

Effect of Globe Game on Students Interest and Achievement in Longitude and Latitude

Julius Ongele Ugama¹ Ndukwe Oji Nnachi² Nkechi Maduagwuna³

Department of Science Education, Faculty of Education,
Ebonyi State University, Ishieke Campus, Abakaliki – Nigeria

Abstract

This study was designed to determine the effect of globe game on students' interest and achievement in longitude and latitude. Three research questions and three null hypotheses were formulated. Design for the study was a quasi-experimental non-equivalent control group's pre-test and post-test design. The sample for this study comprised of Two hundred and eighty four S S11 students. Six secondary schools were drawn through a stratified random sampling technique. Three schools (one male, one female and one co-educational) were assigned to the treatment group while the remaining three schools were assigned to the control group. The treatment group was taught longitude and latitude using the globe game approach while the control group was taught longitude and latitude using the conventional method. Longitude and Latitude Achievement Test was used to collect data on the achievement of students, the Longitude and Latitude Interest Scale was also used to collect data on interest of students in longitude and latitude. Research questions were answered using mean and standard deviation while hypotheses were tested using the Analysis of co-variance (ANCOVA) at an alpha level of 0.05. The result revealed that globe game approach is superior to the conventional method in facilitating interest and achievement but no significant interaction between gender and instructional method. The researchers therefore, recommended that globe game approach should be used in secondary school system.

Keywords: Globe Game, longitude and attitude.

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1. Introduction

Poor achievement of students in mathematics in external examination is linked to the use of conventional method in teaching secondary school mathematics (Obioma, 2014; Galadima, 2015 & Simeon and Francis, 2016). The conventional teaching methods often used by teachers in teaching Mathematics include the lecture method, demonstration and direct instruction, among others. These conventional (chalkboard and talk) methods of teaching stress more on the transmission of knowledge in a manner that emphasizes memorization (Agwagah, 2014 and Bernard, 2015). They reported that mathematics teaching in our school system today still follow the conventional method than the activity method. This conventional (chalkboard and talk) method is a method of teaching whereby the teacher assumes the major role of teaching - learning process while the students only listen and are not actively involved. Activity method should be embraced by the mathematics teachers to ensure optimum achievement in mathematics.

The WAEC Chief Examiners Report (2016), suggested that students' performance in mathematics could be improved through meaningful and proper teaching. According to the report, teachers should help students develop interest in mathematics by reducing the abstractness of mathematics, and hence remove their apathy and fear of the subject. By the use of instructional materials for active learning the cognitive, affective and psychomotor domains of the learners are collectively and simultaneously developed. One of such instructional approach is the mathematical game approach.

A game is regarded as Mathematical when the players can perceive and/or influence the course of the game on the basis of Mathematical considerations (Agwagah, 2001). She evaluated the effectiveness of mathematical games and advanced reasons for the use of games. Among the reasons are that the tools for learning mathematics, learning mathematics by so doing, reduce tension, minimize boredom and encourage acquisition of knowledge and skills, practical application and systematic drill that are necessary for acquiring mathematical knowledge and skills. Games are also valuable for encouraging social skill, for stimulating mathematical discussion, helping the development of mathematical understanding, for developing strategies, for learning new concepts, reinforcing skills and concepts as aid to symbolization and logic (Oldfield, 2015).

Akinlade (2014) and WAEC (2011), have confirmed that longitude and latitude is one of the topics among the abstract and complex aspects of mathematics, which students find difficult to learn, and some teachers find it difficult to teach without the use of instructional materials. As such it is highly speculated that the use of these games in teaching longitude and latitude will go a long way in resolving the conflicts students encounter in learning longitude and latitude. It is argued that since these games are culturally oriented, there is likelihood that the interactive influence of culture on gender may come into play in course of instruction. As such it is yet not known, the extent to which male and female response to the game approach in terms of interest and achievement in teaching

longitude and latitude.

Interest is an important factor needed for a brilliant output of any task (Abonyi and Ebere, 2014). In education, interest is a state of wanting to learn an academic content or subject. Interest is a major learner characteristic that plays a key role in students' achievement in a subject. A learner who is interested in a subject would likely enjoy and feel satisfied in what he or she is expected to do. When lessons do not accommodate students' interest as a tool with which to achieve, learners lose interest and feel disengaged (Weber, 2015).

Previous studies; Obodo (1990); Agwagah (1993) and Okigbo (2014), consistently show that interest is significantly correlated with game methods to enhance students' achievement in longitude and latitude. Achievement is the accomplishment of a goal Wikipedia free encyclopedia (2016). Hence academic achievement refers to the accomplishment of academic goals, the educational outcomes of students or rather the extent to which a student, a teacher or an instructor has achieved the stated educational objectives.

A major problem or issue of academic concern at this point is: what would be the effect of globe game on students' interest and achievement in longitude and latitude?

2.1 Objective of the Study

The main purpose of the study was to find out the effect of Globe Game on students' interest and achievement in longitude and latitude in Senior Secondary II students' mathematics. The study specifically determined:

- The effect of Globe Game on students' interest in longitude and latitude.
- The effect of Globe Game on students' achievement in longitude and latitude.
- The interaction effect of gender and instructional approach on students' achievement in longitude and latitude.

2.2 Scope of the Study

The study was carried out in Nigeria to find effect of globe game on students' interest and achievement in longitude and latitude. The study is delimited to the content area of longitude and latitude for Senior Secondary II students' mathematics curriculum content.

2.3 Research Questions

The following research questions guided this study:

1. What is the effect of the Globe Game on students' interest in longitude and latitude?
2. What is the effect of the Globe Game on students' achievement in longitude and latitude?
3. What is the interaction effect of gender and instructional approach on students' achievement in longitude and latitude?

2.4 Hypotheses

The following null hypotheses were tested at 0.05 significant levels for the study;

- H₀₁:** There is no statistically significant difference in the mean interest scores of students taught longitude and latitude using the globe game approach and those taught longitude and latitude using the conventional approach.
- H₀₂:** There is no statistically significant difference in the mean achievement score of students taught longitude and latitude using the globe game approach and those taught longitude and latitude using the conventional approach.
- H₀₃:** There is no statistically significant interaction between gender and method (globe game) on students' achievement in longitude and latitude.

3.0 Research Method

This study employed a quasi-experimental procedure. The reason is because the researcher, used intact classes and as such could not achieve random assignment of subjects to Treatment and control groups. The specific design the researcher, adopted was a pretest -posttest non-equivalent control group design. Intact classes were used to avoid disruption of normal classes, Ali, 1996. The researchers manipulated the independent variable; that is teaching strategy and observed the effect on the dependent variables that is interest and achievement. The design can be represented thus:

$$\frac{Y^b \times Y^a}{Y^b - X \times Y^a}$$

Where

- Y^b = Measurement taken before treatment
 Y^a = Measurement taken after treatment
 X = Treatment (Globe Game Instruction)
 $-X$ = Control (Conventional Approach)

3.1 Population

The population of the study comprised 1,210 Senior Secondary 11 students in public secondary schools. The choice of the public schools is because they all have peculiar students' behavior and use the same curriculum. The S. S. 11 students were used for the study because the national curriculum for secondary schools provides that Mathematics must be offered by all the S. S. 11 students and longitude and latitude is among the topic to be taught in S.S II Mathematics Federal (Ministry of Education, 2014).

3.2 Sample

The sample size for this study was 284 SS11 students drawn from six secondary schools. The schools were drawn through a purposive random sampling. Three of the drawn schools was assigned to the treatment group while the others was assigned to the control group.

3.3 Instrument for Data Collection

Two instruments namely Longitude and Latitude Achievement Test (LLAT) and Longitude and Latitude Interest Scale (LLIS) were used. Both LLAT and LLIS consisted of 50 five option questions each. The LLAT instrument was used for both the pretest and posttest. The items in the pretest were reshuffled and the colour of the paper changed before administering them as posttest. A student was expected to indicate the extent to which the student agrees or disagrees with the items.

3.4 Validity of Instrument

The Longitude and Latitude Interest Scale (LLIS) was assessed for validity using Factor Analysis. Using the principal component analysis, five factors were extracted. Out of the five factors, no item was purely loaded on factor 2. In all, thirty items were loaded on factors 1, 3, 4 and 5. For factor 1, which addressed Academic Interest, items 5, 6, 9, 10, 15, 21, 31, 32 and 41 were loaded on it. For factor 3 which addressed Vocational Interest, items 23, 25, 35,36,38,39, and 49 were loaded on it. For factor 4 which addressed Leisure Interest, items 3, 7, 8,11,18,44 and 45 were loaded on it. For factor 5 which addressed on General Interest, items 12, 13, 27,29,30,47 and 50 were loaded on it. The remaining 20 items of the instrument were dropped because they did not meet the criteria for accepting an item base on the conditions of Meridith of 1968.

3.5 Reliability of Instrument

Longitude and Latitude Achievement Test (LLAT) was administered to 50 SS II students outside the schools involved in the study. The data obtained from the study were used to calculate the reliability of LLAT using the Kuder-Richardson's formula 20 (K-R-20). A reliability co-efficient of 0.91 was obtained. The data was also used to determine the difficulty and discrimination indices of LLAT.

Reliability was also determined for each of the four (4) sections of the instrument (LLIS) as was extracted using factor analysis. Cluster A which contains items on Academic interest yield an alpha of 0.65, cluster B which contains items on vocational interest yield an alpha of 0.63, cluster C which contains items on leisure interest yield an alpha of 0.68 while cluster D on general interest yield an alpha of 0.77.

3.6 Treatment

Before the onset of the treatment, subjects in both treatment and control groups were given the pre-test. After the pre-test the regular mathematics teachers started the treatment in their respective schools. They adhered strictly to the lesson procedure developed from the packages. The treatment group was taught using the Mathematics on the globe game package. To play the game, a coin is tossed to decide the player that takes the first turn or the players should throw a die in turn and whoever obtains the highest number starts the game. The throw should be repeated if there is a tie only for those players involved. A player plays by spinning the disc. When the disc stops rotating usually the pointer should indicate a pair of letters. The player concerned then writes down the coordinates of the positions of the letters as seen on the globe and calculates the distance along the longitude or latitude as the case may be between his initial position and his position on the globe. A maximum of four points should be scored after a play. That is one point each for correct coordinating of the positions for the letters on the globe, and two points for correct value of the distance between the two points. Each pair taken should be cancelled on the letter chart. The game continues in this order until twelve out of thirteen pairs of the letters on the disc have been taken. Then, at the end of the game a winner results from comparing two points scored by the players. If the pointer stays on the boundary line after a spin, the player loses his chance and scores no point. Further to this, if the pointer happens to indicate a pair of letters which has already been taken the player is allowed a second chance, and if after spinning a second time the pointer either stays on a boundary line or indicates the same or another pair of letters which has been taken, the player loses his chance, otherwise he is scored accordingly, while the control group was taught using the conventional package. The treatment was conducted during the normal school periods, following the normal timetable of the school. At the end of the treatment that lasted for six weeks, the teachers administered the

post-test. Data from the pre and posttest were used to answer the research questions and test the hypotheses which guided the study.

1. In constructing a Globe Game, one must first get a spinning plastic board or disc cut to size.
2. Engage the services of designer or artist to produce English Alphabets and mark them in pairs round the disc or board.
3. Construct a pointer that will be located at the middle or center of the disc to service as an indicator that will rotate.
4. It will also include a picture of a geographical globe on which each of the letters of the English alphabet is marked to define a point of intersection of longitude and latitude.

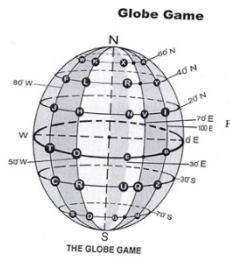


Figure 1: Globe Game

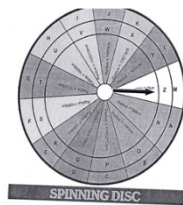


Figure 2: The Globe game

Points	Coordinates of points		Distance apart
	Point 1	Point 2	

Table 1: Score sheet

A	N
B	O
C	P
D	Q
E	R
F	S
G	T
H	U
I	V
J	W
K	X
L	Y
M	Z

Table 2: Letter Chart

3.7 Control of Extraneous Variables

The researchers employed the following measures to ensure that extraneous variables, which may introduce bias or error into the study, were checked appropriately.

- (a) **Teacher Variable:** The researchers organized a pre-experimental conference for all the mathematics teachers that were used for this study. During the conference individual differences of the teachers were identified and remedied. A uniform lesson note was developed by the researchers for teachers in each group. The teachers conducted the experiment in their respective schools. The experiment was regularly monitored by the researchers to ensure that the teachers do not deviate from the agreed pattern of instructions.
- (b) **Instructional Situation Variable:** The researchers issued out the lesson note to the teachers in each group. The teaching was conducted in all classes of SSI 1 in the various schools that were used for this study and not just in the intact classes that were drawn for the study.
- (c) **Intergroup Variable:** Because intact classes were used for this study it is implied that initial equivalence was not achieved for the research subjects in the two groups. In order to control for this inter group differences the experiment employed analysis of co-variance during data analysis.
- (d) **Hawthorne Effect:** The researchers did not select treatment and control groups from the same school to ensure that the students in the treatment and control groups did not mix up at all. This is to reduce the error arising from interaction and exchange of ideas among research subjects from the two groups.

At the beginning of the experiment, the teacher administered the pre-test (for the achievement) to the students and the scores recorded. At the end of the experiment, the post-test for the achievement was administered and the scores of the students recorded.

Research questions were answered using mean and standard deviation while hypotheses were tested using the Analysis of co-variance (ANCOVA) at an alpha level of 0.05.

4.0 Results

4.1 Research Questions

Research Question 1: What is the effect of the Globe Game on students' interest in longitude and latitude?

Table 3: Mean longitude and latitude interest scores of students taught longitude and latitude using the globe game approach and those taught with the conventional method.

Groups	N	Adjusted mean	Std Dev.
Treatment Group (Group Taught with Mathematics on the Globe Game Approach)	169	72.34	6.38
Control Group (Group taught with conventional method).	115	52.40	11.02

Summary of the result in Table 3 reveals that globe game approach yielded adjusted mean interest score of 72.34 with a standard deviation of 6.38 while the conventional method yielded adjusted mean of 52.40 and a standard deviation of 11.02 implying that students taught with the globe game approach obtained higher interest score than those taught with conventional approach.

Research Question 2: What is the effect of the Globe Game on students' achievement in longitude and latitude?

Table 4: Mean longitude and latitude achievement scores of students taught longitude and latitude using the globe game approach and those taught with the conventional method.

Groups	N	Adjusted mean	Std Dev.
Treatment Group (Group Taught with Mathematics on the Globe Game Approach)	169	60.92	10.74
Control Group (Group taught with conventional method).	115	39.08	7.77

Summary of the results presented in Table 4 reveal that globe game approach yielded adjusted mean achievement score of 60.93 with a standard deviation of 10.74 while the conventional method yielded adjusted mean of 39.08 and a standard deviation of 7.77 implying that students taught with the globe game approach obtained higher achievement score than those taught with conventional approach.

Research Question 3: What is the interaction effect of gender and instructional approach on students' achievement in longitude and latitude?

Table 5: Summary of interaction effect of gender and teaching method on students' mean achievement scores in longitude and latitude.

Groups	Adjusted means for gender categories	
	Male students	Female students
Male students	63.53	59.00
Female students	37.61	40.17

Summary of result presented in Table 5 reveal clearly that there is no interaction between gender and teaching method on students' mean achievement scores in longitude and latitude. Result presented in the table indicated that globe game approach is to the conventional approach at the two level of gender (male and female).

4.2 Hypotheses

H₀₁: There is no statistically significant difference in the mean interest score of students taught longitude and latitude using the game approach and those taught longitude and latitude using the conventional approach.

Table 6: Analysis of Co Variance Results for Students Overall Longitude and Latitude Interest scores by teaching methods and by gender

Sources of variation	Sum of squares	DF	Mean squares	F	Sig. of F
Covariate	15017.220	1	15017.220	618.157	.000
Main Effects	25773.345	1	12886.673	530.457	.000
METHODS	25773.017	1	25773.017	1060.900	.000
Explained	41107.765	4	10276.941	423.032	.000
Residual	6777.897	279	24.294		

The ANCOVA table shows that the Sig. of F (.000) is less than the alpha level (0.05). The decision rule is to reject the null hypotheses when the alpha level is greater than the computes significance of F. The researchers, therefore, rejects the null hypothesis and concludes that there is a significant difference in the mean interest scores of students taught longitude and latitude using the globe game approach and those taught longitude and latitude using the conventional approach.

H₀₂: There is no statistically significant difference in the mean achievement score of students taught longitude and latitude using the game approach and those taught longitude and latitude using the conventional approach.

H₀₃: There is no statistically significant interaction between gender and Instructional approach on students' means achievement in longitude and latitude.

Table 7: Analysis of Co- Variance for Students Overall Longitude and Latitude Achievement scores by teaching methods and by gender

Sources of variation	Sum of squares	DF	Mean squares	F	Sig. of F
Covariate	11748.447	1	11748.447	187.917	.000
Main Effects	29295.940	2	14647.970	234.296	.000
METHODS	29006.874	1	29006.874	463.967	.000
GENDER	271.817	1	271.817	4.348	.038
2-Way Interactions	91.978	1	91.978	1.471	.077
Methods & Gender	91.978	1	91.978	1.471	.077
Explained	41504.277	4	10376.069	165.966	.000
Residual	17442.860	279	62.519		
Total	58947.137	283	208.294		

Summary of results in Table 7 reveal that for hypothesis 2, the alpha level (0.05) is greater than the Sig. of F (.000). Based on the decision rule the researchers rejects the null hypothesis and conclude that there is statistically significant difference in the mean achievement score of students taught longitude and latitude using the game approach and those taught longitude and latitude using the conventional approach.

For hypothesis 3, summary of results in Table 7 reveal that the alpha level (0.05) is less than the Sig of F (.077). The researchers therefore uphold the null hypothesis and concludes that there is no statistically significant interaction between gender and Instructional approach on students' means achievement in longitude and latitude.

4.3 Summary of Results

The results revealed that:

- ❖ Globe game approach fostered higher interest in longitude and latitude than the conventional approach. Mathematical game approach is therefore superior to conventional approach in facilitating higher interest among students.
- ❖ There is statistically significant difference in the mean achievement score of students taught longitude and latitude using the game approach and those taught longitude and latitude using the conventional approach.
- ❖ The mean achievement scores of male students are significantly higher than the mean achievement of female students using the globe game approach. But there is no statistically significant interaction between gender and Instructional approach on students' means achievement in longitude and latitude.

5.0 Discussion

The results presented in table 3 above shows that the mean interest score of students in experimental group was higher than the mean interest score for control group. This implies that globe game approach is superior to the conventional approach in enhancing students' interest in longitude and latitude. Therefore interest of students in learning with games is encouraged.

The use of game in teaching /learning has been observed to foster and arouse students' interest in longitude and latitude as both male and female students' enjoyed the globe game approach.

The result on the effect of Globe Game on students' means achievement in longitude and latitude indicated that students taught longitude and latitude using globe game performed significantly better than student' taught using the conventional method. In other words, the experimental group produced higher mean achievement score than the control group taught the same topic using the conventional method.

From this, one could infer that students in the experimental group of this study advanced in level of understanding as they applied their own understanding of the rules of the game in solving mathematical problems such as the one of longitude and latitude.

The interaction effect of gender and instructional approach on students' mean achievement in longitude and latitude reveal that there is no interaction between gender and teaching method on students' mean achievement scores in longitude and latitude. The summary of the result indicated that globe game approach is superior to the conventional approach at the two levels of gender in fostering achievement. Treatment interaction generally implied that different learners with different characteristics may profit more from one type of instructional than from another and therefore it may be possible to find the best match of learners characteristics and instructional approach in order to maximize learning outcomes or whichever dependent variable that is involved.

Although the goal of research in treatment interaction is to find significant disordinal interaction between alternative treatments and personal variables, it must be emphasized here that any approach which yields a superior no interaction is cost effective and better in all ramification. With this in mind, one may begin to appreciate the worth of the mathematical game approach both in its superiority over the conventional approach and its ability to accommodate both males and females in fostering achievement in longitude and latitude.

5.1 Conclusions

The following conclusions were made.

- ❖ The globe game approach as a teaching method is significantly better than the conventional teaching method in enhancing students' interest and achievement longitude and latitude.
- ❖ There is no significant interaction between gender and instructional approach on students' achievement in longitude and latitude. For both males and females, the globe game approach is superior to the conventional approach in fostering interest and achievement in longitude and latitude.

The enhancement of teaching and learning promoted by the finding of this study has called for the need for the mathematics teachers to use mathematical game approach like globe game in teaching student longitude and latitude. Teachers could use the design in let eloping other packages to be used in teaching the students other difficult concepts in Mathematics for better understanding.

As the use of globe game has made both male and female students to achieve highly the concept of longitude and latitude, it is desirable that government should establish and fund educational resource center in each state where Multimedia Projection/ e-learning software packages like globe game could be developed and made available to teachers to be used as other games for teaching the students. This would make the teaching and learning of mathematics very interesting which in turn lead to higher interest and achievement in mathematics. Principals of schools as representatives of governments in their respective schools could see the need to provide and equip mathematics laboratory where teachers could practice difficult mathematical concepts for better understanding by students. This would make for active participation of learners in the classroom, generate interest and enhance understanding, leading to high performance in Mathematics by both male and female students.

The interaction effect between teaching method and gender with respect to achievement is not statistically significant. This means that globe game approach is not gender biased in terms of achievement. It should, therefore, be employed in teaching and learning to enable the students understanding, develop critical and creative thinking in their minds and eradicate the problem of poor interest and achievement in both internal and external examinations.

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