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Effects of Song Based Instructional Strategy on Mathematics Achievement of Primary School Pupils in Calabar South Local Government Area of Cross River State, Nigeria

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Keywords

Gender, Instructional strategy, Mathematics achievement, Song based

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Abstract

This study adopted pretest -post test control quasi experimental design to examine the effects of song based instructional strategy on Mathematics achievement of primary school pupils' in Calabar South of Cross River State, Nigeria. Two research questions were posed which were translated into two null hypotheses. Purposive sampling and simple random sampling techniques was used to select two co-educational schools of which a sample of sixty two(62) primary four pupils 32 pupils for experimental group (15 males and 17 females) and 30 pupils for control group (14 males and 16 females) and used for the study. One instruments titled "Mathematics Achievement Test (MAT) which used as Pre-Test (PREMAT), and Post-Test (POSTMAT) was developed by the researcher and validated by experts was used for data collection. The reliability of the Mathematics Achievement Test (MAT), established using Kuder-Richardson formula 20 (KR–20) after subjecting the instruments to a trial test of 30 primary four pupils who are not part of the sample for the study but have relevant qualities as those in the study gives .89. The research questions were answer using descriptive statistics (mean) and the hypotheses

	were tested using One Way Analysis of Covariance for hypothesis two. The two analyses were tested at .05 level of significance. The findings of the study revealed that there is a significant difference between the mean Mathematics achievement scores of primary school pupils who were taught using song based instructional strategy and those taught without using song based instructional strategy , also Male and female pupils do significantly differ in their mean mathematics academic score when taught using song based instructional strategy. It was therefore concluded that achievement of pupils in Mathematics depend on effective use of song in teaching and learning of Mathematics in primary schools. Based on this, it was recommended amongst others that song based instructional strategy should be adopted in teaching pupils in primary schools in order to enhance their academic achievement in Mathematics.

Introduction

Mathematics is a compulsory and core subject both at the primary and secondary school levels. It is the central to all science subjects (Ibok, Thomas & Nyong, 2019). Mathematics provides pupils with problem-solving skills, logical thinking, and analytical skills that are essential for success in various fields. Every individual needs the knowledge of Mathematics to function intelligently and efficiently because the subject is an integral part of the human life (Ibok & Unoh, 2019). In spite of this wide range of applicability, relevance and usefulness of Mathematics, it is heartbreaking to know that teaching methods employed by most Mathematics teachers in primary schools have contributed to the challenge witnessed by learners at primary schools level. The challenge witnessed by the pupils has resulted to their poor academic achievement in Mathematics, the situation has not being improve, pupil are no longer committed to the study of Mathematics and they are not encourage to do so. Most of the pupils always trouble in recalling of the mathematical concepts that were taught in classes or struggle to learn and often do not achieve success through their learning processes (Ibok, Thomas & Nyong, 2019). The trend of poor academic achievement among pupils' over the years seems to be on the increased. This is because the approaches or strategies for teaching and learning Mathematics at primary school level is not probably being put to use effectively and there are not sufficiently eased the learning process of the subject almost at that levels. The method usually used in classroom teaching is teacher-centered and does not inspire and motivate pupils' interest towards the learning of the

Mathematics in primary schools. In order to address this situation, there is a need for a change in the methodology employed in teaching the subject to learners at the basic level of education.

One of the ways that teachers can used to enhance pupils' academic achievement in Mathematics is the use of song based instructional strategy. The song based instructional strategy is the use of song as a method of teaching in classroom which is capable of enhancing the whole child development in term of intellectual, social, emotional, physical and creativity. In order word song can be used to pass information to the children (communication song), to develop children language (language song) and to keep children busy and develop the physical domains at the same time (action song) (Alemu &. Ashagre, 2015: Kumar, Nukapangu, & Hassan, 2021). Song also offer a diverse range of educational functions, particularly in the case of young and elementary learners, song has been used widely to teach important concepts in Mathematics classroom. Mathematics teachers need to offer a learning environment that is anxiety free and at the same time serves the purpose of learning via song. According to Johar, Ab -Yajid, and Khatibi, (2020), one of the many benefits of using songs in teaching Mathematics is that teachers can acquire the focused attention of learners as well as keep them excited for learning. Mathematics requires a significant amount of repetition to practice the sounds and structures, therefore songs enrich the learning atmosphere in mathematics classes for children because such activities have a high degree of pleasant passion and allow the learners to be active participants(An& Tillman, 2015). An, Tilman, Siemssen, Zhang, Lesser, and Tinajero, (2016) stated that the used of song in teaching mathematics helped students to better understand Mathematics concepts and reduce Mathematics anxiety. A study conducted by (Benyo and Kumar 2020: Kumar 2021: Kumar, Prakash, and Singh, 2021) found a significant effect of songs on pupils' academic achievement. Songs help to offer opportunity for repetition of learning practice which is one of their significant features of learning Mathematics and enhance pupils' achievement in schools. According to Johar, Ab Yajid, and Khatibi, (2020), songs can be diffused into different stages of lessons as warm-ups or fillers to keep the pupils interested in the lessons or classroom learning. Laato, Shivoro, Pope,Gideon, and Sutinen, (2019) in their studies found a significant influence of songs in terms of motivating students to learn mathematics, enhancing academic achievement and removing the stress of doing hard mental work. Courey, Balogh, Siker, and Paik, (2012) stated that the use of song in teaching and learning Mathematics has brought about significant effects on students' achievement in Mathematics. Lawani, Arigbabu, and Adetayo, (2022) examined the effects of using songs to teach junior secondary mathematics and found a significant effect of songs on the academic achievement of students in Mathematics, Lawani,, Ifamuyiwa, Fatade, and Olurinola, (2016) opined that the efficiency of using songs enhancing Mathematics teaching and achievement Bach-Vinyets (2013) affirmed that songs are a good resource for teaching and learning of Mathematics. When songs are incorporated into Mathematics lessons, it keeps learning mathematics natural and comfortable at any level. Linder, Powers-Costello, and Stegelin, (2011) stated that mathematics instruction integrated with songs can effectively increase student's intrinsic motivation and achievement. Wentworth

(2019) conducted the study on the use of integrated mathematics and music lessons at the high school level and found song significantly influence pupils' achievement. Boyd (2013) conducted a study on the relationship between music participation and mathematics achievement in middle school students and found no significant difference in the means of mathematics scores between students who had taught using song comparison to students who were taught without songs activities. Lianb, and Zhoua, (2024) found a significant influence of song on the students' mathematics development. Holmes, and Hallam, (2017) conducted a study on the impact of participation of music on learning mathematics and found a significant influence of song on the mathematics achievement. Mabborang-Caban (2016) examined the effect of songs on students' Attitude and Achievement found out that the attitude and the achievement of the students was better when they were taught with the use of songs. The use of songs improves academic achievement and enhances positive attitude toward a subject. Holmes (2016) examined the impact of participation in music on learning mathematics and found teaching with songs to support the development of mathematical skills and enhances Mathematics achievements

Furthermore, gender differences among primary schools pupils has been identified as one of the factors that has greatly influenced pupils' academic achievement in Mathematics. Unarguably, males and females in view of their biological structures are naturally different. Also, gender stereotyping of Mathematics by some teachers and the society, has been considered to be responsible for scaring females from the subject, making them feel they do not have the wherewithal (just like their male counterparts) to excel in Mathematics (Ibok, Thomas, Nyong, 2019). The study on the demonstrating the need to explore gender differences in academic achievement and motivation was concluded by Ganley and Lubienski, (2016) and found significant difference in Mathematics achievement between boys and girls. The girls exhibit more negative feelings and greater anxiety toward Mathematics than the boys (Ibok, Meremikwu, Orim, Anditung, & Inah, 2023). Solomon and Oyem, (2021) conducted a study on the gender differences in Mathematics achievement of students in selected secondary schools in Delta State, Nigeria and found no significant difference in the achievement of boys and girls students in Mathematics. In the same vein, Ajai, and Imoko (2015) examined gender differences in Mathematics Achievement and Retention Scores: A Case of Problem-Based Learning Method (PBL) and the study revealed that male and female students taught algebra using PBL did not significantly differ in achievement and retention scores, thereby revealing that male and female students are capable of competing and collaborating in mathematics. Herbert, Joyline, and Elliot (2020) examined gender differences in Mathematics achievement among learners in Chipinge and found no significant difference between male and female achievement. Anjum (2015) conducted a research study on gender difference in Mathematics achievement and its relation with reading comprehension of children at upper primary stage and found a significant difference between Mathematics achievement of girls and boys at upper primary school stage. Kaiser and Zhu, (2022)

conducted a study on gender differences in Mathematics achievement: A secondary analysis of programme for international student assessment data from Shanghai and found on average, boy performed significantly better and higher in their mean achievement score in Mathematics their the girls. Oluyemo, Musbahu, Kukwil, Anikweze, and Shaluko (2020) conducted a study on gender differences in Mathematics Interest and Achievement in Junior Secondary School Students, Niger State, Nigeria and found that male students excel in Mathematics more than their female counterparts. Conclusively, when songs are incorporated into mathematics lessons, it keeps learning mathematics natural and comfortable at any level. Mathematics instruction integrated with song can effectively enhance pupils' academic achievement in schools. Armed with this views, that the researchers examined the effect of song based instructional strategy on pupils' academic achievement in Mathematics in Calabar South of Cross River State, Nigeria.

Purpose of the study

The main purpose of the study is to investigate the effects of song based instructional strategy on Mathematics achievement of primary school pupils in Calabar .South Local Government Area of Cross River State, Nigeria. Specifically, the study seeks to find the:

i) Difference between the mean achievement scores of pupils in Mathematics who were taught Mathematics concepts using song based instructional strategy and that of those taught without using song based instructional strategy.

ii) Difference between the mean achievement scores in Mathematics of male and female students taught using song based instructional strategy.

Research questions

The following research questions were designed to guide the study

i. What is the difference in the pre-test and post-test mean achievement scores of pupils' in Mathematics who were taught using song based instructional strategy and that of those taught without using song based instructional strategy.?
ii. What is the difference in the mean achievement scores of male and female pupils in Mathematics who were taught using song based instructional strategy?

Research hypotheses

The following null hypotheses were formulated for the study; which was tested at 0.05 level of significance

i. There is no significant difference in the pretest and post-test mean achievement of pupils in Mathematics who were taught Mathematics concepts using song based instructional strategy and that of those taught without using song based instructional strategy.
ii. There is no significant difference in the mean achievement score of male and female pupils' in Mathematics who were taught Mathematics concepts using song based

instructional strategy and that of those taught using song based instructional strategy.

Materials and Methods

Research Design

The research design adopted was pretest – posttest control group quasi-experimental design. Two intact classes were assigned to the Control group (C) and the Experimental group (E) each.

Sample and Sampling Procedure

The target population of the study was 767 primary four pupils from 21 public primary schools in Calabar South of Cross River State, Nigeria. Purposive sampling was used to select two (2) public primary schools from the area on the basis of equipped Mathematics laboratories, good learning environment, and experienced Mathematics teachers with teaching qualification. Simple random sampling technique (precisely balloting) was next used to assign experimental and control treatments to the schools. The technique was used so as to provide classes where boys and girls work together under the same classroom environment. Proportionate simple random sampling technique was used to select 62 primary four pupils in the two selected schools and used as sample for the study. In school A, 33 pupils (15 males and 17 females) were selected and used as experimental group while in school B, 30 pupils (14 males and 16 females) and for control group.

Instrumentation

The instrument used for data collection was Mathematics Achievement Test (MAT) adopted from Cross River State First School Leaving Certificate past Questions between 2017-2022 comprised 30 multiple-choice items with four options (A to D). The MAT was drawn based on the table of specification which covers six(6) specific domains or behaviours including remembering, understanding, Knowledge, comprehension, applying, analyzing, evaluation and creating. The instruments were face and content validated by three experts and tested for reliability using Kuder Richardson 20 (KR-20) which yielded a coefficient of 0.89.

Administration of the Instrument

The research assistants who were the Mathematics teachers in the sampled schools were trained by the researcher on how the teaching was to be carried out. A pretest PREMAT was administered to subjects in both groups (experiment group and control group) to determine their academic achievement in Mathematics. The control group was taught Mathematics tasks for four weeks using only the conventional method and the experimental group was taught Mathematics tasks for four weeks with song based instructional strategy. At the end of the four weeks, the POSTMAT was administered to all the subjects.

. The instrument was firstly administered as pre-test, scored and kept without any feedback to the pupils. After the treatment, the same test with the same contents was reshuffled and given as post-test. The researcher with the help of research assistants administered research instrument (PREMAT and POSTMAT) to the subjects both tests were scored by the researcher to avoid bias and these items were scored dichotomously. The Correct options was scored 1 Mark each while each incorrect option was scored 0 Mark each. The results obtained were used for analysis. Research questions were answered using mean and standard deviation (SD) while the hypothesis were tested using Analysis of Covariance (ANCOVA) at 0.05 level of significance.

Results

Research questions were answer using mean while research hypotheses were analyzed using analysis of Covariance and tested at .05 significance level. The result of the analysis of research questions one and two is presented in the table 1 and 2 while the hypotheses were presented at Table 3 and 4

Research question one

What difference exists in the mean mathematics achievement score of primary school pupils' who were taught using the song based instructional strategy and those taught without using song based instructional strategy ?

To answer this research question, descriptive statistics was employed, the mean gained by song based instructional strategy and that of conventional method were computed and compared as it is presented in table 1.

Table1: Mean of pre-test and post-test of Mathematics achievement scores of primary school pupils' who were taught using song based instructional strategy and those taught without using song based instructional strategy(N=62)

Variables/ strategies	N	Pre-test mean score	Post-test mean score	Mean gain score
Song based strategy	32	14.1250	18.6250	4.5000
Conventional method	30	12.2667	14.9333	2.6666

The results presented in table 1 revealed that the mean gain score of primary school pupils' who are taught Mathematics tasks using song based instructional strategy (4.5000) is higher than the mean gain score of those who are taught without using song based instructional strategy (2.6666). This implies that primary school pupils who were taught mathematics tasks using the song based instructional strategy performed better than those taught without using song based instructional strategy.

Research question two

To what extent do male and female primary school pupils who were taught using the song based instructional strategy differ in their mean mathematics academic achievement score?

To answer this research question, descriptive statistics was employed, the mean gained by male and that of female pupils' in primary four when taught with song based instructional strategy were computed and compared as it is presented in Table 2.

Table 2: Mean of pre-test and post-test achievement scores of male and female pupils who were taught mathematics tasks using song based instructional strategy (N=32)

Variables/ Gender	N	Pre-test mean score	Post-test mean score	Mean gain score
Male	15	14.6667	20.1333	5.4666
Female	17	13.6471	17.2941	3.6470

The results presented in Table 2 revealed that the mean gain score of male pupils' who are taught mathematics tasks using song based instructional strategy (5.4666) is slightly higher than the mean gain score of their female counterpart taught using the same song based instructional strategy (3.6470). This implies that male pupils who were taught mathematics tasks using song based instructional strategy performed better than their female counterpart who were taught with the same treatment.

Research hypotheses

Ho:1 There is no significant difference between the mean Mathematics achievement scores of primary school pupils who were taught using the song based instructional strategy and those taught without using song based instructional strategy. The independent variable in this hypothesis is song based instructional strategy while the dependent variable is academic achievement in Mathematics. One-way Analysis of Covariance (ANCOVA) was adopted and the result is presented in Table 3.

Table 3: One-way Analysis of Covariance (ANCOVA) on the mean Mathematics achievement scores of primary school pupils who were taught using song based instructional strategy and those taught without using song based instructional strategy(N=62)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	490.979[a]	2	245.490	84.500	.000	.741
Intercept	.007	1	.007	.003	.960	.000
Pre-test	279.959	1	279.959	96.364	.000	.620
Treatment	20.452	1	20.452	7.040	.010	.107
Error	171.408	59	2.905			
Total	18242.000	62				
Corrected Total	662.387	61				

a. R Squared = .741 (Adjusted R Squared = .732)

The information in Table 3 shows that there is a significant difference between the mean Mathematics achievement scores of primary school pupils who were taught using the using song based instructional strategy and those taught without using song based instructional strategy (F=7.040, p=.010). Therefore, the null hypothesis was rejected and the alternative hypothesis was accepted. The result also shows the partial Eta squared estimate which is a measure of effect size as .107. This implies that treatment accounted for 10.7 percent of variance observed in the post-test scores of the use of song based instructional strategy influence pupils' academic achievement in mathematics. The R value of .741 which shows that there is a positive high relationship between the variables of the study and resulted to adjusted R square of .732. This suggested that about 73.2 percent shows the high variation in the dependent variable (pupils' academic achievement) which can be accounted for by pre-test.

Hypothesis two: Male and female primary school pupils do not significantly differ in their mean mathematics academic score when taught using song based instructional strategy. The independent variable in this hypothesis is song based instructional strategy, moderator variable is gender while the dependent variable is academic achievement in Mathematics . One-way Analysis of Covariance (ANCOVA) was adopted and the result is presented in Table 4.

Table 4: One-way Analysis of Covariance (ANCOVA) of the difference between mean mathematics academic score of Male and female primary school pupils who were taught using song based instructional strategy (N=32)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	217.204[a]	2	108.602	29.629	.000	.671
Intercept	2.430	1	2.430	.663	.422	.022
Pre-test	152.967	1	152.967	41.733	.000	.590
Gender	20.031	1	20.031	5.465	.027	.159
Error	106.296	29	3.665			
Total	11424.000	32				
Corrected Total	323.500	31				

a. R Squared = .671 (Adjusted R Squared = .649)

The information in Table 4 shows that there a significant difference in the mean mathematics achievement score of male and female primary school pupils when taught using song based instructional strategy (F=5.465;.p=.027). Therefore, null hypothesis was rejected while the alternative hypothesis was accepted at, 05 level of alpha. The result also shows the partial Eta squared estimate which is a measure of effect size as .159. This implies that treatment accounted for 15.9 percent of variance observed in the post-test scores of the difference in the Mathematics academic achievement of male and female pupils based on song based instructional strategy**.** The R value of .671 which shows that there is a positive high relationship between the variables of the study and resulted to adjusted R square of .649. This suggested that about 64.9 percent shows the moderate variation in the dependent variable (pupils' academic achievement) which can be accounted for by pre-test differences in gender.

Discussion of findings

The finding of the first hypothesis revealed that there is a significant difference between the mean Mathematics achievement scores of pupils who were taught using the song based instructional strategy and those taught without using song based instructional strategy. The finding agreed with Johar, Ab -Yajid, and Khatibi, (2020) who opined that using songs in teaching Mathematics can acquire the focused attention of learners as well as keep them excited for learning. The finding also agreed with An, Tilman,, Siemssen,, Zhang, Lesser, and Tinajero, (2016) who also stated that the used of song in teaching mathematics helped pupils to better understand Mathematics concepts and reduce mathematics anxiety. The fining is in line with a study conducted by (Benyo and Kumar 2020: Kumar 2021: Kumar, Prakash, and Singh, 2021) who found that songs help to offer opportunity for repetition of learning practice which is one of their significant features of learning Mathematics that enhance pupils'

achievement in schools. The finding is in consonance with the study conducted by Laato, Shivoro, Pope,Gideon, and Sutinen, (2019) who found a significant influence of songs in terms of motivating students to learn Mathematics, enhancing academic achievement. The finding agreed with Courey, Balogh, Siker, and Paik, (2012) who stated that the use of song in teaching and learning Mathematics has brought about significant effects on students' achievement in Mathematics. The finding is in agreement with the studies of Lawani, Arigbabu, and Adetayo, (2022), Lawani,, Ifamuyiwa, Fatade, and Olurinola, (2016), Lianb, and Zhoua, (2024), Holmes, and Hallam, (2017) Mabborang-Caban (2016), Holmes(2016)

The finding also agreed with. the finding of Wentworth (2019) who conducted a study on the use of integrated mathematics and music lessons at the high school level and found song significantly influence pupils' achievement.

The result of the second hypothesis revealed that male and female primary school pupils significantly differ in their mean mathematics academic score when taught using song based instructional strategy. The finding is consonance to finding of the study concluded by Ganley and Lubienski, (2016) who found significant difference in mathematics achievement between boys and girls. The finding is contradicted to the finding of Solomon and Oyem, (2021) who found no significant difference in the achievement of boys and girls students in Mathematics. The finding is in agreement with the finding of Oluyemo , Musbahu, Kukwil Anikweze, and Shaluko (2020), Kaiser and Zhu, (2022), Anjum (2015). The finding also disagreed with the finding of Ajai, and Imoko (2015) who did not found significantly difference in achievement of male and female students in Mathematics. The finding the study disagreed with the finding of Herbert, Joyline, and Elliot (2020) who examined gender differences in Mathematics achievement among Learners in Chipinge and found no significant difference between male and female academic achievement.

Conclusion

In view of the findings of this study, the following conclusion were drawn; there is a significant difference between the mean Mathematics achievement scores of pupils who were taught using the song based instructional strategy and those taught without using song based instructional strategy, also Male and female primary four pupils do significantly differ in their mean mathematics academic score when taught using song based instructional strategy. Song based instructional strategy is a learning strategy which help to arouse pupils' interest and .motivate them in learning mathematics tasks. It therefore concluded that achievement of pupils in Mathematics can be enhanced by incorporated song based instructional strategy into the teaching and learning of Mathematics in primary schools.

Recommendations

In line with the findings of the study, the following recommendations were made

i) Song based instructional strategy should be adopted in primary schools in order to enhance academic achievement of primary school pupils' in Mathematics.

ii) Government agencies and professional bodies whose responsibility is to design and revise curriculum for primary schools should incorporate and emphasize the use of song in teaching and learning of Mathematics in primary schools.
iii) Mathematics teachers who have been trained on the use of songs should be encouraged to teach their colleagues in schools in order to enhance pupils' academic achievement in schools
iv) Teachers of Mathematics in primary schools should endevour to note that gender may account for difference in pupil's academic achievement in Mathematics when taught with song. Therefore, Mathematics teaching and evaluation strategies should be free of gender bias. This will make males and females to see themselves as equal, capable of competing and collaborating in school activities.

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