EFFECTS OF COOPERATIVE LEARNING AND CONTINGENCY CONTRACTING ON MATHEMATICS ACHIEVEMENT OF PUPILS WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER IN WARRI, NIGERIA

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ABSTRACT

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. The effects of ADHD on learning difficulties may become overwhelming on these pupils. This is probably caused by some personal, psycho-social and environmental factors distractive enough to negatively affect their concentration in class and achievement in mathematics. Literature substantiates the impact of utilising intervention plans to effectively manage ADHD pupils with specific learning difficulties in order to enhance their academic performance. However, there is dearth of studies that combine co-operative learning strategy and contingency contracting technique to improve the mathematics achievement of pupils with ADHD and accompanying learning difficulties in mathematics. This study, therefore investigated 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, posttest, control group quasi-experimental research design with a 3x2x2 factorial matrix. Multi-stage sampling technique was used to select 90 participants from three randomly selected public primary schools in the 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 (α= 0.93) and Woodcock-Johnson III Mathematics Fluency Achievement Tests Scale (α= 0.84). Seven hypotheses were tested at 0.05 level of significance and data analysed using Analysis of Covariance and Duncan post hoc.

There was a significant main effect of treatment on mathematics achievement of pupils with ADHD ($F_{(2,\ 87)} = 127.29$, $p<0.05$). Co-operative learning strategy was more effective in improving mathematics competence skills ($\bar{x} = 96.6$) of pupils with ADHD than contingency contracting technique. Also, age had significant main effect on mathematics achievement of pupils with ADHD ($F_{(1,\ 88)} = 4.65$, $p<0.05$). However, gender had no significant main effect on mathematics achievement of pupils with ADHD. Likewise, there was no significant interaction effect of age and gender on mathematics achievement of pupils with ADHD. Furthermore, there was no significant interaction effect of treatment, age and gender on mathematics achievement of pupils with ADHD in the study.

Co-operative learning strategy and contingency contracting technique were effective in improving mathematics achievement of pupils with attention deficit hyperactivity disorder. Hence, the study enlightened teachers, school authorities, parents and government of 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.

Word count: 457

CERTIFICATION

This is to certify that this work was carried out by **Esse Elizabeth ASAMAIGO** with **Matric No: 50946** in the Department of Special Education, University of Ibadan, Ibadan, Nigeria.

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DEDICATION

This research work is dedicated to GOD ALMIGHTY who will always fulfill His promises. I say thank you my reliable and dependable GOD.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

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 could be a mirage especially among children with ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD) which could be responsible for a wide variety of learning problems noticed with some children in schools. Often, some children with ADHD manifest behaviours that hinder their ability to concentrate in classroom teaching and learning situation and this prevent 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 (Barkley, Fischer, Edelbrock, & Smallish, 1990; Fergusson & Horwood, 1995). Barry, Lyman, and Klinger (2002), examined 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. The effect of ADHD on mathematical achievement is a very important concern given the value of acquired mathematical skills to human capital development.

Barry et al (2002) further compared a group of 33 children, who met the Diagnostic and Statistical Manual of Mental Disorders 4th ed (American Psychiatric

Association, 1994) criteria for ADHD, with a control group of 33 non-ADHD children. The two groups had average intellectual abilities and ranged in age from 8.9 to 14.5 years. In this study, the group of children with ADHD performed significantly below prediction in mathematics skills and demonstrated a greater discrepancy between actual and predicted achievement than did the group of non-ADHD children. Barry et al stated that children with ADHD experience deficits in some of the abilities constituting the executive functions such as planning, organizing, maintaining an appropriate problem-solving skill(s) to achieve a future goal, inhibiting an inappropriate response or deferring a response to a more appropriate time representing a task mentally (i.e., in working memory), cognitive flexibility, and deduction based on limited information.

Likewise, executive functioning required by ADHD children in reading, writing and mathematics as suggested by Loring (1999) are the cognitive abilities necessary for complex goal-directed behaviour and adaptation to a range of environmental changes and demands. If it is considered that attention processes play a fundamental role in executive functioning, it seems reasonable therefore, that children with ADHD will perform poorly in situations requiring attention and other mental abilities underlying executive functions. Examining whether the academic underachievement that often accompanies ADHD is related to the behavioural or cognitive impairments associated with the disorder, Barry et al. (2002) found that the ADHD behaviours predicted academic underachievement over and above performance on measures of executive functioning for each of the academic areas (i.e., reading, writing, mathematics).

According to Lucangeli and Silvia (2006) this predictively remains even when the participants with comorbid ADHD and Learning Disabilities (LD) are excluded. In contrast, performance on the executive function measures predicted academic underachievement in only one academic area—Mathematics—but this however,

predictively disappears when participants with comorbid ADHD and LD are excluded. These results seem to indicate that disruptive behaviours, perhaps more than cognitive deficits, are associated with impairment in academic functioning, including mathematics. DuPaul, Volpe, Jitendra, Lutz, Lorah, and Gruber (2004) investigated multiple measures (e.g., teacher ratings and behaviour observations) as predictors for concurrent achievement outcomes in mathematics in two samples of first- through fourth-grade children (136 with ADHD, 53 without ADHD). The purpose of this investigation was to identify potential predictors of contemporaneous academic achievement in a sample of children with ADHD.

This study demonstrated that the stronger predictors of achievement test scores were teachers' perceptions of academic skills, but these predictors appeared to vary as a function of the academic content area. Teachers' perception of mathematics skills emerged as primary predictors of performance. Likewise, Zentall, Smith, Lee & Wieczorek, 1994) found that pupils with ADHD had greater difficulty generating their own categories even in nonmathematical 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) asserted 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 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.

In line with the above statement, Newman (1998) stated that the difficulty of ADHD children with mathematical deficiency may be described at three levels: quantitative dyscalculia - a deficit in the skills of counting and calculating; qualitative dyscalculia - the result of difficulties in comprehension of instructions or the failure to master the skills required for a mathematical operation and intermediate dyscalculia – which involves the inability to operate with symbols or numbers. In congruence, Desoete, Roeyers and DeClercq (2004) based on all three criteria, found that the prevalence of dyscalculia was 7.2% and 8.3% in 3rd grade boys (n=699) and girls (n=637) and 6.9% and 6.2% in 4th grade boys (644) and girls (675) respectively.

This implies that Attention Deficit Hyperactivity Disorder affects children around the world, as it occurs across all socio-economic, cultural, and racial backgrounds. Also, it affects children of all intelligence levels (Loe & Feldman, 2007), in line with this context, it is 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). Therefore, 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 situation 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. Thus, the negative implication of ADHD on the educational development, academic success and mathematics achievement of pupils in schools cannot be overemphasized.

Children with a diagnosis of Attention Deficit Hyperactivity Disorder commonly present a wide range of characteristics and problems including academic underachievement and learning difficulty. In fact, it has been estimated that approximately 80% of children with ADHD express academic underachievement and approximately one-third of children with ADHD have specific learning deficiency (Barkley, 2006; DuPaul & Volpe, 2009). Also, according to Goldstein (1999) attention deficit hyperactivity disorder is characterized by a constellation of problems with inattention, hyperactivity and impulsivity. These problems are developmentally inappropriate and cause difficulty in pupil's daily life. In congruence, Nichcy (2004) contended that Attention Deficit Hyperactivity Disorder is a condition that makes it hard for a child to sit still, control behaviour and pay attention in class. Hence, it could make children to experience significant behavioural and cognitive difficulties in their day-to-day schooling life and other work situations at home.

Primary school pupils typically spend 6 hours per day, 5 days per week and 9 months out of 12 months in school. Hence, in the classroom environment pupils are expected to sit quietly for sustained periods of time. Thus, children diagnosed with ADHD often face several challenges in the school environment as compared to a typical child considering the fact that they could have difficulties sitting quietly and focusing their attention during teaching and learning situation. The prevalence of children diagnosed with ADHD in the school system is approximately 3% to 7% (American Psychiatric

Association, 2000). Studies investigating the academic achievement of children with ADHD showed that these children are more likely to receive lower grades in academic subjects and lower scores on standard measures of reading, writing and mathematics than children without disabilities (Saunders & Chambers, 1996), consequently, more than 80% of 11 year olds diagnosed with ADHD were reported as behind by at least two years in reading, spelling, mathematics, or written language. And more than half of the children with ADHD taught in general education classrooms will experience failure in school, or be retained in at least one grade by adolescence, and more than one third will not complete high school.

Frith (1992) posited that defectiveness and unfavourable environment characterized with improper behavioural disposition towards the child during teaching and learning situation could ignite ADHD symptoms in a child. Also, excess in terms of carelessness, inaffection and negligence in the child's upbringing, maladjustment and dissatisfaction encountered in terms of the satisfaction of basic physical, social and psychological needs of the child could aggravate the problems of inattention, hyperactivity and impulsivity in the child. Therefore, in view of this, Attention Deficit Hyperactivity Disorder in pupils expressing poor achievement in mathematics could be observed in the form of the effect of restlessness, inattentiveness and impulsiveness on their academic performance.

Likewise, Ofovwe, Ofovwe and Meyer (2006) conducted a study to establish the prevalence of ADHD among school aged children in Benin City, Nigeria using a total of one thousand, three hundred and eighty four (1384) primary school pupils, aged between 6 and 13 years, who were recruited from six primary schools. Teacher's ratings of the DSM-IV symptoms of ADHD were collected and analyzed as a function of gender and subtype. The results revealed that male pupils who participated in the study with learning difficulty had a higher prevalence rate of ADHD and this support a documented trend in ADHD

reports that male children have a higher rate of ADHD (Bender 1997; Hallowell 1994; Rief 1997). They concluded that the results strengthen earlier observations that there is no significant geographical variation on the prevalence of ADHD among pupils with academic challenges if common definitions and diagnostic tools are employed.

Though, ADHD is not an illness, it is however, a developmental, psychological, social, emotional and intellectual concern that could be a problem when it is severe due to the fact that it could have a major impact on a child's life, considering the fact that schoolwork may be more difficult, and ADHD children are frequently punished for their behaviour (Mayes & Calhoun 2007). Projecting this context further, Abikwi (2009) in Edo State Nigeria, examined the impact of ADHD behaviour on the learning outcome of pupils with learning difficulty and reported that ADHD is incapacitating and impair pupils' academic success, social skills and strain their relationships with other individuals. However, according to Uwe (2000), and Agbu (2003), ADHD may affect all aspects of a pupil's life. According to Frazier, Youngstrom, Glutting and Watkins (2007) when children with ADHD become aware of their difficulties with regulating attention, hyperactivity and impulsivity and the failure that these difficulties lead to within the family, peer group and school, pupils with ADHD could develop low self- esteem and restlessness.

Thus, pupils expressing poor mathematics achievement and manifesting symptoms of ADHD could be disruptive in nature. Supporting this point of view, Gardill (1996) posited that the characteristic feature of hyperactivity in pupils expressing poor mathematics achievement is expressed in the form of fidgeting, leaving seat in classroom when remaining seated is expected; they often run about or climb excessively at inappropriate times; they equally have difficulty playing quietly, throw object on the floor to distract others and talks excessively. This could make ADHD pupils with challenge in

mathematics to have poor attention span and motivation to learn. Invariably, this implies that they need help.

This is a unique characteristic feature associated with the developmental behaviour of pupils expressing symptoms of mathematics deficiency. Some children outlive this behaviour while it persist in others and become a problem that prevents them from fulfilling their potentials and achieving the objectives mapped out for them at their primary school level. However, if such developmental behaviour is identified early, they are amenable to treatment, but if not treated, they sometimes merge almost imperceptibility into more serious and chronic disorders as the child passes into adulthood, or they manifest themselves later as different disorders (Gelford, Jenson & Drew, 1988).

Barkley (1990) posited that one essential element in the effective management of ADHD in pupils experiencing challenges in mathematics is the development and implementation of intervention strategies. Thus, 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 (e.g., self-monitoring, verbal self-instruction, development of problem-solving strategies, self-reinforcement) (APA, 2001; Barkley, 1998b; Pelham, Wheeler, & 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 & Hoza, 1996).

Co-operative learning strategy (i.e., 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 (i.e., group activity). Thus, Slavin, Leavey and Madden, (1984) stated that co-operative learning strategy has been used extensively to promote mathematics achievement of pupils with ADHD.

According to the National Council of Teachers of Mathematics (NCTM; 1991), learning environment created should be an environment that promote active learning and teaching; classroom discourse; and individual, small-group, and whole-group learning. Co-operative learning strategy is one example of an instructional arrangement that can be used to foster active student learning, through which an important dimension of mathematics is learnt and highly endorsed by mathematics educators and researchers. Pupils can be given tasks to discuss, solve problem, and accomplish results. In view of this, co-operative learning strategy is a measure that could be used to supplement textbook instruction by providing pupils with opportunities to practice newly introduced or to review skills and concepts. Teachers can use co-operative learning strategy to help pupils

make connections between the concrete and abstract level of instruction through peer interactions and carefully designed activities.

Diona (2008) asserted that co-operative learning strategy is an important strategy suitable for behaviour modification in teaching and learning situation(s). According to Diona (2008) this strategy is far from being teacher-centered but allows children to be more active throughout the day. Also, co-operative learning strategy have been explained by Slavin (1991) as instructional strategy in which children work in heterogeneous learning teams to help one another to learn academic subjects. Thus, academic success comes from the co-operation of each learner in the group and there are no losers, creating an emotionally safe climate for these children, who have already experienced more than their share of traumatic losses.

Contingency contracting is an agreement between a student and teacher, which states behavioural or academic goals for the student and reinforcers or rewards that the student will receive contingent upon achievement of these goals. This behavioural modification technique has proved to be effective in managing behaviour of hyperactivity, inattentiveness and impulsivity among children expressing learning difficulties in school. Acker and O'Leary (1987) hypothesized that positive attention, such as teacher's praises, would be important at the start of the school year while the teacher and students are establishing rapport that also lead to appropriate classroom behaviour of children with behavioural difficulties such as hyperactivity. Thus, early studies revealed dramatic increases in appropriate behaviour with the implementation of token systems in the classroom.

Therefore, in appraising this context, it could be said to be quite frustrating for exceptionally bright children with ADHD and this is not an uncommon scenario in primary schools in Nigeria as most pupils with ADHD may experience specific academic

deficits in mathematics possibly due to the negative influence of environmental, personal or social factors that could lead to the attainment of poor mathematics achievement. This is the basis for this research work. However, literature thus far indicates that much attention have not been given to address the needs of ADHD pupils with learning difficulty in mathematics in Nigeria. This implies that these pupils would continue to fall through the cracks in our educational system and be denied the official identification and appropriate interventions that would have supported them to reach their academic potentials. Based on this context therefore, this study is focused on the effects of co-operative learning and contingency contracting on mathematics achievement of pupils with Attention Deficit Hyperactivity Disorder in Warri, Nigeria possibly caused by some personal, psycho-social and environmental factors premised to be responsible for primary school pupils with ADHD poor achievement in mathematics based on the overriding influence of age and gender as moderating variables.

1.2 Statement of the Problem

Attention Deficit Hyperactivity Disorder is a frustrating phenomenon associated with primary school pupils expressing deficiencies in mathematics achievement. These children do poorly in mathematics tasks and have higher rate of failure than children that do not express symptoms of ADHD. Thus, Attention Deficit Hyperactivity Disorder impacts children negatively in a myriad of ways. For example, they experience learning difficulty in mathematics. This makes many children with ADHD display low frustration tolerance, tendency to become bored very easily or often, lack of motivation for all but the most stimulating activities, and a relative inability to recognize future consequences of behaviour or to learn from mistakes.

In addition, children with ADHD could perceive themselves as academic failures and as such, often develop a syndrome that includes a variety of self-defeating motives. For example, these pupils due to their disruptive and pervasive nature are low in self-regulated learning strategies, they have low levels of self-efficacy, low motivation, could make negative self-statements, experience hopelessness and helplessness, resulting in poor academic achievement. Therefore, the experience of persistent failure often has compounding and devastating negative effect on the academic and intellectual well-being of pupils with ADHD expressing deficiencies in mathematics achievement in school as they feel they have less control over their situation. The consequences of this traumatic experience most times are the display of violence, aggression, truancy, self-isolation and other complex deviant behaviour.

Based on the foregoing, it is believed that effective treatments are needed to manage the behaviours and to improve the academic achievement of pupils with this condition. In view of this therefore, this study examined the effects of co-operative learning strategy and contingency contracting technique on mathematics achievement of pupils with Attention Deficit Hyperactivity Disorder (ADHD) in Warri, Nigeria.

1.3 Purpose of the Study

The purpose of this study is to experimentally investigate the effects of co-operative learning strategy and contingency contracting technique on mathematics achievement of pupils with Attention Deficit Hyperactivity Disorder (ADHD). Also, this study seeks to determine which of the two experimental programmes is more effective on mathematics achievement of pupils with Attention Deficit Hyperactivity Disorder (ADHD). And equally to ascertain the impact of the moderating effects of age and gender on

mathematics achievement of pupils with Attention Deficit Hyperactivity Disorder in Warri, Nigeria.

1.4 Significance of the Study

Presently, it is of note that some pupils in primary schools express ADHD symptoms with learning difficulty. Therefore, this study would shed light on the effects of ADHD on pupils and its consequent effects which could manifest as learning difficulty in mathematics.

Likewise, the findings of this study could help teachers and other helping practitioners know how best to support children with ADHD and accompanying learning difficulty in mathematics to develop academic competence or skills that would enable them adjust to school and academic task.

This study will be useful in the field of education because it will combine many practices and procedures that will be helpful for educating pupils with Attention Deficit Hyperactivity Disorder expressing deficiencies in mathematics achievement.

It will also help teachers realize that the learning environment that they create is essential for the learning process. By creating an enabling environment and embedding them into their daily teaching routine, it will be easier to address inattentiveness and hyperactivity in the classroom.

Also, considering the fact that continuous failure in mathematics task among pupils with ADHD could lead to the development of a negative self-esteem that could ultimately lead to withdrawal from learning activities, the findings of this study could help teachers and parents change their perception about children with ADHD and make them understand that with a little effort, they could overcome their academic challenges in mathematics.

The findings of this study would equally bring to the awareness of the government of the need to employ more trained and special education teachers in primary schools to help resolve the challenging needs of pupils with ADHD expressing deficiencies in mathematics achievement.

1.5 Scope of the Study

This study investigated the effects of co-operative learning strategy and contingency contracting techniques on mathematics achievement of primary three pupils with Attention Deficit Hyperactivity Disorder in Warri, Nigeria.

1.6 Research Hypotheses

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 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 and age on the Mathematics achievement scores of pupils with ADHD
5. There is no significant interaction effect of treatment and gender on the Mathematics achievement scores of pupils with ADHD
6. There is no significant interaction effect of age and gender on the Mathematics achievement scores of pupils with ADHD

7. There is no significant interaction effect of treatment, age and gender on the Mathematics achievement scores of pupils with ADHD

1.7 Operational Definition of Terms

The following terms are operationally defined in line with the context and content of the study:

Attention Deficit Hyperactivity Disorder (ADHD): This refers to an observed negative behavioural consequence due to consistent expressed condition of hyperactivity, impulsivity and inattention by a pupil leading to learning problems in Mathematics.

Mathematics Achievement: This refers to manifested performance of pupils in mathematics

Co-operative learning strategy: This refers to an instructional strategy in which pupils work in teams to help one another to learn Mathematics skills.

Contingency contracting technique: This refers to the use of specified agreement term(s) between a pupil(s) and teacher, which states condition to be met before pupil(s) would be rewarded.

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

This chapter focused attention on the conceptual clarification, theoretical review and empirical studies on managing pupils with Attention Deficit Hyperactivity Disorder (ADHD) and accompanying learning difficulty in mathematics.

2.1 Conceptual Clarification

Mathematics Achievement

Attention Deficit Hyperactivity Disorder (ADHD)

Causes of ADHD in Children

Identification of ADHD in Children

Co-operative Learning Strategy for Pupils with ADHD

Class Activities that use Co-operative Learning Strategy

Contingency Contracting Technique for Pupils with ADHD

Steps in Contingency Contracting

2.2 Theoretical Review

The Social Construct Theory of ADHD in Children

Appraisal of the Social Construct Theory of ADHD

Criticisms of the Social Construct Theory of ADHD

Self Determination Theory of the Management of ADHD

Applications of Self-Determination Theory

Theoretical Framework of the Study

2.3 Review of Empirical Studies

Co-operative Learning and Mathematics Achievement of pupils with ADHD

Contingency Contracting Technique and Mathematics Achievement of pupils with ADHD

Age and Mathematics Achievement of pupils with ADHD

Gender and Mathematics Achievement of pupils with ADHD

2.4 Appraisal of Literature

2.4.1 Conceptual Model for the Study

2.4.2 Conceptual Perspective

2.4.3 Mathematics Achievement

Mathematics plays a very important role in our daily lives. To successfully survive in the present age of science and technology one cannot totally avoid one aspect of mathematics or the other. It is in realization of the vast applications of mathematics that made Eraikhuemen (2003) to posit that a disciplined and ordered pattern of life can only be achieved through the culture of Mathematics. Unfortunately, students' achievement in this important subject over the years has not been encouraging at the primary, secondary and tertiary levels of education in Nigeria. Abakporo (2005) summarizes this by saying that the state of students' achievement in Mathematics had left much to be desired.

Pupil's mathematics achievement appears to be a top priority among educators, policymakers, and employers. More than ever before, even entry-level positions often require complex mathematics skills. Primary school is a good time to start previewing the role mathematics plays in job success. This implies that the importance of mathematics in most fields of human endeavour cannot be underestimated. Its usefulness in science, mathematical and technological activities as well as commerce, economics, education and even humanities is almost at par with the importance of education as a whole.

Mathematics is one of the key subjects in both the primary and secondary school education system in Nigeria. Fajemidagba (1999) was of the opinion that the teaching of mathematics is very important to all human existence.

Mathematics is one of the formal disciplines that help man lay a solid foundation for future survival. Scientific and technological developments are dependent on Mathematics. The Nigerian government has made mathematics compulsory both at the primary and secondary school levels (Federal Republic of Nigeria 2004). Also mathematics is a basic requirement for admission into some degree courses in most tertiary institutions in Nigeria. Okeke (2006) noted that there was a general fear and hatred for mathematics; a situation which results in decline achievement in the subject. Esu (2006), attributed pupil's poor achievement in mathematics to factors such as: the notion among pupils that mathematics is an abstract and difficult subject, inadequate qualified teachers to teach the subject as specialist, improper method of teaching mathematics, lack of mathematics laboratory, insufficient instructional aids and poor use of instructional materials. Basically the goal of teaching mathematics, especially at the primary level is to prepare pupils to develop critical and creative outlook as they confront the challenges of daily life (Meremikwu 2008).

Thus for the attainment of high achievement in mathematics, meaningful teaching must exist at the concrete operational level. By the nature of children, they need a large number of and variety of educational or instructional resources to interact with. Children at the primary level like to explore, experiment, create and interact intensively with the environment. The use of copious types of instructional resources, therefore, helps create an enabling environment for effective learning of the subject. Several studies have shown other indices that could affect pupils' mathematics achievement. Stringfield and Teddie (1991), in their study of rural education in the United States showed that classes and

schools differ in terms of their learning environment and school resources. Okoyeocha (2005), in a comparative study of public and private schools in 22 schools (11 public and 11 private schools) in Nigeria found that public schools were better equipped than their private counterparts. The location of the school could also influence the level of academic achievement of pupils. Daramola (1985) showed that pupils in urban schools performed significantly better than their counterparts in rural schools

Mathematics is all about finding solutions to problems. All decisions taken are based on such questions as what and how this question is best answer by converting every statement to mathematical statement before solution is sought. The depth of mathematical knowledge an individual has, dictated the level of accuracy of his/her decision. This implies the fact that before an individual can function well in the society he/she must possess or have relatively good knowledge of mathematics especially in this era of technological age. The technological development is highly rooted in the study of mathematics. Okebukola (1992) opined that mathematic is referred to as central intellectual discipline of the technological societies. Kerlinger (1985) describe mathematics as a language of science. Aminu (1990) argued that mathematics is not only the language of sciences, but essential nutrient for thought, logical reasoning and progress. Mathematics liberates the mind and also gives individuals an assessment of the intellectual abilities by pointing towards direction of improvement. He concluded by saying that mathematics is the basis of all sciences and technology and therefore of all human endevaours. Application of mathematics cut across all areas of human knowledge. Despite these wide applicability and importance of mathematics many pupils are still not finding their feet in the subject as a result of their perennial failure in the subject.

Mathematics educators and researchers like (Ale, 1989; Akpan, 1987; Alele – Willaims 1988; Georgewill, 1990; Tella 1998) have over the years carried out researches

on factors responsible for poor mathematics achievement at primary and secondary school. These factors ranging from shortage of qualified mathematics teachers, poor facilities, equipment and instructional materials for effective teaching, use of traditional chalk and talk methods, large pupils to teacher ratio and mathematics fright/phobia to mention but a few. Mathematics appears to be the school subject with which students experience the greatest learning problem; and this is not peculiar to Nigeria. This is an indication that there could be an underlying factor inherent in the nature of the subject (Abadom, 1986). For instance, one aspect of mathematics which could easily trigger off learning difficulty is its substantive structure. Two good examples of the substantive structure of mathematics are: (1) The relation between two and three dimensional geometry; and (2) The relation between the Algebra of Natural Numbers, Integers, Rational Numbers and Real Numbers. Knowledge and understanding of the earlier ones are necessary and pre-requisite to knowledge and understanding of the future ones. Studies have been carried out in a number of countries such as America, Britain and France. For instance (Wotriak, 1977), found intelligence and reasoning ability to be related to mathematical achievement. On the other hand, (Reed, 1978) found logical thinking to have a low positive correlation (r = 0.29) with performance in algebra. It appears that the pupils would need a minimum level of intelligence after which other intervening variables such as pre-requisite knowledge, perseverance and motivation become very important variables and could thus account for the difference in mathematics achievement among pupils.

Also, children with ADHD expressing learning challenges may experience difficulty in mathematics/Arithmetic (Dowker, 2005; Parmar & Singer, 2005; Swanson & Jerman, 2006). Some children are not able to learn basic mathematical fact or fundamental computational skills. Others cannot grasp the principles of estimation, mental calculation and probability. More than 50% of children with learning challenges also have difficulties

with mathematics and this have negative impact on their mathematics achievement (Fuchs & Fuchs, 2001). 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 & Hanish, 2003).

Expressed Mathematics difficulty means the partial lack or error in the counting ability, which is not to be mistaken where these are totally absent (Hrivnák, 2003). Poor Mathematics achievement can occur within any level of intelligence and is a type of learning outcome that is typically noticed in school (Mesterházi, 1996). Due to cultural reasons the society is much more forgiving if a child has problems in mathematics than if (s)he cannot read properly, or writes with bad spelling (Kulcsár, 2005). There is a whole list of syndromes that could indicate poor mathematics achievement, just to extract a few problematic areas: perception, recognizing numbers, understanding the concept of numbers, leaving out some numbers when calculating, going over 10, understanding and performing functions with fractions, considering signs when subtracting, poor mathematical logic, use of symbols, serializing numbers, grouping, understanding ratios, time, volume, dimension, … etc. (Mesterházi, 1996; Hrivnák, 2003). Therapy includes developing skills using personalised programmes for developing mathematical abilities and increased use of demonstration, e.g.: Montessori-tools, coloured rods, using fingers (Mesterházi, 1996) and should increase levels of perception, concentration, memory, thinking, language skills, establishing basic mathematical concepts on numbers and their use in measurements, functions and symbols, … etc. (Hrivnák, 2003).

However, there is a range of mathematics difficulties that children with ADHD could experience. Some pupils' mathematics achievement is hindered by basic

mathematics facts and operations. While performing mathematical functions, they may lose their place and write numbers in the wrong column or forget a minus sign in front of a number. Pupils may confuse operational symbols, copy problems incorrectly, or reverse numbers from one line to another. Pupils who know how to solve a complex problem or equation often do not get full credit because they lose points on basic mathematics errors. Pupils benefit from using graph paper, which helps structure their working space and allows them to keep track of necessary spatial information. Also, using calculators allows students to focus on the problem process rather than mechanical calculations (Scott, 1994). Also some children have difficulty with mathematical problem solving, or the kind of thinking needed to work out mathematics problems. Children may process word problems inaccurately, lack organized problem-solving tactics, or struggle to retrieve formulas from their memory (Lerner, 1995, p. 487). These children could exhibit mathematics learning difficulties of the following nature:

- They may fail to write numerals and mathematical symbols correctly.
- They may experience difficulty in recalling the meaning of the symbols and the answer to basic facts
- They may experience difficulty in counting, doing mathematical calculation and computational work.
- They may find difficulty in following the proper steps and reasoning for solving mathematical problems, particularly the word problems.
- They may experience difficulty in acquiring proper understanding of the basic mathematical concepts like place value, directed numbers, directions and dimensions, measuring units, etc,

- Pupils might have spatial problems and difficulty aligning numbers into proper columns.
- Have trouble with sequence, including left/right orientation. They will read numbers out of sequence and sometimes do operations backwards. They also become confused on the sequences of past or future events
- Pupils typically have problems with mathematics concepts in word problems, confuse similar numbers (e.g., 7 and 9; 3 and 8), and have difficulty using a calculator.
- It is common for Pupils with dyscalculia to have normal or accelerated language acquisition: verbal, reading, writing, and good visual memory for the printed word.
- Pupils have difficulty with the abstract concepts of time and direction (e.g. inability to recall schedules, and unable to keep track of time). They may be chronically late.
- Pupils have inconsistent results in addition, subtraction, multiplication and division. Pupils have poor mental mathematics ability.
- When writing, reading and recalling numbers, these common mistakes are made: number additions, substitutions, transpositions, omissions, and reversals.
- Inability to grasp and remember mathematics concepts, rules, formulas, sequence (order of operations), and basic addition, subtraction, multiplication and division facts. Poor long-term memory (retention & retrieval) of concept mastery. Pupils understand material as they are being shown it, but when they must retrieve the information they become confused and are unable to do so.

Appraising this development, Mangal (2007) contend that some activities and teaching strategies could be utilized as remedial measure as thus:

- Try to provide clear and concise instructions for the meaningful understanding of the basic concepts, skills related to diagnosed area of weakness/difficulties.
- Try to provide examples and non-examples for the clarification of fundamental concepts and principles.
- Present self as a model for learning the right way of doing calculation and solving problems and also use peers as models.
- Provide opportunities for sufficient practice and drill work, monitor children's level of understanding by providing immediate corrective and positive reinforcement
- Assess pupils frequently by using a variety of measures.

Children's understanding of the principles associated with counting appears to emerge from a combination of inherent constraints and counting experience (Briars & Siegler, 1984; Gelman & Gallistel, 1978). Early inherent constraints can be represented by Gelman and Gallistel's (1978) five implicit principles. These principles are one-to-one correspondence (one and only one word tag, e.g., "one," "two," is assigned to each counted object), stable order (the order of the word tags must be invariant across counted sets), cardinality (the value of the final word tag represents the quantity of items in the counted set), abstraction (objects of any kind can be collected together and counted), and order irrelevance (items within a given set can be tagged in any sequence). The principles of one-to-one correspondence, stable order, and cardinality define the counting rules, which in turn provide the skeletal structure for children's emerging knowledge of counting (Gelman & Meck, 1983).

In addition to these inherent constraints, children make inductions about the basic characteristics of counting by observing standard counting behaviour and associated outcomes (Briars & Siegler, 1984; Fuson, 1988). These inductions likely elaborate Gelman and Gallistel's (1978) counting rules and result in a belief that certain unessential features of counting are essential. These unessential features include standard direction (counting must start at one of the endpoints of a set of objects) and adjacency. The latter is the incorrect belief that items must be counted consecutively and from one contiguous item to the next—that is, jumping around during the act of counting results in an incorrect count. By 5 years of age, many children know the essential features of counting described by Gelman and Gallistel but also believe that adjacency and standard direction are essential features of counting. The latter beliefs indicate that young children's conceptual understanding of counting is rather rigid and immature and is influenced by the observation of standard counting procedures.

Many children with ADHD expressing poor mathematics achievement, independent of their reading achievement levels or I.Q., have a poor conceptual understanding of some aspects of counting. These children understand most of the inherent counting rules identified by Gelman and Gallistel (1978), such as stable order and cardinality, but they consistently err on tasks that assess order irrelevance or adjacency from Briars and Siegler's (1984) perspective. It is not currently known whether the poor counting knowledge of children with ADHD expressing poor mathematics achievement only extends beyond the second grade. In any case, the poor counting knowledge of these children appears to contribute to their delayed competencies in the use of counting to solve Mathematics problems and may result in poor skill at detecting and, thus, correcting counting errors (Ohlsson & Rees, 1991).

The most thoroughly studied developmental and schooling-based improvement in arithmetical competency is the change in the distribution of procedures, or strategies children use during problem solving (Ashcraft, 1982; Carpenter & Moser, 1984; Geary, 1994; Siegler, 1996; Siegler & Shrager, 1984). During the initial learning of addition, for instance, children typically count both addends (e.g., 5 + 3). These counting procedures are sometimes executed with the aid of the fingers, the finger counting strategy, and sometimes without them, the verbal counting strategy (Siegler & Shrager, 1984). The two most commonly used counting procedures, whether children use their fingers or not, are termed counting on and counting all (Fuson, 1982; Groen & Parkman, 1972). The counting-on procedure typically involves stating the larger value addend and then counting a number of times equal to the value of the smaller addend, such as counting 5, 6, 7, 8 to solve 5 + 3. Counting all involves counting both addends starting from 1. The development of procedural competencies is related in part to improvements in children's conceptual understanding of counting and is reflected in a gradual shift from the frequent use of counting all to counting on (Geary et al., 1992; Siegler, 1987).

At the same time, the use of counting procedures appears to result in the development of memory representations of basic facts (Siegler & Shrager, 1984). Once formed, these long-term memory representations support the use of memory-based problem-solving processes. The most common of these are the direct retrieval of arithmetic facts and decomposition. With direct retrieval, children state an answer that is associated in long-term memory with the problem presented, such as stating "/eyt/" (i.e., eight) when asked to solve 5 + 3. Decomposition involves reconstructing the answer based on the retrieval of a partial sum. For instance, the problem 6 + 7 might be solved by retrieving the answer to 6 + 6 (i.e., 12) and then adding 1 to this partial sum (David 2004). The use of retrieval-based processes is moderated by a confidence criterion that represents

an internal standard against which the child gauges his or her confidence in the correctness of the retrieved answer. Children with a rigorous criterion only state answers that they are certain are correct, whereas children with a lenient criterion state any retrieved answer, correct or not (Siegler, 1988).

As the strategy mix matures, children solve problems more quickly because they use more efficient memory based strategies and because, with practice, it takes less time to execute each strategy (Delaney, Reder, Staszewski, & Ritter, 1998; Geary, Bow-Thomas, Liu, & Siegler, 1996; Lemaire & Siegler, 1995). The transition to memory-based processes results in the quick solution of individual problems and reduction of the working memory demands associated with solving these problems. The eventual automatic retrieval of basic facts and the accompanying reduction of the working memory demands in turn appear to make the solving of more complex problems in which the simple problems are embedded (e.g., word problems) less error prone (e.g., Geary & Widaman, 1992).

Competencies in any given area of mathematics will depend on a conceptual understanding of the domain and procedural knowledge that supports actual problem solving (Geary, 1994). Base-10 arithmetic is one example in which instruction focuses on teaching the conceptual foundation (i.e., the repeating number system based on sequences of 10) and its related procedural skills, such as trading from the tens column to the units column while solving complex arithmetic problems (e.g., subtracting 129 from 243; Fuson & Kwon, 1992). Thus, children with ADHD commit many counting errors while solving simple arithmetic problems, and they tend to use developmentally immature strategies (e.g., finger counting) and problem-solving procedures (e.g., counting all). A few studies have assessed the procedural competencies of children with ADHD during the solving of multistep arithmetic problems, such as 45 × 12 or 126 + 537. Russell and Ginsburg (1984)

found that fourth-grade children with ADHD committed more errors than their peers of the same I.Q. level when solving such problems. These errors involved the misalignment of numbers while writing down partial answers or errors while carrying or borrowing from one column to the next (David 2004).

2.5 Attention Deficit Hyperactivity Disorder (ADHD)

Attention Deficit Hyperactivity Disorder involves the display of developmentally inappropriate levels of inattention, impulsivity, and over activity resulting in functional impairment across two or more settings (APA, 1994). ADHD affects about three percent to seven percent of the school-age population (APA, 2000). The disorder is diagnosed much more often in boys than in girls. Females are traditionally thought to be at lower risk of ADHD than males; however, recent studies have indicated that girls also may be at increased risk of remaining undetected and untreated (Budd, Leibowitz, Riner, Mindell & Goldfarb, 1981). One commonly offered explanation for this is that Attention-Deficit Disorder (ADD), which is presumed to be more common among girls (Lahey, Pelham, Schaughency, Atkins, Murphy & Hynd 1988), may be less obvious to parents and therefore less likely to prompt help-seeking.

Children with this disorder are at higher than average risk for academic underachievement, conduct problems, and social relationship difficulties, as a function of the core symptoms of ADHD (Barkley, 1990). The disorder is chronic for most individuals and requires long-term treatment (Blazer, 1999). According to the Diagnostic and Statistical Manual of Mental Disorders (2000) in ADHD, the essential feature is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of development (p.78). Children with ADHD typically exhibit behaviour that is classified into two main

categories: poor sustained attention and hyperactivity-impulsiveness. As a result, three subtypes of the disorder have been proposed by the American Psychiatric Association in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV): predominantly inattentive, predominantly hyperactive-impulsive, and combined types (Barkley, 1997). A child expressing hyperactivity commonly will appear fidgety, have difficulty staying seated or playing quietly, and act as if driven by a motor. Children displaying impulsivity often have difficulty participating in tasks that require taking turns. Other common behaviours may include blurting out answers to questions instead of waiting to be called and flitting from one task to another without completing any. The inattention component of ADHD affects the educational experience of these children because ADHD causes them to have difficulty in attending to detail in directions, sustaining attention for the duration of the task, and misplacing needed items. These children often fail to give close attention to details, make careless mistakes, and avoid or dislike tasks requiring sustained mental effort.

Although these behaviours are not in themselves a learning disability, almost one-third of all children with ADHD have learning disabilities (National Institute of Mental Health [NIMH], 1999). Children with ADHD may also experience difficulty in reading, mathematics, and written communication (Anderson, Williams, McGee, & Silva, 1987; Cantwell & Baker, 1991; Dykman, Akerman, & Raney, 1994; Zentall, 1993). Furthermore, ADHD commonly occurs with other conditions. Literature indicates that approximately 40–60 percent of children with ADHD have at least one coexisting disability (Barkley, 1990a; Jensen, Hinshaw, Kraemer, Lenora, Newcorn & Abikoff 2001; Jensen, Martin, & Cantwell, 1997). Although any disability can coexist with ADHD, certain disabilities seem to be more common than others. These include disruptive behaviour disorders, mood disorders, anxiety disorders, tics and Tourette's syndrome, and

learning disabilities (Jensen, et al., 2001). In addition, ADHD affects children differently at different ages. In some cases, children initially identified as having hyperactive-impulsive subtype are subsequently identified as having the combined subtype as their attention problems surface.

These characteristics affect not only the academic lives of students with ADHD they may affect their social lives as well. Children with ADHD of the predominantly hyperactive-impulsive type may show aggressive behaviours, while children of the predominantly inattentive type may be more withdrawn. Also, because they are less disruptive than children with ADHD who are hyperactive or impulsive, many children who have the inattentive type of ADHD go unrecognized and unassisted. Both types of children with ADHD may be less co-operative with others and less willing to wait their turn or play by the rules (NIMH, 1999; Swanson, 1992; Waslick & Greenhill, 1997). Their inability to control their own behaviour may lead to social isolation. Consequently, the children's self-esteem may suffer (Barkley, 1990a). In the United States, an estimated 1.46 to 2.46 million children (3 percent to 5 percent of the student population) have ADHD (American Psychiatric Association, 1994; Anderson, et al., 1987; Esser, Schmidt, & Woemer, 1990; Pastor & Reuben, 2002; Pelham, Gnagy, Greenslade, & Milich, 1992; Wolraich, Hannah, Pinock, Baumgaertel, & Brown, 1996). Boys are four to nine times more likely to be diagnosed, and the disorder is found in all cultures, although prevalence figures differ (Ross & Ross, 1982).

ADHD is not a new phenomenon, although recently it has been the common label used to describe children with a specified symptom cluster exhibited in levels of inattention, impulsivity, and / or hyperactivity that exceed appropriate developmental levels (Anastopoulos, Shelton, DuPaul & Guevremont, 1993). Anastopoulos, et al (1993) further state that the first published cases of children with symptom clusters similar to

those used in the ADHD diagnostic categories appeared in the middle 1800s. Still (1902) report children whose behaviour was distinguished by over activity and inattention, onset in childhood but persisted over time, and were significantly developmentally different from their aged appropriate peers; these children had "volitional inhibitions" that resulted in behavioural deficits as well as "defects in moral control," which likely resulted from neurological difficulties (Anastopoulos, Shelton, DuPaul & Guevremont, 1993).

The DSM-I did not list any developmentally significant guidelines to distinguish ADHD or its symptoms, whereas the DSM-II did include a section titled "Behaviour Disorders of Childhood and Adolescence," which listed the criteria for Hyperkinetic Reaction of Childhood (Anastopoulos, Shelton, DuPaul & Guevremont, 1993).The DSM-III labeled a cluster of symptoms as "Attention Deficit Disorder with Hyperactivity," thus inserting the change in focus to inattention as the hallmark feature of this newly emerging disorder at the time. The DSM-III also identified impulsivity as it is noted alongside inattention and hyperactivity for the first time (Anastopoulos, Shelton, DuPaul & Guevremont, 1993). The DSM-IV has many new features in the identification of ADHD symptoms, including 18 symptom descriptors, with nine inattention symptoms and nine in the hyperactivity-impulsivity component (Anastopoulos, Shelton, DuPaul & Guevremont, 1993).

Literature suggests that middle childhood is a period when children have the most difficulty managing their ADHD (Carroll, Houghton, Taylor, Hemingway, List-Kerz, Cordin & Douglas, 2006). For instance, children with ADHD have symptoms of inattention, hyperactivity, and impulsivity (Sutcliffe, Bishop, & Houghton, 2006). Moreover, "if the problems of ADHD are not adequately addressed between the ages of six and twelve years, more serious secondary problems may develop," such as low-self-esteem, depression, oppositional defiant disorder (ODD), mood disorder (MD), and

conduct disorder (CD) (Parker, 2005, p. 25). Therefore, this may support the idea that teachers should be aware of the signs and symptoms of ADHD so they can make an appropriate referral. This may save the student and family from experiencing much hardship and frustration in the future.

Many interventions may be effective when treating ADHD. For example, stimulant medication (Gureasko-Moore, DuPaul & White, 2006), class-wide interventions (Harlacher, Roberts, & Merrell, 2006), behavioural strategies and self-monitoring techniques (Harris, Friedlander, Saddler, Frizzelle, & Graham, 2005) can improve symptoms of ADHD in children and adolescents. Again, if elementary school teachers can appropriately refer children to be screened for ADHD in the early years, children may then receive services during childhood to help manage their ADHD throughout childhood, adolescence, and even adulthood.

Teachers play a pivotal role in the lives of many children. "They teach and manage them every day, often identify them as in need of further assistance, and become involved in monitoring and treatment plans" (Lauth, Heubeck & Mackowiak, 2006, p. 386). They may also be the first to recognize students with ADHD because of the increased demand of concentration in the classroom as well as being able to compare students with each other (Lauth et al. 2006). It may be likely that a teacher is the first person to recognize symptoms of ADHD and thus, need to discuss it with the family. A child diagnosed with ADHD may not only have difficulties in the classroom with inattention, hyperactivity, and impulsivity, but these symptoms "are often associated with troublesome interpersonal relationships with family members" as well (Holmberg & Hjern, 2006, p. 664). The behavioural outcomes from these symptoms cause marital disturbances, conflict between siblings, and parents to feel depressed, blame themselves, and feel socially isolated (Alexander-Roberts, 2006). Overall, ADHD either directly or indirectly affects

individuals, families, and communities. Not only do students with ADHD lag behind their peers in a myriad of ways, but ADHD often puts an emotional and financial burden on families as well as impact our society. Literature reveals a variety of interventions that may help students with ADHD, their families, teachers, and their classmates.

2.6 Causes of ADHD in Children

ADHD has traditionally been viewed as a problem related to attention, stemming from an inability of the brain to filter competing sensory inputs such as sight and sound. Recent research, however, has shown that children with ADHD do not have difficulty in that area. Instead, researchers now believe that children with ADHD are unable to inhibit their impulsive motor responses to such input (Barkley, 1997; 1998a). It is still unclear what the direct and immediate causes of ADHD are, although scientific and technological advances in the field of neurological imaging techniques and genetics, promise to clarify this issue in the near future. Most researchers suspect that the cause of ADHD is genetic or biological, although they acknowledge that the child's environment helps determine specific behaviours.

Imaging studies conducted during the past decade have indicated which brain regions may malfunction in patients with ADHD, and thus account for symptoms of the condition (Barkley, 1998a). A 1996 study conducted at the National Institutes for Mental Health (NIMH) found that the right prefrontal cortex (part of the cerebellum) and at least two of the clusters of nerve cells known collectively as the basal ganglia are significantly smaller in children with ADHD (as cited in Barkley, 1998a). It appears that these areas of the brain relate to the regulation of attention. Why these areas of the brain are smaller for some children is yet unknown, but researchers have suggested mutations in several genes that are active in the prefrontal cortex and basal ganglia may play a significant role

(Barkley, 1998a). In addition, some non-genetic factors have been linked to ADHD including premature birth, maternal alcohol and tobacco use, high levels of exposure to lead, and prenatal neurological damage. Although some people claim that food additives, sugar, yeast, or poor child rearing methods lead to ADHD, there is no conclusive evidence to support these beliefs (Barkley, 1998a; Neuwirth, 1994; NIMH, 1999).

2.7 Identification of ADHD in Children

Although toddlers and preschoolers, on occasion, may show characteristics of ADHD, some of these behaviours may be normal for their age or developmental stage. These behaviours must be exhibited to an abnormal degree to warrant identification as ADHD. Even with older children, other factors (including environmental influences) can produce behaviours resembling ADHD. The criteria set forth by the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) is used as the standardized clinical definition to determine the presence of ADHD. A person must exhibit several characteristics to be clinically diagnosed as having ADHD:

Severity. The behaviour in question must occur more frequently in the child than in other children at the same developmental stage.

Early onset. At least some of the symptoms must have been present prior to age 7.

Duration. The symptoms must also have been present for at least 6 months prior to the evaluation.

Impact. The symptoms must have a negative impact on the child's academic or social life.

Settings. The symptoms must be present in multiple settings.

2.8 DSM-IV Diagnosing Criteria for Attention Deficit/Hyperactivity Disorder

- According to the DSM-IV, a person with Attention Deficit/Hyperactivity Disorder must have either (1) or (2):
- Six (or more) of the following symptoms of **inattention** have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

2.8.1 Inattention

(a) Often fails to give close attention to details or makes careless mistakes in school work, work, or other activities

(b) Often has difficulty sustaining attention in tasks or play activities

(c) Often does not seem to listen when spoken to directly

(d) Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behaviour or failure to understand instructions)

(e) Often has difficulty organizing tasks and activities

(f) Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)

(g) Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)

(h) Is often easily distracted by extraneous stimuli

(i) Is often forgetful in daily activities

(2) Six (or more) of the following symptoms of hyperactivity-impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

2.8.2 Hyperactivity/Impulsivity

(a) Often fidgets with hands or feet or squirms in seat

(b) Often leaves seat in classroom or in other situations in which remaining seated is expected

(c) Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings or restlessness)

(d) Often has difficulty playing or engaging in leisure activities quietly

(e) Is often "on the go" or often acts as if "driven by a motor"

(f) Often talks excessively

(g) Often blurts out answers before questions have been completed

(h) Often has difficulty awaiting turn

(i) Often interrupts or intrudes on others (e.g., butts into conversations or games)

B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.

C. Some impairment from the symptoms is present in two or more settings (e.g., at school [or work] and at home).

D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.

E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not

better accounted for by another mental disorder (e.g., Mood Disorder, Anxiety Disorder, Disassociative Disorder, or a Personality Disorder).

Attention Deficit/Hyperactivity Disorder, Combined Type: if both Criteria A1 and A2 are met for the past 6 months.

Attention Deficit/Hyperactivity Disorder, Predominantly Inattentive Type: if Criterion A1 is met but Criterion A2 is not met for the past 6 months.

Attention Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type: if Criterion A2 is met but Criterion A1 is not met for the past 6 months

2.9 Co-operative Learning Technique for Pupils with ADHD

Co-operative learning is an approach to group work that minimizes the occurrence of those unpleasant situations and maximizes the learning and satisfaction that result from working on a high-performance team. A large and rapidly growing body of research confirms the effectiveness of co-operative learning in higher education (Johnson, Johnson & Stanne, 2000; Smith, Sheppard, Johnson & Johnson 2005; Springer, Stanne & Donovan 1997; Terenzini, Cabrera, Colbeck, Parente & Bjorklund 2001). Relative to students taught traditionally—i.e., with instructor-centered lectures, individual assignments, and competitive grading—co-operatively taught students tend to exhibit higher academic achievement, greater persistence through graduation, better high-level reasoning and critical thinking skills, deeper understanding of learned material, greater time on task and less disruptive behaviour in class, lower levels of anxiety and stress, greater intrinsic motivation to learn and achieve, greater ability to view situations from others' perspectives, more positive and supportive relationships with peers, more positive attitudes toward subject areas, and higher self-esteem (Bransford, Brown & Cocking 2000).

There are several reasons why co-operative learning works as well as it does. The idea that students learn more by doing something active than by simply watching and listening has long been known to both cognitive psychologists and effective teachers (Bransford, Brown & Cocking 2000) and co-operative learning is by its nature an active method. Beyond that, co-operation enhances learning in several ways. Weak students working individually are likely to give up when they get stuck; working co-operatively, they keep going. Strong students faced with the task of explaining and clarifying material to weaker students often find gaps in their own understanding and fill them in. However, students working alone may tend to delay completing assignments or skip important information.

According to the Johnson & Johnson model, co-operative learning is instruction that involves students working in teams to accomplish a common goal, under conditions that include the following elements (Johnson, Johnson & Smith 1998): Positive interdependence: Team members are obliged to rely on one another to achieve the goal. If any team members fail to do their part, everyone suffers consequences. Individual accountability: All students in a group are held accountable for doing their share of the work and for mastery of all of the material to be learned. Face-to-face promotive interaction: Although some of the group work may be parcelled out and done individually, some must be done interactively, with group members providing one another with feedback, challenging reasoning and conclusions, and perhaps most importantly, teaching and encouraging one another. Appropriate use of collaborative skills: Students are encouraged and helped to develop and practice trust-building, leadership, decision-making, communication, and conflict management skills. Group processing: Team members set group goals, periodically assess what they are doing well as a team, and

identify changes they will make to function more effectively in the future (Johnson, Johnson & Smith 1998).

This implies that co-operative learning is an approach to organizing classroom activities into academic and social learning experiences. Students must work in groups to complete tasks collectively. Unlike individual learning, students learning co-operatively capitalize on one another's resources and skills (asking one another for information, evaluating one another's ideas, monitoring one another's work, etc.) (Chiu, 2000; 2008). Furthermore, the teacher's role changes from giving information to facilitating students' learning (Chiu, 2004). Formal co-operative learning is structured, facilitated, and monitored by the educator over time and is used to achieve group goals in task work (e.g. completing a unit). Any course material or assignment can be adapted to this type of learning, and groups can vary from 2-6 people with discussions lasting from a few minutes up to a period. Types of formal co-operative learning strategies include jigsaw, assignments that involve group problem solving and decision making, laboratory or experiment assignments, and peer review work (e.g. editing writing assignments). Having experience and developing skill with this type of learning often facilitates informal and base learning (Johnson, Johnson & Holubec 1988).

Informal co-operative learning incorporates group learning with passive teaching by drawing attention to material through small groups throughout the lesson or by discussion at the end of a lesson, and typically involves groups of two (e.g. turn-to-your-partner discussions). These groups are often temporary and can change from lesson to lesson (very much unlike formal learning where two students may be lab partners throughout the entire semester contributing to one another's knowledge of science). Discussions typically have four components that include formulating a response to questions asked by the educator, sharing responses to the questions asked with a partner, listening to a partner's responses

to the same question, and creating a new well-developed answer. This type of learning enables the student to process, consolidate, and retain more information learned (Johnson, Johnson & Holubec 1988).

In group-based co-operative learning, these peer groups gather together over the long term (e.g. over the course of a year, or several years such as in high school or post-secondary studies) to develop and contribute to one another's knowledge mastery on a topic by regularly discussing material, encouraging one another, and supporting the academic and personal success of group members. Base group learning is effective for learning complex subject matter over the course or semester and establishes caring, supportive peer relationships, which in turn motivates and strengthens the student's commitment to the group's education while increasing self-esteem and self-worth. Base group approaches also make the students accountable to educating their peer group in the event that a member was absent for a lesson. This is effective both for individual learning, as well as social support (Johnson, Johnson & Holubec 1988).

Co-operative learning produces greater student achievement than traditional learning methodologies (Johnson & Johnson 1994). They found that 63% of the co-operative learning groups analyzed had an increase in achievement. Students who work individually must compete with their peers to gain praise or other forms of rewards and reinforcements. In this type of competition many individuals attempt to accomplish a goal with only a few winners. The success of these individuals can mean failures for others. There are more winners in a co-operative team because all members reap from the success of an achievement. Low achieving students tend to work harder when grouped with higher achieving students. There is competition among groups in co-operative learning. Some forms of group competition promote cohesiveness among group members and group spirit. Co-operative learning has social as well as academic benefits. One of the essential

elements of co-operative learning is the development of social skills. Children learn to take risks and are praised for their contribution. Also, they are able to see points of view other than their own. Such benefits contribute to the overall satisfaction of learning and schooling. Students work with classmates who have different learning skills, cultural background, attitudes, and personalities. Heterogeneous groups promote student learning. These differences force them to deal with conflicts and interact with others. Social interaction improves communication skills that become a necessity to functioning in society (Johnson & Johnson 1994).

Within each group students should be properly spaced to maintain eye-to-eye contact, share materials without bumping elbows, and communicate without disturbing other groups. Students working in co-operative groups do not always sit in one place. They usually move around the room to gather information. Barriers should be minimized to facilitate movement. Different groups should be spaced far enough to avoid conflict, provide enough room for the teacher to aid students and to monitor group action and behaviour. The group configurations must allow the groups to take instruction from the teacher. This means they must be able to hear and see the teacher's instructions from their workstations. Students do not always work in co-operative groups. Teachers may want students to work individually on some projects. The class set up should be flexible enough for students to work separately when necessary (Adams, Carlson & Hamm 1990).

2.10 Class Activities that use Co-operative Learning Strategy

Jigsaw-Groups with five students are set up. Each group member is assigned some unique material to learn and then to teach to his group members. To help in the teaching and learning situation, students across the class working on the same sub-section get together to decide what is important and how to teach it. Consequently, after practice in groups

pupils become more academically reformed and would be in a better position to teach each other (David & Roger 2001) Tests or assessment follows.

Think-Pair-Share - Involves a three step co-operative structure. During the first step individuals think silently about a question posed by the instructor. Individuals pair up during the second step and exchange thoughts. In the third step, the pairs share their responses with other pairs, other teams, or the entire class (David & Roger 2001).

Three-Step Interview - Each member of a team chooses another member to be a partner. During the first step individuals interview their partners by asking clarifying questions. During the second step partners reverse the roles. For the final step, members share their partner's response with the team (Kagan, 1994).

RoundRobin Brainstorming- Class is divided into small groups (4 to 6) with one person appointed as the recorder. A question is posed with many answers and students are given time to think about answers. After the "think time," members of the team share responses with one another round robin style. The recorder writes down the answers of the group members. The person next to the recorder starts and each person in the group in order give an answer until time is called (Kagan, 1994).

Three-minute review - Teachers stop any time during a lecture or discussion and give teams three minutes to review what has been said, ask clarifying questions or answer questions (Kagan, 1994).

Numbered Heads Together - A team of four is established. Each member is given numbers of 1, 2, 3, & 4. Questions are asked of the group. Groups work together to answer the question so that all can verbally answer the question. Teacher calls out a number (two) and each two is asked to give the answer (Kagan, 1994).

Team Pair Solo - Students do problems first as a team, then with a partner, and finally on their own. It is designed to motivate students to tackle and succeed at problems which

initially are beyond their ability. It is based on a simple notion of mediated learning. Students can do more things with help (mediation) than they can do alone. By allowing them to work on problems they could not do alone, first as a team and then with a partner, they progress to a point they can do alone that which at first they could do only with help (Kagan, 1994).

Circle the Sage - First the teacher polls the class to see which students have a special knowledge to share. For example the teacher may ask who in the class was able to solve a difficult mathematics homework question. Those students (the sages) stand and spread out in the room. The teacher then has the rest of the classmates each surround a sage, with no two members of the same team going to the same sage. The sage explains what they know while the classmates listen, ask questions, and take notes. All students then return to their teams. Each in turn, explains what they learned. Because each one has gone to a different sage, they compare notes. If there is disagreement, they stand up as a team. Finally, the disagreements are aired and resolved (David & Roger 2001).

Partners - The class is divided into teams of four. Partners move to one side of the room. Half of each team is given an assignment to master to be able to teach the other half. Partners work to learn and can consult with other partners working on the same material. Teams go back together with each set of partners teaching the other set. Partners quiz and tutor teammates. Team reviews how well they learned and taught and how they might improve the process (David & Roger 2001).

2.11 Contingency Contracting Technique for Pupils with ADHD

Contingency contracting is a widespread intervention used within a variety of disciplines to address problematic behaviour. Contingency contracting has been shown to increase desired behaviour as well as to decrease undesired problem behaviour. The term

"contingency contract" first began with the work of Homme (1966), who used written contracts with adolescent students who were potential dropouts to spell out the reinforcers that followed completion of academic tasks. Since Homme's use of such plans, many disciplines have been able to apply similar techniques to successfully increase positive behaviour and to decrease negative behaviour. Within the field of behaviour analysis, behaviour contracts have been used to address behaviours such as student studying behaviour (Bristol & Sloane, 1974; Cantrell, Cantrell, Huddelston, & Wooldrige, 1969; Kelley & Stokes, 1982; Miller & Kelley, 1994; Welch & Holborn, 1988), child aggressive behaviours (Wahler & Fox, 1980), and sports performance (Mellalieu, Hanton, & O'Brien, 2006). These contracts have been proven to work with a multitude of behaviours as well as different populations such as individuals with intellectual disabilities, typically functioning children and adults, and individuals with autism (Bristol & Sloane, 1974; Kelley & Stokes, 1982; Miller & Kelley, 1994; Wahler & Fox, 1980; Welch & Holborn, 1988).

This is a mutual contract made between the student and the teacher that can help to motivate the student towards desirable behaviour change. By definition a contract is an agreement-verbal or written-between two parties. The term contingency means there is a relationship between what one does and the consequences (Kerrin, Jacques & Imelda, 2001). Contingency management has been found to be an effective way of increasing academic and social behaviour of children with Attention Deficit Hyperactivity Disorders. Clearly Parents are taught a variety of skills such as contingent use of praise, positive attention, token reinforcement, specific instructions, planned ignoring form in or problem behaviour, exclusionary and non-exclusionary time out (also known as quiet time), and contingency contracts. Parents learn to apply these skills at home and in the community with target children in the family in order to teach these children pro-social behaviour (Mathew, Shylaja & Jan. 2000). Contingency contracting involves a written agreement, to

which the student must agree: The target behaviours must be stated: The goals must be manageable for the students to achieve: There should be a sense of belonging and involvement by the student: The student is then rewarded according to the terms of the contract.

Therefore, a contingency contract is an agreement between a student and teacher, which states behavioural or academic goals for the student and reinforcers or rewards that the student will receive contingent upon achievement of these goals. Behavioural or academic improvement goals can be part of a contract. A contract should have only one stated goal. They are not appropriate for behaviours that are dangerous to the student or others, such as physical aggression or self-injurious behaviour (Curwin & Mendler 1988). In applying contingency contract the teacher first assess the present level of performance. If the goal is that the student learn and practice raising their hand instead of interrupting, the teacher must first establish to what degree this behaviour is exhibited. Does the student raise their hand 10 times an hour or 10 times a day? If the goal is for the student to complete more mathematics work, the teacher must establish the level of productivity. Does the student need to complete two worksheets a day or a week? (Curwin & Mendler 1988).

This implies that a contingency contract specifies the contingent relationship between the completion of a specified behaviour and access to a specific reinforcer. A contract describes the tasks and the reward, and has a record of progress. Implementing a contract involves a complex package of interventions, but contracts are widely used in classroom, home, and clinical settings. A token economy is a behaviour change system that consists of a list of target behaviours to be reinforced, tokens or points that learners receive for emitting those target behaviours, and a menu of items/activities for which they can exchange their tokens. Important considerations must be made for how to begin,

implement, maintain, evaluate, and remove such systems. There are six basic steps for implementing a token economy: selecting the tokens, identifying the target behaviours or rules, selecting the backup reinforcers, establishing the ratio of exchange, writing procedures for when and how tokens will be dispensed and exchanged, and field testing the system (Carr & Punzo, 1993).

A group contingency is when a common consequence is contingent upon the behaviour of an individual member of a group, a part of the group, or everyone in the group. There are three major forms of group contingencies: independent, dependent, and interdependent group contingencies. There are six guidelines for implementing a group contingency: choosing a powerful reinforcer, determining the behaviour to change and collateral behaviours that might be affected, setting appropriate performance criteria, combining with other procedures, selecting the most appropriate group contingency, and monitoring individual and group performance (Carr & Punzo, 1993).

The Behaviour-Reward Contingency Plan is designed to assist educators and administrators in creating an environment that is conducive to learning, while ensuring appropriate student behaviour. This innovative model is based on the concepts of response cost, time-out, student contracts, and reward/recognition, which are employed to shape behaviour according to agreed upon expectations. In essence, the Behaviour-Reward Contingency Plan is a programme wherein students receive a reward at the end of each week, which is contingent upon the degree to which they have met the behavioural expectations stated in the student contract. This model addresses some of the typical hidden curriculum issues through which educators strive to impart the values of a democratic society (Johnny, Ruth & Sue 1994).

It has been well-documented that various factors related to reward and positive recognition are extremely important elements associated with influencing a youngster's

behaviour. Concomitantly, negative reinforcement and denial of privileges are also behavioural management strategies linked to shaping an individual's conduct. All of the aforementioned impact a student's behaviour in school in a combined manner. Due to the complexity of factors that influence behaviour, it becomes very difficult to flush out which particular factors influence a child's or adolescent's behaviour at school and in the home environment. Most would agree, however, an educator, guidance counsellor, school psychologist, or anyone else attempting to influence a youngster's behaviour may never really know which element(s) in the school, home, or peer group are impacting students' behaviour, whether it is positive or negative conduct (Johnny, Ruth & Sue 1994).

Johnny, Ruth and Sue (1994) affirm that a legitimate question arises, "What can educators do to create an environment conducive to learning and ensure appropriate student behaviour?" The Behaviour-Reward Contingency Plan, an innovative model based on the concepts of response cost, time-out, student contracts, and reward/recognition, addresses that question. Administrators and educators are encouraged to include additional strategies aimed at influencing student behaviour, thereby, tailoring the model for their particular school climate. Thus, the intent herein is to present the Behaviour-Reward Contingency Plan for educators and administrators in a public elementary, middle/junior or high school setting. However, this behaviour management model provides a system for managing students, but is not all inclusive or a cure-all for what ails the schools, in terms of student behaviour. Response cost is a monetary sanction placed on the student wherein they forfeits money earned or to be received for fulfilling an obligation. The response cost principle is employed when a student misbehaves, including the following infractions: refusing to follow a legitimate request from a school employee, failing to complete a request or an assigned task within the specified time frame, committing an appropriate act against another, or disobeying a school rule, regulation, or policy.

Reward/recognition refers to some type of tangible or intangible support given to a student for exhibiting an appropriate or positive behaviour. Time-out refers to the removal of a student from a setting in which they have misbehaved to an isolated environment in which the student has very limited freedom. Student contract is a document that stipulates behavioural expectations for a student. The contract also identifies the maximum weekly reward for the student. The terms of the contract indicate that there is response costs associated with behaviour that deviates from the list of expectations. The contract is signed by the student and those responsible for assisting the youngster in fulfilling the contract (i.e. parent/guardian, teacher, principal) (Johnny, Ruth & Sue 1994).

2.12 Steps in Contingency Contracting

- The teacher identifies the specific behaviour required of the student. The positive behaviour needed to replace the negative behaviour is stated very clearly and positively. This tells the student what he/she will do.
- The teacher identifies the reinforcement for which the student will work. The student should only receive the reinforcement for performing the behaviour specified in the contract.
- The teacher specifies the terms of the contract. The terms should include the amount or type of behaviour required and the amount or type of reward.
- Write the contract. The contract should state the desired behaviour, the term of the contract as well the date the contract begins and when it will end. The student is then rewarded according to the terms of the contract.

2.13 Rewards

Rewards that are the most powerful to students are those that are seen by the student as attractive. They should only occur within the conditions of the contract and be delivered immediately upon the completion of the required behaviour. These steps should increase the probability for the desired behaviour to be repeated by the student.

Types of Rewards

- Edible – Snacks at launch
- Social - 20 minutes free play
- Activity – classroom helper

2.14 Theoretical Review

2.14.1 The Social Construct Theory of ADHD in Children

The social construct theory of ADHD argues that Attention Deficit Hyperactivity Disorder is not necessarily a valid medical diagnosis, but rather a socially constructed explanation to describe behaviours that are not genuinely pathological, but rather simply do not meet prescribed social norms (Parens & Johnston 2009). Some proponents of the social construct theory of ADHD seem to regard the disorder as genuine, though over-diagnosed in some cultures. These proponents cite as evidence that the DSM IV, favoured in the United States for defining and diagnosing mental illness, arrives at levels of ADHD three to four times higher than criteria in the ICD 10, (International Classification of Diseases, Tenth Revision) the diagnostic guide favoured by the World Health Organization (Singh 2008). A popular proponent of this theory, Thomas Szasz, has argued that ADHD was "invented and not discovered" (Szasz, 2001).

Sami Timimi who is a child and adolescent psychiatrist, explains ADHD as a social construct rather than an objective 'disorder' (Timimi, & Begum 2006). Timimi argues that

western society creates stress on families which in turn suggests environmental causes for children expressing the symptoms of ADHD (Timimi, & Begum 2006). They also believe that parents who feel they have failed in their parenting responsibilities can use the ADHD label to absolve guilt and self-blame. A common argument against the medical model of ADHD asserts that while the traits that define ADHD exist and may be measurable, they lie within the spectrum of normal healthy human behaviour and are not dysfunctional. However, by definition, in order to diagnose with a mental disorder, symptoms must be interpreted as maladaptive. In America, the Diagnostic and Statistical Manual (DSM-IV) requires that "some impairment from the symptoms is present in two or more settings" and that "there must be clear evidence of significant impairment in social, school, or work functioning" for a diagnosis of ADHD to be made (Timimi, & Begum 2006).

In the ADHD Social Construct Theory the idea is that ADD (Attention Deficit Disorder) and ADHD (Attention Deficit Hyperactivity Disorder) are generally speaking, not biological or psychiatric disorders, but can be better explained by environmental causes or even the personality type of the person. For example an ADD person can be introvert, while the hyperactive person is an extrovert. This theory suggests that the observed behaviours are not abnormal, but normal behaviour for a part of the human race. However the extreme overreactions are caused by environmental factors. Among these factors are cramped living conditions with inadequate play space, the poor classroom environment together with the increased educational burden children are expected to adjust to undermining their unfavouable developmental circumstances. For example: a young child sitting quiet and still for three quarters of an hour at a time, listening to something they are told to learn, but which they do not find interesting, is an unnatural behaviour. This is a new phenomenon in human history.

2.14.2 Appraisal of the Social Construct Theory of ADHD

Social construct theorists accept that the so-called ADHD traits exist in the individual. However, they 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. 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.

2.14.3 Criticisms of the Social Construct Theory of ADHD

The argument in support of the relation between the social construct theory and ADHD is indeed a strong one; however, ADHD varies from one individual to the other in terms of causes and symptoms. So, a single explanation for each individual diagnosed with ADHD may not be the right approach towards understanding this very complex disorder. Also, the diagnosis of all psychiatric disorders is based on the opinion of the diagnostician, so to say that ADHD is not a disorder just because there is no objective characteristic present in individuals with this disorder that does not exist in normal individuals, may be a little too far-fetched.

2.14.4 Self Determination Theory of the Management of ADHD

According to self-determination theory, proposed by Deci and Ryan (2000, 2008), individuals experience one of two forms of motivation: autonomous or controlled. When they experience autonomous motivation, they experience a profound sense of volition and choice. In contrast, when individuals experience controlled motivation, they feel obliged and driven by forces that transcend the self, such as managers or society in general. Which of these two forms of motivation prevails, rather than merely the level of motivation, determines the inclinations and behaviours of individuals in specific contexts. Self-determination theory can explain some fascinating findings. For example, unsurprisingly, 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 (Burgess, Enzle, & Schmaltz, 2004). This behaviour implies a sense of choice, which fosters an autonomous motivation.

Self-determination theory evolved from the distinction between intrinsic and extrinsic motivation (Deci, 1975; Vansteenkiste, Lens, & Deci, 2006). When individuals experience intrinsic motivation, they engage in behaviours they perceive as inherently interesting, satisfying, gratifying, enjoyable, 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. Originally, these two forms of motivation were regarded as additive (Atkinson, 1964); that is, increases in either intrinsic or extrinsic motivation would promote a corresponding escalation in behaviour. However, in contrast to this additive model, an extensive array of studies showed that

extrinsic rewards, such as deadlines (Amabile, DeJong, & Lepper, 1976), and surveillance (Plant & Ryan, 1985), tended to curb the intrinsic motivation to engage in these acts (for a meta-analysis, see Deci, Koestner, & Ryan, 1999).

In some instances, however, these extrinsic rewards did not compromise the intrinsic motivation of individuals. Specifically, rewards that did not depend on performance did not cub intrinsic motivation, presumably because such incentives did not seem to control behaviour (Deci, Koestner, & Ryan, 1999). Taken together, these findings indicated that any forces that curb autonomy and choice--impending rewards, threats, or evaluations, for example--tend to reduce intrinsic motivation (Deci & Ryan, 2000). Similarly, a social climate that is supportive, rather than controlling, also tends to inflate intrinsic motivation (e.g., Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). One exception to this pattern of observations was observed: positive evaluations of performance, although not a manifestation of autonomy, sometimes increase rather than decrease intrinsic motivation (Deci, Koestner, & Ryan, 1999). Accordingly, Deci and Ryan (2000) argued that information that underscores the competence of individuals also confers intrinsic motivation.

According to self-determination theory, individuals are more likely to experience a sense of autonomous motivation, ultimately optimizing wellbeing and progress, if their basic psychological needs are fulfilled (Ryan & Deci, 2000). That is, all humans experience a profound need to feel autonomous, competent, and related to other individuals (Deci & Ryan, 2000). Some contexts facilitate the achievement of these fundamental psychological needs. These contexts, according to self-determination theory, facilitate internalization and integration and thus foster autonomous motivation (Ryan & Deci, 2000).

Hence, contexts that promote autonomy, competence, and relationships will ultimately inflate the likelihood of autonomous motivation. For example, behaviours that are endorsed in some context, and are thus extrinsically motivated, will eventually be integrated if individuals feel connected and related to the individuals in this setting. Thus, several studies have characterized the contexts that afford this sense of autonomy and thus promote integration. To establish these contexts, referred to as autonomy supportive, authority figures, such as parents, managers, and teachers, should relate uninteresting activities to core values, acknowledge the feelings and perspectives of the individual, provide sufficient information, and offer some sense of choice (Deci, Eghrari, Patrick, & Leone, 1994). These supportive conditions enhance autonomy and wellbeing in many contexts (Williams & Deci, 1996; Williams, Levesque, Zeldman, Wright, & Deci, 2003).

Overall, compared to controlled motivation or no motivation, autonomous motivation is associated with an extensive gamut of desirable outcomes. First, autonomous motivation is related to positive mood states, such as wellbeing (e.g., Ryan, Rigby, & King, 1993), coupled with less burnout (e.g., Fernet, Guay, & Senecal, 2004) and a healthier life style, together with adherence to medical recommendations (e.g., Pelletier, Dion, Slovenic-D'Angelo, & Reid, 2004; Williams, Rodin, Ryan, Grolnick, & Deci, 1998; Williams, Freedman, & Deci, 1998). Second, autonomous motivation is related to persistence (e.g., Pelletier, Fortier, Vallerand, & Brire, 2001), ultimately improving weight loss for example (Williams, Grow, Freedman, Ryan, & Deci, 1996). Third, autonomous motivation is related to cognitive performance, especially on tasks that demand deviations from a standard set of procedures, and thus is associated with creativity (e.g., Koestner, Ryan, Bernieri, & Holt, 1984) and conceptual understanding (e.g., Grolnick & Ryan, 1987). Finally, autonomous motivation is related to social behaviour, such as better control over prejudice (Legault, Green-Demers, Grant, & Chung, 2007).

The concept of autonomous versus controlled motivation can also explain the over justification effect. Specifically, sometimes, individuals feel less motivated to engage in a task after, rather than before, incentives are offered. That is, the provision of incentives, such as rewards or punishments, can actually diminish the autonomous motivation of individuals. Individuals are less inclined to enjoy or cherish the activity (Deci, Koestner, & Ryan, 1999). Many studies have shown that an autonomous or intrinsic motivation enhances creativity. Nevertheless, Grant and Berry (2011) highlighted some complications that challenge the simplicity of this conclusion. In particular, according to Grant and Berry (2011), autonomous and intrinsic motivation tends to enhance the originality, but not always the utility, of ideas. That is, when individuals experience these forms of motivation, their suggestions are often novel but may not be useful.

To clarify, if individuals experience an autonomous and intrinsic motivation, their primary objective is to satisfy their curiosities and pursue their interests. Their attention, therefore, tends to be oriented towards novel stimuli or unconventional concepts. Because of this orientation, their thoughts and suggestions are more likely to be original. Although original, these thoughts will not necessarily align to the needs of other people. They will not, therefore, fulfill one of the key criteria of creativity and usefulness. However, if individuals experience a pro-social motivation, in which they care about the interests of other people, their suggestions are more likely to be useful. Because of this pro-social motivation, individuals are more inclined to adopt the perspective of other people. Their thoughts and suggestions, consequently, are more likely to align somewhat to the needs and concerns of other individuals. Their ideas will tend to be useful. In short, these arguments imply that an autonomous and intrinsic motivation is likely to promote creativity, but only if individuals also exhibit a pro-social motivation. Grant and Berry (2011) conducted three studies that substantiate this hypothesis. In the first study,

participants completed a scale that assesses intrinsic motivation at work. They also completed questions that gauge the degree to which they are motivated to benefit other people at work, reflecting a pro-social motivation. Finally, their supervisors rated the extent to which their ideas are creative. As hypothesized, intrinsic motivation was positively related to creativity, but only when pro-social motivation was elevated.

2.14.5 Applications of Self-Determination Theory

In addition to formal theory development, research has applied SDT in many domains including education, organizations, sport and physical activity, religion, health and medicine, parenting, virtual environments and media, close relationships, and psychotherapy. Across these domains research has looked at how controlling versus autonomy-supportive environments impact functioning and wellness, as well as performance and persistence. In addition, supports for relatedness and competence are seen as interactive with volitional supports in fostering engagement and value within specific settings, and within domains of activity. This body of applied research has led to considerable specification of techniques, including goal structures and ways of communicating that have proven effective at promoting and maintaining volitional motivation. By focusing on the fundamental psychological tendencies toward intrinsic motivation and integration, SDT occupies a unique position in psychology, as it addresses not only the central questions of why people do what they do, but also the costs and benefits of various ways of socially regulating or promoting behaviour.

2.15 Theoretical Framework of the Study

This work is anchored on Self-Determination Theory (SDT) as proposed by (Deci & Ryan 2000, 2008; Ryan & Deci, 2000). Self-Determination Theory (SDT) represents a

broad framework for the study of human motivation and personality. SDT articulates a meta-theory for framing motivational studies, a formal theory that defines intrinsic and varied extrinsic sources of motivation, and a description of the respective roles of intrinsic and types of extrinsic motivation in cognitive and social development and in individual differences. Perhaps more importantly SDT propositions also focus on how social and cultural factors facilitate or undermine people's sense of volition and initiative, in addition to their well-being and the quality of their performance. Conditions supporting the individual's experience of autonomy, competence, and relatedness are argued to foster the most volitional and high quality forms of motivation and engagement for activities, including enhanced performance, persistence, and creativity. In addition SDT proposes that the degree to which any of these three psychological needs is unsupported or thwarted within a social context will have a robust detrimental impact on wellness in that setting.

The dynamics of psychological need support and need thwarting have been studied within families, classrooms, teams, organizations, clinics, and cultures using specific propositions detailed within SDT. The SDT framework thus has both broad and behaviour-specific implications for understanding practices and structures that enhance versus diminish need satisfaction and the full functioning that follows from it. According to SDT individuals experience the fundamental need to experience autonomy, feel competent, and development relationships, called relatedness. Autonomy refers to the motivation of individuals to pursue their personal values and interests. Competence refers to the development of key skills and abilities. Relatedness refers to a sense of belonging in groups or close relationships with friends and family. When all of these needs are fulfilled, individuals experience improvements in wellbeing and satisfaction. They also become more resilient rather than sensitive to problems. However, many common trends, such as the inclination to conceal personal problems or work extensive hours, can impede the

likelihood that such needs are fulfilled. Based on the trust of this context therefore, this study is wheeled on the principle of self-determination theory.

2.16 Empirical Studies

2.16.1 Co-operative Learning and Mathematics Achievement of pupils with ADHD

Attention Deficit Hyperactivity Disorder (ADHD) describes a disorder in which a child displays significant difficulties with poor attention, impulsivity and overactive behaviour (Braswell, Bloomquist & Pederson, 1991, p.5) while most children display these behaviours at some time in their lives, children diagnosable as having ADHD display them in a way (frequency, duration, severity, etc.) which is significantly inappropriate for their mental age and at a significantly different rate than their peers. Additionally, ADHD is a developmental disorder which persists through life. Correlate behaviours of ADHD children can be observed as early as infancy. ADHD infants can be described temperamentally as being irritable, difficult to soothe and as having irregular sleeping and eating patterns. ADHD is thought to affect 35% of elementary school age children. Because of how schools are run, with children being expected to be still and comply, ADHD pupils commonly have problems in school. Teachers commonly describe children with ADHD as often being off-task, fidgeting, playing with objects (i.e., tapping pencils, playing with coins), impulsively vocalizing their feelings or reactions and often being out of their seat (Braswell, et al.).

Forness, Youpa, Hanna, Cantwell, and Swanson (1992) found 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 (Braswell, et al.) 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, Youpa, Hanna, Cantwell, & Swanson, 1992).

Co-operative learning strategy can be used to promote classroom discourse and oral language development. Wiig and Semel (1984) described 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 (e.g., Johnson & Johnson, 1986) supports cooperative learning as an effective approach for including pupils with poor achievement in mathematics in classroom group work and promoting peer acceptance. Also, Slavin, Madden, & Leavey (1984) posit that teachers could integrate cooperative learning strategy as a measure to remedy the challenges faced by ADHD pupil's expressing poor achievement in mathematics. Thus, in cooperative learning groups with proper instruction and preparation (i.e., previous direct instruction on skills), school children expressing poor achievement in mathematics could benefit from peer interactions to learn Mathematics skills and concepts.

Johnson and Johnson (1991) found 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. Research (e.g., Johnson & Johnson, 1986) supports cooperative learning as an effective approach for including pupils expressing poor achievement in mathematics in classroom group work and promoting peer acceptance.

According to Johnson et al. (1994), there are five basic elements of cooperative learning strategy that could be used to help develop Mathematics competency skills among pupil's expressing poor achievement in mathematics: positive interdependence, face-to-face interaction, individual accountability, group behaviours, and group processing. Positive interdependence means that pupils see the importance of working as a team and realize that they are responsible for contributing to the group's effort. They further affirmed that face-to-face interaction involves pupils working in environmental situations that promote eye contact and social space so that pupils can engage in discussions. Also, individual accountability suggests that each person is responsible to the group and must be a contributing member- not someone who lets others do all of the work. Likewise, group behaviours refer to those interpersonal, social, collaborative skills needed to work with others successfully. While group processing is a time after the co-operative learning task is finished when team members analyze their own and their group's abilities to work collaboratively.

Jenkins and O'Connor, (2003) found 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 aid in classroom management and provide 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 help improves outcomes for all pupils and provides opportunities for practice that help acquisition of new knowledge and transfer of skills and content knowledge.

Likewise, Gillies and Boyle (2006) found similar results in their study of teachers' perception that pupils participating in co-operative learning greatly enhanced their academic achievement. Gillies and Ashman (2000) reported that students were able to "fill in gaps in their own understanding, develop new perspectives, and construct more elaborate cognitive knowledge". Furthermore, Box and Little (2003) conducted a study to see if the use of advanced organizers and co-operative learning would affect self-concept and academic achievement for five third grade classes. They found that academic achievement was positively affected by the classes using co-operative learning, which contrasts with the control class not using these techniques. Vermette, Harper and DiMillo (2004) found in their literature review that peer interactions contributed to academic success because the influence of peer learning seemed to lead to higher level thinking. Gillies and Ashman (2000) suggested in their study of the effects of co-operative learning on pupils with learning difficulty in mathematics that some of the benefits of this learning technique include that "it promotes socialization and positive student interactions and improved attitudes to learning". In the same study, the authors noted that children who worked in co-operative learning groups were "consistently more co-operative and helpful, used language that was more inclusive and gave more explanation to assist understanding". In other words, pupils were able to get along better, be kinder and more cooperative and attitudes were found to improve. Children who accept each other socially are better able to learn with one another.

2.16.2 Contingency Contracting Technique and Mathematics Achievement of pupils with ADHD

Pupils with attention-deficit/ hyperactivity disorder (ADHD) typically are characterized as inattentive, impulsive, and overactive, and may exhibit a variety of problems within the school setting (Barkley, 1990). These pupils often experience difficulty in paying attention, following directions, staying seated, and working independently in the classroom. Due to the variety and seriousness of the difficulties pupils with ADHD experience in school they find it difficult to comprehend mathematical skills, for which classroom teachers often feel overwhelmed and frustrated by pupils with ADHD challenging behaviours. One essential element in the effective management of the problems of poor mathematics achievement among pupils with ADHD is the development and implementation of intervention strategies (Barkley, 1990; DuPaul & Stoner, 1994). The target areas (e.g., behavioural, academic, or social) for intervention should be those in which change is desired (Barkley, 1990).

Although research evidence suggests that biological factors underlie ADHD symptomatology, it also suggests that many environmental factors have an impact on the severity of symptoms exhibited by ADHD pupils expressing poor mathematics achievement (Barkley, 1990; DuPaul & Stoner, 1994). For example, ADHD pupils expressing poor mathematics achievement appear to respond better to frequent feedback with immediate and highly salient consequences (Pfiffner & Barkley, 1990). Similarly, one-to-one instructional situations, increased supervision, the use of novelty, and the presentation of numerous opportunities for pupils to actively respond to teaching and learning situation necessary to enhance positive academic success for ADHD pupils expressing poor mathematics achievement (Pfiffner & Barkley, 1990). In contrast, infrequent and delayed feedback with minimally salient consequences, as well as group

instruction, less supervision, and familiar repetitive tasks tend to intensify ADHD symptoms (Pfiffner & Barkley, 1990). 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).

Inappropriate behaviours can be detrimental to the success of ADHD pupils experiencing poor mathematics achievement in the classroom and also disruptive to the learning environment of other pupils within the general education classroom. It requires teachers to use academic time to deal with control and discipline rather than academics (De Martini-Scully, Bray, & Kehle, 2000; Wilkinson, 2005). General education teachers often respond to ADHD pupils expressing poor mathematics achievement challenges with a punitive and inconsistent approach. Although behaviours of ADHD pupils experiencing mathematics difficulty occur in a patterned manner, the reactions of a general education teacher typically change from day to day (Jull, 2008). For example, ADHD pupils experiencing mathematics difficulty may verbally interrupt the lesson multiple times a day, but the teacher may respond differently to each interruption depending upon his or her frustration level and only follow through with a disciplinary action after 10 days of disruptions. This creates a cycle of negative behaviour from the pupils paired with negative attention from the teacher (Cook, 2005).

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. This positive teacher behaviour provides ADHD pupils expressing poor mathematics achievement with reinforcement and attention for good behaviours rather than bad behaviours. Furthermore, it brings better communication and a deeper relationship between the teacher and ADHD pupils and continues to allow the teacher to keep his or her attention focused on the entire class (Brandy, 2010).

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 and his colleagues commented 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) 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 and colleagues implemented a behaviour contract which required the teacher and students to meet two times a day to review the contract, agree upon rewards, problem solve, 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 and colleagues commented that the contracts were neither obvious nor interfering to other pupils in the classroom. Furthermore, they noted that a positive relationship between the pupils and teacher resulted from the contracts because of the increase in communication (Brandy, 2010).

Navarro, Aguilar, Aguilar, 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 behaviour problems as the contracts were implemented. Wilkinson's study (2003), focused on a nondisabled 7-year old female, exhibited the same successful results in an ABAB research study. A behaviour contract was put in place to decrease the student's disruptive and off-task behaviours in the general

education classroom. Both the teacher and student were happy with the behaviour contract as an intervention and felt that it was beneficial to them (Brandy, 2010).

Flood and Wilder (2002) paired contracts with functional communication training (FCT) in a study of an 11 year old male diagnosed with ADHD who exhibited off-task behaviour and poor academic achievement. Researchers assessed the student's rewards with a verbal survey and gave access to these desirable items with successful intervals of on-task behaviour. They found a marked decrease in off-task behaviour when the contract was in place and the student was taught functional communication. This research was conducted in a one-on-one setting in a therapy room, but the researchers noted that it continued to be successful in the general education classroom, although no data were collected. Ruth (1996) paired behaviour contracts with goal setting instruction to increase appropriate classroom behaviours for a large group of self-contained pupils in first through sixth grade. Using an AB design, she found that these pupils, diagnosed with ED, LD, and dual ED/LD, were successful in consistently meeting their behaviour goals on a daily and weekly basis during the contract phase. Four principles were incorporated into these formal contracts: the use of specific goals, the use of leveled goals for daily, weekly, and monthly time periods, and the allowance of the goal and incentive negotiation by the student, and the consistency of performance feedback in charting, posting, and weekly conferences. The use of behaviour contracts and goal-setting was very successful in decreasing inappropriate behaviours (Brandy, 2010).

De Martini-Scully, Bray, and Kehle (2000) paired behaviour contracts with the use of precision requests to study two 8 year old ADHD pupils expressing poor mathematics achievement in the general education setting. Using a multiple baseline reversal single subject design, they determined that precision request and contracts were very successful for these two pupils and they were able to decrease their disruptive

behaviour and increase their mathematics competency in the classroom. Stage, Jackson, Moscovitz, Erickson, Thurman, Jessee and Olson, (2006) also worked with three different pupils expressing poor mathematics achievement diagnosed with ADHD or developmental disabilities in Kindergarten, 1st grade, and 9th grade in their research. They used an informal contingency intervention with individualized contingencies for decreased disruptive behaviour in the classroom. Despite their differences in age, disability, and setting, all three pupils decreased their problem behaviours and improved on their Mathematics competence when contingencies were in place.

Overall, research on token systems indicates that they are effective in addressing a number of the problem behaviours exhibited by the child with ADHD. In the limited number of studies examining the effectiveness of a token economy to address the behaviour of children with ADHD, a token system has been shown to: (1) decrease rates of impulsive and disruptive behaviour (Carlson, Mann & Alexander, 2000; Johnson, Handen, Lubetsky, & Sacco, 1994); (2) increase adherence to rules and on-task behaviour (Carlson et al., 2000; Johnson et al.,, 1994); and, (3) increase rates of task completion and accuracy for academic tasks (Carlson et al., 2000) in the classroom setting. Outside of the classroom environment, researchers have used the token economy to: (1) increase the display of sportsmanlike conduct (e.g., giving high fives and verbal praise to teammates, helping a player up from the floor, giving a nonaggressive pat) during in sporting events (Hupp & Reitman, 1999; Hupp, Reitman, Northup, O'Callaghan, & LeBlanc, 2002); (2) reduce rates of inattentive and disruptive behaviour in recreational settings (Reitman, Hupp, O'Callaghan, Gulley, & Northup, 2001); and, (3) improve performance in physical activities, such as a structured exercise program (Trokiables, French, & O'Connor, 2001).

Several studies indicate that token reinforcement systems produce high levels of on-task behaviour as well as increased academic achievement (Barkley, 1998; Grandy &

McLaughlin, 1999; McLaughlin, & Williams, 1988). Incentive-based behavioural programmes have produced better results than the use of negative reinforcement or depriving privileges (Hogan, 1997; DuPaul, & Stoner, 1994). They compared the effects of a token reinforcement system and medication (Ritalin) on the academic achievement of three students with ADHD. Their findings indicated that the delivery of token reinforcement resulted in increased levels of academic achievement. Although the medication was effective in reducing hyperactivity, the academic growth of the students was hindered while they were being medicated.

2.16.3 Age and Mathematics Achievement of pupils with ADHD

Attention Deficit Hyperactivity Disorder (ADHD) is the most commonly diagnosed behavioural disorders during childhood (Tannock & Schachar, 1996). ADHD includes a heterogeneous array of symptoms which overlaps markedly with oppositional defiant disorder, conduct disorder, affective disorders such as depression, anxiety, learning difficulty and communication disorders. The most common age for diagnosis is between the ages of 7 and 9, although symptoms may be apparent before the age of 3 (Cohen, 1993). According to DSM-IV-TR criteria, the onset of ADHD is before age 7, however, many individuals are not diagnosed until a later age due to the prominent expression of ADHD symptoms in the school setting. ADHD is characterized by a persistent pattern of behavioural symptoms of inattention, hyperactivity, and impulsivity (Barkley, 1990). Children showing behaviours that are characteristics of ADHD have been found to be highly "at-risk" for maladaptive educational and social outcomes.

Generally, children diagnosed with ADHD will face problems with their ability in focusing, their level of impulsiveness and their motor activity. Children with ADHD are very easily distracted and often lose concentration and this probably suggests their poor achievement in mathematics tasks considering the fact that mathematics task require

prompt and adequate concentration. Thus, these pupils normally will have difficulties staying on track, as a result, may not complete assignments on time (Mulrine, Prater, & Jenkins, 2008). Therefore, teachers in the classroom will face great challenge in assisting these children to focus on their work. The behaviours are not age appropriate, so an older person may misbehave in a similar way to a much younger peer. Individuals have difficulty focusing their attention to complete a specific task, they can be hyperactive and impulsive and can suffer from mood swings and 'social clumsiness'(Mulrine, Prater, & Jenkins, 2008). Depending on the country of study, 3% to 10% of school age children are inattentive and/or experience difficulties in learning mathematics and/or reading even though they are not of low intelligence and do not suffer from educational deprivation (Lyon, Shaywitz, & Shaywitz, 2003; Spencer, Biederman, Wilens, & Faraone, 2002; von Aster & Shalev, 2007; Wilson & Dehaene, 2007).

More recently it has been argued that poor mathematics achievement among ADHD pupils is probably as a result of specific difficulty in basic numerical processing (i.e., intuitions for quantities resulting in mental representation of quantities or magnitudes; see, for example, Butterworth 2005b; Wilson & Dehaene, 2007). However, this might be surprising because behavioural deficits among ADHD pupils are heterogeneous (i.e. varied behaviour patterns across children) and also because, as in the case of many other developmental disorders (Frith, 2001; Gilger & Kaplan, 2001; Karmiloff-Smith, 2006), multiple problems are the rule, and pure disorders apply to a minority of cases only. That is, a child whose development is atypical in only numerosity understanding is unusual. Specifically, studies show that only a minority of children experiencing outstanding mathematical learning difficulties have isolated MLD. Rather, 20%-60% of children with MLD have associated learning problems such as dyslexia or ADHD (Curry & Stabile, 2004; Lewis, Hitch, & Walker, 1994).

Attention-deficit/hyperactivity disorder ADHD, affecting 4% to 10% of school age children (Skounti, Philalithis, & Galanakis, 2006), is associated with substantial academic underachievement in mathematics and reading (Elia, Ambrosini, & Berrettini, 2008; Spira & Fischel, 2005). For example, recent estimates suggest that 25% of children with ADHD express poor mathematics achievement (Mayes & Calhoun, 2006). However, in contrast to co-occurring reading difficulties, mathematical difficulties in ADHD have received scant attention from either clinicians or researchers, despite its functional significance. For example, quantitative literacy is a strong predictor of attaining full-time employment (Rivera-Batiz, 1992), which is a major problem, among adults with ADHD (Biederman et al., 2005).

Existing studies indicate that children with ADHD exhibit problems in completing arithmetic calculations quickly and accurately resulting in dismay mathematics achievement (Barry, Lyman, & Klinger, 2002; Benedetto-Nasho & Tannock, 1999) and that these problems may persist into adulthood (Biederman et al., 2005). Some researchers attribute the significant mathematics underachievement in children with ADHD to attentional, working memory, spatial memory and executive functions impairments needed for calculations (e.g., Geary, 2005; Rotzer et al., 2008). Specifically, in numerical computations every small detail, such as the position of the digit or differences in operational signs, is relevant for performing well on tasks. Such general cognitive impairments (i.e., not specific to mathematics) are considered to be integral features of the ADHD syndrome (Barkley, 1997; Castellanos, Sonuga-Barke, Milham, & Tannock, 2006) and hence, may cause mathematical difficulties in some of these children either they are younger or older (Benedetto-Nasho & Tannock, 1999; Passolunghi, Marzocchi, & Fiorillo, 2005).

Dehaene (1992), contend 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 was suggested that Mathematics facts like those generated by division or subtraction involve manipulation of quantities, i.e., core system of numbers (e.g., Ischebeck et al., 2006). It is reasonable to assume that there are ADHD children whose difficulties arise from deficits in processing quantities as well as executive dysfunctions. Shenoy (1992) studied a population of 1549 children in the age range of five to eight years from middle socio-economic status and reported scholastic backwardness in 11 per cent of boys and 8 per cent of girls and an interesting trend of decline in percentage of scholastic backwardness in girls and increase in boys was noted. Rozario (1991) in a study of 110 children of 9 years of age from lower, middle socio-economic status, found nearly one third children to be scholastically backward a majority of them had specific learning disabilities.

Adams (1999) examined the relationship between behavioural problems and academic attainment in a large UK primary school. A school population - 364 children aged 8 to 11 years was assessed on a range of cognitive ability tasks. These included standardized tests of reading, arithmetic and verbal and non-verbal intelligence. Under achievement were assessed using different criteria. To assess behaviour, teacher completed the strengths and Difficulties Questionnaire (R-Good-man, 1997) for each participating child. Finally, academic progress of subset of children was assessed after one year and the results indicated that there was a significant relationship between behaviour and academic achievement. Also, prosocial behaviour was positively correlated with reading & arithmetic, while hyperactivity and conduct problems were negatively correlated. This association was especially strong in the children rated by the

Questionnaire as hyperactive, and among these children, around 1 in 5 had a specific reading deficit.

2.16.4 Gender and Mathematics Achievement of pupils with ADHD

Gender differences favouring males having more confidence studying mathematics are well recorded. Differences among teenagers have been reported, for example, by Bohlin (1994), Hannula and Malmivuori (1997), Pehkonen (1997), and Leder (1995) reported that already in grade 3, boys estimated themselves to be better in mathematics than girls. In mathematics achievement the results on gender differences are less clear. In IEA's large international studies the gender differences previously favoured boys. In more recent studies the gender differences have decreased and in many countries disappeared completely (Beaton, Mullis, Martin, Gonzales, Smith & Kelly 1997). However, robust gender differences are still found, for example, in some tasks on infinity and fractions (Hannula 2003).

The question of gender differences in mathematics achievement, attitudes, and affect is a continuing concern as scientists seek to address the underrepresentation of women at the highest levels of science, technology, mathematics, and engineering (Halpern, Benbow, Geary, Gur, Hyde & Gernsbacher, 2007; National Academy of Sciences, 2006). Stereotypes that girls and women lack mathematical ability persist, despite mounting evidence of gender similarities in math achievement (Hyde, Lindberg, Linn, Ellis, & Williams, 2008). Furthermore, some have proposed the *gender stratification hypothesis*, arguing that cross national patterns of gender differences in math achievement reflect gender inequities in educational and economic opportunities available in a given culture (Guiso, Monte, Sapienza, & Zingales, 2008; Riegle-Crumb, 2005).

Stereotypes about female inferiority in mathematics (Bhana, 2005; Li, 1999) stand in distinct contrast to the actual scientific data reported in previous studies. This discrepancy is particularly problematic because such negative stereotypes can impair math test performance and cause anxiety via stereotype threat (Blascovich, Spencer, Quinn, & Steele, 2001). Reviewing evidence from research with infants and preschoolers, Spelke (2005) concluded that gender similarities are the rule in the development of early number concepts. Girls earn better grades in mathematics courses through the end of high school (Kenney-Benson, Pomerantz, Ryan, & Patrick, 2006). In the United States, gender differences in mathematics achievement are declining. A meta-analysis in 1990 (Hyde, Fennema, & Lamon., 1990) found an effect size of *d* _ _0.05 for the gender difference in math achievement among the general population, indicating a negligible female advantage (note that positive values of *d* represent higher scores for males than females, whereas negative values represent higher scores for females). At that time the gender gap increased during high school.

Another metaanalysis used data sets representing large probability samples of American adolescents and found *d* _ 0.03 to 0.26 across the different data sets (Hedges & Nowell, 1995). More recent data indicate that the gender difference in math achievement has been eliminated. A study of statewide mathematics tests administered between 2005 and 2007 for Grades 2–11 found *d* _ 0.0065, without the increased gender gap in adolescence found with earlier data (Hyde et al., 2008). These findings, for U.S. samples, are consistent with the *gender similarities hypothesis*, which maintains that males and females are similar on most, but not all, psychological variables (Hyde, 2005). For the United States, meta-analytic studies of gender differences in attitudes and affect toward mathematics demonstrate that males tend to hold more positive attitudes about math, though the gap is small (Hyde, Fennema, Ryan, Frost & Hopp, 1990). Hyde et al. (1990)

found that, developmentally, the gap widens during high school, when males report greater self-confidence (*d* _ 0.25).

It is estimated that from three to five percent of all school-age children in Canada – and elsewhere – suffer from Attention Deficit Hyperactivity Disorder. Found in most cultures and in most countries (Simeon & Wiggins, 1993), ADHD is four or five times more common among boys, and it is first noticed, usually, between three and four years of age. Regardless of gender, ADHD produces the same effects: children are unable to concentrate on any task for more than a few minutes. Moreover, they charge through each day with excessive energy. They talk during quiet periods, ignore social rules, leave their seats, and create disturbances in the classroom. Basic to all these behaviours, they are moody, and very impulsive. ADHD children have normal intelligence, but they show deficits in their ability to focus their attention. They literally cannot seem to sit still, and are readily distracted by irrelevant information (Baron-Cohen, 2003).

Boys trail girls in reading throughout school, and leave high school reading about one grade level below girls. Girls, however, score only slightly behind boys in mathematics and science upon graduation (Freeman, 2004). About 16% of boys and 8% of girls between the ages of 5 to 17 with Mathematics disabilities have been diagnosed with ADHD. Boys are 3 times more likely than girls to be diagnosed as having ADHD without a learning disability (Quickstats, 2005). Boys are more likely to repeat a grade and to drop out of school (Freeman, 2004). Boys engage in more risky behaviours, such as drug use, and are more likely to be involved in violent behaviour or be bullied at school (Freeman, 2004). Whereas the number of girls entering and completing college continues to rise, the number of boys who pursue and complete a college degree has stagnated. In 2001, 57% of college graduates were women (Freeman, 2004).

Barbra and Cosentino (2011) report that research done in the past ten years has also suggested that ADHD affects males and females differently. A 1999 study funded by the National Institute of Mental Health (NIH) compared 140 ADHD girls with 122 control girls and found that: Girls with ADHD were more likely to have inattentive symptoms as opposed to hyperactive-impulsive symptoms and disruptive behaviours seen in boys. Compared to girls without the disorder, girls with ADHD had significantly higher rates of comorbid behaviour disorders (conditions that occur at the same time) such as oppositional defiant disorder and conduct disorder. (Although these rates are lower than those seen in boys with ADHD.) Barbra and Cosentino (2011) report further reveal that girls with ADHD displayed higher levels of mood and anxiety disorders (consistent with those seen in boys with ADHD) than in children without ADHD. Contrary to previous studies which found that girls with ADHD demonstrated greater cognitive impairment than boys, Barbra and Cosentino (2011) report reveal that the magnitude of cognitive impairments was consistent with reports on boys with ADHD.

Similarly, over the past decade, systematic observation codes have been developed and psychometrically tested to identify the specific classroom behaviours that distinguish students with ADHD from their same-aged peers without ADHD (Abikoff, Jensen, Arnold, Hoza, Hechtman & Pollack 2002; Platzman, Stoy, Brown, Coles, Smith & Falek, 1992; Skansgaard & Burns, 1998). It is evident that pupils with ADHD exhibit higher rates of gross motor activity and fidgeting, negative verbalizations, as well as various other off-task behaviours relative to pupils without ADHD. Furthermore, boys with ADHD typically exhibit higher rates of interference, gross motor activity, and aggression than their female counterparts. However, girls with ADHD solicit attention and assistance from the teacher more often than their male counterparts (Abikoff et al., 2002). Despite gender differences, previous studies using direct observational procedures have found that boys

and girls expressing Mathematics learning disabilities with ADHD exhibit higher rates of disruptive and off-task behaviours in the classroom setting than their matched-gender counterparts without ADHD. Thus, previous research suggests that it is the elevated levels of off-task behaviours that contribute to the academic underachievement experienced by pupils with ADHD (Abikoff et al., 2002; Platzman et al., 1992; Skansgaard & Burns, 1998). Indeed, Rapport, Scanlan and Denney, (1999) clearly demonstrated the direct impact of ADHD symptoms on vigilance, which affected memory, which, in turn, had an impact on academic achievement.

However, gender differences do not appear to be significant in terms of anger among ADHD children (Piko, Keresztesa & Pluhar 2006). Children of either gender with high Mathematics disabilities levels have poor cognitive processing skills and poor relationships in school (Lamb, Puskar, Sereika, Patterson & Kaufmann 2003). Also, children with mathematics learning disabilities diagnosed of ADHD demonstrate aggressive behaviour and have difficulties for interpreting social codes more often than their peers (Holmberg & Hjern 2008). On the other hand, a study on boys with ADHD in an aggressive game showed that manipulation of their background anger did not affect their aggressive behaviour (Pelham, Milich, Cummings, Murphy, Schaughency & Greiner 1991). A self-report questionnaire study of 23 boys diagnosed with ADHD and without co-morbid oppositional defiant disorder (ODD) or conduct disorder suggests that the children with ADHD negotiate their angry feelings towards a friend with him/her less often than those in a control group. Boys with ADHD report anger regulation strategies that require impulse control less often than their counterparts without ADHD (Bonekamp & Von 2007).

In the US, boys make up two thirds of students in special education—including 80 percent of those diagnosed with emotional disturbances or autism—and boys are two

and a half times as likely as girls to be diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) (Office of Special Education Programs, 25th Annual Report to Congress Washington, D.C.: U.S. Department of Education, 2003). The number of boys diagnosed with disabilities or ADHD has exploded in the past 30 years, presenting a challenge for schools and causing concern for parents. But the reasons for this growth are complicated, a mix of educational, social, and biological factors. Evidence suggests that school and family factors—such as poor reading instruction, increased awareness of and testing for disabilities, or over-diagnosis—may play a role in the increased rates of boys diagnosed with learning disabilities or emotional disturbance. But boys also have a higher incidence of organic disabilities, such as autism and orthopedic impairments, for which scientists don't currently have a completely satisfactory explanation. Further, while girls are less likely than boys to be diagnosed with most disabilities, the number of girls with disabilities has also grown rapidly in recent decades, meaning that this is not just a boy issue (Office of Special Education Programs, 25th Annual Report to Congress Washington, D.C.: U.S. Department of Education, 2003).

2.17 Appraisal of Literature

Literature revealed that a large percentage of children due to their characteristic display of inattentiveness, hyperactivity and impulsivity in class suffer from learning difficulty which hinder their ability to concentrate in classroom teaching learning situation and therefore do not master or partially master-these required academic skills (reading, writing & arithmetic) and the consequence is grave across their developmental lifespan. Children with a diagnosis of attention-deficit/hyperactivity disorder (ADHD) commonly present a wide range of characteristics and problems including learning difficulty, frustration, helplessness and academic underachievement. In fact, it has been estimated that approximately 80% of children with ADHD experience academic underachievement

and approximately one-third of children with ADHD have specific learning difficulty (Barkley, 2006; DuPaul & Volpe, 2009).

The prevalence of children diagnosed with ADHD in the school system is approximately 3% to 7% (American Psychiatric Association, 2000). Studies investigating the academic achievement of children with ADHD show that these children are more likely to receive lower grades in academic subjects and lower scores on standard measures of reading, writing and mathematics than children without disabilities (Saunders & Chambers, 1996). More than 80% of 11 year olds diagnosed with ADHD were reported as behind by at least 2 years in reading, spelling, mathematics, or written language (Anderson, Williams, McGee, & Silva, 1987). More than half of the children with ADHD taught in general education classrooms will experience failure in school, or be retained in at least one grade by adolescence, and more than one third will not complete high school (Weiss & Hechtman, 1986).

Attention Deficit Hyperactivity Disorder (ADHD) affects more and more children around the world, as it occurs across all socio-economic, cultural, and racial backgrounds and affects children of all intelligence levels (Barkley, 2006; Loe & Feldman, 2007; Sonuga-Barke, 2002, 2003). In view of this context, it is of note that pupils with Attention Deficit Hyperactivity Disorder (ADHD) experience great difficulty with the academic structure and demands of school and they consistently achieve below their potentials (Lauth, Heubeck & Mackowiak, 2006; Lucangeli & Cabrele, 2006). 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). This implies that the corresponding effect of attention deficit hyperactivity disorder could result to expressed deficit in pupils' self-esteem, expressed helplessness and poor adjustment to teaching and

learning situation in 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 concern individuals. Thus, the negative implication of ADHD on the educational development, academic success and mathematics achievement of primary school pupils cannot be overemphasized.

2.18 Conceptual Model for the Study

The conceptual model serves as a guide and roadmap with a theoretical connotation highlighting the basis of a study. It showcases the content and context of a study. It gives a descriptive presentation of a particular studies embodiment. Thus, it gives a structured account of the treatment packages used in the study and graphical presentation of the cause effect via manipulation of variables and inter-twinning effect on account of the relationship between the independent variables and moderating variables to produce an observable behavioural effect on the dependent variable.

Thus on account of this study, the independent variables (co-operative learning strategy and contingency contracting technique) will be subject to effective manipulation by the researcher to determine their effect on enhancing the mathematics achievement of pupils with ADHD in cognizance with the possible inducing effect of the moderating variables (age and gender). Interestingly, the moderating variables are those factors inherent in the subjects (pupils with ADHD) that may invariably, have a direct relationship between the independent and dependent variables. Thus, the consequential expectation of the dynamic relationship between these variables is the expected behavioural change on the dependent variableo to be expressed by and observe in the subjects that have participated in the intervention programme. This implies the effect of co-operative

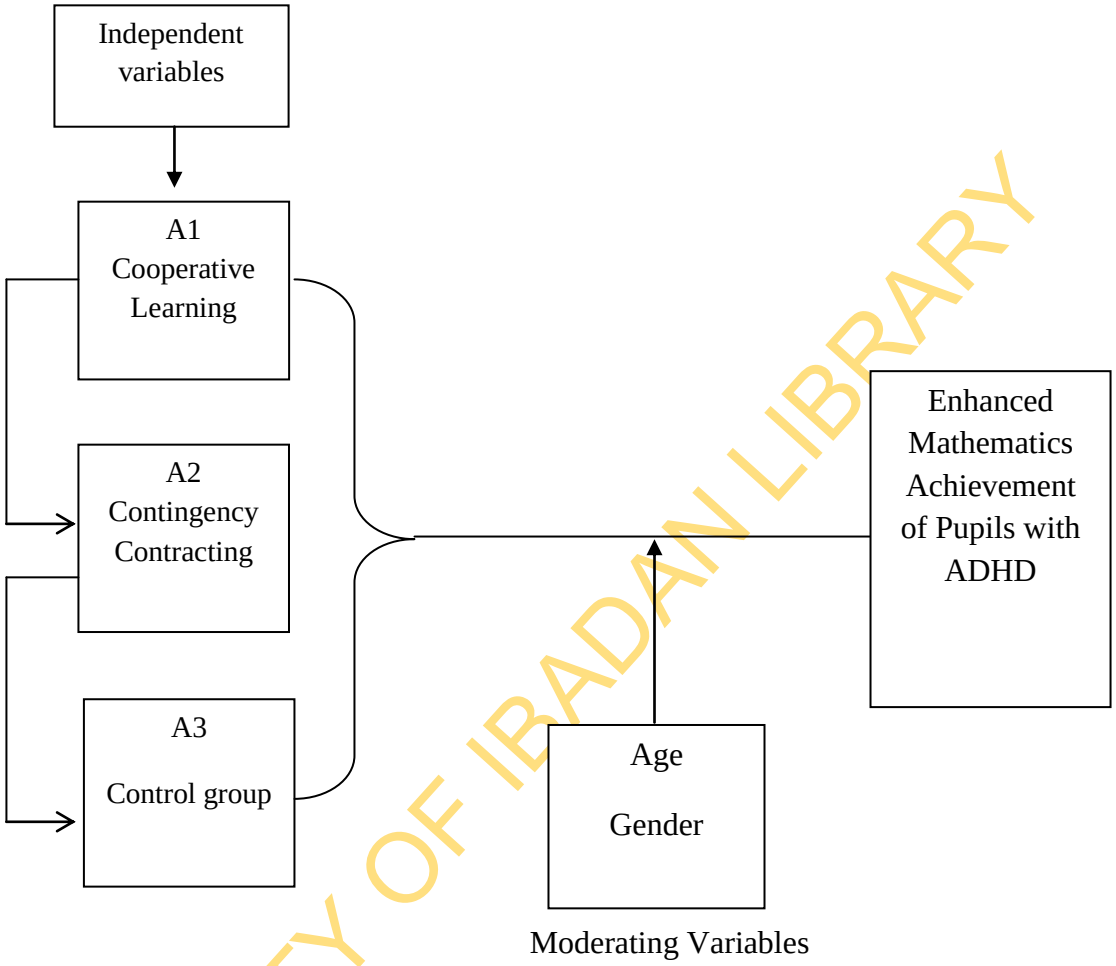
learning and contingency contracting on mathematics achievement of pupils with ADHD. The total interaction of the various variables in the study is represented with the behavioural equation as thus, S – O – R.

S= Stimulus (independent variables)

O= Organism (moderating variables, factors inherent in the organism)

R= Response (dependent variables. Modified behaviour).

Figure 1: CONCEPTUAL MODEL FOR THE STUDY



CHAPTER THREE

3.0 METHODOLOGY

This chapter dealt with the various methods adopted in arriving at an effective research decision. It includes the research design, participants involved in the study, instruments administered, the procedure adopted in selecting the participants of the study and the statistical analysis of data.

3.1 Research Design

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 been recognized for its ability to establish causes and effects of relationships due to intervention. It is also able to show the potential for controlling all threats to validity so that a cause and effect relationship could be established. The treatment groups were 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 in table 3.1. The three groups were obtained by random assignment of equal number of participants into the groups (Table 3.1).

TABLE 3.1

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

Treatment	GENDER				
	Male		Female		
	Older Pupils 9-10yrs	Younger Pupils 7-8yrs	Older Pupils 9-10yrs	Younger Pupils 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

3.2 Summary of Design:

Pretest, Posttest, Control group Experimental design

A1: O_1 x O_4 = Co-operative Learning Strategy experimental group one Pretest, Posttest

A2: O_2 x O_5= Contingency Contracting Technique experimental group two Pretest, Posttest

A3: O_3 - O_6= Control Group Pretest, Posttest

3.3 Population

The population consists of all primary three ADHD school pupils experiencing difficulty in Mathematics achievement in Warri, Delta State, Nigeria.

Table 3.2: Demographic information for the 90 participants in the study

Table 3.2 above shows that the participants vary with regard to their demographic information. A total of 37 participants representing (41.1%) were 7-8 years while 53 (58.9%) of the participants were 9-10 years of age. With regard to gender, 45 (50%) of the participants were

male, while 45 (50%) of the participants were female.

Demographic information		Number	Percentage (%)	Cumulative (%)
Age				
	Younger Pupils 7-8yrs	**37**	**41.1**	**41.1**
	Older Pupils 9-10yrs	**53**	**58.9**	**100**
Gender				
	Male	**45**	**50**	**50**
	Female	**45**	**50**	**100**

3.4 Sample and Sampling Technique

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, 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 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. From among the fifty four primary schools in Warri South Local Government Area, at the first stage of the multi-stage sampling, forty primary schools were selected through the hat picking method, at the second stage, thirty were selected, at the third stage, twenty were selected, at the fourth stage, ten were selected and at the fifth stage, one of the primary schools was selected through the hat picking method. Then from among the thirty primary schools in Warri South-West Local Government Area, at the first stage of the multi-stage sampling, twenty-five primary schools were selected through the hat picking method, at the second stage, twenty were selected, at the third stage, ten were selected and at the fourth stage, one of the primary schools was selected also through the hat picking method. Furthermore from among the thirty-seven primary schools in Warri North Local Government Area, at the first stage of the multi-stage sampling, thirty primary schools were selected through the hat picking method, at the second stage, twenty-five were selected, at the third stage, twenty were selected, at the fourth stage, ten were selected and at the fifth stage, one of the primary schools was selected through the same hat picking method.

Thereafter, it was the stage to screen for participants who are ADHD primary three school pupils experiencing difficulty in mathematics. Participants from the three schools used for the study were attained through screening at various stages of the multi-stage sampling procedure. At this stage, teachers from the three selected primary schools having been briefed of the screening technique were given the Vanderbilt ADHD Diagnostic Teacher Rating Scale to screen for pupils with ADHD (using the behavioural section). At this point two hundred and sixty one (261) pupils with ADHD were selected. Furthermore, from observation and experience of teaching these pupils with ADHD for more than one

term, their teachers were asked to pick out all ADHD pupils experiencing difficulty in mathematics especially those who scored below the 40% pass mark. In doing this, one hundred and ninety five (195) primary three ADHD pupils who expressed poor mathematics achievement were picked.

Thereafter, using the performance section of the same instrument, teachers graded ADHD pupils with mathematics difficulty as follows:

Grades	Above Average	Average	Problematic
Scores	39% to 30%	29% to 20%	19% to 0%

Again, since the researcher intended using ninety (90) participants with thirty (30) from each school for effective management due to the peculiarity of the participants, the teachers were asked to first screen out those who are above average in mathematics. At that stage, one hundred and fifteen (115) primary three ADHD pupils who expressed poor mathematics achievement that are average and problematic were selected. The next stage was to screen out those with average performance in mathematics and ninety (90) primary three ADHD pupils who expressed poor mathematics achievement that are problematic were selected. Through the multi-stage sampling technique, ninety participants were selected for the study. The three groups comprising thirty (30) participants each were then randomly assigned to treatment and control groups in the three randomly selected public primary schools in the three local government areas in Warri.

3.5 Rationale for Choosing Primary Three Pupils

- Primary three pupils are believed to be between 7-10 years old. This age form 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 struggle 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 expressed poor mathematics achievement adjust to required academic task.

3.6 Criteria for Selection

Participants were primary three school pupils from the three randomly selected schools in Warri, Delta State. Participants were selected using Vanderbilt ADHD Diagnostic Teacher Rating Scale based on their rating by their teachers. Those that scored high above the mean in ADHD rating and below the mean for learning difficulty in mathematics (see appendix) were selected for the study. Also:

- Participants should be willing to participate.
- Participants should be able to communicate fairly well in English language.
- Ability to provide informed parental consent.
- Participants must be a pupil in the sampled schools.

3.7 Instruments

The following instruments were used for the study:

The Vanderbilt ADHD Diagnostic Teacher Rating Scale by (Wolraich, Hannah, Pinock, Baumgaertel & Brown, 1998).

The Woodcock III Mathematics Fluency Achievement Tests Scale by (Woodcock, McGrew & Nancy 2007).

3.8 Description of Instruments

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. In addition, 7 criteria for oppositional defiant disorder (ODD) and 5 criteria for conduct disorder (CD) are included, along with 5 criteria from the Pediatric Behaviour Scale (Lindgren & Koeppl, 1987) that screen for anxiety and depression. 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; 4x3; 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.

3.9 Procedure

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.

3.10 Summary of the treatment package (See Appendix)

3.10.1 Experimental Group One: Cooperative Learning Strategy

The eight sessions covered the following:

Session One: General orientation and administration of instrument to obtain pre-test scores. Introductory talk (Motivational talk)

Session Two: Working in groups

Session Three: Addition

Session four: Subtraction

Session five: Multiplication

Session Six: Division

Session Seven: Good study habits

Session Eight: Revision of all activities in the previous session and administration of instrument for post treatment measures.

3.10.2 Experimental Group 11: Contingency Contracting Technique

Session One: General orientation and administration of instrument to obtain pre-test scores. Introductory talk (Motivational talk)

Session Two: Ability to work as individuals

Session Three: Addition

Session four: Subtraction

Session five: Multiplication

Session Six: Division

Session Seven: Good study habits

Session Eight: Revision of all activities in the previous session and administration of instrument for post treatment measures.

3.10.3 Control of Extraneous Variables

In controlling extraneous variables that possibly could affect the results of the study, null hypotheses were tested to guide against experimental biases. Thus, equal numbers of participants were randomly assigned to experimental and control groups. Expectedly, the administration of test and treatment took care of extraneous variables. Therefore, the Rosenthal effect was controlled by keeping the control group busy with their usual daily school routine during the experimental sessions. Also, the method of data analysis employed, Analysis of Covariance (ANCOVA) was used to control extraneous variables beyond the reach of the design and other procedure of research.

3.11 Method of Data analysis

The following statistical designs were used in this study: Test of mean difference (t-test) and ANCOVA (Analysis of Covariance). The t-test was used to determine if there is significant difference or not in the Mathematics score levels of (male & female; older & younger) pupils exposed to treatment and those not exposed to treatment while the 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.

CHAPTER FOUR

4.0 RESULTS

This chapter presents the results from the seven hypotheses stated and tested in the study. For each of the seven hypotheses tested, the statistical tests of significance selected and applied to the data are described and a statement confirming the acceptance or rejection of the hypotheses is made. This is followed by interpretation.

4.1 Hypothesis One

There is no significant main effect of treatment on the Mathematics achievement scores of pupils with ADHD.

To test this hypothesis, 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 as presented in tables 4.1, 4.2, 4.3 and 4.4

Table 4.1: 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			

*Significant at 0.01 (2tailed) ** Significant at 0.05 (2tailed)

The result in table 4.1 showed 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 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 was rejected. In order to find out the magnitude of groups mean scores, Table 4.2 is presented.

Table 4.2: 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	-18.52		6.35	
Older	61	8.81		-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 MCA as observed in Table 4.2 showed the performance of all the groups in mathematics achievement. The Control group had the lowest adjusted posttest mean score

($\bar{x}$ = 37.0) followed by Contingency contracting group with the adjusted mean score (= 94.7) while the Co-operative learning strategy group had the highest adjusted posttest mean score (= 96.6). 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 (i.e. non-treatment group). These values were obtained by adding the grand mean ($\bar{x}$ = 76.11) with the respective adjusted deviation. The table also indicated 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. In order to determine the actual source of the observed significant main effect in ANCOVA, a Duncan post hoc analysis was carried out on the posttest mean scores of the three (cooperative learning strategy, contingency contracting and control groups). The summary of the Duncan test is presented below in Table 4.3

Table 4.3: Duncan Post-Hoc Multiple range comparison of the posttest mean scores of treatment on Mathematics achievement of pupils with ADHD.

Measure	Treatment Groups CLS COC Control Mean
Mathematics Achievement	Cooperative Learning Strategy 96.61
	Contingency Contracting 94.7
	Control 37.0

Table 4.3 revealed that the main effect of ADHD on mathematics achievement of pupils with ADHD is higher on the control group compared to the treatment groups.

4.2 Hypothesis Two

There is no significant main effect of age on the mathematics achievement scores of pupils with ADHD. Table 4.1 showed 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 ($F_{(1,88)} = 4.65$, $P < .05$). 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 was rejected. The Duncan pos-hoc table 4.4 showed that the mean score of younger pupils with ADHD is ($\bar{x}$ = 82.46) while that of the older pupils with ADHD is ($\bar{x}$ = 73.09). 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.

Therefore, the direction of increasing main effect of age on mathematics achievement scores of younger and older pupils with ADHD is older < younger pupils with ADHD. In order to determine the actual source of the observed significant main effect in ANCOVA, a Duncan post hoc analysis was carried out on the post mean scores of the groups (younger and older). The summary of the Duncan test is presented in Table 4.4.

Table 4.4: Duncan Post-Hoc Multiple range comparison of the pre-posttest mean scores of Mathematics achievement of pupils with ADHD between older and younger pupils.

Measure	**Age (Younger Pupils and Older Pupils) Mean**
Age	**Younger Pupils 82.46** **Older Pupils 73.09**

Table 4.4 revealed the main effect of age on the mathematics achievement scores of pupils with ADHD between younger and older pupils.

4.3 Hypothesis Three

There is no significant main effect of gender on the mathematics achievement scores of pupils with ADHD. Table 4.1 showed that there was no significant main effect of gender in the pretest/post-test mathematics achievement scores of pupils with ADHD between male and female respondents ($F_{(1,88)}$ = 1.185, P > .05). Therefore the null hypothesis was accepted. The MCA table 4.2 showed that the mean score for male is ($\bar{x}$ = 76.20) while that of female is ($\bar{x}$ = 76.04). 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.

4.4 Hypothesis Four

There is no significant interaction effect of treatment and age on the mathematics achievement scores of pupils with ADHD. The result in table 4.1 showed that there was no significant interaction effect of treatment and age in the pre-posttest 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.

4.5 Hypothesis Five

There is no significant interaction effect of treatment and gender on the mathematics achievement scores of pupils with ADHD. Table 4.1 showed that in the 2-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.

4.6 Hypothesis Six

There is no significant interaction effect of age and gender on the mathematics achievement scores of pupils with ADHD. Table 4.1 showed that in the 1-way analysis, age is significant while gender is not. However, in the 2-way analysis the interaction

showed 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.

4.7 Hypothesis Seven

There is no significant interaction effect of treatment, age and gender on the mathematics achievement scores of pupils with ADHD. Table 4.1 showed 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 ($F_{(1, 88)}$ = 0.670, P > .05). 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 is accepted.

4.8 Summary of Findings

The purpose of this study was to determine the effects of co-operative learning strategy and contingency contracting technique on mathematics achievement of pupils with Attention Deficit Hyperactivity Disorder in Warri, Nigeria**.** The results of the findings are therefore summarized as follows:

1. There is significant main effect of treatment in the posttest mathematics achievement scores of pupils with ADHD in the experimental and control groups. This means that the treatment is effective in improving the mathematical competency skills of pupils with ADHD.

2. There is significant main effect of age in the pre-posttest mathematics achievement scores of pupils with ADHD between younger and older pupils with ADHD. This implies that the differential value of age influenced the mathematics achievement scores of participants.
3. There is no significant main effect of gender in the pre-posttest mathematics achievement scores of pupils with ADHD between male and female participants. This implies that gender did not influence the level of learning difficulty in mathematics achievement of the participants.
4. There is no significant interaction effect of treatment and age in the pre-posttest mathematics achievement scores of pupils with ADHD in the experimental and control groups. This implies that the level of age of the participants has no significant effect on treatment gain.
5. There is no significant interaction effect of treatment and gender on the pre-posttest mathematics achievement scores of pupils with ADHD in the experimental and control groups. This implies that the gender identity of the participants has no significant effect on treatment gain.
6. There is no significant interactive effect in the interaction between age and gender in the pre-posttest mathematics achievement scores of pupils with ADHD in the experimental and control groups. This implies that age and gender identity of the participants has no significant effect on treatment gain.
7. There is no significant interactive effect in the interactions between treatment, age and gender in the pre-posttest mathematics achievement scores of pupil with ADHD in the experimental and control groups. This suggests that the interaction did not influence the treatment gain.

CHAPTER FIVE

5.0 DISCUSSION OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter comprises of the discussion of the findings in the study based on the seven hypotheses stated in the study; conclusion, implications of the findings, recommendations as well as suggestions for further research.

5.1 Discussion of Findings

5.1.1 Hypothesis One

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-posttest mathematics achievement scores of pupils with ADHD in the experimental and control groups. Therefore, the hypothesis was rejected. This implies that the two therapeutic programmes proved 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 showed that the treatment gain was effective. However, the low scores attain by participants in the control group as observed in the posttest mean score could be explained in line to the fact that they were not exposed to any treatment package.

The findings proved 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. The results of the findings also revealed that pupils with

ADHD who are experiencing learning difficulty in mathematics in the cooperative learning strategy group performed better than their counterparts in the contingency contracting technique group. This can be explained in terms of the effectiveness of each of the training programme in managing the mathematics challenges of pupils with ADHD experiencing learning difficulty in mathematics. This could be attributed to the manner of the utilization of diverse techniques such as homework, revision, discussion and question used in the delivery of each of the training programme. Based on their uniqueness, these training programmes are expected to produce varying degree of effectiveness in enhancing the effective management of mathematical skill deficiencies of pupils with ADHD experiencing learning difficulties in mathematics.

This finding is consistent with the work of Jenkins and O'Connor (2003) who found 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.

Also, the findings is an indication that the intervention programme has effectively develop in pupils with ADHD experiencing learning difficulty in mathematics resourceful potential that would be useful to them in managing their academic challenges. This findings 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. Furthermore, the

reason why there is significant main effect of treatment in the posttest mathematics achievement scores of pupils with ADHD experiencing learning difficulty in mathematics in the experimental and control groups could be aligned to the fact that after the exposure to appropriate training intervention programme germane to the needs of pupils with ADHD experiencing learning difficulty in mathematics, they were able to rediscover themselves, identify the cause of their academic deficiencies and resolve for a change that would ensure academic success. Based on this self-rediscovery, they were quick to appreciate, appraise and utilized effectively the skills they were taught and exposed to in the training programme. In view of this development it could be adjudged that they were able to thus, adjust positively to overcome their academic challenges.

This further confirmed the findings of Johnson and Johnson (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 teaching 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.

5.1.2 Hypothesis Two

There is no significant main effect of age on the mathematics achievement scores of pupils with ADHD. The results showed 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. Therefore the null hypothesis was rejected. This implies that age had significant effect in the mathematics achievement scores difference between older

and younger pupils with ADHD among participants for the intervention programme. Table 4.2 revealed 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 influenced 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, appraised their strength and weakness 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 was suggested that arithmetic facts like those generated by division or subtraction involve manipulation of quantities, i.e., core system of numbers.

5.1.3 Hypothesis Three

There is no significant main effect of gender on the mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement. The result showed 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. Therefore, the hypothesis was accepted. This implies that the issue of gender identity did 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 students within the general education classroom. Furthermore, based on the fact that they manifest same behavioural traits, there is every tendency that they could express similar sense of helplessness, confusion and dismay towards the learning of appropriate mathematical skills that could make them excel academically. Thus, 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 a pupils dropping out of school (Wilkinson, 2005). They exhibit a wide range of inappropriate behaviours including disruption, disobedience, destruction, and aggression (Cullinan & Sabornie, 2004).

5.1.4 Hypotheses Four

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 posttest 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. Thus, their level of confidence and disposition of innate ability could not

influence the posttest mathematics achievement scores of pupils with ADHD expressing deficiencies in mathematics achievement in the experimental and control groups. Possibly because they could have personally assumed that the posttest instrument stands for a grading examination and in view of this they expressed anxiety and could not properly organise themselves or their thought appropriately.

This gives credence to Lerner, (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 (Lerner, 2004). 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.

5.1.5 Hypotheses Five

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 posttest 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. Also, research by Hanich, Jordan, Kaplan and Dick (2001); Jordan, Hanich and Kaplan (2003), claimed that children with mathematical difficulties appear to lack an internal number line and are less skilled at estimating magnitude. McCronea (2002) illustrates this with reference to his nine year old daughter who will always count out the answer to mathematics problems on her fingers before responding. Thus, this also implies that being a boy or girl, pupils with ADHD expressing deficiencies in mathematics achievement react to teaching and learning situation similarly in an anxiety prone manner.

5.1.6 Hypothesis Six

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 posttest 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 feeling 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 & Hanich 2003).

5.1.7 Hypothesis Seven

There is no significant interaction effect of treatment, 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 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 did not influence the treatment. Therefore the null hypothesis is accepted. However, the likely reason why treatment, age and gender did 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 measure 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. Therefore, the result could further imply that Attention Deficit Hyperactivity Disorder in pupils expressing learning difficulty in mathematics could be observed in the form of the effect of restlessness, inattentiveness and impulsiveness on their academic achievement. 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 situation in classroom.

5.1.8 Conclusion

This study determined the effects of cooperative learning strategy and contingency contracting technique on mathematics achievement of pupils with attention deficit hyperactivity disorder in Warri, Nigeria. The training programmes were carried out, data that were generated for the study were analyzed and the discussion revealed the following:

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.

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.

5.2 Implications of the Study

This study has several implications which includes among others the fact that the study have proved that cooperative learning strategy and contingency contracting technique are effective intervention mechanism in managing and improving the mathematics competency skills of pupils with ADHD expressing deficiencies in mathematics achievement in school.

Also, the study has expose pupils with ADHD expressing deficiencies in mathematics achievement in school to intervention programmes that has helped developed their social, academic and mathematics competence skills which would help them tackle mathematics task 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.

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.

5.3 Limitations of the Study

The study only focused on the effects of cooperative learning strategy and contingency contracting technique on mathematics achievement of pupils with attention deficit hyperactivity disorder in Warri, Nigeria.

The study only concentrated on primary three pupils manifesting learning difficulty in mathematics due to the possible inter-play of some personal, psycho-socio and environmental influencing factors which are symptoms of ADHD affecting their academic performance.

Again only three local government areas, three schools and a population of ninety (90) pupils with ADHD expressing deficiencies in mathematics achievement were used for the study. This could reduce the extent to which the result can be generalised.

5.4 Recommendations

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:

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 device 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 failure but should be encouraged and re-enforced positively to overcome their frustrating academic experiences and function optimally in school and attain good academic performance.

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 (time-table), 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 endevour to appropriately use contingency contracting technique to reinforce the desire to learn in pupils with ADHD expressing deficiencies in mathematics achievement.

5.5 Suggestions for Further Studies

This study has given insight for further research work in the area of managing mathematics achievement of pupils with ADHD experiencing difficulty in learning mathematics.

However, an important study as this should cover a wider scope than what the researcher covered in this study. Also, the sample size should be increased and other relevant instruments should be made use of.

Therefore, it is suggested that a replica of this study be carried out after a few years to confirm the results obtained in this study. The study should also be extended to examine both junior and senior secondary school pupils with ADHD expressing deficiencies in mathematics achievement so that their challenges could be identify on time and proper academic foundation built for them.

5.6 Contributions to Knowledge

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

- The 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 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.
- 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 realistic.

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APPENDIX "A"

UNIVERSITY OF IBADAN

FACULTY OF EDUCATION

DEPARTMENT OF SPECIAL EDUCATION

Dear Respondents,

This questionnaire is designed basically for a research purpose. It seeks to know how you would react to these statements. All, information provided would be treated confidentially. Please, be honest in your Responses.

SECTION A

Demographic Information

1 Age

2 Gender (Male) (Female)

3 Father's educational qualification…… (PRIMARY SCH) (SECONDARY SCH) (OND) (NCE) (Bsc) (Masters)

(OTHERS)……

4 Mothers educational qualification…….. (PRIMARY SCH) (SECONDARY SCH) (OND) (NCE) (Bsc) (Masters)

(OTHERS)……

5 Father's occupation……

6 Mother's occupation……

MODIFIED VERSION OF WOODCOCK--JOHNSON III MATHEMATICS FLUENCY ACHIEVEMENT TESTS SCALE BY RICHARD W. WOODCOCK, KEVIN S. MCGREW AND NANCY MATHER (2007)

2 2 4 **x 3**	**2 6 3** **x 2**	**3 3 4** **x 4**	**2 0 3** **x 5**
2 + 4 + 6=	**10 + 0 + 2=**	**11 + 1 + 0=**	
12 ⁄ 2=	**14 ⁄ 0=**	**8 ⁄ 8=**	**6 ⁄ 1=**

Vanderbilt ADHD Diagnostic Teacher Rating Scale

Name: _____ Grade: _____

Date of Birth: _____ Teacher: _____ School: _____

Each rating should be considered in the context of what is appropriate for the age of the children you are rating.

	Frequency Code: 0 = Never; 1 = Occasionally; 2 = Often; 3 = Very Often			
1. Fails to give attention to details or makes careless mistakes in schoolwork	0	1	2	3
2. Has difficulty sustaining attention to tasks or activities	0	1	2	3
3. Does not seem to listen when spoken to directly	0	1	2	3
4. Does not follow through on instruction and fails to finish schoolwork (not due to oppositional behavior or failure to understand)	0	1	2	3
5. Has difficulty organizing tasks and activities	0	1	2	3
6. Avoids, dislikes, or is reluctant to engage in tasks that require sustaining mental effort	0	1	2	3
7. Loses things necessary for tasks or activities (school assignments, pencils, or books)	0	1	2	3
8. Is easily distracted by extraneous stimuli	0	1	2	3
9. Is forgetful in daily activities	0	1	2	3
10. Fidgets with hands or feet or squirms in seat	0	1	2	3
11. Leaves seat in classroom or in other situations in which remaining seated is expected	0	1	2	3
12. Runs about or climbs excessively in situations in which remaining seated is expected	0	1	2	3
13. Has difficulty playing or engaging in leisure activities quietly	0	1	2	3
14. Is "on the go" or often acts as if "driven by a motor"	0	1	2	3
15. Talks excessively	0	1	2	3
16. Blurts out answers before questions have been completed	0	1	2	3
17. Has difficulty waiting in line	0	1	2	3
18. Interrupts or intrudes on others (e.g., butts into conversations or games)	0	1	2	3
19. Loses temper	0	1	2	3

(continued on next page)

Vanderbilt ADHD Diagnostic Teacher Rating Scale (continued)

	Frequency Code: 0 = Never; 1 = Occasionally; 2 = Often; 3 = Very Often			
20. Actively defies or refuses to comply with adults' requests or rules	0	1	2	3
21. Is angry or resentful	0	1	2	3
22. Is spiteful and vindictive	0	1	2	3
23. Bullies, threatens, or intimidates others	0	1	2	3
24. Initiates physical fights	0	1	2	3
25. Lies to obtain goods for favors or to avoid obligations (i.e., "cons" others)	0	1	2	3
26. Is physically cruel to people	0	1	2	3
27. Has stolen items of nontrivial value	0	1	2	3
28. Deliberately destroys others' property	0	1	2	3
29. Is fearful, anxious, or worried	0	1	2	3
30. Is self-conscious or easily embarrassed	0	1	2	3
31. Is afraid to try new things for fear of making mistakes	0	1	2	3
32. Feels worthless or inferior	0	1	2	3
33. Blames self for problems, feels guilty	0	1	2	3
34. Feels lonely, unwanted, or unloved; complains that "no one loves him/her"	0	1	2	3
35. Is sad, unhappy, or depressed	0	1	2	3

PERFORMANCE

	Problematic		Average	Above Average	
Academic Performance					
1. Reading	1	2	3	4	5
2. Mathematics	1	2	3	4	5
3. Written expression	1	2	3	4	5
Classroom Behavioral Performance					
1. Relationships with peers	1	2	3	4	5
2. Following directions/rules	1	2	3	4	5
3. Disrupting class	1	2	3	4	5
4. Assignment completion	1	2	3	4	5
5. Organizational skills	1	2	3	4	5

Treatment Package

Experimental Group One: Co-operative Learning

Session One: General orientation and administration of instrument to obtain pre-test scores.

During the first session, participants were warmly received and introduced to each other in a friendly manner that enhance the establishment of rapport needed to engineer the successful take off of the intervention programme.

Introduction (Motivational talk)

The researcher taking into consideration the tender nature of the children for the study and the different challenges that might have contributed to their experience of mathematics under achievement informed them that they are not only good children that are intelligent but they are also good learners that are interested about learning. They should see themselves as intelligent children that can come first in their classes if they could just put in more effort to concentrate in doing their class work, supporting each other and paying attention to their teacher in class. The researcher did this based on the premise that these children need or expect their teachers to encourage, challenge, and arouse them. And considering the fact that more often than not, these children are faced with many distracters which serve as hindrance to their success in school. Thus, effective learning in the classroom definitely depends on the teacher's ability to preserve the keenness that brought these children to school in the first place.

Though there is no specific recipe for motivating children with learning challenges as many factors affect a given Childs' motivation to study. These include interest in the topic/subject, knowledge of its usefulness, a general wish to achieve something and of course self-confidence and self-esteem. Of course, not all children are motivated by the same principles, needs, wishes, or wants. Some children are motivated by the endorsement

of others, some by the support of peers, teachers, parents or significant others. This could be made possible through co-operative learning strategy.

Co-operative learning is an approach to group work that minimizes the occurrence of those unpleasant situations and maximizes the learning and satisfaction that result from working on a high-performance team. According to the Johnson & Johnson model, co-operative learning is instruction that involves students working in teams to accomplish a common goal, under conditions that include the following elements (Johnson, Johnson & Smith 1998): Positive interdependence: Team members are obliged to rely on one another to achieve the goal. If any team members fail to do their part, everyone suffers consequences. Individual accountability: All students in a group are held accountable for doing their share of the work and for mastery of all of the material to be learned. Face-to-face promotive interaction: Although some of the group work may be parcelled out and done individually, some must be done interactively, with group members providing one another with feedback, challenging reasoning and conclusions, and perhaps most importantly, teaching and encouraging one another. Appropriate use of collaborative skills: Pupils are encouraged and helped to develop and practice trust-building, leadership, decision-making, communication, and conflict management skills. Group processing: Team members set group goals, periodically assess what they are doing well as a team, and identify changes they will make to function more effectively in the future (Johnson, Johnson & Smith 1998).

Class Activities

The children were informed of the duration of the programme which is eight weeks and that each session would be held for half an hour. An agreed day, time and venue for the conduct of the treatment sessions were agreed upon. Then the pre-test instruments were administered to the children with appropriate instructions to enable the researcher project objectively into their academic challenges. Then the researcher collected the questionnaires after the children have filled them. After the collection of the filled questionnaires, the benefits of the experimental sessions to the children were further explained to them.

Home Assignment

The children were asked to write numbers (1-1000) on a half-page writing exercise book. This could help enhance straightness and legibility in their writing.

1	2	3	4	5	6	7	8	9	10	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	28
30	31	32	33	34	35	36	37	38	39	40	41	42	43

Closing Remark

- The children were commended for their time, effort and desire for a change.
- The children were encouraged to do their homework.
- The children were reminded of the time and venue of the next session.

Session Two: Working in group

Learning should not be a solitary pursuit. Group support helps create a network of academic friends that can offer support, advice and a fresh approach to learning among children experiencing mathematics under achievement challenges. It is of note that some children seem naturally enthusiastic about learning, but many need-or expect-their teachers or peers to inspire, challenge, and stimulate them: "Effective learning in the classroom depends on the teacher's ability ... to maintain the interest that brought children to school in the first place. It is clear that whatever level of motivation children bring to the classroom will be transformed, for better or worse, by what happens in that classroom. And group co-operative learning is germane in this direction.

Learning in co-operative group among ADHD pupils experiencing mathematics challenges could serve as a magical formula for motivating them to improve on their academic performance. However, many factors affect a given Child's motivation to work and to learn as observed in their level of interest in the subject matter, perception of its usefulness, general desire to achieve, self-confidence and self-esteem, as well as patience and persistence could make them success academically. And, of course, not all children are motivated by the same values, needs, desires, or wants. However, it is clear that some children are often easily inspired, empowered and motivated by the approval and support of others to overcoming their academic challenges. Thus, to put ADHD pupils in group of six for easy monitoring under the co-operative learning strategy could help enhance their self-motivation as their peer support in the group could help as thus:

- Give frequent, early, positive feedback that supports the child's believe that they can do well.
- Ensure opportunities for the child's success by assigning tasks that are neither too easy nor too difficult.

- Help the child find personal meaning and value in the material.
- Create an atmosphere that is open and positive.
- Help the child feel that he is a valued member of a learning community.

Thus, the children were warmly welcomed individually by their names. This made them have confidence in the researcher and a sense of belongingness. The researcher then reviewed the assignment (homework) with the children by guiding them to making necessary corrections.

Class Activities

The researcher would give each group Mathematics task for them all to solve as a team.

GRP 1	12 x 23= 34x13= 45+12= 32+16=
GRP 2	14+67= 45+02= 15x12= 00x24=
GRP 3	11+42= 47-23= 67-34= 18+89=
GRP 4	324 x 6= 6136x2= 14+04+87=
GRP 5	349x2= 615x1= 49+13+02=

The researcher further explained to the pupils that the implication of their working in a group is to support each other.

Home Assignment

As take home assignment, the children still as groups were asked to write out multiplication table 2 x 2 to 12.

Closing remarks:

- The children were commended for their sense of commitment.
- The children were reminded of the time and venue of the next session.

Session Three: Addition

Addition is the process of adding figures together to get a total. Addition helps develop arithmetic ability and enhance Mathematics competence in ADHD children with poor mathematics achievement problem. The process of addition principally starts with adding two figures (numbers) to several for example, 2+2=4 12+6=18 etc. Acquiring this skill helps children in develop Mathematics competence.

The children were welcomed positively and warmly. The researcher then reviewed the home work with the children and effect possible corrections.

Class Activities

The children were made to come out in their groups to add sums on the chalkboard. For example

247 + 115=
562+ 667=

On this note, the researcher furthered explain to the understanding of the children that if they develop the habit of finding solution to Mathematics sums, it could help them to develop their Mathematics competence fast.

Home Assignment

The children were asked to write 4x1 to 4x12.

Closing remarks:

- The children were commended for their contribution.
- The children were reminded of the time and venue of the next session.

Session four: Subtraction

Subtraction is a Mathematical skill highly valued in modern society, even in a time of computers and technology. This enables an individual to appreciate the reduction in value of things or objects. It is an important method of communicating reduction in value. The researcher welcomed the children expressing unconditional positive regard. Review the homework with them and then introduce the topic for the session. The researcher in reviewing the home work with the children made necessary correction.

Class Activities

The children were asked to work out some subtraction sums in group. The essence is for the less able pupils to be motivated and inspired by the more able pupils to adjust and overcome their Mathematical challenging situations. They were given ten minutes. Based on their responses the children were being made to role-play behavioural attitude that could enhance good Mathematical skills such as concentration, being focused, attentive and sitting properly etc.

Home Assignment

The children were asked to write figures 1-2000 from home. Their ability to do this could help improve their mathematics counting competence.

Closing remarks:

- The children were thanked and their commitment reinforced through praises.
- The children were reminded of the time and venue of the next session.

Session five: Multiplication

Although children appear to possess some degree of appreciation of cardinality well before they learn the verbal counting system, these abilities are nonetheless quite limited early on and blossom as children learn to multiply figures in the mode of counting in proportion and sequence. For example, infants recognize cardinal distinctions only between sets ranging from 1 to about 3 or perhaps 4. However, cardinal numerical abilities appear to improve rather dramatically as children undergo the lengthy process of mastering the written and verbal counting system. Thus it appears that learning the written and verbal counting sequence is a prerequisite for displaying explicit knowledge of some numerical concepts. This implies that children in the early school years move from simply learning and using numbers to knowing that numbers have a valuable purpose. They begin to learn that numbers can be manipulated to understand and solve problems.

Class Activities

The children were asked to multiply numbers as thus:

223 x 2	254 x 5	456 x26	406 x46

Home Assignment

The children were asked to read their times table figure from 2 to 6 times.

Closing remarks:

- The children's efforts were commended.
- The children were reminded to do their homework.
- The children were reminded of the time and venue of the next session.

Session Six: Division

This is the ability to reduce number or figures to a reasonable size for a purpose. For example:

4⁄2=2

16⁄4= 4

9⁄3=3

Class Activities

The children under the observation of the researcher were made to practice more in group in the class room.

Home Assignment

Homework: the children were asked to do some work on subtraction as in this example

4 7 -2 3	6 5 -4 8	6 0 8 -4 7 9	7 8 9 -5 4 1

Closing remarks:

- The children were thanked and their efforts commended.
- The children were reminded of the time and venue of the next session.

Session Seven: Good study habit

The children were welcomed pleasantly to the day's session by the researcher. The researcher then reviewed the home assignment, with the children and equally asked them to practice on the chalkboard. This served as correction for them all. Furthermore, the researcher explained to the children that they can overcome their academic challenges if they try to study always at home after close of school by doing their homework well and also revising what their teacher must have taught them at school. Creating good study habits is essential for success in school. Successful pupils have good study habits. They apply these habits to all of their class work. A habit is simply a behaviour pattern that is repeated until it becomes automatic. The most important thing is to encourage and motivate these children to develop interest in schooling and their school work.

Class Activities

The researcher exposed the children to subtraction exercise for example:

4-2= 6-1=	6 9 -3 7	4 3 -2 7
7-4=		

They were each called upon from the various groups to work on the chalkboard so that others could see and be motivated to learn too.

Home Assignment

The children were asked to read and write out times tables from 2 times to 12 times on their exercise books. For example:

2x1=2	3x1=3
2x2=4	3x2=6
2x3=6	3x3=9
2x4=8	3x4=12

Closing remarks:

- The children's efforts were commended.
- The children were reminded of the time and venue of the next session.

Session eight: Revision of all activities in the previous session and administration of instrument for post treatment measures.

The researcher reflected on the effect of the therapeutic sessions. The researcher accomplished this through the asking of questions based on the experience the children were exposed to so as to determine whether the children have been able to comprehend and make use of the skills they have been taught. To make it more effective some of the previous sessions were rehearsed to facilitate lasting retention by the children. Post-test instruments were administered on the participants. Attained responses served as post-treatment scores. A three week follow-up programme was observed to monitor participants' progress.

Closing Remarks

The researcher thanked and appreciated the children for their committed co-operation and beckon on them to ensure proper utilization of the skills and techniques acquired from the programme.

Experimental Group 11: Contingency contracting

Session One: General orientation and administration of instrument to obtain pre-test scores.

The researcher welcomed the children warmly and ensures group members get familiarized with each other in a friendly manner to enhance the establishment of rapport needed to engineer the successful takeoff of the intervention programme. The researcher further explained the benefit of the intervention programme to the children.

Introduction: (Motivational talk)

Contingency contracting is a widespread intervention used within a variety of disciplines to address problematic behaviour. Contingency contracting has been shown to increase desired behaviour as well as to decrease undesired problem behaviour. Contingency contracting has been proven to work with a multitude of behaviours as well as different populations such as individuals with intellectual disabilities, typically functioning children and adults. Contingency contracting takes the form of a mutual contract made between the pupils and their teacher that could help to motivate them towards desirable behaviour change. By definition a contract is an agreement-verbal or written-between two parties. The term contingency means there is a relationship between what one does and the consequences. Contingency contracting has been found to be an effective way of increasing academic and social behaviour of children with Attention Deficit Hyperactivity

Disorders. Clearly Parents are taught a variety of skills such as contingent use of praise, positive attention, token reinforcement, specific instructions, planned ignoring form in or problem behaviour, exclusionary and non-exclusionary time out (also known as quiet time), and contingency contracts. Parents learn to apply these skills at home and in the community with target children in the family in order to teach children pro-social skills. Contingency contracting involves a written agreement, to which the child must agree; the target behaviours must be stated; the goals must be manageable for the child to achieve; there should be a sense of belonging and involvement by the child; the child is then rewarded according to the terms of the contract. When this is done effectively, it motivates and develops self-confidence in the child to further improve on the expected desired behaviour.

Self-confidence is an individual's characteristic (a self-construct) which enables a person to have a positive or realistic view of themselves or situations that they are in. It refers to a person's expectation of his or her ability to achieve a goal in a given situation and is a very influential factor in ensuring that a person's potential is realized. In other words, a person with a high self-confidence has a realistic view of themselves and their capability which makes them persistence in their endeavours. Therefore, self-confidence is extremely important in almost every aspect of people's lives. Self-confidence is being certain and trusting about oneself in regard to addressing certain tasks or all tasks. Self-confidence is critical to effective performance in the school and is the source of assertiveness, which is fully representing oneself to others. One's self-confidence can be cultivated by using a variety of approaches, e.g., ongoing success when performing tasks, ongoing support and affirmation from teachers and significant others in the school, etc. Therefore, self-confidence is the core of self-development; the building block on which goal setting, motivation, problem solving, communication, willpower and other aspects of

self help stem from. No confidence puts us at a major disadvantage in life. The principle of contingency contracting is predisposed to developing self-confidence in people, children inclusive.

Class Activities

The researcher informed the children that the programme would run for eight weeks and that each session would be held for half an hour. Then the rules and expectation guiding the functional operation of the group were made known to the children. Then term(s) of the contract were determined and agreed upon by the children and the researcher. The researcher and the children then jointly discuss and agree on the time and days of meeting. Also, their maximum co-operation was solicited for after which the pre-test instruments were administered on them to enable the researcher project objectively into their academic character. After they have responded to the instruments, the researcher then collected them back.

Home Assignment

The children were asked to write number figure 1-1000 on a sheet of paper which was used to infer into their mathematics counting ability.

1	2	3	4	5	6	7	8	9	10	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	28
30	31	32	33	34	35	36	37	38	39	40	41	42	43

Closing remarks:

- The children were commended for their time, effort and desire to learn.
- The children were reminded of the time and venue of the next session

Session Two: Ability to work as individuals

Mathematics difficulty could mean the partial lack or error in the counting ability. Teachers know only too well the anguish of watching one or two children in their class struggle with learning mathematics. Indeed, despite teachers' best efforts, some children are left behind their peers, and never achieve success in learning mathematics at school. Success in learning mathematics is important for many aspects of everyday life and for access to further learning and employment opportunities once children leave school. Counting, Place Value, Addition and Subtraction and Multiplication and Division are important indices in children's ability to learn and do well in mathematics. For some young children, the progression to counting collections and counting forwards and backwards from various starting points is prolonged or difficult. These relates to two of the counting levels described by the Unbreakable List Level, and the Breakable Chain Level. These levels describe the development that occurs in order for children to count collections, or count forwards and backwards by ones. The Unbreakable List Level involves the number word sequence being broken into individual words, which are used in counting by relating each number word to a perceptual item to be counted for example:

D D D D D D D D D D D D D D D D D D D D =20	O O O O O O O O O O O O O O O O O O O O O =21

Children begin to relate the last word counted to the cardinal meaning for the group of counted items (the cardinality principle). They can then use count-all strategies to add two numbers. The Breakable Chain Level involves children being able to start saying the number word sequence from any number word. They eventually use this ability in

combination with the cardinal-to-count transition in word meaning to add by a more efficient counting-on method, in which counting to determine the final sum begins with the first addend number word, instead of beginning the count from one. For example, when adding four more items to a known collection of eight items, a child switches from the 'manyness' meaning of eight, to thinking of eight as word in the number sequence, and counts on four more words to reach the total of twelve. For example 8 --- ---- ---- ----- this implies counting from 8, 9, 10, 11 to 12. These two levels, as they relate to counting collections and counting forwards and backwards, are not only important for children's counting development, but also are important for the development of numerical problem-solving strategies.

However, mathematics in early childhood education is more than counting to ten, but knowing how to count and learning that each numeral stands for a specific number of objects are basic mathematics concepts. Children gradually come to understand the constancy of numbers such as the threeness of three. Children were encouraged to think about numbers when the need arises naturally from any activity or experience which has some meaning for them.

The researcher welcomed the children friendly, accord them respect and treat them with positive regards. The researcher reviewed the homework with the children. Then the children were made to practice counting applying techniques as rote counting which could help the children learn to say the numerals in correct order and rational counting to attach a number of units to each numeral. For example it is a common practice in our schools for teachers to express association of numbers as thus: 1 and 2 (12) (twelve) 1 and 6 (16) (sixteen) 2 and 0 (20) (twenty) etc.

Class Activities

The researcher made the children to practice some work on individual basis in their exercise books. As part of the researcher's contingency contracting agreement with the children, any of them that complete the task correctly was given a pencil.

1	12 x 23= 34x13= 45+12= 32+16=
2	14+67= 45+02= 15x12= 00x24=

Home Assignment

As take home assignment, the children were asked to write out multiplication table 2x2 to 12.

Closing remarks:

- The children were commended for their desire to learn.
- The children were encouraged to do their homework.
- The children were reminded of the time and venue of the next session

Session Three: Addition

Addition is the process of adding figures together to get a total. Addition helps develop arithmetic ability and enhance Mathematics competence in ADHD children with learning disabilities in Mathematics. The process of addition principally starts with adding two figures (numbers) to several for example, 2+2=4 12+6=18 etc. Acquiring this skill helps children to develop Mathematics competence.

The children were welcomed positively and warmly. The researcher then reviewed the home work with the children and effect possible corrections.

Class Activities

The children were made to come out one after the other to add sums on the chalkboard. For example

247 + 115=
562+ 667=

On this note, the researcher furthered explain to the understanding of the children that if they develop the habit of finding solution to Mathematics sums, it could help them to develop their Mathematics competence fast.

Home Assignment

The children were asked to write 4 x 1 to 4 x 12.

Closing remarks:

- The children were commended for their contribution.
- The children were reminded of the time and venue of the next session.

Session four: Subtraction

Subtraction is a Mathematical skill highly valued in modern society, even in a time of computers and technology. This enables an individual to appreciate the reduction in value of things or objects. It is an important method of communicating reduction in value. The researcher welcomed the children expressing unconditional positive regard. Review the homework with them and then introduce the topic for the session. The researcher in reviewing the home work with the children made necessary correction.

Class Activities

The children were asked to work out some subtraction sums. The essence is to motivate and inspire pupils to develop confidence as to be able to adjust and overcome their Mathematical challenging situations. They were given ten minutes. Based on their responses the children were being made to role-play behavioural attitude that could enhance good Mathematical skills such as concentration, being focused, attentive and sitting properly etc.

Home Assignment

The children were asked to write figures 1-2000 from home. Their ability to do this could help improve their mathematics counting competence.

Closing remarks:

- The children were thanked and their commitment reinforced through praises.
- The children were reminded of the time and venue of the next session.

Session five: Multiplication

Although children appear to possess some degree of appreciation of cardinality well before they learn the verbal counting system, these abilities are nonetheless quite limited early on and blossom as children learn to multiply figures in the mode of counting in proportion and sequence. For example, infants recognize cardinal distinctions only between sets ranging from 1 to about 3 or perhaps 4. However, cardinal numerical abilities appear to improve rather dramatically as children undergo the lengthy process of mastering the written and verbal counting system. Thus it appears that learning the written and verbal counting sequence is a prerequisite for displaying explicit knowledge of some numerical concepts. This implies that children in the early school years move from simply

learning and using numbers to knowing that numbers have a valuable purpose. They begin to learn that numbers can be manipulated to understand and solve problems.

Class Activities

The children were asked to multiply numbers as thus:

223 x 2	254 x 5	456 x26	406 x46

Home Assignment

The children were asked to read their times table figure from 2 to 6 times.

Closing remarks:

- The children's efforts were commended.
- The children were reminded to do their homework.
- The children were reminded of the time and venue of the next session.

Session Six: Division

This is the ability to reduce number or figures to a reasonable size for a purpose. For example:

4⁄2 = 2

16⁄4 = 4

9⁄ 3= 3

Class Activities

The children under the observation of the researcher were made to practice more in the class room and those that got their work right were reinforced with a token (pencil).

Home Assignment

Homework: the children were asked to do some work on subtraction as in this example

47 -23	65 -48	608 -479	789 -541

Closing remarks:

- The children were thanked and their efforts commended.
- The children were reminded of the time and venue of the next session.

Session Seven: Good study habit

The children were welcomed pleasantly to the day's session by the researcher. The researcher then reviewed the home assignment, with the children and equally asked them to practice on the chalkboard. This served as correction for them all. Furthermore, the researcher explained to the children that they can overcome their academic challenges if they try to study always at home after close of school by doing their homework well and also revising what their teacher must have taught them at school. Creating good study habits is essential for success in school. Successful pupils have good study habits. They apply these habits to all of their class work. A habit is simply a behaviour pattern that is

repeated until it becomes automatic. The most important thing is to encourage and motivate these children to develop interest in schooling and their school work.

Class Activities

The researcher exposed the children to subtraction exercise for example:

4-2= 6-1=	6 9 -3 7	4 3 -2 7
7-4=		

They were each called upon from the various groups to work on the chalkboard so that others could see and be motivated to learn too.

Home Assignment

The children were asked to read and write out times tables from 2 times to 12 times on their exercise books. For example:

2x1=2	3x1=3
2x2=4	3x2=6
2x3=6	3x3=9
2x4=8	3x4=12

Closing remarks:

- The children's efforts were commended.
- The children were reminded of the time and venue of the next session.

Session eight: Revision of all activities in the previous session and administration of instrument for post treatment measures.

The researcher reflected on the effect of the therapeutic sessions. The researcher accomplished this through the asking of questions based on the experience the children were exposed to so as to determine whether the children have been able to comprehend and make use of the skills they have been taught. To make it more effective some of the previous sessions were rehearsed to facilitate lasting retention by the children. Post-test instruments were administered on the participants. Attained responses served as post-treatment scores. A three week follow-up programme was observed to monitor participants' progress.

Closing Remarks

The researcher thanked and appreciated the children for their committed cooperation and beckon on them to ensure proper utilization of the skills and techniques acquired from the programme.

Control Group

Session 1

Topic: Administration of pre-test instrument

The researcher welcomed the children and creates an endearing psychologically stimulating environment for discussion. The children were adequately informed of what the exercise is all about and their sincere co-operation was sought for after which the pre-test instruments were administered to the participants. The researcher collected the instruments back and thanked the children for their time and effort. Equally they were informed of time and venue of the next meeting.

Session 2

Topic: Administration of post-test instrument on the 8th week.

The researcher welcomed the children, administered the post-test instrument as to attain the post-test scores and then thanked the children for their time and effort.