

# Effects of Cooperative Learning and Contingency Contracting on Mathematics Achievement of Pupils with Attention Deficit Hyperactivity Disorder in Delta State, Nigeria

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## ABSTRACT

*This study aimed at evaluating the effects of Co-operative Learning Strategy and Contingency Contracting Technique on mathematics achievement of pupils with Attention Deficit Hyperactivity Disorder (ADHD) in Delta State, Nigeria using the pretest, posttest, control group quasi-experimental research design with a 3x2x2 factorial matrix. Multi-stage sampling technique was used to select 90 participants from three public primary schools in three local government areas of Delta State. The participants were randomly assigned to treatment and control groups. Participants in the two treatment groups were exposed to eight weeks of Co-operative Learning Strategy and Contingency Contracting Technique. Two instruments used were: Vanderbilt ADHD Diagnostic Teacher Rating Scale and Woodcock-Johnson III Mathematics Fluency Achievement Tests Scale. Data were analysed using Analysis of Covariance and MCA. Children with Attention Deficit Hyperactivity Disorder (ADHD) and accompanying learning difficulties in mathematics experience considerable degree of helplessness as a result of their inability to successfully solve mathematical problems. It is observed that while, Co-operative learning strategy is more effective in improving mathematics competence skills of pupils with ADHD than contingency contracting technique, Co-operative learning strategy and contingency contracting technique are effective in improving mathematics achievement of pupils with attention deficit hyperactivity disorder. Therefore, it is recommended that teachers of pupils with ADHD and accompanying learning difficulties in mathematics should adopt the two strategies to reinforce positive attitude to teaching learning situation of these children.*

**Keywords:** *Co-operative learning, Contingency contracting, pupils, Mathematics achievement, Attention Deficit Hyperactivity Disorder.*

## INTRODUCTION

The mastery of basic academic skills of reading, writing and mathematics by children in primary schools across the globe is a vital goal of the Universal Basic Education. Much emphasis is given to this expectation considering the fact that it is a necessary pre-requisite

for success in school, employment settings and the society at large. However, the attainment of this goal is a mirage especially among children with Attention Deficit Hyperactivity Disorder (ADHD) which is responsible for a wide variety of learning problems noticed with some children in schools. Pupils with Attention Deficit Hyperactivity Disorder (ADHD) generally have poor scholastic outcomes, including grade retentions and school dropout. Deshazo-Barry, Lyman and Klinger (2002) examine the occurrence of academic underachievement in a group of children diagnosed with ADHD and found that the greater the severity of behavioural disposition in children with ADHD, the greater the negative impact on their school performance. Thus, the effect of ADHD on mathematical achievement is a very important concern given the value of acquired mathematical skills to human capital development. Examining whether the academic underachievement that often accompanies ADHD is related to the behavioural or cognitive impairments associated with the disorder, Deshazo-Barry, Lyman and Klinger (2002) observe that ADHD behaviours predicted academic underachievement over and above performance on measures of executive functioning for each of the academic areas (that is, reading, writing, mathematics).

Therefore, in line with this context, it is worthy of note that pupils with Attention Deficit Hyperactivity Disorder experience great difficulty with the academic structure and demands of school and they consistently achieve below their potentials. Not surprisingly, there appears to be a correlation between the severity of the symptoms of ADHD and achievement. Thus, the more severe the symptoms, the greater the negative impact on school performance (Deshazo-Barry, Lyman & Klinger, 2002). Consequently, the corresponding effect of Attention Deficit Hyperactivity Disorder could result in expressed deficit in pupils' self-esteem, expressed helplessness and poor adjustment to teaching and learning situations in the classroom. These more often than not, could have some negative impact not only on the well-being of such pupils, but also on significant others and society as it causes behavioural problems in pupils and frustration in other concerned individuals. This implies that the negative implication of ADHD on the educational development, academic success and mathematics achievement of pupils in schools cannot be overemphasized.

Forness, Youpa, Hanna, Cantwell and Swanson (1992) find that the poor mathematics achievement problems associated with pupils with ADHD often lead to poor motivation and difficulty in developing problem-solving abilities. In order to help these children succeed scholastically and socially, it is very important that there is intervention which is tailored to the child's specific needs. Educational interventions are important to ensure that a child's educational needs are met; this could mean special services for children who express poor achievement in Mathematics in addition to ADHD. The trend today is to provide more supports to the mainstream classroom rather than separating students. It is important that parents, teachers, and school faculty involved in designing an individual education plan do not assume that ADHD pupil's expressing poor achievement in Mathematics are less intellectually competent than their classmates. In fact, research has it that little cognitive differences exist between ADHD and other children, nor do children with ADHD tend to have I.Qs outside of the normal range (Forness et, al. 1992).

Co-operative learning strategy can be used to promote classroom discourse and oral language development. Wiig and Semel (1984) describe mathematics as conceptually dense. That is, students must understand the language and symbols of mathematics because contextual clues, like those found in reading, are lacking in mathematics. For example, math vocabulary (e.g., greater-than, denominator, equivalent) and mathematical symbols (e.g., =, <, or >) must be understood to work problems as there are no contextual clues to aid understanding. In a cooperative learning activity, vocabulary and symbolic understanding can be facilitated with peer interactions and modeling. Research (Johnson & Johnson, 1986) support cooperative learning as an effective approach for including pupils with poor achievement in mathematics in classroom group work and promoting peer acceptance. Jenkins and O'Connor (2003) find that co-operative learning strategies, is effective in attending to the needs of ADHD pupils expressing poor achievement in mathematics at the classroom level because it aids in classroom management and provides a means to deliver differentiated instruction. Likewise, Fuchs and Fuchs (2005) posit that many studies of pupils with ADHD expressing poor mathematics achievement have shown that pairing pupils who have stronger academic skills with those with weaker skills from kindergarten helps improve outcomes for all pupils and provides opportunities for practice that help acquisition of new knowledge and transfer of skills and content knowledge.

Likewise, behaviour contracts have been seen to be effective in reducing inappropriate behaviour in inclusion settings. In view of this, Allen, Howard, Sweeney, and McLaughlin (1993) investigate the use of contracts for three elementary-age students with no identified disability who exhibited inappropriate classroom behaviour and were off-task throughout the day. The use of individualized behaviour contracts caused an immediate and noteworthy increase in on-task behaviours for all three students. The implementation of these contracts included a daily time that was set aside for the student and teacher to meet and review contract goals, a valuable component to the building of a positive relationship. After the contracts were removed, their on-task behaviours remained high, indicating maintenance of this intervention. Allen, Howard, Sweeney and McLaughlin (1993) comment on the minimal amount of time needed from the teacher to effectively implement the contract, a very important characteristic of an intervention to a busy classroom teacher.

Mruzek, Cohen and Smith (2007) have agreed with the ease of using contingency contracts in their study of two elementary school boys in a self-contained classroom, one with Asperger Syndrome and another with an emotional disability. The boys exhibited inappropriate behaviours in the classroom including aggressive tantrums and disruptive verbalizations. Using a changing criteria design, Mruzek, Cohen and Smith (2007) implement a behaviour contract which required the teacher and students to meet two times a day to review the contract, agree upon rewards, solve problems, and talk about successful interactions. Both participants demonstrated an immediate increase in successful behaviours during the intervention phases, despite the fact that their contracts changed on a weekly basis to focus on different behaviours. Mruzek, Cohen and Smith (2007) comment that the contracts were neither obvious nor interfering to other pupils in the classroom.

The influence such environmental factors can have on the severity of symptoms displayed by ADHD pupils experiencing mathematics difficulty clearly justifies the need for employing appropriate behavioural and educational strategies. ADHD pupils experiencing mathematics task difficulty often demonstrate inappropriate behaviours in the classroom and these behaviours have shown to predict poor academic achievement, rejection from peers, and an increased chance of pupils' dropping out of school (Wilkinson, 2005). They exhibit a wide range of inappropriate behaviours including disruption, disobedience, destruction, and aggression (Cullinan & Sabornie, 2004). Dehaene (1992), contends that core numerical abilities are still discernible in older children and adults and form the building blocks for the development of new cognitive skills such as formal and higher mathematical abilities. For example, it is suggested that Mathematics facts like those generated by division or subtraction involve manipulation of quantities, i.e., core system of numbers. It is reasonable to assume that there are ADHD children whose difficulties arise from deficits in processing quantities as well as executive dysfunctions.

This study is anchored on social construct theory of Parens and Johnston (2009). The social construct theory accepts that the so-called ADHD traits exist in the individual. However, the theorists believe that the boundary between normal and abnormal behaviour is subjective and not objective, which means that ADHD is only a 'construct' and not an objective entity. Simply said, the so-called 'symptoms' of ADHD lie within the range of normal healthy human behaviour and are not at all dysfunctional; and for symptoms to be classified as a disorder, they need to be maladaptive, which is not true for ADHD behaviours. In a society which places emphasis on passivity and order, individuals on the active end of the spectrum are seen as problems. A medical label of ADHD helps in removing the guilt and blame from the people who are actually the cause of the problem. On the other hand, other societies are more tolerant and consider the child as just an 'active child'. Similarly, some societies have a more flexible attitude towards the sitting arrangement of children in school. They even allow movement within the class. So, they may not perceive the inability of a child to sit still as an ADHD symptom. Based on the germane nature of this theory, this study is anchored on its principle. In this study, the following hypotheses were formulated in null forms.

1. There is no significant main effect of treatment on the Mathematics achievement scores of pupils with ADHD.
2. There is no significant main effect of age on the Mathematics achievement scores of pupils with ADHD
3. There is no significant main effect of gender on the Mathematics achievement scores of pupils with ADHD
4. There is no significant interaction effect of treatment, age and gender on the Mathematics achievement scores of pupils with ADHD

#### **METHOD**

The study adopts a pre-test, post-test, control group quasi-experimental research design with a 3x2x2 factorial matrix. The pre-test, post-test control group design is used in the study because the design has been recognized for its ability to establish causes and effects of relationships due to intervention. The treatment groups are denoted by alphabet A, as thus: Cooperative Learning Strategy (A1), Contingency Contracting Technique (A2) and the Control Group (A3) constituting the row of the treatment design. The column denotes the moderating variables (age and gender) varying at two levels represented by B where B1 represents older (Male) level of age and B2 represents older (Female) level of age. Also, C1 represents younger (Male) level of age and C2 represents younger (Female) level of age respectively. The design is presented on table 1.

**Table 1:** A 3x2x2 Factorial Matrix Quasi-Experimental Design on Mathematics Achievement Scores of Pupils with ADHD

Treatment	Gender				Total
	Male		Female		
	Older Pupils 9-10yrs	Younger Pupils 7-8yrs	Older Pupils 9-10yrs	Younger Pupils 7-8yrs	
A1 Co-operative Learning	A1 B1n=10	A1 C1n=5	A1 B2n=8	A1 C2n=7	30
A2 Contingency Contracting	A2 B1n=12	A2 C1n=3	A2 B2n=9	A2 C2n=6	30
A3 Control Group	A3 B1n=8	A3 C1n=7	A3 B2n=6	A3 C2n=9	30
Total	30	15	23	22	90

The population consists of all primary three ADHD school pupils experiencing difficulty in Mathematics achievement in Delta State, Nigeria. The sample for this study consists of ninety (male and female) primary three pupils who display the symptoms of ADHD as responsible for their Mathematics achievement in Delta State, Nigeria. Delta State has twenty-five local government areas. Through the multi-stage sampling technique, eighteen local government areas were first selected using the hat picking method, at the second stage, twelve local government areas were selected, at the third stage, six local government areas were selected and at the fourth stage, three local government areas were then selected through same hat picking method. These selected local government areas were Warri South, Warri South-West and Warri North from among the twenty five local government areas of Delta State. Also, the multi-stage sampling technique was used to select pupils used for the study and one primary school each from among the fifty four primary schools in Warri South, thirty in Warri South-West and thirty seven in Warri North. The Rationale for Choosing Primary Three Pupils are:

- Primary three pupils are believed to be between 7-10 years old. This age range forms a very critical developmental stage for children. Also, this stage falls within the middle threshold of a Child's educational development. Therefore, it is best that serious attention is given to it.
- This stage is the time most children try to get stabilised in the school system having probably struggled to transit two classes.
- This is the stage when children start using pen/ biro to write directly from the chalkboard. This in itself is a challenge that requires positive support for ADHD pupils who express poor mathematics achievement adjust to required academic tasks.

The VADTRS is a standardized diagnostic teacher rating scale (Wolraich et al

1998) used for the screening of ADHD pupils and selection of ADHD pupils expressing learning disabilities in mathematics as sampled participants for the study. It includes all 18 of the DSM-IV criteria for ADHD. The wording has been simplified so that the reading level is slightly below third grade. The diagnosis is considered present if scores of 2 or 3 on a 0-3 scale (indicating that behaviour is "often" or "very often" present) are checked for the requisite number of criteria based on the DSM-IV definition of ADHD diagnosis. The performance section of the VADTRS is an eight-item scale with three items relating to academic performance: (a) reading, (b) mathematics, and (c) written expression. Another five items to evaluate classroom behavioural performance: (e) relationship with peers, (f) following directions/rules (g) disrupting class (h) assignment completion and (i) organizational skills. The teacher rates each of these on a 5-point scale from "problematic" to "above average." It has an internal consistency reliability of .93. Woodcock 111 Mathematics Fluency Achievement Tests Scale by Woodcock, McGrew and Nancy (2007) was used to measure mathematics achievement among ADHD pupils used for the study. The scale contains simple addition, subtraction and multiplication as thus,  $1+7$ ;  $4\times 3$ ;  $7-0$ ; etc. The test has an internal reliability of 0.90. However, ten of the items were adapted and modified to suit the curricula of the pupils to be used for this study. The items were revalidated through a pilot study (testing its suitability with similar audience) using a test-retest to ascertain its reliability. The test-retest produced an internal reliability coefficient of 0.84.

Permission to carry out this research was obtained from the school authorities to be used for the study. Preliminary visits were equally made to the three primary schools. Through the visits the researcher got acquainted with the schools, got the class teachers informed of the purpose of the research work and liaised with them to help in the screening of ADHD pupils and pupils with learning difficulty in Mathematics through the use of a standardized ADHD teacher screening instrument to get participants for the study. This was done through the multi-stage sampling technique. Similarly, the initial visit to the schools was used as a pilot study. The three primary schools used for the study were far apart to avoid possible contamination. Two schools were used as the treatment groups while one school served as the control group. The researcher trained five research assistants using instructional guide lines of Cooperative Learning Strategy and Contingency Contracting Technique. This training lasted for three days. At the end of the training the research assistants were evaluated to determine their competence in using the methods.

Through this evaluation, the researcher was able to select three capable research assistants that helped the researcher in the cause of delivering the treatment packages. The treatment groups were trained while the control group members were engaged with their school work. The training was conducted during the participants' extra-curricular activities period. The study was completed within a school term so as to avoid time lag effects on the study. Thus, the researcher conducted training sessions with the two experimental groups for a period of 8 weeks at half an hour each. The participants and the researcher agreed on suitable days of the week when the training sessions were held. The days and time were (Mondays Tuesdays, and Thursdays between 11.00am - 11.30am). This period serves as their extra-curricular activity period. To avoid mortality effect of participants,

positive reinforcement strategies were used in the like of giving out pencils, biros and note books to participants who responded positively to the treatment activities as a measure to motivate them. Analysis of Covariance (ANCOVA) was used to compare the differential effectiveness of the independent variables (cooperative learning strategy & contingency contracting technique). In order to know the direction of the difference and to ascertain the amount of variations due to each independent variable, a Multiple Classification Analysis (MCA) was carried out. To test the hypotheses, Analysis of Covariance (ANCOVA) was employed to analyse the post test scores of pupils with ADHD, using the pre-test scores as covariates to find out if post experimental differences were significant. The result obtained was tested at 0.05 significant levels.

## RESULTS AND DISCUSSION

**Table 2:** Summary of Analysis of Covariance (ANCOVA) of Pre-Post Test Interactive Effects of Mathematics Achievement Scores of Pupils with ADHD in the Treatment Groups, Age and Gender

Source	Sum of Squares	DF	Mean Square	F	Sig.	Remark
Covariates	4231.015	1	4231.015		19.952	.01
Main effects	55223.790	4	13805.948	65.104	.01	
Treatment	53986.260	2	26993.130	127.290	.01	Sig.
Age	986.150	1	986.150	4.650	.05	Sig.
Gender	251.381	1	251.381	1.185	.280	N.S.
2-ways Interactions	2001.445	5	400.289	1.888	.106	N.S.
Trt x Age	541.808	2	270.904	1.277	.285	N.S.
Trt x Gender	307.864	2	153.932	.726	.487	N.S.
Age x Gender	403.203	1	403.203	1.901	.172	
Trt x Age x Gender	141.991	1	141.991	.670	.416	N.S.
Explained	61598.241	11	5599.840	26.407	.01	
Residual	16540.648	78	212.060			
Total	78138.889	89	877.965			

**Table 3:** Multiple Classification Analysis (MCA) showing the direction of the results in the Pre-Post Mathematics Achievement Scores of Pupils with ADHD in the Treatment Groups, Age and Gender Grand Mean=76.11

Variable + Category	N	Unadjusted Deviation	Eta	Adjusted for independent + covariates deviation	Beta
Treatment Groups:					
Cooperative Learning	30	18.56		20.50	
Contingency Contract	30	17.22		18.59	
Control	30	-35.78		-39.08	
			.86		.94
Age:					
Younger	29	10.52		6.35	
Older	61	3.81		-3.02	
			.43		.15
Gender:					
Male	45	0.11		0.09	
Female	45	0.23		-0.07	
			.05		
Multiple R-squared					.761
Multiple R					.872

The results on table 2 show that there was significant main effect of treatment in the pretest/post-test mathematics achievement scores of pupils with ADHD in the experimental and control groups. This means that there was a significant main effect of treatment in the mean posttest mathematics achievement scores of participants exposed to

treatment and the control group. This implies that pupils with ADHD in the experimental groups benefited from the treatment package as they were able to improve on their mathematical skill competences better than pupils with ADHD in the control group who were not exposed to any treatment package. Therefore, the hypothesis that there is no significant main effect of treatment on the Mathematics achievement scores of pupils with ADHD was rejected. In order to find out the magnitude of groups mean scores, the MCA as observed on table 3 shows the performance of all the groups in mathematics achievement. The Control group had the lowest adjusted posttest mean score of 40.3 followed by Contingency contracting group with the adjusted mean score of 93.3 while the Co-operative learning strategy group had the highest adjusted posttest mean score of 94.7. Therefore, the result indicates that the impact of ADHD is much more on participants in the control group and less on contingency contracting and cooperative learning strategy groups respectively. It further reveals the differential-values of the pre and post treatment outcome and equally shows the effectiveness of the treatment package over the control (that is, non-treatment group). These values were obtained by adding the grand mean of 76.11 with the respective adjusted deviation. The table also indicates that treatment accounted for as much as 76% ( $MR^2 = 0.761$ ) of the variance of the participants mathematics achievement scores while the remaining 24% are due to other unexpected sampling errors. The cooperative learning strategy and contingency contracting treatment groups had adjusted posttest scores that were higher than the grand mean while the control group had an adjusted posttest mean score that is below the grand mean. Therefore the direction of increasing main effect of treatment on mathematics achievement of pupils with ADHD is cooperative learning strategy >contingency contracting > control.

Table 2 shows that there is significant main effect of age in the pretest/post-test mathematics achievement scores of pupils with ADHD between younger and older pupils. This implies that based on the effect of the treatment, younger pupils with ADHD adjusted much more favourably to improvement on their mathematical skill deficiencies than the older pupils with ADHD. Therefore the null hypothesis that there is no significant main effect of age on the mathematics achievement scores of pupils with ADHD is rejected. The MCA shows that the mean score of younger pupils with ADHD is 86.63 while that of the older pupils with ADHD is 79.92. This shows that younger pupils with ADHD had a higher mean score and by implication expressed better improved adjustment on their learning difficulty in Mathematics challenges than the older pupils. This is attained by adding the grand mean to the adjusted deviation figure of younger and older pupils with ADHD and also using the weighted mean.

Table 2 shows that there is no significant main effect of gender in the pretest/post-test mathematics achievement scores of pupils with ADHD between male and female respondents. Therefore, the null hypothesis that there is no significant main effect of gender on the mathematics achievement scores of pupils with ADHD is accepted. The MCA on table 2 shows that the mean score for male is 76.22 while that of female is 76.34. This shows that the impact of gender on the mathematical skill challenges is not significant. This is attained by adding the grand mean to the adjusted deviation figure of male and female



pupils with ADHD. Table 2 shows that in 1-way analysis, both the Treatment Groups and Age are significant but gender is not significant. In the 2-way interaction, there is no significant interactive effect in the interactions between treatment, age and gender. Also, in the 3-way interactions, no significant interaction is found. This implies that the impact of the interaction of treatment, age and gender on the mathematics achievement scores of pupils with ADHD is not significant. Therefore the null hypothesis that there is no significant interaction effect of treatment, age and gender on the mathematics achievement scores of pupils with ADHD is accepted.

The result of the findings reveals that there was significant main effect of treatment on the pre-test and post-test mathematics achievement scores of pupils with ADHD in the experimental and control groups. This implies that the two therapeutic programmes prove to be effective in improving pupils with ADHD mathematics competence and ability to adjust to the challenges of applying necessary mathematical skills to solving mathematical sums which appear tasking to them before the training. The post test scores in mathematics of participants in the experimental groups show that the treatment gain was effective. However, the low scores attained by participants in the control group as observed in the posttest mean score could be explained in line with the fact that they were not exposed to any treatment package. This finding is consistent with the work of Jenkins and O'Connor (2003) who find that co-operative learning strategies, is effective in attending to the needs of pupils with ADHD experiencing learning difficulties in mathematics at the classroom level because it aids in classroom management and provide a means to deliver differentiated instruction. Likewise, Fuchs and Fuchs (2005) posit that many studies on pupils with ADHD experiencing mathematics difficulty have shown that pairing pupils who have stronger academic skills with those with weaker skills from kindergarten improves outcomes for all pupils and provides opportunities for practice that help acquisition of new knowledge and transfer of skills and content knowledge.

The results also show that there is significant main effect of age in the posttest mathematics achievement scores of pupils with ADHD between older and younger pupils with ADHD. The implication is that age has significant effect in the mathematics achievement scores difference between older and younger pupils with ADHD among participants for the intervention programme. The MCA on table 3 reveals that younger participants experiencing learning difficulties in mathematics perform better in the treatment programme as reflected in their posttest mathematics achievement scores than the older participants experiencing learning difficulty in mathematics. This implies that age influences the ability of the participants to benefit from the treatment programme. This result could be premised on the possible reason that due to the efficacy of the treatment programme, younger pupils with ADHD expressing deficiencies in mathematics achievement were able to mirror deep down into their person, evaluate their foremost academic conduct, appraise their strengths and weaknesses and then resolve to overcome their challenges by being confident in their ability and capability to succeed in their mathematics task than the older participants. This development is contrary to Dehaene (1992), contention that core numerical abilities are still discernible in older children and adults and form the building blocks for the development

of new cognitive skills such as formal and higher mathematical abilities. For example, it is suggested that arithmetic facts like those generated by division or subtraction involve manipulation of quantities, that is, core system of numbers. Furthermore, the results show that there is no significant main effect of gender in the posttest mathematics scores of pupils with ADHD expressing deficiencies in mathematics achievement between male and female participants. This implies that the issue of gender identity does not influence the mathematics achievement scores of participants. In the light of this therefore, this development could be premised on the fact that pupils with ADHD expressing deficiencies in mathematics achievement share same or similar developmental and academic characteristic trait. Therefore, in view of this, they are likely to manifest similar inappropriate behaviours detrimental to their success in the classroom and also disruptive to the learning environment of other pupils within the general education classroom. This is consistent with the fact that pupils with ADHD expressing deficiencies in mathematics achievement either boy or girl often demonstrate inappropriate behaviours in the classroom and these behaviours have shown to predict poor academic achievement, rejection from peers, and an increased chance of pupils dropping out of school (Wilkinson, 2005). They exhibit a wide range of inappropriate behaviours including disruption, disobedience, destruction, and aggression (Cullinan & Sabornie, 2004).

Nevertheless, the result shows that there is no significant interactive effect in the interactions between treatment, age and gender of the posttest mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement. This suggests the fact that age and gender do not influence the treatment. Therefore, the null hypothesis is accepted. However, the likely reason treatment, age and gender do not interactively have significant effect on the mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement could be adjourned to the fact that they all experience and express similar measures of inattentiveness, lack of concentration, difficulty in understanding how best to apply or use appropriate mathematics skills to solve mathematical problems when the situation arises during classroom teaching and learning situation. Concurring, Deshazo-Barry, Lyman and Klinger (2002) posit that there appears to be a correlation between the severity of the symptoms of ADHD and achievement. Thus, the more severe the symptoms, the greater the negative impact on school performance. This equally supports the fact that the corresponding effect of attention deficit hyperactivity disorder could result to displayed deficit in pupil's self-esteem, expressed helplessness and poor adjustment to teaching and learning situations in classroom.

This study has several implications which includes among others the fact that the study has proved that cooperative learning strategy and contingency contracting technique are effective intervention mechanisms in managing and improving the mathematics competency skills of pupils with ADHD expressing deficiencies in mathematics achievement in schools. Also, the study has exposed pupils with ADHD expressing deficiencies in mathematics achievement in schools to intervention programmes that have helped develop their social, academic and mathematics competence skills which would help them tackle mathematics tasks and other related academic problems effectively and adjust positively

to their academic challenges. Since the two intervention programmes applied were effective, the skills learnt would enable pupils with ADHD expressing deficiencies in mathematics achievement develop confidence in themselves, believe in their ability to succeed, develop positive attitude to school and learning, reduce their restlessness, non-attentiveness and improve on their academic achievement.

### **CONCLUSION AND RECOMMENDATIONS**

This study determines the effects of cooperative learning strategy and contingency contracting technique on mathematics achievement of pupils with attention deficit hyperactivity disorder in Delta State, Nigeria. The training programmes were carried out, the findings revealed that Cooperative learning strategy and contingency contracting technique were effective in improving the mathematics competency skills of pupils with ADHD expressing deficiencies in mathematics achievement. Despite the fact that both Cooperative learning strategy and contingency contracting technique were effective in improving the mathematics competency skills of pupils with ADHD expressing deficiencies in mathematics achievement; cooperative learning strategy was more effective in improving the mathematics competency skills of pupils with ADHD expressing deficiencies in mathematics achievement.

It is believed that this study has established that the mathematics achievement of pupils with ADHD could be enhanced with the use of co-operative learning strategy and contingency contracting technique. It has demonstrated the effects of cooperative learning strategy and contingency contracting technique on mathematics achievement of pupils with ADHD. It has demonstrated the relevance of intervention programmes in the management of learning difficulty in mathematics of pupils with ADHD in primary schools. With this, the possibility of turning the academic difficulty of pupils with ADHD expressing deficiencies in mathematics achievement to positive opportunity that could guarantee them success in their academic pursuit is a possibility and reality.

The family, society and significant others should take time to appreciate and understand the academic and developmental challenges faced and experienced by pupils with ADHD expressing deficiencies in mathematics achievement as to devise appropriate measures to help them overcome their challenges and adjust well to their challenges. Counselling/psychological intervention programmes should be put in place to help guide pupils with ADHD expressing deficiencies in mathematics achievement to self-rediscover their potentials, abilities and capabilities and improve their academic attainment. The government should ensure that functional counselling and psychological services are made available in schools to attend to the needs of pupils with ADHD expressing deficiencies in mathematics achievement. Pupils with ADHD expressing deficiencies in mathematics achievement should not be labelled or stigmatized as failures but should be encouraged and re-enforced positively to overcome their frustrating academic experiences and function optimally in school and attain good academic performance.

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