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ENHANCEMENT POTENCY OF MATH CLUB ACTIVITIES ON JUNIOR SECONDARY SCHOOL STUDENTS' MATHEMATICS LEARNING

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ABSTRACT

Mathematics has been described as a precision tool used by all scientists in their search for clear understanding of the physical world. It plays a pivotal role in enabling science and technology contribution to national development. To be precise, its several and varied applications in all fields of human endeavours can never be over emphasised. Considering the importance of the subject, it is worrisome that students at all levels performed below expectation. One of the root causes of this is the way and manner in which the subject is being presented to the students. This is the more reason why a study of this nature is being carried out to see how a social based strategy (Math Club Activities) can be used to enhance students' attitude towards and achievement in Mathematics. The study adopted quasi- experimental design and used purposive sampling method to select four (4) public schools for the study (2 Experimental and, 2 Control groups). Intact classes were used as control group while only members of math club formed the participants in the Experimental group. In all, 204 (104 male, 100 female) J.S 2 students were used for the study. Four (4) research instruments were used for the study; Mathematic Achievement Test (MAT), Student Mathematical Attitude Scale (SMAS), General Intelligence Test (GIT) and Treatment Package (TP). The treatment lasted for four weeks and the data collected was subjected to Analysis of Covariance (ANCOVA) using SPSS software. The result of the study shows that there was a significant main effect of treatment (Math Club Activities) on students' achievement in Mathematics $F_{(1,195)} = 10.362$, $p < .05$ *and on students' attitude towards Mathematics* $F_{(1,195)} = 12.376$, $p < .05$. *It was also revealed from the study that intelligence has a significant effect on students' achievement in Mathematics* $F_{(1,195)} = 35.614$, $p < .05$ *and attitude towards Mathematics* $F_{(1,195)} = 15.457$, $p < 0.5$. *However, the effect of gender on students' achievement and attitude towards Mathematics was not statistically significant. Based on the result of the findings, it was revealed that involvement of students in Math Club Activities has greatly influenced students' achievement in and attitude towards Mathematics. Therefore stakeholders in Mathematics education should exploit the maximum benefits embedded in math club to improve achievement in and attitude of students towards Mathematics.*

1. BACKGROUND OF THE STUDY

In the present technology age where the utmost priority of every nation is development, vast and adequate knowledge of Mathematics cannot be left behind. This is because of the utilitarian purposes the subject plays not only in the field of science and technology but also its application in all field of human endeavours. According to Odeyemi (2000) Mathematics serves as the foundation of science and technology and many fields of human endeavour depend on it. Therefore it can be concluded that Mathematics is an indispensable agent of nation's development.

Despite the identified importance of Mathematics, it is still disturbing that attitude and general performance of students at all levels is not encouraging, and this has been a serious concerned to all stakeholders. Literatures had shown that a lot of factors were responsible for this. Korau (2006) opined that learners themselves, teachers, textbooks, curricular and school environment are responsible for students' poor achievement in Mathematics, while Ifamuyiwa (2004) attributed the poor performance to the belief that the subject is meant for only brilliant students. But in their findings Furinghetti and Pekhonen (2002) opined that the way the subject is represented in the classroom and perceived by students even when teachers believe they are presenting it in an authentic and context dependent way, stands to alienate many students from Mathematics.

However, it is important to note that outside school, real-life situation for which we need the knowledge of Mathematics may not come in a familiar form, therefore there is need for an individual to transform the situation in order to fit in for the usefulness and application of Mathematical knowledge. Based on this, it is very necessary to motivate students to learn Mathematics with interest and involvement through appreciation of its intrinsic worth. One of the ways of achieving this as suggested by Afuwape (2001) and Aremu (2002) is to involve students in some mathematics practical activities, such as club and games.

Math Club Activities unlike conventional teaching method teaches not only the curricular concept, but the logic development necessary to understand mathematics that will be applicable to all other branches of Mathematics. Through math club, members are able to

suppress the negative social stigma of Mathematics and tend not to lose focus about the purpose of Mathematics. Papanastasiou and Bottiger (2004), opined that club activities mode has positive effect on belief about school subjects.

Thompson (2009) asserted that majority of those who attend math club meetings have positive attitude towards Mathematics. When students are placed in a tension free environment, where they feel relaxed and able to relate to their friends and teacher freely, there is every tendency for them to develop a sense of belonging and as a result, it fosters their positive attitude towards what they are learning. This was in consonance with the findings of Papanastasiou and Bottiger (2004) who established a positive relationship between the students' Mathematics attitude and achievement in relation to the math club.

Up till now there is still divergence opinion about gender and attitude towards and achievement in Mathematics. While some researchers (Mohd, Mahmood, and Ismail 2011, Oni 2005) asserted that there was no significant effect of gender on students' attitude and performance in Mathematics, some, (Adeleke ;2012, Maliki, Ngban and Ibu; 2009) established that the effect was significant with male outstanding their female counterparts, and few (Brandley 2003 and Tella 2000) hold a contrary view that female perform better than male. Hence stable position on the issue is yet to be established.

Another variable considered in this study is intelligence. According to available literature, intelligence is one of the determinants of students' achievement in any school subject. (Laidra, Pullmann & Allik 2007 and Naderi, Abdullah, Aizan & Sharir 2010) in their studies asserted that intelligence is causally related to achievement. This

implies that the more intelligence one is the more is ones' performance. Based on this background, this study therefore sought to establish the effect of math club activities on student' attitude towards and achievement in mathematics. The framework presented in the figure 1 adapted from Badru 2009 will be used to direct the study

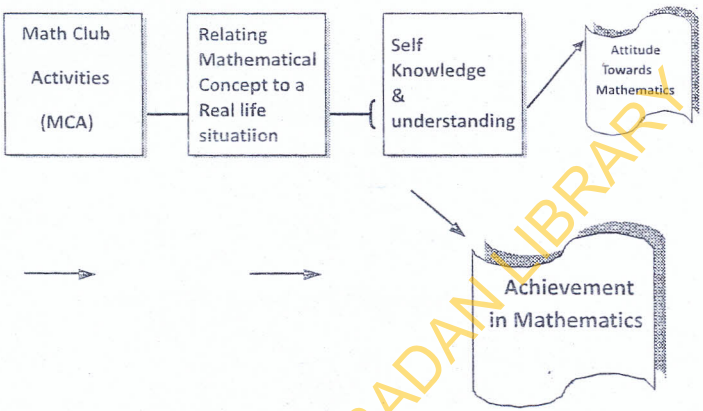

Fig 1 Theoretical Framework of MCA and Achievement in Mathematics

2. STATEMENT OF THE PROBLEM

One of the problems identified as the cause of students' poor performance in mathematics is the way the subject is being taught to students. Social based approaches to Mathematics teaching need to be explored to provide empirical information for policy formulation. Based on this, a study of this nature is carried out to see the extent to which active involvement of students in club activities i.e. Math Club can improve their attitude and achievement in Mathematics.

3. HYPOTHESIS

(1) There is no significant main effects of (a)Treatment (b)Gender (c)Intelligence on Students' (i) Attitude towards Mathematics (ii) Achievement in Mathematics

(2) There is no significant 2-way interaction effect of (a) Treatment and Gender (b) Treatment and Intelligence (c) Gender and Intelligence on Students'

(i) Attitude towards Mathematics (ii) Achievement in Mathematics

(3) There is no significant 3-way interaction effect of Treatment, Gender and Intelligence on Students'

(i) Attitude towards Mathematics (ii) Achievement in Mathematics

4. METHODOLOGY

(i) Research design

The study adopted 2 x 2 x 2 pre- test and post- test, control group, quasi – experimental design.

O_1 X O_2 Experimental Groups

O_1 O_2 Control Groups

O_1 stands for pre- test score
O_2 stands for post- test score
X stands for treatment

(a) Factorial Design

Table 1: shows a 2 x 2 x 2 factorial design for the study

Treatments	Gender	Intelligence	
		High	Low
Maths Club Activities	Male		
	Female		
Control	Male		
	Female		

(b) Variables of the study

(i) **Independent variable**

(A) Maths Club (Treatment)
(B) Conventional approach

(ii) **Moderating Variables**

(A) Gender
(i) Male
(ii) Female

(B) Intelligence
(i) Low
(ii) High

(iii) **Dependent Variables**

(A) Students' Achievement in Mathematics
(B) Students' Attitudes to Mathematics

(2) **Sample**

Purposive sampling method was adopted to select sample for the study. Four (4) Junior Secondary Schools were selected from Ido Local Government of Oyo State of Nigeria. Two (2) schools were used for the experiment while the other two served as control group. Only students who volunteered to be members of Math Club form the participants in the experimental group while two intact classes from two selected schools formed the control group. In all 204 JS2 students were used for the study. Control group consists of 108 (52 boys and 56 girls) while members of the club in the other two (2) selected schools constitute the experimental group i.e. 96 (52 boys and 44 girls).

(3) **Instruments**

The four instruments used for the study includes:

(a) Mathematics Achievement Test. (MAT)

The construction of the Mathematics Achievement Test (MAT) was done by the researchers using 9 – Year Basic Education Curriculum for J.S.S 2 class. The topics were copied and table of specification was developed to cover the first three levels of Bloom Taxonomy of Educational objectives i.e. Knowledge, Comprehension and Application. Table 2 shows the table of specification.

Table 2: Table of specification

CONTENTS	KNOW-LEDGE 25%	COMPRE-HENSION 35%	APLLICATIO N 40%	TOTAL 100%
Transactions in the homes and offices (33%)	3 (7,15,24)	3 (8, 25, 28)	4 (1, 2, 16, 23)	10
Algebraic Expression (33%)	3 (4, 5, 17)	3 (9,10,18)	4 (26, 27,29, 30)	10
Simple Equation (17%)	1 (6)	2 (11, 12)	2 (18, 20)	5
Estimation and Approximation (17%)	1 (21)	2 (3,13)	2 (14,22)	5
Total	8	10	12	30

60 items were initially developed; this was given to experienced Mathematics teachers in Junior Secondary Schools for scrutiny and vetting. Other experts in the field of Mathematics were also requested to ascertain the suitability of the items with reference to the targeted population and in terms of language clarity. In compliance with their comments and advice some questions were reframed while some were replaced. The items were then pilot tested on 60 students who were not part of the study. Item analysis was then carried out and items with difficulty indices between 40% and 60% and discriminating indices of 0.30 and above were retained. Only 34 items survived out of which 30 items were finally selected for the study. Reliability

coefficient of the items was then determined by using Kuder – Richardson KR20 which gave a reliability estimate of 0.69 which means the instrument is reliable.

(b) **Students' Mathematical Attitude Scale (SMAS):**

SMAS was developed by the researchers to elicit information on students' attitude towards Mathematics. The questionnaire consists of two sections. Section A was on the bio data of the students i.e. Gender, Age and Class. Section B consists of 30 items with 4 Points Likert Scale response format that is Very True (4), True (3), Rarely True (2), Not True (1). The instrument was validated by subjecting it to experts' criticism and comments to establish the content and construct validity of the instrument. The instrument was thereafter administered to 60 J.SS 2 students who were not part of the study. Cronbach Alpha was used to adjudge its reliability, this yielded a reliability coefficient of 0.83 which shows that the instrument was highly reliable. For the purpose of scoring and interpretation, responses were scored from 4 – 1 for positive items and in the reverse for the negative items. The respondent's total score is the sum of the weights of responses. A high score indicates a highly positive attitude while a low score means a very negative attitude.

(c) **General Intelligence Scale (GIS)**

The researchers adapted the Intelligence Scale developed by Odebunmi (1991). The Scale which was adopted by Osunde (1995) was developed to measure the general intelligence level of both adults and children. The Scale consists of 60 items. It has a coefficient Alpha of 0.79 which guarantees its internal consistency and construct validity. Some of

the items were modified by the researchers and pilot tested on sample of 60 J.S.S 2 students from a co – educational school similar to the target sample to re validate the instruments. Twenty – five items were finally selected for the study. The scale was scored on the basis of correct response which attracted one mark per item.

(4) Treatment Package (Math Club Activities)

Math Club Activities students in experimental group were engaged in are described below:

(a) Week one.

(i) **Activities:** Pep talk, correction of misconception/misused words in mathematics, riddles and games.

(ii) **Objective:** To motivate members of the club to appreciate the importance of mathematics, relate it to real life situation and catch fun.

(b) Week Two

(i) **Activity:** Relating human body and beam balance to simple linear equation.

(ii) **Objective:** To relate their body and beam balance to simple linear equation and see equation as an "Algebraic Balance

(c) Week Three

(i) **Activity:** Practical demonstration of distributive law and relating it to expansion and factorisation of algebraic expression.

(ii) **Objective:** To motivate members to appreciate the concept, factorisation and expansion algebraic expression through distributive law.

(d) **Week Four**

(i) **Activity:** Play way interaction with shopping corner.

(ii) **Objective:** Member will be able to relate Arithmetic with real life transactions both at home and in the school.

(5) **Pre – test Treatment Activities**

The researchers sought for permission from the authority of the selected schools. With the assistance and cooperation of the mathematics teachers, maths club was set up in each of the experimental schools, of which membership was opened to any JS2 students of the school and it is voluntary. The names of interested students were written down by their teachers and they were educated about the research work.

A week before the commencement of the activities, both MAT and SMAS were administered on the participants in all the selected schools to serve a pre – test. Also, to determine the level of intelligence of the participants, GIT was administered on them. Immediately after the test, all the copies of the instruments were collected.

(6) **Post Treatment activities**

After the completion of the experiment in the sixth week, a post – test was conducted using the same MAT and SMAS.

(7) **Data Analysis**

The treatment lasted four weeks and the data collected was subjected to Analysis of Covariance (ANCOVA) using SPSS software.

5. RESULT AND FINDINGS

(1) **Hypothesis 1a:** There is no significant main effects of (a) Treatment, (b) Gender and (c) Intelligence on Students' (i) Attitude towards Mathematics (ii) Achievement in Mathematics

Table 3a: Analysis of Co – variance (ANCOVA) of Students' Attitude towards Mathematics by Treatments, Gender and Intelligence.

Source of Variation	Sum of Sq	Df	Mean Sq	F	Sig of F	Eta Sq
Corrected Model	9897.386[a]	8	1237.173	7.635	.000	.239
Intercept	49191.939	1	49191.939	303.582	.000	.609
Pre-Att Score	1701.891	1	1701.891	10.503	.001	.051
Treatment	2005.341	1	2005.341	12.376	.001	.060
Gender	37.030	1	37.030	.229	.633	.001
Intelligence	2504.600	1	2504.600	15.457	.000	.073
Treatment* Gender	26.983	1	26.983	.167	.684	.001
Gender * Intelligence	24.846	1	24.846	.153	.696	.001
Treatment* Intelligence	244.501	1	244.501	1.509	.221	.008
Treatment*Gender* Intelligence	99.076	1	99.076	.611	.435	.003
Error	31597.452	195	162.038			
Total	1965007.00	204				
Corrected Total	**41494.838**	**203**				

a. R Squared = .239 (Adjusted R Squared = .207)

Table 3b: Marginal Mean Estimates on Post_Attitude score based on Treatment

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Experimental	99.932	1.371	97.229	102.636
Control	93.081	1.301	90.515	95.648

Table 3c: Marginal Mean Estimates on Post_Attitude score based on Intelligence

Intelligence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
low Intelligence	92.799	1.432	89.975	95.623
high Intelligence	100.215	1.185	97.877	102.552

Covariates appearing in the model are evaluated at the following values: Pre_Attitude = 72.29.

Table 4a: Analysis of Co – variance (ANCOVA) of Students' achievement in mathematics by Treatments, Gender and Intelligence.

Source of Variation	Sum of Sq	Df	Mean Sq	F	Sig of F	Eta Sq
Corrected Model	3564.426[a]	8	445.553	53.568	.000	.687
Intercept	673.064	1	673.064	80.922	.000	.293
Pre-Ach Score	1594.329	1	1594.329	191.684	.000	.496
Treatment	86.188	1	86.188	10.362	.002	.050
Gender	8.634	1	8.634	1.038	.310	.005
Intelligence	296.218	1	296.218	35.614	.000	.154
Treatment *Gender	2.691	1	2.691	.324	.570	.002
Gender * Intelligence	25.071	1	25.071	3.014	.084	.015
Treatment* Intelligence	17.059	1	17.059	2.051	.154	.010
Treatment*Gender*Intelligence	44.759	1	44.759	5.381	.051	.027
Error	1621.907	195	8.317			
Total	40552.000	204				
Corrected Total	5186.333	203				

R Squared = .687 (Adjusted R Square = .674)

Table 4b: Marginal Mean Estimates on Post_Achievement score based on Treatment

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Experimental	13.592	0.309	12.983	14.201
Control	12.235	0.284	11.675	12.795

Covariates appearing in the model are evaluated at the following values: pre-Attitude test score = 11.09.

Table 4c: Marginal Mean Estimates on Post_Achievement score based on Intelligence

Intelligence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
low Intelligence	11.486	0.35	89.975	12.176
high Intelligence	14.341	0.281	97.877	14.895

Covariates appearing in the model are evaluated at the following values: pre- Attitude test score = 11.09.

Table 3a shows that there is significant effect of treatment (Math Club Activities) on students' attitude towards Mathematics $F_{(1,195)} = 12.376$, $p < .05$. Since the P value of the F-ratio indicates significance, consequently, the hypothesis 1(ai) was rejected. The partial eta square estimate was .060 this means that the treatment accounted for 6% of the observed variation in students' attitude towards Mathematics. Post hoc analysis result in Table 3b reveals that the experimental group had the higher marginal mean attitude score (99.932) than the control group that had mean score of 93.081.

Also from table 4a it was revealed that there was significant effect of treatment (Math Club Activities) on student achievement in Mathematics $F_{(1,195)} = 10.362, p<.05$. Since the P value of the F-ratio indicates significance, then Hypothesis 1(aii) was rejected. The partial eta square estimate was .050 this implies that the treatment accounted for 5% of the observed variation in students' achievement. Post hoc analysis result in Table 4b similarly reveals that the experimental group had the higher marginal mean achievement score (13.592) than the control group that had mean achievement score of 12.24.

(2) **Hypothesis 1b:** There is no significant main effect of Gender on Students'

(i) Attitude towards Mathematics (ii) Achievement in Mathematics

Table 3a shows that there is no significant

effect of gender on student' attitude towards Mathematics $F_{(1,195)} = .229$, $p > .05$. The null hypothesis 1b (i) was therefore not rejected.

In the same vein, Table 4a shows that the effect of gender on students' achievement in mathematics was not significant $F_{(1,195)} = 1.038$, $p > .05$. Therefore, hypothesis 1b (ii) was not rejected.

(3) **Hypothesis 1 c:** There is no significant main effect of Intelligence on Students' (i) Attitude towards Mathematics (ii) Achievement in Mathematics

Table 3a reveals that there was significant effect of intelligence on students' attitude towards mathematics $F_{(1,195)} = 15.457$, $p < .05$. Therefore, the null hypothesis 1c(i) was rejected. The partial eta square estimated was .073 this implies that intelligence only accounted for 7.3% of the variation in the attitude of the students towards Mathematics. Further verification using post hoc analysis as shown in table 3c, to determine the direction of effect reveals that high intelligent students had the higher mean attitude score (100.22) while their counterparts with low intelligence had the mean attitude score of 92.80.

Likewise, from table 4a, it was revealed that there was significant effect of intelligence on students' achievement in mathematics $F_{(1,195)} = 35.614$, $p < .05$. The null hypothesis 1c(ii) was therefore rejected. The partial eta square estimate was .154 this implies that 15.4 % of the variance observed in the students' achievement in mathematics was accounted for by Intelligence. Similarly, further verification using post hoc analysis as shown in table 4c, to determine the direction of effect reveals that high intelligent

students had the higher mean achievement score (14.34) while their counterparts with low intelligence had the mean attitude score of 11.49.

(4) **Hypothesis 2a :** There is no significant 2-way interaction effect of Treatment and Gender on students' (i) Attitude towards mathematics (ii) Achievement in mathematics.

From table 3a, it was shown that there was no significant interaction effect of treatment and gender on students attitude towards mathematics $F_{(1,195)} = .167$, $p > .05$. It was also revealed from table 4a that the interaction effect of treatment and gender on students' achievement in Mathematics was not significant $F_{(1,195)} = .324$, $p > .05$. Therefore, the null hypothesis 2a was not rejected.

(5) **Hypothesis 2b:** There is no significant 2-way interaction effect of Treatment and Intelligence on students' (i) Attitude towards Mathematics (ii) Achievement in Mathematics.

Table 3a reveals that there is no significant interaction effect of Treatment and Intelligence on students' Attitude towards Mathematics $F_{(1,195)} = 1.509$, $p > .05$. Likewise, table 4a shows that there is no 2-way interaction effect of Treatment and Intelligence on students' Achievement in Mathematics $F_{(1,195)} = 2.051$, $p > .05$. The null hypothesis 2b was therefore not rejected.

(6) **Hypothesis 2c:** There is no significant 2-way interaction effect of Gender and Intelligence on students' (i) Attitude towards Mathematics (ii) Achievement in Mathematics.

From table 3a it was revealed that the interaction effect of Gender and Intelligence on students' Attitude towards Mathematics was not significant $F_{(1,195)} = .153$, $p > .05$. Also, table 4a shows that

there is no significant interaction effect of Gender and Intelligence on students' Achievement in Mathematics $F_{(1,195)} = 3.014$, $p > .05$. Therefore, the null hypothesis 2c was not rejected.

(7) **Hypothesis 3:** There is no significant 3-way interaction effect of Treatment, Gender and Intelligence on Students' (i) Attitude towards Mathematics (ii) Achievement in Mathematics

Table 3a shows that there is no significant 3-way interaction effect of Treatment, Gender and Intelligence on Students' Attitude towards Mathematics $F_{(1,195)} = .611$, $p > .05$. Therefore, the null hypothesis 3(i) is not rejected.
Table 4a also reveals that there is no significant interaction effect of Treatment, Gender and Intelligence on Students' Achievement in Mathematics $F_{(1,195)} = 5.381$, $p > .05$. Hence the null hypothesis 3(ii) was not rejected.

6 DISCUSSION

The treatment (Math Club Activities) was found to have significant effect on students' attitude towards and achievement in Mathematics with students in experimental group having higher attitude towards Mathematics and performing better in the post test on achievement in Mathematics than their counterparts in the control group. This was in line with the study of (Piccolo, Harbaugh, Carter, Capraro & Carpraro 2008 and Papanastasiou & Bottiger 2004) who established that there is positive relationship between students' mathematics attitude and achievement in relation to the math club. This may be as a result that students in math club have opportunity to discuss, share opinions, work together, share experience on their problems areas, interact with one another and carry out some manipulating skills that are mathematically oriented.

The finding on gender shows that there was no significant effect of gender on students' attitude towards and achievement in Mathematics. This was in consonance with the findings of (Manoah, Indoshi and Othuon) 2011; Yinyinola; 2008; and Oni; 2005) but in odd with (Awofala, 2010; Adeleke; 2007; and Tella; 2000). The non-significant main effect of gender may be as a result of effect of gender equity in Mathematics which has been given serious attention by stakeholder.

Intelligence was found to have significant effect on students' attitude towards and achievement in Mathematics. This was in line with the study of (Laidra, Pullmann & Allik, 2007) who reported that students' achievement relies most strongly on their cognitive abilities through all grade levels. The findings was not a surprise because some researchers such as (Good, Aronson, and Inzlicht, 2003; and Sidhu; 2005) had established the fact that the more intelligent one is, the more ones' achievement.

From the result of the study it was also revealed that there is no significant 2-way interaction effect of the variables of the study. This implies that none of the variables jointly affect both the students' attitude towards Mathematics and their achievement in Mathematics. Likewise, the 3-way interaction effect of Treatment, Gender and Intelligence was not significant on the students' attitude towards and achievement in Mathematics.

7 RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

(1) Mathematics education should not be restricted to development of rote-learning, but also nurture the ability of students to produce relevant new learning to their classroom experience through math club activities.

(2) Mathematics teachers need to be more committed and dedicated to establish math club and make it functional to improve and sustain students' interest in Mathematics.

(3) Government and appropriate authority should encourage and support Mathematics teachers to establish and sustain math club in schools.

8 CONCLUSION

It is believed among students especially those in secondary schools that Mathematics is a difficult subject. This position might be the product of approaches mathematics teachers do use to present their instructional content. Effort has been directed in this study towards social-based instructional strategy- Math club Activities which really enhanced students' attitude towards and achievement in Mathematics. The call therefore goes to all teachers especially those that are teaching mathematics at secondary schools, to diversify approach and integrate various social-based activities while executing their job roles in the classroom. This will change age-long negative attitude towards Mathematics and consequently improve cognitive achievement of students in Mathematics.

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