115 females) were drawn using a simple random sampling technique. Three research questions and three research hypotheses were formulated to guide the study. A Mathematics achievement test (MAT) was administered to the control and experimental groups of students after the experimental treatment. The instrument was validated by appropriate experts and the reliability coefficient was calculated using Spearman's reliability coefficient. The instrument had a reliability coefficient of 0.85 and as such, adjudged to have a high reliability index. The hypotheses were tested using t-test statistic. Among the findings were that use of geo-board game increases the students' achievement in identifying and differentiating polygons and in describing and locating coordinate points. Again, it was found out that gender has no significant effect on the achievement of students when taught with geo-board. Following the findings, the following recommendations were made: that Mathematics teachers should incorporate geo-board game in teaching various concepts in Mathematics; federal and state ministries of Education, professional bodies, such as the Mathematical Association of Nigeria (MAN) etc., should organize in-service training and/or workshop on regular basis for the teachers to upgrade their knowledge on the modern trends in teaching process, especially on the use of geo-board game. Finally, teachers should be encouraged, by relevant authorities, to use geo-board game. This can be done by providing them with necessary materials, including creating more time on the timetable for Mathematics.

Key words: Geo-board game, Mathematics achievement and Gender.

Introduction

Mathematics as a science subject is important. Its usefulness in our present society cannot be over emphasized. It is overtly that the subject Mathematics has been proved as an essential subject in primary and secondary schools in Nigeria today. According to Malik and Salman (2018), Mathematics is a concenter subject which serves as a foundation for pupils' level of thinking, skill development and problem solving. Any nation that must develop their manpower scientifically and technological wise must have a strong mathematical foundation at the basic school level. Malik (2017) opined that Mathematics is a unifying subject that prepares pupils for a useful and meaningful living, and that Mathematics is the language and key to everyday activities of mankind in science and technology.

Mathematics is a science which is applied to both physical science and other fields (Ambali, 2014). Ogbonna (2007) stated that among other physical science subjects, Mathematics is the backbone in national capacity building. This is because Mathematics equips individuals with the capacity to enumerate, calculate, measure, collate, group, analyze and relate quantities and ideas, among others. In Arts and Humanities, mathematical concepts such as measurement, enlargement, symmetry, sequence, proportion, angle of elevation and depression, provide the baseline for better understanding of some related universal concepts like earth and the space (Odili, 2006). Educational institutions, whether Primary, Secondary or Tertiary, have courses that are mathematics-based or mathematically-inclined. This is because Mathematics is used for thinking about and facilitation of the learning of all other subjects especially sciences.

Mathematics is seen by society as the foundation of scientific and technological knowledge that is vital in the socio-economic development of the nation, (Anaduaka, Olaoye, and Sunday, 2018). Because of this, Mathematics is a compulsory subject at both primary and secondary levels in Nigeria. Mathematics is also used as a basic entry requirement into any of the prestigious courses

in tertiary institution such as medicine, architecture and engineering among other degree programmes. Students with an interest in a subject like Mathematics are likely to be more motivated to manage their own learning and develop the requisite skills to become effective learners of that subject. Hence, interest in Mathematics is relevant when considering the development of effective learning strategies for Mathematics. In contrast, anxiety about learning Mathematics can act as a barrier to effective learning. Students who feel anxious about their ability to cope in Mathematics learning situations may avoid them and thus lose important career and life opportunities.

Despite the importance of Mathematics to societal development, it is a subject that many students fear, fail and possibly dislike (Areelu, 2014). Mathematics has always been perceived as the most difficult subject in the school curriculum (Poopola and Ajani, 2011). This has resulted in learners having a negative attitude towards the subject and this attitude seems to have existed from one generation to another. Learners, including adults, who have failed Mathematics at one time or the other, preserve this image of failure and justify their failure by devaluing the importance of the subject – an attitude that influences the efforts that educators put into the teaching of the subject (Ajani and Konku, 2012)

The students' low achievement in Mathematics at the Basic Education Certificate Examination (BECE) has been found to be caused by the following factors, among others, e.g. lack of understanding of basic mathematical principles (Bursal and Paznokas, 2006), poor teaching and learning environment and lack of modern equipment (Adegoke, 2013), poor mathematical ability of the students (Olatoye, 2007), students' poor attitude toward Mathematics, inadequate teaching materials, lack of motivation of both teachers and students. Other explanations target teacher expectations, teacher quality, tracking, testing, family characteristics, and student characteristics (Areelu, 2014).

This is why Odili (2006) and Iyekekpolor (2007) agreed that Mathematics education in Nigeria is still in a deplorable state. This students' low achievement in Mathematics has been of great concern to Mathematics educators in the country. In order to address this issue, Mathematics educators such as Harbor-Peters (2000), Iji (2012) and Obodo (2007) explored different strategies to ensure that Mathematics is properly taught and learnt in the schools. Various attempts have been made towards improving students' low achievement in Mathematics in secondary school education without much remarkable successes. This could be due to the use of inappropriate teaching method in the Mathematics classroom. There is therefore, the need to explore more instructional strategies to enhance students' achievement in the subject. Use of geo-board game in Mathematics instruction is one of such strategies that researchers are exploring its efficacy. Would students' achievement in Mathematics improve more when taught with geo-board game than when taught using other instructional strategies? Would its use bridge the gap in gender in achievement in Mathematics?

Games or plays are the birth right of every child. Hence, Mathematics educators inferred that the achievement of students in Mathematics can be achieved through games. In the words of Mwalor (1993), Mathematics games are activities involving cooperation and competition guided by standard rules. In other words, a game is a contest (play) between adversaries (players) operating under constraints (rules) in order to achieve an objective (winning or pay-off). To buttress this, Agwagah (2001) asserted that a game is a situation in which two or more participants, the players, confront one another in pursuit of certain conflicting objectives. So, for those objectives to be achieved, it involves skills, chance, and endurance on the part of two or more persons who play the game. However, a game can be considered as mathematical when the players can perceive and/or influence the course of the game on the basis of mathematical considerations (Thiele, 1994). This implies that not all games are Mathematics games. A Mathematics game must have mathematical structure. This is why this study considers geo-board game as an instructional

strategy to determine its effect on the academic achievement of the junior secondary school students on selected mathematical concepts such as identifying and differentiating polygons, describing and locating coordinate points, representing and calculating areas of geometric patterns and describing their properties; demonstrating parallelogram theorem; demonstrating alternate, obtuse, acute, reflex, and vertically opposite angles.

Gender disparity in Mathematics achievement has worried scholars in the field of Mathematics. Ozomadu (2006) found no significant difference in achievement between gender and teaching method. Hydea and Mertz (2009) observed that females have reached parity with males. Ogunkunle (2007), in separate studies, established significant difference between males and females, in favour of male Mathematics students while in another study, established difference in favour of females. These studies above, with contradictory results, have made the influence of gender on academic achievement of students inconclusive. This work, therefore, investigated the level of male and female students' achievement when geo-board was used to teach some selected mathematical concepts.

Statement of Problem

Mass failure of Mathematics at all levels of education in Nigeria is a big challenge to the nation. Lack of interest and fear of Mathematics are hindrances to passing examination. Despite the relative importance of Mathematics in science and information based courses, as well as in medicine and social science, students' performance in the subject in both internal and external examinations has remained consistently poor. Mathematics educators have tried and are trying to identify the major causes of problems associated with the teaching and learning of Mathematics in schools. Among the leading causes are lack of adequate preparation, shortage of qualified teachers, inadequate teaching aids, lack of good school environment and infrastructural facilities.

Also it is evident from literature that the use of Mathematics games may affect positively students' academic achievement. Yet there is dearth of studies in this area particularly in Nigeria and so it becomes imperative to have a study that will find out if really Mathematics games (geo-board game) have effect on students' academic achievement in Mathematics in junior secondary schools in Ideato North L. G. A., Imo state.

Purpose of Study

The main purpose of this study was to determine the effect of geo-board game on academic performance of junior secondary school students in some selected mathematical concepts. Specifically, the study sought to determine:

1. The achievement of students taught identifying and differentiating polygons with geo-board game and those taught with conventional method.
2. The achievement of students taught describing and locating coordinate points with geo-board game and those taught with conventional
3. The achievement of male and female JS2 students taught identifying and differentiating polygons; and describing and locating coordinate points with geo-board.

Research Questions

The following research questions were formulated to guide the study:

1. What is the achievement mean score of students taught identifying and differentiating polygons with geo-board game and those taught with conventional method?
2. What is the achievement mean score of students taught describing and locating coordinate points with geo-board game and those taught with conventional method?
3. What is the achievement mean score of male and female JS2 students taught all selected mathematical concepts with geo-board?

Research Hypotheses

The following research hypotheses were formulated for the study:

1. There is no significant difference between the academic achievement mean scores of students taught identifying and differentiating polygons with geo-board game and those taught with conventional method.
2. There is no significant difference between the academic achievement mean scores of students taught describing and locating coordinate points with geo-board game and those taught with conventional method.
3. There is no significant difference between the academic achievement mean score of male and female JS2 students taught all selected mathematical concepts with geo-board.

Method

The study adopted a posttest randomized quasi-experimental research design. The population of the study consisted of 1,496 JS2 students in the area. A sample of 240 (125 males 115 females) JS2 students were drawn using a simple random sampling technique. Three research questions and three research hypotheses were formulated to guide the study. A Mathematics Achievement Test (MAT) was administered to the control and experimental groups of students after the administration of treatment. It was scored on 100% basis. The instrument was validated by appropriate experts and the reliability coefficient was calculated using Spearman's reliability coefficient. The instrument had a reliability coefficient of 0.85 and as such, adjudged to have a high reliability index. The research questions were answered using mean and standard deviation while the hypotheses were tested using t-test statistic at alpha level of 5%. The decision was based on 50% average for mean scores. That is, mean score that is below 50% is adjudged low while 50% and above was considered high mean score.

Results

Research Question one: What is the achievement mean score of students taught identifying and differentiating polygons with geo-board game and those taught with conventional method?

Table 1: Results of achievement mean score of students taught identifying and differentiating polygons with geo-board game and those taught with conventional method.

Groups	N0 of students	Mean	Standard deviation	Decision
Experimental	128	68.6	9.6	High achievement
Control	112	57.8	8.4	High achievement

From table 1 above, the mean scores of the experimental and control groups are quite above the bench mark of 50%. This indicates that both sets of the students achieved better irrespective of the treatment. However, it can also be observed that there is a difference in their mean achievement. Therefore, the significant mean difference of their means need to be determined statistically.

Research Question Two: What is the achievement mean score of students taught describing and locating coordinate points with geo-board game and those taught with conventional method?

Table 2: Results of achievement mean scores of students taught describing and locating coordinate points with geo-board game and those taught with conventional method.

Groups	N0 of students	Mean	Standard deviation	Decision
Experimental	128	54.5	11.55	High achievement
Control	112	43.3	7.64	Low achievement

In table 2 above, there is a mean difference in the two groups of the students. Meanwhile, the experimental group showed a mean score that is above the bench mark. This implied that the students in experimental group achieved high while the students in the control group achieved low. The significance of the mean difference was determined with t-test statistic.

Research Question Three: What is the achievement mean score of male and female JS2 students taught all selected mathematical concepts with geo-board?

Table 3: Results of achievement mean scores of male and female students taught all the selected mathematical concepts with geo-board game.

Groups	N0 of students	Mean	Standard deviation	Decision
Males	125	68.12	9.5	High achievement
Females	115	66.89	8.3	High achievement

Table 3 above, shows that both male and female students who were taught with geo-board game, achieved high. However, there is a mean difference which the significance was determined with t-test statistic.

HO₁: There is no significant difference between the achievement mean scores of students taught identifying and differentiating polygons with geo-board game and those taught with conventional method.

Table 4: T-test Results of hypothesis one **HO₁**

Groups	N0 of students	Mean	Standard deviation	Sig level	t-Cal	T-tab	Decision
Experimental	128	68.6	9.6	0.05	9.29	1.96	Rejected
control	112	57.8	8.4				

In table 4, the t-test cal of 9.29, which is above the t-critical value of 1.96 at 0.05 level of significance, indicates that there is significant mean difference between the performance of the two groups of students. That is to say that those taught with geo-board game did better than those taught with conventional method.

HO₂: There is no significant difference on the achievement mean scores of students taught describing and locating coordinate points with geo-board game and those taught with conventional method.

Table 5: T-test Results of hypothesis two **HO₂**

Groups	N0 of students	Mean	Standard deviation	Sig level	t-cal	T-tab	Decision
Experimental	128	54.5	11.55	0.05	8.96	1.96	Rejected
control	112	43.3	7.64				

Table 5 shows that there is a significant mean difference between the achievement of students taught describing and locating coordinate points with geo-board game and those taught with conventional method. The t-cal of 8.96 is greater than the t-critical value of 1.96 at 0,05 level of significance.

HO₃: There is no significant difference on the academic achievement mean score of male and female JS2 students taught the selected mathematical concepts with geo-board.

Table 6: T-test Results of hypothesis three **HO₃**

Groups	N0 of students	Mean	Standard deviation	Sig level	t-cal	T-tab	Decision
Male	125	68.12	9.5	0.05	1.07	1.96	Fail to reject
Female	115	66.89	8.3				

Finally, in table 6, the t-cal of 1.07 which is less than the t-critical value of 1.96, shows that there is no significant difference between the mean score of males and females.

Discussion of findings

Based on the result in table one, it appears to suggest that both students in experimental and control groups achieved high mean score, though with experimental group scoring higher. This implies that the problem of poor achievement in Mathematics among secondary school students can be tackled through practical oriented approach. Obviously, use of geoboard game belongs to such approaches. For instance, this study clearly showed that the students taught identifying and differentiating polygons with geoboard had higher mean with mean gain score of 10.8 than their counterpart taught with conventional method. This finding is in consonance with the report of WAEC Chief Examiner (2012) that teachers should be encouraged to use instructional materials during lessons so as to re-enforce the learning of mathematical concepts. More so, the result confirms the postulations of Alio and Okafor (2010), that use of appropriate teaching materials to teacher Mathematics concepts and principles, arouses students' interest and increase the volume of learnt materials. This mean different was found significant as shown in table 4. Table 4 indicated a significant mean difference in favour of the experimental group. This implies that, though the student may achieve high, the use of geo-board in teaching has a significant positive effect on the achievement of the students.

Similarly, table 2 indicates that students taught describing and locating coordinate points with geo-board game achieve higher than those taught with conventional method. This shows that use of geoboard game, which can be improvised by the teacher, is vital to and good for improved achievement in describing and locating coordinate points. This finding is supported by Daniel (2001) and Adeniran (200) with the statement that improvised materials (geoboard) sourced from the students' environment makes them exposed to creativity, innovation and curiosity, all of which are fundamental to qualitative teaching and learning processes. The t-test result in table 5 also confirmed a significant mean difference between the mean score of the experimental and control group; indicating that geo-board game has significant effect on the academic achievement of students.

Finally, the results in table 3 showed a slight difference between the score of male and female students taught with geoboard. However, the t-test result in table 6 indicated no significant difference. This implies that gender has no significant effect on the academic achievement of the students. That is both male and female students benefitted equally from the use of geoboard game in teaching all the selected mathematical concepts. This finding is similar to that of Olasehinde & Olatoye (2014) and also that of Ajai and Imoke (2015) that gender had no effect on academic achievement of students in Mathematics. However, the finding contradicts that of Ogbu (2005), who found that female students who were taught with stimulation games achieved higher than their male counterparts.

Conclusion

The researcher concludes that teaching and learning of Mathematics with geoboard game improve students' achievement in Mathematics more than teaching and learning with conventional method. Again, gender is not a significant factor in using geoboard games to teach JS2 students Mathematics. Both males and females achieved equally when taught with geoboard games.

Recommendations

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

1. Mathematics teachers should incorporate geo-board game in teaching various concepts in Mathematics.
2. Teachers should be encouraged by their supervisors to use geo-board game and other Mathematics games, by providing them with necessary materials, including creating more time on the timetable for Mathematics.
3. Federal and state ministries of Education, professional bodies, such as the Mathematical Association of Nigeria (MAN) etc., should organize in-service training and/or workshop

on regular basis for the teachers to upgrade their knowledge on the modern trends in teaching process, especially on the use of geo-board game.

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