Attention Deficit Hyperactivity Disorder (ADHD) and Accompanying Learning Difficulties Experienced in Solving Mathematical Problems among Primary School Pupils in Warri, Delta State, Nigeria

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ABSTRACT

This study investigates the accompanying learning difficulties experienced in solving Mathematical problems among Primary School Pupils in Warri, Delta State, Nigeria as result of Attention Deficit Hyperactivity Disorder (ADHD). The aim is to evaluate the effects of Co-operative Learning Strategy and Contingency Contracting Technique on mathematics achievement of pupils with ADHD in Warri, Nigeria. The study adopted pretest, post-test, control group quasi-experimental research design with a 3 x 2 x 2 factorial matrix. Multi-stage sampling technique was used to select 90 participants, three public primary schools and three local government areas in Warri. 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. Four hypotheses were tested at 0.05 level of significance and data analysed using Analysis of Covariance and MCA. The result of the study reveals the fact that mathematics achievement of pupils with ADHD could be fostered to enhance better academic accomplishment with the use of these intervention programmes. 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 strategy, Contingency contracting technique, Primary school pupils, Mathematics achievement, Attention Deficit Hyperactivity Disorder.*

INTRODUCTION

Children with ADHD manifest behaviours that hinder their ability to concentrate in classroom teaching and learning situation and this prevents them from mastering or partially mastering the required mathematics skills necessary for them to develop the expected competency. The lack of potential in developing the mathematics competency often has grave consequences across their developmental lifespan. Pupils with Attention Deficit Hyperactivity Disorder (ADHD) generally have poor scholastic outcomes, including grade retentions and school dropout (Fergusson and Horwood, 1995). Likewise, Zentall, Smith, Lee and Wieczorek (1994) find that pupils with ADHD had greater difficulty generating their own

categories even in non mathematical problem-solving tasks. They further contended that pupils show an attention preference for salient or novel features of stimuli but have difficulty in focusing on relevant stimuli that are neutral, subtle, small/detailed, or embedded within tasks. Thus, it is observed that pupils with ADHD may fail in some mathematics problem-solving tasks because they do not attend to relevant stimuli and therefore do not build the conceptual knowledge needed for the task. In the same vein, Swanson and Jerman (2006) assert that pupils who display hyperactivity, inattentiveness and impulsivity are ADHD in nature and sometimes express difficulty in conceptualising mathematics skills. Some of these pupils are not able to learn basic arithmetic facts or fundamental computational skills. Others cannot grasp the principles of estimation, mental calculation and probability. For example 4 + 3 = 7; ---- + 4= 7; or 7-..... =3. Also, others find mastery of fractions or decimals difficult. For example, ½ = 0.5, $^{2}/_{5}$ = 0.4; 0.2 =.....; ($^{1}/_{5}$) or 0.8 =.....; ($^{4}/_{5}$). These pupils for the fact that they tend not to sit and listen to the teacher instead are self-distracting, see this task as extraordinarily challenging. Based on this weakness, most of them are unable to sort relevance from extraneous information and to recognise correct computational procedure.

Also, children with ADHD expressing learning challenges may experience difficulty in mathematics/Arithmetic (Dowker, 2005; Parmar and Singer, 2005; Swanson and Jerman, 2006). Some children are not able to learn basic mathematical facts or fundamental computational skills. Poor mathematics achievement among ADHD pupils is indicated when their achievement in mathematics is substantially below what is expected on the basis of the Child's other abilities. Relatively few children identified as having learning difficulty have only mathematics challenges; for most, this difficulty is part of their overwhelming and pervasive underachievement (Jordan and Hanish, 2003).

According to Lerner (2004) learning difficulty affects the manner in which individuals with normal or above normal intelligence take in, retain, and express information. It is commonly recognized as a significant deficit in one or more of the following areas: oral expression, listening comprehension, written expression, basic reading skills, reading comprehension, mathematical calculation, or problem solving. Individuals with learning difficulty in mathematics also may have difficulty with sustained attention, time management, or social skills (Lerner, 2004). This possibly suggest the fact that since these pupils had consistently been experiencing failure in mathematics task, they have overtime assumed a state of confusion and despair such that they have lost that self-believing spirit that could make them develop the needed self-confidence to concentrate and succeed in their mathematics task. This supports Mabbott and Bisanz (2008) claim that children with identifiable learning difficulty in mathematics are distinguished by poor mastery of number facts, fluency in calculating and working memory, together with a slower ability to use 'backup procedures', concluding that overall mathematics deficiencies may be a function of difficulties in computational skills and working memory. However, behavioural approaches could be used to remedy this situation. Behavioural approaches represent a broad set of specific interventions that have the common goal of modifying the physical and social environment to alter or change behaviour (APA, 2001). They are used in the treatment of

ADHD to provide structure for the child and to reinforce appropriate behaviour. Types of behavioural approaches include a systematic programme of contingency management (e.g. positive reinforcement, "time outs," response cost, and token economy), co-operative learning (training in problem-solving and social skills), and cognitive-behavioural treatment (for example, self-monitoring, verbal self-instruction, development of problem-solving strategies, self-reinforcement) (APA, 2001; Pelham, Wheeler and Chronis, 1998). In general, these approaches are designed to use direct teaching and reinforcement strategies for positive behaviours and direct consequences for inappropriate behaviour. Of these options, systematic programmes of intensive contingency management and co-operative learning conducted in specialized classrooms and summer camps with the setting controlled by highly trained individuals have been found to be highly effective (Pelham and Hoza, 1996).

Co-operative learning strategy (that is, jigsaw, learning together, group investigation, student teams-achievement divisions, and teams-games-tournaments) is a strategy that could be used for instructional purpose for teaching academic and collaborative skills to develop competencies in school children. This implies that co-operative learning strategy appears highly desirable because of its tendency to reduce peer competition and isolation, and to promote academic achievement and positive interrelationships. Along this perspective therefore, it could be said that the major benefit of co-operative learning strategy, is to provide pupils with academic challenges and social interaction difficulties, an instructional atmosphere and arrangement that fosters the application and practice of collaborative skills within a natural setting (that is, group activity). Thus, Slavin, Leavey and Madden (1984) state that co-operative learning strategy has been used extensively to promote mathematics achievement of pupils with ADHD. Johnson D. and Johnson R. (1991) find that co-operative learning strategy actively engages ADHD pupils expressing poor achievement in mathematics in classroom teaching learning activities. It results in positive peer pressure on all individuals to achieve group goals. It also supports each individual to ensure that those of varying ability can achieve these goals. Johnson D. and Johnson J. (1986) support cooperative learning as they opine that it is an effective approach for including pupils expressing poor achievement in mathematics in classroom group work and promoting peer acceptance.

According to Lassman, Jolviette and Wehby (1999), teachers who work with ADHD pupils expressing poor mathematics achievement need continuing support and training in specific behaviour management strategies, and opportunities to develop positive relations with pupils. One research-based strategy that has been shown to decrease inappropriate behaviours associated with ADHD pupils experiencing mathematics difficulty is behaviour contracting. According to Cook (2005), behaviour contracts are able to disrupt the negative cycle that often occurs between ADHD pupils expressing poor mathematics achievement and a teacher. Behaviour contracts replace negativity with positive teacher attention, which in turn increases pupil's self-esteem. Navarro, Aguilar M., Aguilar C, Alcade and Marchena (2007) also researched the use of contingency contracts with three pupils without disabilities in the general education using a multiple baseline research

design. As in previous studies, these pupils demonstrated inappropriate behaviours including lying on desks, refusing to work, making verbal complaints, and making noises. They found that all students had a significant reduction in their personal targeted behaviourial problems as the contracts were implemented. This work is anchored on Self-Determination Theory (SDT) as proposed by (Deci and Ryan, 2000). Self-Determination Theory (SDT) represents a broad framework for the study of human motivation and personality. Self-determination theory can explain some fascinating findings. For example, ADHD pupils with learning disabilities are less likely to become absorbed and engrossed in their work when someone else, such as their teacher, imposes a deadline. Interestingly, this problem dissipates if ADHD pupils with learning disabilities set themselves a more stringent condition as observed in the application of contingency contracting and co-operative learning strategies by the teacher in the teaching learning situation. This behaviour implies a sense of choice, which fosters an autonomous motivation.

Self-determination theory evolved from the distinction between intrinsic and extrinsic motivation. When individuals experience intrinsic motivation, they engage in behaviours they perceive as inherently interesting, satisfying, gratifying, enjoying, fulfilling, and absorbing. When individuals experience extrinsic motivation, they engage in behaviours merely because of the objective consequences they might attract, such as tangible rewards or praise. Based on the trust of this context therefore, this study is wheeled on the principle of self-determination theory. In this study the following hypotheses were tested at 0.05 level of significance:

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

It is believed that this study has contributed to knowledge in the following ways:

- It has proved to teachers, school authorities, parents and government that mathematics learning difficulty could be managed to help enhance better academic performance among pupils with ADHD.
- It has brought to the awareness of teachers that the poor academic situation of pupils with ADHD expressing deficiencies in mathematics achievement in school is not beyond management but with the use of appropriate teaching methods and support they could help pupils with ADHD overcome their academic deficiencies and attain academic success.

METHOD

The study adopted 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 the ability of showing the potential for controlling all threats to validity so that a cause and effect relationship could be established.

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

Treatment	**GENDER**				
	Male		**Female**		
	Older Pupils	**Younger Pupils**		**Older Pupils**	**Younger Pupils**
	9-10yrs	**7-8yrs**	**9-10yrs**	**7-8yrs**	**Total**
A1 Co-operative Learning	A1 B1n=10	A1 C1n=5	A1 B2n=8	A1C2n=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 Warri, 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 Warri, Delta State, Nigeria. Delta State has twenty-five local government areas. Through the multi-stage sampling technique, three local government areas, one school from each of the local government areas and ninety pupils were selected using the hat picking method, from Warri South, Warri South-West and Warri North from among the twenty five local government areas of Delta State.

The VADTRS is a standardized diagnostic teacher rating scale (Wolraich, Hannah, Pinock, Baumgaertel and Brown, 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 x 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 liaise 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.

The following statistical designs were used in this study: ANCOVA (Analysis of Covariance) and Multiple Classification Analysis (MCA). Analysis of Covariance (ANCOVA) was used to compare the differential effectiveness of the independent variables (cooperative learning strategy & contingency contracting technique). 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. 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.

RESULTS AND DISCUSSION

The result on table 2 shows 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 ($F_{(2,87)} = 127.29$, $p < .01$). This means that there was a significant main effect of treatment in the mean post-test 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 competencies better than pupils with ADHD in the control group who were not exposed to any treatment package. Therefore, the hypothesis was rejected. In order to find out the magnitude of groups mean scores. The result on table 2 further shows that there was no significant interaction effect of treatment and age in the pre-post-test mathematics achievement scores of pupils with ADHD in the experimental and control groups ($F_{(2,87)} = 1.277, p < .05$). This implies that the degree in differential value of the effect of the interaction of treatment and age on the levels of learning difficulty in mathematics of the participants was not statistically high enough for it to be significant. Hence the null hypothesis was accepted. Table 2 shows that in the two-way interaction, the interaction had no significant interactive effect ($F_{(2.87)} = 0.726, p > .05$). This implies that the degree in differential value of the effect of the interaction of treatment and gender on the levels of learning difficulty in mathematics of the participants is not high enough for it to be significant. Therefore, the null hypothesis was accepted.

The MCA as observed on table 3 showed the performance of all the groups in mathematics achievement. The Control group had the lowest adjusted post-test mean score followed by Contingency contracting group with the adjusted mean score while the Co-operative learning strategy group had the highest adjusted post-test mean score. Therefore, the result indicated 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 revealed the differential-values of the pre and post treatment outcome and equally showed the effectiveness of the treatment package over the control (that is, non-treatment group). These values were obtained by adding the grand mean with the respective adjusted deviation. The table also indicated that treatment accounted for as much as 76% 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 post-test scores that were higher than the grand mean while the control group had an adjusted post-test 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. There is no significant interaction effect of age and gender on the mathematics achievement scores of pupils with ADHD. Table 2 showed that in the one-way analysis, age is significant while gender is not. However, in the two-way analysis, the interaction showed that there was no significant interactive effect between age and gender ($F_{(1, 88)} = 1.901, P < .05$). This implies that the impact of the interaction of age and gender on the mathematics achievement scores of pupils with ADHD is not high enough for it to be significant. Therefore the null hypothesis was accepted. There is no significant main effect of treatment on the mathematics achievement scores of pupils with ADHD. The result of the findings revealed that there was significant main effect of treatment on the pre-post-test mathematics achievement scores of pupils with ADHD in the experimental and control groups. Therefore, the hypothesis was rejected.

This implies that if pupils with ADHD expressing learning difficulty in mathematics are exposed to corrective interventions as measures to help them explore and maximally use their potentials, it could go a long way to help improve their academic achievement in mathematics and raise their self-confidence and belief that they have what it takes to succeed in school. Also, the findings is an indication that the intervention programme has effectively developed in pupils with ADHD experiencing learning difficulty in mathematics resourceful potential that would be useful to them in managing their academic challenges.

This finding therefore attests to the fact that learning difficulty in mathematics experienced and expressed by pupils with ADHD could be managed with the effective use of cooperative learning strategy and contingency contracting technique. This further confirms the findings of Johnson D. and Johnson J. (1991) that co-operative learning strategy is an effective approach which when appropriately used, actively engages pupils with ADHD expressing deficiencies in mathematics achievement in classroom learning activities as peers give positive supports to each other. It results in positive peer pressure on all individuals to achieve group goals. It also supports each individual to ensure that those of varying ability can achieve these goals. The result also implies that to manage pupils with ADHD learning difficulty in Mathematics for them to succeed scholastically and socially, it is very important that interventions are projected to meet these pupils' specific needs. There is no significant interaction effect of treatment and age on the mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement. The results of the findings showed that there was no significant interactive effect of age in the post-test mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement in the experimental and control groups. This shows that age did not influence the ability of the participants to benefit from the treatment programme. Therefore, the null hypothesis is accepted.

This could be adjoined to the fact that due to the nature and presupposed experience of pupils with ADHD expressing deficiencies in mathematics achievement, they are naturally restless, inattentive, impulsive and possibly non-concentrating during teaching and learning activities. This gives credence to Lerner's (2004) assertion that learning difficulty affects the manner in which individuals with normal or above normal intelligence take in, retain, and express information. It is commonly recognized as a significant deficit in one or more of the following areas: oral expression, listening comprehension, written expression, basic reading skills, reading comprehension, mathematical calculation, or problem solving. Individuals with learning difficulty in mathematics also may have difficulty with sustained attention, time management, or social skills. This possibly suggest the fact that since these pupils had consistently been experiencing failure in mathematics task, they have overtime assume a state of confusion and despair such that they have lost that self-believing spirit that could make them develop the needed self-confidence to concentrate and succeed in their mathematics task. Hence, this could be the basis why the interactive effect of treatment and age had no significant effect on the mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement in the experimental and control groups used for the study.

There is no significant interaction effect of treatment and gender on the mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement. The result of the findings revealed that there was no significant interactive effect of gender in the post-test mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement in the experimental and control groups. This implies that gender did not influence the ability of the participants to benefit from the treatment. Therefore, the hypothesis is accepted. This could be premised along the projection that pupils with ADHD expressing deficiencies in mathematics achievement either male or female experience similar difficulty in being able to apply appropriate mathematics skills in solving mathematical problems in similar manner based on their characteristic nature of poor concentration, hyperactivity, impulsivity, inattentiveness, lack of confidence, academic disillusionment and helplessness. This supports Mabbott and Bisanz (2008) claim that children with identifiable learning difficulty in mathematics are distinguished by poor mastery of number facts, fluency in calculating and working memory, together with a slower ability to use 'backup procedures', concluding that overall mathematics deficiencies may be a function of difficulties in computational skills and working memory. There is no significant interaction effect of age and gender on the mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement. The result showed that there was no significant interactive effect in the interaction between age and gender in the post-test mathematics scores of pupils with ADHD expressing deficiencies in mathematics achievement. Therefore, the hypothesis is accepted. This implies that age and gender had no moderating influence on the mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement.

This could be premised on the fact that either being older or younger, boy or girl pupils with ADHD expressing deficiencies in mathematics achievement do express the same feelings of worthlessness, confusion and helplessness based on this, they equally exhibit same trait of class disruptions, lack of concentration and lack of confidence. Hence this could likely be the reason why age and gender did not have significant interactive effect on the mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement. Supporting this point of view, Dowker (2005); Parmar and Signer (2005); Swanson and Jerman (2006) assert that pupils who display hyperactivity, inattentiveness and impulsivity are ADHD in nature and sometimes express deficiencies in mathematics achievement. Some of these pupils are not able to learn basic arithmetic fact or fundamental computational skills. Others cannot grasp the principles of estimation, mental calculation and probability. For example 4 + 3 = 7; ---- + 4 = 7; or 7-..... = 3. Also, others find mastery of fractions or decimals difficult. For example, ½ = 0.5, $^{2}/_{5}$ = 0.4; 0.2 = ...; ($^{1}/_{5}$) or 0.8 =.....; ($^{4}/_{5}$). These pupils for the fact that they tend not to sit and listen to the teacher but instead are self-distracting see this task as extraordinarily challenging. Based on this weakness, most of them are unable to sort relevance from extraneous information and to recognise correct computational procedure (Jordan and Hanich, 2003). The study provides reasonable information that can be applied in the management of academic underachievement of pupils with ADHD expressing deficiencies in mathematics

achievement so that they would equally have prospective future and contribute positively to the growth and development of the Nigerian society. The study has revealed the complex nature of pupils with ADHD expressing deficiencies in mathematics achievement, their fear, frustration and state of helplessness and the need for government and schools to make available functional counselling and psychological services as a meaning to coming to the aid of this set of pupils on time before their situation gets worst. The study will enable parents to be aware of the academic developmental needs of their children who are experiencing difficulty in learning mathematics and know how best to help them out, relate with them, guide them effectively to enable them develop self-confidence and attain success at school.

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	N.S.
Trt x Age x Gender	141.991	1	141.991	.670	.416	
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		.94.15
Age:					
younger	29	10.52		6.35	
Older	61	3.81		-3.02	
			.43		.761
Gender:					
Male	45	0.11		0.09	
Female	45	0.23		-0.07	
			.05		.872
Multiple R-squared					.761
Multiple R					.872

CONCLUSION AND RECOMMENDATIONS

The treatment programme had significant main effect in its interactive effect between older and younger pupils with ADHD expressing deficiencies in mathematics achievement. Also, the significant interactive effect between age and gender mediate the efficacies of the two training programmes. Learning difficulty in mathematics can be managed. Also, mathematics competency skills of pupils with ADHD expressing deficiencies in mathematics achievement can be positively improved upon to foster academic success of pupils with ADHD expressing deficiencies in mathematics achievement in school. Pupils with ADHD are experiencing and have experienced in the past academic failure and low performance in basic subjects of reading, writing, and mathematics. The motivation and aspirations of these set of pupils usually is at a very low level. They continually express anxiety, restlessness, inattentiveness or impulsivity, get low grades in school and seem to take it for granted that they will continue to get this caliber of grades despite what they may try to do. Based on this context therefore, the researcher would like to make the following recommendations:

Pupils with ADHD expressing deficiencies in mathematics achievement should be given adequate academic orientation and re-orientation on the need for them to develop positive attitude to school and learning. Have personal reading guide (timetable), attend class regularly, be attentive in class, do their homework regularly and be confident in their ability to succeed in their academic pursuit. Teachers should use appropriate teaching methods and aids that will not only stimulate the desire to learn among pupils with ADHD expressing deficiencies in mathematics achievement but also motivate them to conquer their academic deficiencies and challenges. Teachers should endeavour to use cooperative learning strategy as effective measures to encourage pupils expressing deficiencies in mathematics achievement as self-help to develop their mathematics competency through self-support. Here the teacher should pair more competent and less competent pupils with learning disabilities in mathematics to work together. Also, teachers should endeavour to appropriately use contingency contracting technique to reinforce the desire to learn in pupils with ADHD expressing deficiencies in mathematics achievement.

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