

THE EFFECT OF MATHEMATICAL GAMES ON PRIMARY SCHOOL PUPILS-ACHIEVEMENT IN MATHEMATICS

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Abstract

This study investigated the effect of mathematical games on primary school pupils' achievement in Mathematics. The result of the study showed that pupils taught with mathematical games performed significantly better than those taught with traditional procedure. It was also equally discovered that there was no significant gender difference in the performance of pupils taught using mathematical games. The paper suggests that teachers should at all times use mathematical games in the teaching of mathematics for proper understanding of mathematical concepts.

Introduction

The cruxes of passing down skills in a piece of instruction have been the focus of academic and pedagogical researchers for some time now. The needs to identify the means by which learners can be made to grasp the contents of lessons easily and intelligibly have always been the concern of the educators. The primary school is the level at which conceptual development is still limited. The teacher must therefore try to provide variety of materials and experiences, which will lead pupils to greater understanding of mathematical concepts. Games provide such experiences. Hence, mathematics educators have called for the inclusion of games in the mathematics curriculum of young children.

A game according to Brown (1977) is a competitive activity involving skills, chance, endurance on the part of two or more persons who play according to a set of rules, usually for their amusement or for that of spectators. A game is therefore a situation in which two or more participants; the players, confront one another in pursuit of certain conflicting objectives (Agwagah, 2001).

A game is regarded as mathematical when the player can perceive and/or influence the course of the game on the basis of mathematical considerations (Thiele, 1990). In other words, a game is a mathematical game when it has a mathematical structure.

Mathematical games can be of advantage to both pupils and teachers (Campbell and Drummond, 1977; Ernest, 1986; Cruikshank and Martin, 1981). Agwagah (2001) opines that "Games can help pupils develop positive self-concept by reducing fear of mathematics and anxiety at the same time". The winning offers them opportunity for courage and confidence in the learning of mathematics. If mathematical games are effectively planned, they can be used to enhance creativity, encourage problem solving, introduce new mathematical ideas and improve study habit (Johnson, 1973).

Children enjoy playing games and games are their most natural means of expression. This justifies the use of games in the mathematics classroom. This study is therefore to investigate the effect of mathematical games on primary school pupils' achievement in mathematics.

Statement of the Problem

There has been a continuous search for ways and means of improving children's performance in Mathematics. But it seems that as the search continues children's performance in mathematics gets worse, especially at the primary school level which should be the foundation for further studies in the subject. The question therefore is, 'why do children fail mathematics'?

One of the reasons is "rate of learning" (Liebeck, 1984). According to him, children learn not only in different ways, but at different rates. This implies that the learning process is never the same for different children. Here lies the challenge for the teachers in using mathematical games, which offers alternate techniques for reinforcing children's understanding of mathematical concepts.

Purpose of the Study

The purpose of this study was to determine the effectiveness of mathematical games in fostering

learning and removing gender disparity in academic performance. It was designed to unveil the degree of efficiency of mathematical games as aid to learning and teaching when compared to traditional method of instruction.

Significance of the Study

One of the importance of the study is to combine learning with pleasure. Mathematical games are means of releasing tension and also establishing a friendly atmosphere which allows the free growth of the skills and knowledge of mathematics. Findings from the study would also enable the researcher to make recommendation on the effect of mathematical games in the teaching and learning of mathematics.

Hypotheses

The following hypotheses were formulated for the study:

- (1) There is no significant difference in the mean achievement scores of pupils taught with mathematical games and those taught with the traditional method,
- (2) There is no significant difference in the mean achievement scores of male and female pupils taught with mathematical games.

Research Design

The research design was quasi-experimental. Specifically, the study was pre-test and post-test non-equivalent control group design. One group of pupils (experimental) was taught using mathematical game developed by the researcher while the other (control) group was taught simple linear equations using the traditional method.

Population/Sample

The target population was made up of all the public primary schools in Kano Municipal. Two schools were randomly sampled from a total of ten public primary schools. The study sample consisted of eighty-four (84) primary six pupils from two intact classes randomly selected from two public primary schools. Two groups - experimental and control groups of forty-two (42) pupils each divided into (21) male and female were used.

Research Instrument

Data collection was made with researcher-developed algebra achievement test in simple linear equations. The instruments were pre-test and post-test often (10) short essay type questions. Test blue prints was constructed for the development of these instruments. Four units were taught during the study. There were a total of six (6) knowledge questions and four higher order questions in the essay test blue print. The same questions used in the pre-test were also used in the post-test only that the questions were rotated.

Validation and Reliability of the Instrument

The face and content validation of the pre-test and post-test instrument were ascertained by two experts in measurement and evaluation and two experts in Mathematics Education each of whom have had a minimum of six years teaching experience. Final copies of the instrument were produced with strict adherence to the observation made by the experts.

Spearman Brown Prophecy formula was used to calculate the reliability of the 10 items of the essay test. A reliability co-efficient of 0.82 was obtained. A marking scheme was prepared for the essay test to increase the scorer's reliability.

Experimental Procedure

Before the commencement of the main treatment, the pre-test was administered to both the experimental and the control groups. The results indicated that the two groups in the school were homogeneous before the commencement of the experimental study.

In the schools used for the study; mathematics was allocated two lesson periods of thirty-five minutes per week. The experimental group was taught with mathematical game - the equation card game while the control group was taught with the traditional method. In designing the instructional game, the title of the game, grade level, number of players, skills being taught, materials/equipment required, procedures and rules were

included. The pupils were taught by their regular mathematics teachers under the supervision of the researcher. These teachers had one-week training on the experimental conditions. The experiment lasted for two weeks of two periods a week. The post-test was administered to each group at the end of the experiment. The hypotheses were tested at 0.05 level of significance using independent t-test of difference of means.

Data Analysis and Results

Hypothesis One

There is no significant difference in the mean achievement scores of pupils taught with mathematical games and those taught with traditional method. The summary of the result of Data Analysis is shown in Tables 1 and 2.

Table 1: Mean, Standard Deviation and T-Ratio of Experimental and Control Group in Pre-Test

Group	N	X	S.D	D.F	T. Cal	T-Critical	P	Decision
Experimental	42	48.62	11.20	82	0.13	1.98	0.05	NS*
Control.	42	48.75	11.13					

* NS - Not Significance.

Table 2: Mean Standard Deviation and T-Ratio of Experimental and Control Group in Post-Test

Group	N	X	S.D	D.F	T. Cal	T-Critical	P	Decision
Experimental	42	68	11.79	82	5.86	1.98	0.05	S*
Control	42	52.40	9.52					

*S - Significance.

Interpretation

In Table 1, the pupils in the control group and experimental group were at the same cognitive level with mean of 48.62 and standard deviation of 11.20 for the experimental group as against mean of 48.75 and standard deviation of 11.13 for the control group in the pre-test. This gave a t-ratio of $t = 0.13 < 1.98$ which is the critical value at 0.05 level of significance. This showed that there was no significant difference in the performance of pupils in the two groups during the pre-test.

From Table 2, the post-test result showed that there was a significant difference in the mean achievement of the pupils in the two groups. This was reflected by the t-test value of $t = 5.86 < 1.98$ which is the critical value at 0.05 level of significance. Mean of 68.00 and standard deviation 11.79 for experimental group as against mean of 52.40 and standard deviation of 9.52 for control group, indicated that the experimental group taught with mathematical games performed significantly better than their counterparts in the control group. Hypothesis one is therefore rejected.

Hypothesis Two

There is no significant gender difference in the mean achievement of pupils taught with mathematical games. The data analysis results are shown in Tables 3 and 4 below.

Table 3: T-Test Analysis of P re-Test Scores Among Genders

Group	N	X	S.D	D.F	T. Cal	T-critical	P
Male	21	52.90	10.66	40	2.15	2.02	0,05
Female	21	45.67	10.65				

Table 4; T-test Analysis of Post-Test Scores Among Genders

Group	N	X	S.D	D.F	T. Cal	JT-critical	P
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Male	21	68.19	11.25	40	0.0104	2.02	0.05
Female	21	67.81	11.93				

Interpretation

Table 3 shows that there was a significant gender difference in the performance of students in the experimental group during the pre-test with males scoring higher. However, this was eliminated by the performance of the group in the post-test which produced a t-ratio of $t = 0,0104 < 2.02$ as against t-ratio of $t = 2.15 > 2.02$ obtained from pre-test. The result thus showed that there is no significant gender difference in the performance of the subjects in the experimental group taught with mathematical games.

Discussion

The study showed that the use of mathematical games in teaching mathematics have positive effect on the pupils' achievement in mathematics. The pupils taught with mathematical games performed significantly better than their counterparts taught with traditional procedure. This finding confirms the assertion of Agwagah (2001) who advanced that the use mathematical games get pupils actively involved in the learning activities; offer means of helping pupils to continuously learn new concepts; encourage creative thinking in pupils, stir the sense and stimulate inquisitiveness.

The nullification of the attended achievement gap between male and female pupils which was prevalent in the pre-test and post-test of the experimental group is another important outcome of using games for teaching. Johnson (1973) had opined that the use of mathematical games for instruction stimulate and scintillate the learners, creating room for higher concentration and individualized approach to concept mastery which could have been responsible for the gender blending in the performance of the pupils in the experimental group. The teaching enabling and content mastery enforcement attributes of mathematical games could also have been the root cause of gender equality in the achievement of pupils in the experimental group.

Conclusion

The main purpose of this study was to find out the effect of mathematical games on primary school pupils' achievement in mathematics. The result showed that there exists a significant difference in the performance of the pupils in the two groups and no significant gender difference in the performance of pupils in the experimental group. This implies that the use of mathematical games in teaching enhances effective learning and higher performance as well as induces gender parity in mathematics achievement.

Recommendations

Based on the findings of the study and the conclusion drawn, the following recommendations are made:

- (1) Mathematics teachers should be trained and be well acquainted with mathematical games.
- (2) The principal/head teacher and Ministries of Education should make the use of mathematical games compulsory in teaching some mathematical concepts.
- (3) Enough periods should be set aside by school heads for teaching and learning mathematics with mathematical games.
- (4) Pupils should be allowed to practice mathematics at their leisure time using mathematical games.

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