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Effect of Mathematics Palace Game on Senior Secondary School Students' Achievement on Plane Shapes.

[1]Khama Valentine A & [2]Nwosu Stanley U.

[1&2]Department of Mathematics and Computer Education, Enugu State University of Science and Technology (ESUT), Enugu.

Email: [1]valentine.khama@esut.edu.ng

ABSTRACT

This study investigated the effect of mathematics palace game on senior secondary school students' achievement on plane shapes. Quasi-experimental design was used for the study. Two intact classes were used for the study. A sample of 120 Senior Secondary School One students, drawn by simple random sampling technique, was used for the study. The subjects were of two groups: one consisting of the experimental group and the other the control group. Plane Shape Achievement Test was the instrument used to collect data. Two research questions and two hypotheses guided the study. The data for the research questions were answered descriptively using mean and standard deviation. The findings of the study revealed that there is a significant difference in the mean achievement scores of students taught plane shapes using the mathematics palace game and those taught plane shapes using the lecture method. The male and female students in the experimental group have mean achievement scores close to each other. It was recommended, among others, that school head teachers should organize workshops for mathematics teachers in their respective schools on design, construction and use of mathematics palace game.

INTRODUCTION

Mathematics is the orderly study of the structures and patterns of abstract entities. Normally, the subjects that mathematics talks about, corresponds to objects about which an intuitive understanding relates (Mathematics Dictionary, 2009). This explains that mathematics is precise and accurate and develops the human cognitive domain. Nneji (2014) stated that mathematics develops in its learners the habit of precise and logical thought; it is used for thinking about and facilitating the learning of all other subjects. Mathematics empowers students with the skill to understand better the information of the world we live in. Among other things, mathematics empowers and equips us with knowledge that will enable us to be useful to our society and the world at large. Regardless of the nature and importance of mathematics, it has low performance among students (Ezema, 2008).

There is need for innovation in the teaching methods and strategies employed by teachers in the teaching of mathematics. Obodo (2004) defined innovation as a deliberate change whereby one or more definite changes are accepted by a state, country, group or school for the purpose of achieving some objectives or goals.

Mathematics laboratories should be put into consideration when talking about teaching strategies. Agwagah (2001) observed that the problem of ineffective teaching can be tackled through planned and intelligent application of the mathematics laboratory. Mathematics laboratory is a place where students can learn and explore various facts

and mathematical theories using varieties of activities and materials.

Games can also be seen as laboratory technique, a method of teaching concepts and topics with the use of games to make learning fun and draw interest of students. Karen (2012) defined game as an activity of rules performed or done with others for the purpose of entertainment, education or other reasons. In many games, the objective is to win by defeating the other player or players or being the first to reach a specified goal, while in others, role-playing or co-operation is emphasized. These games when introduced in teaching mathematical concepts, become mathematical games that have great effect in a teaching instruction (Karen, 2012). Over the past several years, educators have been increasingly incorporating various games into their teaching curriculum in their efforts to create fun and engaging learning environment for students. With the use of games as teaching techniques, students become more active and not distracted. Students need to be engaged more and be put at the center of the learning experience to change from "passive vessel" to active participants (Pannesse &Carlesi, 2007). The use of games is capable of involving the students in the teaching and learning activities as well as help to remove individual differences and absent mindedness which characterize most mathematical lessons (Etukudo, 2004).

The expression "mathematical games" can be used to refer to a game, to a puzzle or to a problem of any degree of difficulty. The history of mathematics shows that mathematicians of all ages dedicated some of their energies to activities that could be classified as games (Joao & Jorge, 2013). In other words, a game is mathematical when it has mathematical structure. A mathematical game is a game whose rules, strategies and outcomes are defined by clear mathematical parameters (Eze, 2005). Mathematics needs to be concretized for students to be able to comprehend without forgetting. Amusement and pleasure ought to be combined with instruction in order to make the subject more interesting. Brunner (1960) stated that games provide a superb means of getting children to participate actively in the process of learning as players rather than spectators. Mathematical games are one of the potent means of stimulating interest in mathematics learning. If mathematical games are effectively planned, they can be used to enhance creativity, encourage problem solving, introduce new mathematical ideas and improve study habit (Eze, 2005).

According to National Mathematical Centre (2012), mathematics palace game is a mathematics game designed to enable students recall and apply correctly, the formulae in solving problems on plane shapes and others specified. The mathematics palace game is a board game made from cardboard sheets. It consists of a pack of cards, die, eight game tokens, pack of teaching cards for references and a summary of basic concepts of the topic. The interest of every player is to get to the "mathematical palace" first. To do so, the competitors must solve and answer questions from the board and cards selected. These questions could be on a topic or related topics under discussion. The questions would be numbered for easy identification. This will help students to respond to the questions involved in the game. A winner is decided by the first player to get all his game tokens to the "mathematical palace" numbered fifty on the game board. Furthermore, the National Mathematical Centre (2012) specified that the interest of every player is to get to the "mathematical palace". The game could be prepared for any level of the educational system. In place of teaching and learning of plane shapes, the mathematical palace game is more suitable and appropriate; it can be

used to learn at school or any convenient spot. Mathematical palace game is a remedy to the poor use of teaching strategies as full retention and interest of the learner is acquired.

Purpose of the Study

The main purpose of this study was to determine the effect of mathematics palace games on senior secondary school students' achievement on plane shapes.

Specifically, the study sought to:

1. Determine the mean achievement scores of senior secondary school students taught plane shapes using mathematics palace game (experimental group) and those taught plane shapes using lecture method (control group).
2. Determine the mean achievement scores of male and female students in the experimental group.

Research Questions

Two research questions guided the study.

1. What are the mean achievement scores of senior secondary school students taught plane shapes using mathematics palace game (experimental group) and those taught plane shapes using lecture method (control group)?
2. What are the mean achievement scores of male and female students in the experimental group?

Hypotheses

The following hypotheses were tested at .05 level of significance.

Ho1: There is no significant difference between the mean achievement scores of senior secondary school students taught plane shapes using mathematics palace game (experimental group) and those taught plane shapes using lecture method (control group).

Ho2: There is no significant difference between the mean achievement scores of male and female students in the experimental group.

Method

The quasi-experimental research design of non-equivalent control group was adopted in the study. The study was carried out in Enugu South Local Government Area of Enugu State. The population for the study consisted of 1,250 students of senior secondary school 1 in the Local Government Area. A sample of 120 senior secondary school 1 (SS1) students were gotten through simple random sampling technique (balloting). The sample was made up of 60 students in the experimental group and 60 students in the control group. The sample also consisted of 30 male and 30 female students in the experimental group, as well as 30 male and 30 female students in the control group. Instrument used for data collection was Plane Shapes Achievement Test (PSAT). The instrument was developed by the researcher. It was made up of 30 multiple choice questions with four options each. The items were drawn using a table of specification to ensure adequate coverage of the content area covered in the study as well as maintain even spread across the different levels of the cognitive domain.

PSAT was face validated by three research experts, one of whom was a specialist in measurement and evaluation and the other two specialists in mathematics education. PSAT was also trial-tested and the result obtained was used to calculate the reliability coefficient to get .77 using Kuder-Richardson's formula 20 (KR-20). Data obtained from research questions were analyzed using mean and standard deviation while the two null hypotheses were tested at .05 level of significance using students t-test.

Results

The results were presented in tables according to the research questions and hypotheses that guided the study.

Research Question 1
What are the mean achievement scores of senior secondary school students taught plane shapes using mathematics palace game (experimental group) and those taught plane shapes using lecture method (control group)?

Table 1: Mean Achievement Scores and Standard Deviations of Experimental and Control Groups.

Group	N	Mean	SD
Experimental group	60	55.0	21.8
Control group	60	40.0	22.7

The table showed that the students in the experimental group had a mean score of 55.0 and a standard deviation of 21.8 while the students in the control group had a mean score of 40.0 and a standard deviation of 22.7. The students that were taught using mathematics palace game had high mean achievement score than those of the control group. This suggests the need for mathematics teachers to de-emphasize the use of lecture method and lay more emphasis on the use of mathematics palace game in teaching plane shapes.

Research Question 2
What are the mean achievement scores of male and female students in the experimental group?

Table 2: The Mean Achievement Scores and Standard Deviation of the Experimental Group.

Experimental group	N	Mean	SD
Male	30	56.0	21.8
Female	30	55.0	20.5

From table 2 above, the mean achievement scores of the male students was 56.0 and a standard deviation of 21.8 while the female students had the mean achievement scores of 55.0 and a standard deviation of 20.5. This implied that the use of mathematics palace game was very effective to the male and female students in the experimental group.

Hypothesis One
There is no significant difference between the mean achievement scores of senior secondary school students taught plane shapes using mathematics palace game (experimental group) and those taught plane shapes using lecture method (control group).

Table 3: t-test on the mean achievement scores of senior secondary school students in the experimental and control groups

Groups	N	mean	std. deviation	t-cal	t-crit	df	dec.
Experimental	60	55.0	21.8	3.694	1.658	118	s
Control	60	40.0	22.7				

The result in table 3 showed that t-calculated (3.694) is greater than t-critical (1.658). Therefore, the hypothesis is rejected based on the result. Hence, there is a significant difference between the mean achievement scores of students in experimental and control groups.

Hypothesis Two:
There is no significant difference between the mean achievement scores of male and female students in the experimental group.

Table 4: t-test on the Mean Achievement Scores of Male and Female Students in Experimental Group

Gender	N	Mean	std deviation	t-cal	t-crit	df	dec
Male	30	56.0	21.8	0.178	1.671	58	NS
Female	30	55.0	20.0				

The result in table 4 showed that t-calculated (0.178) is less than the t-critical (1.671). Therefore, the null hypothesis is not rejected based on the result. So, there is no significant difference between the male and female students in experimental group.

Discussion of Findings
The result for Research Question 1 shows that students taught with mathematics palace game (experimental group) had a higher mean score (55.0) in the posttest than students taught with lecture method (control group) who obtained a mean score of 40.0.The finding for hypothesis one shows that there is a significant difference between the mean achievement score of students taught plane shapes with the use of mathematics palace game and those taught with lecture method. Hence, students taught plane shapes with the use of mathematics palace game achieved significantly higher than those taught with the use of lecture method. This means that the use of mathematics palace game in teaching and learning is a success and should be encouraged. This finding may have been obtained due to the fact that mathematics games provide amusement in addition to enhancing achievement. The use of mathematics palace game in the classroom provides opportunity for play which students enjoy a lot. The above findings are in line with the findings of Nwabueze (2009) and Eze (2005) who found that mathematics games are effective in teaching students. Agwagah (2001) also showed that experimental group performed better than the control group.

The findings of Research Question 2shows that the mean scores for the males and females are close to each other. The findings for hypothesis 2 shows that there is no

significant difference between the mean achievement scores of male and female students taught plane shapes with the use of mathematics palace game. This shows that the use of mathematics palace games in secondary schools are equally effective for male and female students. Mathematics palace game can be used in teaching plane shapes irrespective of gender differences.

Conclusion

From the findings of the study, the researcher concluded that the use of mathematics palace game in teaching secondary school mathematics enhanced students' achievement. Gender is not a significant factor in using mathematics palace game in teaching senior secondary school students plane shapes. Males and females achieve equally in using mathematics palace game.

Recommendations

The following recommendations were made;

1. The state government, state ministry of education and its agencies should arrange training workshops for the secondary school teachers on the design, construction and use of mathematics palace game in teaching plane shapes in mathematics.

2. Professional associations such as The Mathematical Association of Nigeria (MAN), Science Teachers Association of Nigeria (STAN) and others should arrange workshops during their annual conferences on how to design, construct and use mathematics palace game in teaching of plane shapes in secondary school mathematics.

3. Curriculum planners should include and emphasize the use of mathematics palace game in teaching plane shapes.

4. School head teachers should organize workshops for mathematics teachers in their respective schools on design, construction and use of mathematics palace game.

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