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# EFFECT OF CHESS BOARD GAME APPROACH ON SECONDARY SCHOOL STUDENTS' INTEREST IN MATHEMATICS IN ENUGU EDUCATION ZONE.

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#### Abstract

The Study investigated effect of Chess Board Game (CBG) approach on Junior Secondary School One (JSS 1) students' interest in mathematic. The area of study was Enugu Education Zone of Enugu State. Two research questions and two hypotheses guided the Study. The research design for this study was quasi experimental. The sample for the Study was 270 JSS 1 students drawn from two co - educational Secondary Schools in Enugu Education Zone of Enugu State. A total of 6 intact classes were used for the study. The researchers used one instrument for data collection which is Mathematics Interest Scale (MIS). MIS was validated by three experts – two in mathematics education and one in measurement and evaluation. The reliability index of MIS in Baggaley's manuals of interest inventories was .84 and an alpha ( $\alpha$ ) of .78 as its internal consistency index. The experimental group was taught selected mathematic s topics using Chess Board Game approach, while the control group was taught the same topics using expository method. The data were analyzed using adjusted Mean and Standard Deviation (S.D.), while hypotheses were tested using Analysis of Covariance (ANCOV A) at .05 level of significance. CBG approach was found to have improved students' interest in mathematics. CBG approach has also shown differential effect on interest of male and female students in mathematics in favour of the male students. Two recommend actions were made, of which one was that mathematics teachers should utilize CBG approach in mathematics classes in order to motivate and sustain students' interest in mathematics.

Keywords: Chess Board Game, Mathematics, Interest and Expository method.

## Introduction

Mathematics is an omniscience subject because its presence is felt virtually in all subjects. It is considered as a scientific tool used to interpret scientific phenomena. Amadi (2021), emphasized its overwhelming roles in the field of learning and made recommendations about how to improve its quality of teaching and learning. Also, Amadi (2021), opined that science is technology in operation, while mathematics is the bed rock of science and technology. Strengthening the above views, Uka and Iji (2013) in Amadi (2021), maintained that mathematics is an indispensable tool for the attainment of the seven-point Agenda listed below due to its position in the school curriculum and roles it plays in the society at large. The seven-point Agenda include: (i) Power and Energy; (ii) Food Security; (iii) Wealth Creation and Employment; (iv) Mass Transport; (v) Land Reform; (vi) Security and (vii) Education. This explains why mathematics is one of the core Subjects at the secondary school level. Every student must take all the six subjects (mathematics inclusive) in group 'A' as in accordance with the National Policy on Education (N.P.E.) (F.R.N., 2015). This policy also makes mathematics an important Subject in the 6 - 3 - 3 - 4 structure, that is, every child must study mathematics for six years in primary school, three years in junior secondary school, three years in senior secondary school as a compulsory subject.

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In addition, Amadi (2021), maintained that mathematics is important because it is very much needed for pursuit of higher education in sciences, technology, social sciences, education and in some art courses. Despite the overwhelming importance and usefulness of mathematics in Nigeria educational system, development of the individual and the nation at large through the study of science and technology, the students' achievement due to low interest in mathematics both in internal and external examination has continued to deteriorate year by year (Ezeugo & Agwagah, 2000) in Ogbu (2015). Corroborating the above finding, Anaduaka and Okafor (2013) in Ogbu (2015), opined that students maintain unsteady and poor performance in all important subject - mathematics over the years as a result of low interest. The West African Examinations' Council (WAEC) Chief Examiners' Reports of May/June Senior Secondary Certificate Examination (SSCE)/ West African Senior Secondary Certificate Examination (WASSCE) from 2011 - 2015 revealed unsteady performance in Mathematics (Ogbu, 2015). Also, Ugwu (2013) in Ogbu (2015), pointed out that the West African Senior Secondary Certificate Examination (WASSCE) results for 1990 and 1991 revealed that 10.5% and 11.13% respectively passed mathematics at credit level. According to Iweka, Onwuka and Moseri (2010) in Amadi (2021), the woeful state of students' Performance in mathematics as a result of lack of interest mathematics is worrisome. Supporting the above views, Amadi(2021), disclosed the poor and fluctuating achievement results of Nigeria students in Mathematics at SSCE/ WASSCE May/June from 2000 - 2011. They opined that A1 –C6 ranged from 1.72% to 56.96%, while P7 – F9 ranged from 43.04% to 93.33% consecutively for twelve years. Further still, in the reports of the Head of National Office (HNO) of WAEC – Adenipekun (2019), revealed the full statistics of 2016 – 2020 WAEC results and students 'dwindling achievement in Mathematics as follows: A1 -C6 ranged from 31.3% to 38.9% with average percentage of 36.9%, while D7 – F9 ranged from 61.1% to 68.8% with average percentage of 63.2%.

WASSICE RESULTS IN MATHEMATICS FROM 2010 - 2020.						
YEAR	TOTAL	CREDIT AND	PASS AND BELOW			
	SAT	<b>ABOVE (A1 – C6).</b>	(D7 – F9).			
2016	1,543,974	950,730 (61.6%)	593,244 (48.4%)			
2017	1,558,452	1,108,657(71.1%)	449,795 (28.9%)			
2018	1,571,536		513,482 (32.7%)			
		1,058,054(67.3%)				
2019	1,590,173	1,020,519(64.2%)	569,654 (35.8%)			
2020	61,509		37,018 (60.2%)			
		24,491(39.8%)				
TOTAL		60.8%	39.2%			
AVERAGE						

# WASSSCE RESULTS IN MATHEMATICS FROM 2016 – 2020.

DATA SOURCE: National Bureau of Statistics (NBS, 2020).

As can be seen from the statistics in the table above, there was an unsteady trend in the achievement of the students in WASSCE mathematics within the five years' period under review. Statistical data show 9.5 percent increase between 2016 and 2017; 3.1 percent decline between 2018 and 2019; and 21.0 percent decline between 2019 and 2020. Adenipekun (2019), in his report as the WAEC's Head of Nigeria National Office, opined that students' dwindling achievement in mathematics is associated with students lack of interest due to the approach being adopted by the mathematics tutors.

In WAEC (2020), it was noted in the Chief Examiners' Report that the poor achievement of the students in mathematics was associated with the fact that the students lacked logical

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reasoning and problem solving abilities to interpret word problems in mathematics questions as well as solve them. Another striking reason adduced for the continual poor interest in mathematics by SSCE/ WASSCE students was poor approach/method of teaching mathematics (Ogbu, 2015; Amadi, 2021).Hence, to ameliorate this ugly trend, there arises urgent need to find practical way to improve the students' interest in Mathematics for the much needed technological advancement in Nigeria as well as qualitative education of Nigerians.

Nonetheless, innovative strategies could be one sure way of proffering the needed solution. Such innovative strategies are evident in the works of the following:; Mathematics Games Odo, (2015); Microsoft Excel (Ogbu, 2015); Computer Aided Instruction (Albert, 2015) and Monopoly Board Game(Amadi, 2019). Although these approaches/strategies have been found effective for teaching mathematics, yet Secondary School Students' interest in mathematics are still low as revealed in the table above knowing full well that interest spurs achievement. This tends to suggest that there is need to explore more strategies/approaches for teaching mathematics in Junior Secondary School (JSS) which may improve the Students' interest in mathematics which eventually would enhance their achievement in mathematics yet to be identified and investigated.

Chess Board Game (CBG) approach which involves teaching mathematics using Chess Board is indeed an approach being neglected by teachers of mathematics. CBG approach as the name suggests is the use of Chess Board to provide instruction. According to Amadi (2015, CBGis an Indian originated game played by two people on 42cm by 42cm carved wooden board containing 64 small square boxes (eight rows and eight columns) and 32 pieces of: king (02); queen (02); knight (04); bishop (04); pawn (16) and rook (04). The square boxes are arranged in two alternating colours (Light and Dark).



## **DIAGRAM OF CHESS BOARD GAME**

Boruchi (2011) in Amadi (2021), reported that CBG has recreational approach. According to him, although recreational approach is one of the most basic and ancient types of knowledge, yet it has not formed a part of normal instructional discourse in Nigeria. Though, it has become explicit that a lot of advanced Mathematical principles arose from ancient leisure practices. Current emphases on Mathematics instruction have continually ignored recreational aspects of Mathematics. Thus, among the recreational Mathematical games is the CBG approach. Celone (2011) in Amadi (2021), defined Chess as "a process of thought conditioned and limited by Instructions and Rules of the Game. The judgments of thought are certified or visibly expressed upon the chess board in movement of various forces." As a game, CBG approach is very necessary and important to Junior Secondary School Students because game, according to Nwoye (2012) in Amadi (2021), is one of the varieties which will stimulate the interest of learners in mathematics teaching/ learning and also enhance their

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interest. Thus, CBG approach recreates and refreshes the mind, and by so doing, may make learning novel and non – monotonous in mathematics teaching/learning.

From the foregone, it is clear that the use of CBG approach in teaching/learning of mathematics might improve secondary school students' reading skills which in turn would enhance their interest in mathematics. Chess Board has an attribute of illustrating any given mathematics concept from its components which may provide enough activities for the students. Thus, Chess Board is designed in such a way that it can use the principles of logical sequence of instruction from simple to complex and from concrete experience to abstract reasoning. Therefore, CBG approach may provide for individual differences since it can be seen, touched and manipulated. However, a pertinent question may arise as to find out whether CBG approach might have differential effect due to gender in terms of interest in mathematics. Gender in this write – up can be classified into male and female as found in co – educational secondary schools. Could it be that either the disparity or non – disparity existing between male and female students' interest in mathematics be adequately addressed by CBG approach? Researchers have not yet investigated this using CBG approach. In view of the foregone, an empirical assessment of effect of CBG approach on students' interest in mathematics might have some useful benefits which worth investigating..

# Statement of the Problem

Interest of students in mathematics is usually affected by a number of factors. Such factors include teacher factor, student factor, school factor, government factor, curriculum and the quality of mathematics teaching. Unfortunately, students' poor achievement in SSCE/WASSCE mathematics due to interest has been blamed on the inability of mathematics educators to incorporate leisure activities into formal mathematics instruction. The extent to which such mathematics oriented leisure activities influence students' interest in mathematics remains a challenge.

The Schools of Thought of recreational approach to mathematics instruction are of the opinion that recreational or leisure mathematical games has the potency to increase secondary school students' problem solving skills and interest in mathematics. They believe that such an approach might enhance secondary school students' interest in mathematics. (Ohaju, 2014; Odo, 2015; Ogbu, 2015; and Amadi, 2021), in their research reports maintained that various instructional approaches/strategies enhance students' interest both in mathematics and other science related subjects. Hence, the need arises to introduce some of these leisure mathematical games in the process of teaching/learning of mathematics in Nigerian secondary schools. One of these games is the Chess Board Game (CBG).

Interest is one of the internal factors that influences students' learning especially in mathematics. Interest also refers to the readiness to react either towards or against a situation, person or thing in a particular manner. Onoh (2005) in Ogbu (2015), maintained that there is need for interest as a condition for learning. This statement pre-supposes that there is burning desire to make teaching/learning of mathematics interesting so that students can learn effectively. He contended that there is a great neglect of learners' interest in teaching mathematics. Ogbu (2015), pointed out that students who have interest in a mathematics lesson show a high degree of understanding in mathematics content.

Although, the issue of interest in mathematics has been pronounced, not much effort has been dissipated on the dimensions of interest and their impact in mathematics instruction. There is, therefore, urgent need to explore avenues for improving and boosting interest in learners

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(students) in mathematics. It is very important to note that the interest students need is the deep and living interest that goes along with all serious effort. Interest is a mark of selfactivity or personally acquired experience. Amadi (2021), opined that interest is the preference for particular type(s) of activities, that is, the tendency to seek out and participate in certain activity(ies). Interest is conceptualized as the zeal or willingness to participate in any activity(ies) from which one derives some pleasure. Thus, if a student exhibits positive likeness to study mathematics, it implies that he/she will gainfully spend time studying mathematics.

According to Schukajlow (2015), interest is a condition and situation which relates to individual wishes or necessities. It can also be defined as the preference in someone together with happiness. Interest does not appear spontaneously, but turns up because of participation, experience and habit when studying or working. Interest as an expression of likeness or dislike which plays a significant role in learning all subjects including mathematics. He asserts further that interest as used in psychological and educational measurement is a motivational construct. The implication of Schukajlow's view of interest is that an individual's effort to satisfy his/her needs, motivates him/her to take action or participate in activities that will lead him/her to success. There is, therefore, a direct link between interest and motivation. According to Mitchell (2016), interest is an organismic condition which results in a desire for further stimulation from a particular type of object, idea or experience. This indicates that interest concerns choice and preference to a particular type of activity to the other.

A number of empirical studies have been conducted both internationally and locally which relate closely to interest in mathematics, among which are (Ohaju, 2014; Abugu, 2015; Ferguson. (2015); Odo, 2015; Ogbu, 2015; Schukailow, 2015; Mitchell, 2016; Amadi, 2021). They believed that such approaches/strategies might likely enhance interest of secondary school students in mathematics, yet, they are not efficacious. They also maintained in their research reports that various instructional approaches/strategies enhance students' interest both in mathematics and other science related subjects. Hence, the need arises to introduce some of these leisure mathematical games in the process of teaching /learning of mathematics in Nigerian secondary schools which might be efficacious in enhancing students' interest. One of these games is the Chess Board Game (CBG). The problem is: To what extent would the use of Chess Board Game (CBG) approach enhance Junior Secondary School students' interest in mathematics as well as gender when used in teaching mathematics?

# **Purpose of the Study**

The study sought to determine the effect of Chess Board Game approach on the mean:

- 1. Mathematics interest scores of students;.
- 2. Mathematics interest scores of students due to gender.

# **Research Questions:**

The following research questions guided the study:

- 1. Is there any significant difference between mean mathematics interest scores of students taught mathematics using Chess Board Game and those taught with expository method?
- 2. Is there any significant difference between mean mathematics interest scores of male and female students taught mathematics using Chess Board Game?

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## **Research Hypotheses**

The following null hypotheses (HO<sub>s</sub>) were formulated and tested at .05 level of significance to further guide the study:

- HO<sub>1:</sub> There is no significant difference between mean mathematics interest scores of students taught mathematics using Chess Board Game approach and those taught with expository method.
- HO<sub>2:</sub> There is no significant difference between mean mathematics interest scores of male and female students taught mathematics using Chess Board Game approach.

## Method

The study employed quasi- experimental design. The population for the study comprised 5,257 JSS1 students in the 31 Public Junior Secondary Schools in the following three Local Government Areas (Enugu East, Enugu North and Isi Uzo) in Enugu Education Zone(Source: Statistics Department of Post Primary Schools' Management Board (PPSMB, 2019/2020), Enugu. The Sample for the study comprised 270 Junior Secondary School one (JSS1) students drawn through random sampling by balloting from three Co – Educational Secondary Schools with at least four streams in one class from Enugu East(school I), Enugu North (school II) and Isi Uzo (school III) Local Government Areas. The break down comprised 135 JSS1 students in experimental group and 135 JSS1 students in control group. In analysis, pretest scores constituted co-variate to the posttest scores.

Further, six intact classes were drawn from the three selected co-educational schools through simple random sampling. Two intact classes from each school on the three Local Government Areas. For school I, one intact class was assigned to the experimental group, while the remaining intact class was assigned to the control group. For schools II and III, two intact classes were assigned to the experimental group, while the remaining two intact classes were assigned to the control group. Therefore, in schools I,II and III, three intact classes (135 students) were assigned to the experimental group, while the remaining three intact classes (135 students) were assigned to the control group.

The researchers used one instrument for data collection which is Mathematics Interest Scale (MIS). The researchers adapted the MIS from Baggaley's in Ogbu (2015) which had 20 items. The 20 items survived the face validation. The instrument was adapted to suit this study in that grammar, syntax and re – arrangement of the items in equal number (as observed by the validators that positive statements should be grouped together so also the negative statements) to enable the items be relevant to mathematics. The instrument is a four (4) – point Likert Scale: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The above four- point Likert type scale has weighting scale points of: 4,3,2,1, respectively for positive statements, while weighting scale points of: 1,2,3,4, respectively are for negative statements. Hence, the maximum score is 80 marks, while the minimum score is 20 marks. The MIS addresses students' interest in mathematics. The MIS is used for pretest and posttest. However, the serial numbers of the items in MIS pretest were re- arranged to make them look different to the students at the first glance during post testing. Note also that the MIS has two parts. Part one is the demographic, while part two contains the 20 items with the four – point Likert type scale.

## Data Analysis

Research questions were answered using mean and standard deviation. ANCOVA was used in testing the null hypotheses at .05 level of significance. Analysis was carried out using Statistical Package for Social Sciences (SPSS) software.

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**Decision Rule:** The null hypothesis was refused to be accepted whenever  $P \le .05$  (That is, the null is significant whenever  $P \le .05$ ), otherwise upheld. The study lasted for six weeks. **Results:** The results of data were presented as follows according to the research questions and hypotheses raised for the study:

**Research Question One:** Is there any significant difference between mean mathematics interest scores of students taught mathematics using Chess Board Game and those taught with expository method?

Table 1 shows the results for research question 1.	
Table 1: Mean Interest Scores and Standard Deviations of Experimental and	Control
Groups in Mathematics Interest Scale (MIS).	

Group	Pre-MAT		Post-MAT		
	Mean	SD	Mean	SD	Mean Diff. B/w
Gps	_Experimen	tal			
N1 = 135	24.30	13.80	29.90	4. 99	5.60
Control					
N2 = 135	20.37	15.40	21.07	6.31	0.77

Table 1 shows that posttest adjusted mean score (29.90) is greater than the pretest mean score (24.30) by 5.60 for the experimental group. For the control group, the posttest mean score (21.07) is higher than the pretest adjusted mean score (20.37) by .70. The standard deviation of 4.99 in post MIS for the experimental group is lower than the standard deviation of 5.37 for the control group in post MIS. Therefore, the spread of scores in experimental group is more homogeneous compared with the control group.

**Research Question Two:** Is there any significant difference between mean mathematics interest scores of male and female students taught mathematics using Chess Board Game? The results for research question one are presented in Table 2.

in Wathematics Interest Searc (WHS):					
Group		Post 1			
	Μ	lale	Female	e	
	Mea	n SD	Mear	n SD	Mean Diff. B/w
Gender.					
Experimental					
$N_1 = 135$	33.65	4.14	32.32	9.27	1.33
Control					
$N_2 = 135$	11.88	8.78	10.72	9.66	

Table 2: Mean Interest Scores of Male and Female Students by gender	in Experimental
in Mathematics Interest Scale (MIS).	

Table 2 shows that the posttest mean interest scores of male and female Students for the experimental group by gender are 33.65 and 32.32 respectively. Male Students mean interest score is greater than that of the female Students by 1.33. The posttest standard deviations of male and female Students for the experimental group by gender are 4.14 and 9.27 respectively. Therefore, the spread of scores in experimental group for the male Students is more uniform than those of the female Students whose scores are heterogeneous.

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# Hypothesis Two

There is no significant difference between mean mathematics interest scores of male and female students taught mathematics using Chess Board Game.

Source	Type III Sur of Squares	n df	Mean Square	F	Sig	. Partial
Eta Squared	Decision					
Corrected Model	1097.583ª	6	182.9 30	6.348	.000	.126
Intercept	34566.672	1	34565.672	1199 .417	.000	.820
Method	1054.041	1	1054.041	36.575	.000	.122 Significant
Method * Gender	132.000	1	132.00	18.069	.005	.213 Significant
Gender	30.545	2	15.273	.530	.589	.004
Group* Gender	24.548	2	12.274	.426	.654	.003
Error	7579.325	63	28.819			
Total: 25	51377.000	270				
Corrected Total :	8676.907	269				

Table 3: Two – way Analysis of Covariance (ANCOVA)	Results of Experimental Group
on Students' Interest in MIS Posttest due to gender.	

Table 3 shows that the Chess Board Game approach is significant. This is because the computed F – value (36.575) was found significant at .000 which is less than .05 level of significance set for the study. Therefore, there is a significant difference between the mean interest scores of students due to gender in the post interest scale in the experimental group. Reject Hypothesis Two. Table 3 further shows that method \*Gender is significant. This is because the computed F – value (18.069) was found significant at .005 which is less than .05 level of significance set for the study. Hence, there is a significant difference between the mean interest scores of male and female students in the post interest scale in the Experimental Group. Hypothesis Two is subsequently rejected.

# Findings

The findings of this study were discussed in line with the research questions answered and hypotheses tested for the study. The results in table 1 indicated that the students in the experimental group had an overall higher mean interest scores than the mean interest scores of the control group in mathematics.

The result is also in consonance with the research of Ogbu (2015), that MS – Excel enhances students' mean interest in Statistics and Amadi (2021), that CBG approach improves students' mean interest in mathematics.

For research hypothesis two, the findings in table 3 shows that, there is a significant difference between the mean interest scores of students due to gender in the post interest scale in the experimental group. Table 3 further shows that method \*Gender is significant. Hence, there is a significant difference between the mean interest scores of male and female students in the post interest scale in the experimental group in favour of the male students.

This finding agrees with the findings of Ohaju (2014) and Ogbu (2015), which revealed that the use of instructional materials enhances male students' interest in mathematics. This indicates that the use of Chess Board Game (CBG) approach is effective in enhancing JSS 1 male and female students' interest in mathematics. This means using Chess Board Game

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(CBG) approach would motivate differently JSS students' interest in mathematics Nigerian schools. This might lead to interest enhancement in mathematics generally.

# Conclusion

The results of the study and the discussion of the findings show that the use of Chess Board Game (CBG) approach is efficacious in enhancing interest of JSS students in mathematics. Its effectiveness in producing the desirable effects on the interest of JSS students in mathematics is predicated upon the fact that:

- 1. There is a significant difference between the mean mathematics interest scores of students in the experimental group and control group in the post interest scale in favour of the experimental group.
- 2. There is a significant difference between the mean mathematics interest scores of male and female JSS1 Students in the experimental group in the post interest scale.

## **Educational Implications of the Study**

The results of the study have provided empirical evidence on the efficacy of Chess Board Game (CBG) approach in teaching/learning of mathematics. This efficacy suggests the imperative need for mathematics teachers to employ CBG approach in teaching mathematics concepts and topics. Put in another way, mathematics concepts and topics taught using CBG approach would cease to be mere recall of facts, formulae and theories, thereby, reducing the abstraction associated with mathematics generally. Students would therefore, be able to incorporate play while learning mathematics and as well use their own mental process to solve mathematics problems leisurely

The involvement of students in the use of CBG approach would be providing an environment free from boredom in which equilibrium can occur in the minds of the students. The results of this study have implications for the three tiers of governments that cater for teachers in the provision of in – service training and workshops for mathematics teachers in the use of CBG approach during mathematics classes. This would equip the mathematics teachers with the needed skills, knowledge and dexterity which are likely to have positive effect on students' interest in mathematics.

The presence of interaction between instructional approach and gender (school type) on the students' interest in mathematics indicates that the CBG approach is gender based. Therefore, mathematics teachers should use CBG approach during mathematics classes to inculcate and develop creative and critical thinking in male, female and co – educational JSS1 Students. It is pertinent that local, state and federal governments should establish and fund mathematics resource centres where Mathematics Instructional Materials (MIM<sub>S</sub>) including CBG among others could be made and kept for mathematics teachers in both primary and secondary schools for use by mathematics teachers.

The fact that Chess Board Game (CBG) approach been proven to facilitate high level of mathematics understanding, is an evidence that it enhances interest of JSS students in mathematics. This, therefore, requires mathematics authors and curriculum developers to incorporate Chess Board Game (CBG) in mathematics textbooks and curriculum.

## Recommendations

Based on the results of this study and the educational implications, the following recommendations were made:

Cite this article as:

- 1. Mathematics teachers should be encouraged to utilize Chess Board Game (CBG) approach in mathematics classes in order to motivate, stimulate and sustain students' interest in mathematics.
- 2. Mathematics teachers in both primary and secondary schools should practice the use of Chess Board Game approach in mathematics classes as this has proven efficacious in teaching/learning of mathematics.

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