THE EFFECTS OF A SMALL GROUP INTERVENTION PROGRAMME ON GROSS MOTOR AND SOCIAL SKILLS OF SELECTED AUTISTIC CHILDREN

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DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own original work, that I am the authorship owner thereof (unless to the extent explicitly otherwise stated) and that I have not previously submitted it in its entirety or in part for obtaining any qualification.

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SUMMARY

Movement plays an important role in a child's life. Typically developing children develop motor skills as they explore their environment. Motor skills are important, as they contribute to a child's overall wellbeing, assisting in play, academics, social development and physical activity. These motor milestones developed during childhood, and can be used as indicators of atypical development. Children with a complex neurodevelopmental disorder such as Autism Spectrum Disorder (ASD) show signs of atypical development, as they are recognised as being clumsy and uncoordinated in their gross and fine motor skills. Besides motor delays, parents and caregivers report that children with ASD also exhibit delays in social communication, interaction and repetitive behaviours and interests, during the early stages of development.

Research has suggested a possible relationship between motor and social development. For example, motor skills are important as they provide children with the necessary tools to successfully engage in physical activity, socially communicate and interact with peers. Children with ASD, however, participate in physical activity less often than typically developing children which hinders the mastery of motor skills, in turn causing social isolation and further social dysfunction. Interventions are, therefore, necessary to provide children with ASD opportunities to learn the essential gross motor skills, which could help them improve their self-esteem, leading to increased participation in physical activity and further social skill development.

The purpose of the current study was to implement a 12-week specialised group intervention programme to improve the gross motor and social skills of selected children diagnosed with ASD between the ages of 8 and 13 years. In the Cape Town area, a governmental school for autistic learners was recruited to take part in this study, as the school divided learners into classes based on their level of autistic function. Therefore, the sample in the current study was a sample of convenience. Two classes (N=7) at the school participated; 1 formed the experimental group (n=4) and the other the control group (n=3). The children completed the Movement Assessment Battery for Children-2 (MABC-2), and parents or legal guardians and teachers of participants filled out the Social Responsiveness Scale-2 (SRS-2) questionnaire. This was done to provide an overview of the children's fine and gross motor and social skill proficiency. A 12-week group intervention programme was designed and then implemented by the researcher, with the focus on improving overall gross motor proficiency and social skills of participants in the experimental group.

The effect of the 12-week group intervention programme was determined by analysing and comparing the pre- to post-test results. The group-time interaction effect was examined to

determine if the experimental group presented a different effect from the control group over time. The main findings of the current study showed that the 12-week group intervention programme made significant improvements in the total motor proficiency as well as in the balance subtest of the MABC-2 in children with ASD. Significance was also found within the experimental group in the aiming and catching subtest of the MABC-2. Unfortunately, the current study found no significant improvements after the 12-week group intervention programme in total social skill competency, as well as in all subtests of the SRS-2 in children with ASD.

The current study shows the effectiveness of a 12-week group intervention programme on the gross motor skills of children with ASD. The findings also suggest that social skills should be taught alongside motor skills, in order to achieve positive outcomes in both aspects of development. Further investigation is needed with regards to the relationship between motor and social skills, as well as additional examinations as to whether improved motor skills, results in improved social development.

KEYWORDS: Motor skills; Social skills; Autism Spectrum Disorder; MABC-2.

OPSOMMING

Beweging speel 'n belangrike rol in 'n kind se ontwikkeling tot 'n volwaardige volwassene. Kinders sal tipiese motoriese vaardighede aanleer soos hulle hul omgewing verken. Motoriese vaardighede is belangrik omdat dit tot akademiese, sosiale, fisieke, speel aktiwiteite en 'n kind se algehele welstand bydra. Die mylpale wat gedurende die kinderjare bereik word, is 'n belangrike aanwyser van atipiese ontwikkeling. Kinders met 'n komplekse neuro-ontwikkelingsversteuring soos Outisme Spektrum Versteuring (OSV), toon tipies tekens van atipiese ontwikkeling omdat hulle onbeholpe en ongekoördineerd in hul groot en fynmotoriese vaardighede voorkom. Afgesien van motoriese agterstande rapporteer ouers en versorgers dat kinders met OSV gedurende die vroeë kinderjare ook agterstande in sosiale kommunikasie, interaksie en herhalende gedrag en belangstellings toon.

Navorsing toon 'n moontlike verhouding tussen motoriese en sosiale ontwikkeling. Motoriese vaardighede is belangrik omdat dit kinders met die nodige vaardighede toerus om fisieke aktiwiteite suksesvol uit te voer, om te kan speel, om te sosialiseer en om met hulle eweknieë te kan verkeer. Kinders met OSV sal tipies aan minder fisieke aktiwiteite as kinders wat normaal op dié gebiede ontwikkel, deelneem en sodoende sal dit tot verdere sosiale isolasie en sosiale disfunksie aanleiding gee. Intervensies is daarom, belangrik om kinders met OSV geleenthede te bied om die noodsaaklike grootmotoriese vaardighede, wat hul selfagting kan verhoog, hul deelname aan fisieke aktiwiteite kan verhoog en verbetering in sosiale ontwikkeling kan aanmoedig, aan te leer.

Die doel van die huidige studie was om met 'n gespesialiseerde groep intervensieprogram die grootmotoriese en sosiale vaardighede van 'n geselekteerde groep kinders, tussen die ouderdom van 8 en 13 jaar, wat met OSV, gediagnoseer is te implementeer. Een regeringskool vir Outistiese leerders in die Kaapstad omgewing is geselekteer om aan hierdie studie deel te neem. Omdat die skool die leerders in klasse op grond van hul graad vlak van Outisme verdeel, is daar van 'n gerieflikheidsteekproef gebruik gemaak. Leerder in twee klasse (N=7) van die skool het deelgeneem; 1 groep was die eksperimentele groep (n=4) en die ander groep (n=3) die kontrolegroep. Die kinders het die *Movement Assesment Battery for Children-2 (MABC-2)*, voltooi en die ouers of die wettige voogde en onderwysers het die *Social Responsiveness Scale-2 (SRS=2)*, vraelys voltooi. Die is gedoen om 'n oorsig van die kinders se fyn- en grootmotoriese- sowel as sosiale vaardighede te bekom. Die 12-week groep intervensieprogram wat op die algehele verbetering van groot motoriese- en sosiale vaardighede van al die deelnemers in die eksperimentele groep gefokus het, is deur die navorser ontwikkel en geïmplementeer.

Die effek van die 12-week groep intervensieprogram is deur die ontleding en vergelyking van die voor- en na-toets data bepaal. Die groep-tyd interaksie-effek is ondersoek om te bepaal of die eksperimentele groep 'n ander effek as die kontrole groep met verloop van tyd toon het. Die belangrikste bevindinge van die huidige studie het getoon dat die 12-week groep intervensieprogram aansienlike verbeteringe in die totale motoriese vaardigheid, sowel as in die balans sub-toets van die *MABC-2*, by kinders met OSV te weeg gebring het. Betekenis is ook binne die eksperimentele groep by die mik- en vang sub-toets van die *MABC-2* gevind. Ongelukkig is geen betekenisvolle verbeteringe in sosiale vaardighede, sowel as in al die sub-toetse van die *SRS-2* by die kinders met OSV gevind nie.

Die huidige studie het die doeltreffendheid van 'n 12-week groep intervensieprogram op die grootmotoriese vaardighede van kinders met OSV getoon. Die bevindinge dui ook daarop dat sosiale vaardighede saam met motoriese vaardighede aangeleer moet word, om sodoende positiewe uitkomste in beide aspekte van ontwikkeling te kan bereik. Verdere navorsing met betrekking tot die verhouding tussen motoriese en sosiale vaardighede is nodig, sowel as verdere navorsing om te bepaal of verbeterde motoriese vaardighede 'n verbetering in sosiale ontwikkeling sal toon.

SLEUTELWOORDE: Motoriese vaardighede; Sosiale vaardighede; Outisme Spektrum Versteuring; MABC-2

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LIST OF ABBREVIATIONS

AB:	Age Band
ADHD:	Attention Deficit Hyperactivity Disorder
ADI-R:	Autism Diagnostic Interview-Revised
ADOS:	Autism Diagnosis Observation Schedule
APA:	American Psychiatric Association
ASD:	Autism Spectrum Disorder
BOTMP-2:	Bruininks-Oseretsky Test of Motor Proficiency-2
CDC:	Centres for Disease Control and Prevention
CDD:	Childhood Disintegrative Disorder
CSS:	Calibrated Severity Score
DCD:	Developmental Coordination Disorder
DSM-5:	Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition
DSM-IV-TR:	Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision
FASD:	Foetal Alcohol Spectrum Disorder
FMS:	Fundamental Motor Skills
GMDQ:	Gross Motor Development Quotient
LSD:	Least Significant Difference
MABC:	Movement Assessment Battery for Children
MABC-2:	Movement Assessment Battery for Children-Second Edition
MRI:	Magnetic Resonance Imaging
MSEL:	Mullen Scales of Early Learning
PANESS:	Physical and Neurological Exam for Subtle Signs
PDD:	Pervasive Developmental Disorders
PDD-NOS:	Pervasive Developmental Disorder Not Otherwise Specified
PRT:	Pivotal Response Treatment

SEM:	Standard Error of Measure
SRS-2:	Social Responsiveness Scale-Second Edition
SSIS:	Social Skills Improvement System
TGMD:	Test of Gross Motor Development
TOMI:	Test of Motor Impairment
WCED:	Western Cape Education Department

APPENDIXES

CHAPTER ONE

PROBLEM STATEMENT

INTRODUCTION

Autism was originally thought to be a rare condition, but recently it has become recognised as a childhood neurodevelopmental disorder (Johnson & Myers, 2007:1184; Amaral *et al*., 2011:30; Pinborough-Zimmerman *et al*., 2012:521). This disorder appears to be a lifelong condition, which manifests from early childhood into adulthood (Nyden *et al*., 2010:1659; Amaral *et al*., 2011:30; Matson *et al*., 2011:2304), and has been characterised by deficits or delays in development (Berkeley *et al*., 2001:405).

Previously, autism was understood to be the foundation of a spectrum of disorders (APA, 2000:69; Amaral *et al*., 2011:30). The Spectrum included Autistic Disorder, Rett's Disorder, Childhood Disintegrative Disorder (CDD), Asperger's Disorder and Pervasive Developmental Disorder not Otherwise Specified (PDD-NOS) (APA, 2000:69; Amaral *et al*., 2011:30). According to the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision (DSM-IV-TR), the spectrum is classified under the term Pervasive Developmental Disorders (PDD). The term PDD refers to the group of disorders known as Autism Spectrum Disorders (ASD), which exhibit common impairments in behaviour (APA, 2000:69; Volkmar & Wiesner, 2009:1; Amaral *et al*., 2011:30). Pervasive developmental disorders are diagnosed in the early stages of development, normally when the child begins to engage in structured social play (Teitelbaum *et al.*, 1998:13986; APA, 2000:69). The Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (DSM-5) was recently published in 2013, which reported that autism is now grouped under one name; Autism Spectrum Disorder (ASD) (APA, 2013:50). Children, who previously received a diagnosis of autistic disorder, Asperger's disorder, or PDD-NOS, are now identified as having ASD with associated symptoms (APA, 2013:51). Children along the spectrum are diagnosed from information gathered from family members, health professionals and educational facilitators who have observed children's uncharacteristic behaviours (Filipek *et al.*, 2000:471).

Autism Spectrum Disorder is usually grouped into high or low functioning according to the child's level of perceived function (Leary & Hill, 1996:48), for example, a child's intellectual level may help to establish this distinction (Fein *et al*., 1999:3; Papadopoulos *et al*., 2011:628). Children who

are considered to be low functioning exhibit more severe symptoms of autism, whereas children considered to be of high functioning have less severe symptoms (Stevens *et al*., 2000:346-347).

Ordinarily, social skills allow children to adjust to and deal with their immediate environment (Matson & Wilkins, 2007:30), but children with ASD often find it challenging to interact socially and communicate with others. This is seen through their atypical actions and behaviours, for example, difficulties with language skills, initiating and ending social engagement, sustaining social relationships with others, reciprocating and responding to social gestures, sharing of enjoyment and maintaining eye contact (Bellini *et al*., 2007:153; White *et al*., 2007:1858; Banda *et al*., 2010:619; Dotson *et al*., 2010:199; Cappadocia & Weiss, 2011:70; MacDonald *et al*., 2013:272). Typically developing children find it difficult to understand and interpret the atypical play behaviours/gestures of children with ASD and this leads to isolation and social exclusion (Wolfberg & Schuler, 1993:468; Thomas & Smith, 2004:195).

Clumsiness has been identified as a typical symptom of ASD (Ghaziuddin *et al.*, 1992:651). When a child is clumsy, he or she is uncoordinated and awkward, which may affect their motor skill development through their inability to complete motor tasks correctly and efficiently. Leary and Hill (1996:44) acknowledge that motor impairments can have an effect on a person's ability to successfully communicate, share and interact with others. Agreeing with Leary and Hill (1996:44), Qiu *et al*. (2010:546) found that motor problems may be connected to social communicative symptoms in children with ASD, through the disruptions in the basal ganglia in the brain. This confirms what MacDonald *et al*. (2013:279) found; that there is a relationship between motor skills and social interaction deficits.

Gross and fine motor impairments have been found by numerous researchers to be present in children with ASD (Ming *et al.*, 2007:569; Ozonoff *et al*., 2008:644; Provost *et al.*, 2007:327; Green *et al*., 2009:314; Kopp *et al*., 2010:350; Whyatt & Craig, 2012:1805). Such children show early developmental delays in motor skill ability. Manual dexterity and ball skills have been considered by some researchers to be the two main areas of motor impairment in children with ASD (Whyatt & Craig, 2012:1808). These motor skills play an important role in the acquisition of additional skills in further social and academic domains (Baranek, 2002:398; Whyatt & Craig, 2012:1808).

Leary and Hill (1996:40) use the term "movement disturbance" when referring to uncharacteristic movements. This term describes the difficulty that children may have when initiating, implementing and completing movements. Young children with ASD find it hard to perform motor tasks as

complexity increases. Green *et al*. (2009:315) found that the more complex the motor task, the more influence it may have on the motor performance of these types of children.

Group-based interventions help teach children with ASD necessary social skills required when communicating and interacting with peers in a group setting (De Rosier *et al.*, 2011:1034). MacDonald *et al.* (2013:273) stated that when children with ASD are taught functional motor skills in a group setting, this process creates an environment, which might facilitate the practice of social skills during physical activity leading to later social success. Children communicating and interacting successfully in a group setting, may lead to successful motor skill development, because children will want to participate in physical activity more frequently, which will facilitate gross motor development.

Previous studies researching social interaction and communication have focused on children with ASD aged eight to 12 years (Qui *et al*., 2010:540; De Rosier *et al*., 2011:1035; Ward *et al*., 2013:3). The current study intends to add to this research. The DSM-IV-TR demonstrates that with age, social relationships may improve, however, at this young age children with ASDs have no desire or interest in forming relationships with peers (APA, 2000:70). Previous research has indicated that a group intervention programme has the ability to positively enhance social skills with peers, especially for children who have high functioning ASD (Banda *et al.*, 2010:624; De Rosier *et al*., 2011:1041). Therefore, the current study intended to use a group intervention programme to create an opportunity for the participants to interact socially with each other and potentially enhance their social skills. Furthermore, although previous research has shown that group intervention programmes cause minimal effects on gross motor skills in comparison to individual interventions (Sowa & Meulenbroek, 2012:56), the current study used a group intervention programme aimed at improving participants' gross motor skills. Sowa and Meulenbroek, (2012:56) have found that physical exercise has a positive effect on the motor performance and social functioning of children diagnosed with ASD. Therefore the current study aimed to contribute to that research.

MOTIVATION AND POTENTIAL BENEFITS

The study of social interaction and gross motor skills of selected autistic children is important, because these children (8 to 13 years) already have developmental delays; therefore, intervention is useful at this stage of development. Previous research using group interventions has been insufficient. Most researchers focused on forms of individual therapy or intervention. A group intervention programme has the potential to enhance participants' social readiness and interaction

because all the participants have to work together and communicate. This improvement in social readiness and interaction with others, may lead to friendships forming as well as contributing to academic performance. The more children interact socially, the more they participate in physical activity, which could lead to improvements in gross motor performance. The development of gross motor skills is essential for children with autism, because this enables them to develop fine motor movements, which are an important component of success in their schooling years.

Participation in physical activity is important for all children; because it contributes to their overall wellbeing. Having participants' in this study engage in moderate exercise, may contribute to their overall physical, social, emotional and intellectual wellbeing. Engaging in physical activity allows children to develop social skills such as taking turns, cooperating and learning about winning and losing.

PROBLEM STATEMENT

The purpose of the current study is to design a specialised group intervention programme, with potential to improve gross motor and social skills of selected children diagnosed with Autism Spectrum Disorder (ASD) between the ages of eight to13 years.

METHODOLOGY

Study design

The researcher used a quasi-experimental design to conduct this study, because the sample already formed existing groups in the form of two classes in a selected school. The school provided the researcher with two available classes which formed the experimental and control group, and did not allow any change to occur between the two groups.

Sample

In the Cape Town area, a governmental school for autistic learners was recruited to take part in this study, as the school divided learners into classes based on their level of function. Thus, the sample in the current study was a sample of convenience. Learners in two classes (N=7) at the school participated; 1 formed the experimental group (n=4) and the other the control group (n=3). Children in the experimental group participated in a group intervention programme, while the control group continued with their normal daily routine which included academics and recreational activities. Therefore the control group only received pre- and post-intervention testing. All the children were at a similar level of autistic function according to the occupational therapists at the school.

Children were included in the current study if they were of the right age group, if they were in one of the assigned classes, if they had been diagnosed with the DSM-IV-TR manual according to the occupational therapist at the school, if they had no injury preventing them from participating, if their parents or guardians consented, and finally, if their parents or guardians or teachers had completed the Social Responsiveness Scale-Second Edition (SRS-2) questionnaire.

Children were excluded from the current study if they had any physical injuries stopping them from participating in physical activity, if they choose not to participate in the group intervention programme and if their parents did not provide consent for them to take part in the study.

Testing procedures

Two assessments were used in the current study, one motor assessment and one social skill severity measure. The Movement Assessment Battery for Children-Second Edition (MABC-2) test was administered pre- and post-test to determine the children's fine and gross motor proficiency and to determine if the group intervention programme had an effect on the sub-components (manual dexterity, aiming and catching, and balance) of the MABC-2 at the conclusion of the researcher-designed group intervention programme. The Social Responsiveness Scale-Second Edition (SRS-2) was completed by parents and teachers at pre- and post-test to determine the children's social skill competence and to determine if the group intervention programme had an effect on the sub-components (social awareness, social cognition, social communication, social motivation and restricted interests and repetitive behaviours), of the SRS-2.

The researcher administered the 12-week group intervention programme (Appendix F) to the experimental group twice a week (45 minutes per session) during school hours with the focus on improving overall gross motor proficiency and social skills of participants in the experimental group. While the experimental group participated in the group intervention programme, the control group continued with their usual academics and recreational activities.

Intervention programme

The group intervention programme (Appendix F) was administered to four children diagnosed with high-functioning ASD, twice a week for 12-weeks. Children participated in active games aimed at improving overall gross motor and social skills. Activities were designed to target the underlying factors associated with motor skills such as core strength, motor planning and body coordination. The majority of activities were group-based (2 or more per team), which allowed children to interact and communicate with one another verbally and non-verbally.

Statistical analysis

The data collected was statistically analysed using a mixed model repeated measures ANOVA, with group and time as fixed effects and the participants as random effects. Post hoc testing was also done using Fisher least significant difference (LSD) testing. The group-time interaction effect was examined to determine if the experimental group presented a different effect from the control group overtime. Descriptive statistics and summary results were reported as means and standard deviations. Statistical significance was set at ($p<0.05$).

Ethical aspects

Permission to perform this study was provided by the ethics committee of Stellenbosch University (#HS1015/2013) and the Western Cape Education Department. The principal of the selected school, parents or legal guardians and teachers provided written informed consent before testing began and all the participants volunteered to take part in the current study by signing an assent form. All data collected remained confidential and will be kept for a maximum of 3 years at the Department of Sport Science at Stellenbosch University.

The area where the group intervention took place was cleared of any obstacles and equipment which may have caused injuries. Participants were never left unattended and a teacher or occupational therapist was always present to make sure the children felt comfortable and to assist the researcher with the intervention programme. If any injuries occurred, the school protocol regarding injuries would have been followed immediately.

Limitations to the current study

There were several limitations which affected the current study. The greatest limitation was the number of participants able to take part in the current study. Only 7 participants out of the 14 originally recruited, brought back consent forms and therefore were ethically allowed to take part the current study. This limited number made the sample size too small to make generalisations, even though the population was specialised. The Social Responsiveness Scale-2 (SRS-2) questionnaire was ordered from America, forcing the researcher to wait 6 weeks until it arrived in South Africa. This radically reduced the group intervention period, causing the intervention to be reduced to a 12-week instead of the original 17-week intervention. Term dates of the school and public holidays also resulted in time constraints for the group intervention programme. The limitations of the current study will be discussed in more detail in Chapter 5.

An in-depth discussion of the current study's methodology will be discussed in Chapter 3.

SUMMARY OF CHAPTERS

Chapter 1 provides a brief introduction to the current study and illustrates a summary of the methodology. Chapter 2 provides a detailed discussion of relevant literature. Chapter 3 presents the methodology, followed by a report and discussion of the results in Chapter 4. Finally, Chapter 5 provides conclusions, limitations and recommendations for further research.

CHAPTER TWO

LITERATURE REVIEW

INTRODUCTION

> *"Functional movement is the ability to produce and maintain a balance between mobility and stability along the kinetic chain while performing fundamental patterns with accuracy and efficiency"* (Okada *et al*., 2011:252).

Movement is a crucial component and common theme (Mannino, 2013:40) of life. It is through movement that infants and young children learn the characteristics associated with the physical, cognitive and social domains (Keenan, 2002:2; Cools *et al*., 2009:154). By exploring their environment, the child is able to acquire a set of motor skills which could possibly have an impact on the development of additional skills later in life (Keenan, 2002:76; Inverson, 2009:229,230). These motor skills provide stability and control over one's own body parts and other surrounding objects, while a child explores the environment (Cools *et al*., 2009: 154). Essentially, it is important that children move effectively in space during early childhood, so that a variety of motor skills are learnt before reaching their schooling years in order to function successfully in a classroom, sport or playground setting (Chambers & Sugden, 2002:158; Cools *et al*., 2009: 154; Liu, 2012:323).

Typically developing children develop the motor skills necessary to play, do schoolwork and interact with others. This means that children are able to complete more complex motor tasks later in life (Cheatum & Hammond, 2000:8). This is not however observed in children who have learning or behavioural problems. Children with Autism Spectrum Disorder (ASD) are often, referred to as clumsy, because their body parts do not work well together in a sequence, inhibiting their ability to perform simple and/or complex motor tasks, at the same time hindering social interaction with others (Cheatum & Hammond, 2000:9). Children benefit from motor development as it is an important aspect of learning, that helps children explore the environment, engage in social interaction and physical activity, as well as develop academic skills (Mohammadi, 2011:345).

The following section provides an in-depth discussion of the characteristics associated with ASD.

AUTISM SPECTRUM DISORDER (ASD)

It has been just over 70 years since Leo Kanner, an American psychiatrist published an in-depth research paper about autism in 1943 or as he called it "early infantile syndrome" (Blacher & Christensen, 2011:172; Valmo 2013:3). Kanner, (1943:242) and a colleague examined a number of children who appeared to have common behavioural disturbances. He described a group of children

who exhibited distinct and unusual characteristics remarkably similar to schizophrenia, noting that at some point each child had been diagnosed with schizophrenia. However, Kanner concluded that both disorders had characteristics unique to each condition, indicating a distinction between the two syndromes (Kanner, 1943:248; Valmo, 2013:3)

Following Kanner's publication, Hans Asperger an Austrian psychiatrist released a similar dissertation in 1944, in which he examined four boys between the ages of seven and 11 years old. He used the term "autistic psychopathy" to describe this behavioural disorder and similarly emphasised that the disorder was independent from childhood schizophrenia (Asperger, 1944:67; Valmo, 2013:3). Asperger also highlighted that although autism was extremely distinctive in comparison to other disorders or typically developing children, diagnosed individuals were uniquely distinctive by personality, interests, severity and intelligence (Asperger, 1944:67). Kanner and Asperger's work has been considered to be the original influential works in the field of autism research and still forms part of the initial phase of diagnostic identification and treatment (Valmo, 2013:4).

Autism Spectrum Disorder affects children globally; yet, the prevalence of ASD in South Africa is unknown, as most data collected arises from developed countries (Springer *et al*., 2013:95). The prevalence of ASD has increased overtime in the United States. In 2008, The Centres for Disease Control and Prevention (CDC) specified that one in every 88 children met the criteria for ASD. Recently in 2014, findings have indicated that amongst children aged eight years old, ASD is now prevalent in one of every 68 children (Mandell & Lecavalier, 2014:482); furthermore the gender ratio of males to females is four to one (Reader's Digest, 1986:55; APA, 2013:57). In recent years, knowledge and awareness among parents and professionals about ASD has grown, due to the changes made in the diagnostic criteria, the procedures used in detecting at risk children and the age at which the disorder is now detected (Guillem *et al.*, 2006:899). That knowledge has resulted in growing numbers of young children being diagnosed with ASD (Manning-Courtney *et al.*, 2013:2; Haglund & Kallen, 2011:164).

Previously, individuals were diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition-Text Revision (DSM-IV-TR). In 2013, the American psychiatric association published a new diagnostic manual called the Diagnostic and Statistical Manual of Mental Disorders-fifth edition (DSM-5) (APA, 2013). According to the DSM-5, autism is now grouped under one name; Autism Spectrum Disorder (APA, 2013:50; Gibbs *et al*., 2012:1750).

Autism Spectrum Disorder includes conditions formerly referred to as early infantile autism, childhood autism, Kanner's autism, high-functioning autism, atypical autism, pervasive developmental disorder not-otherwise specified, childhood disintegrative disorder and Asperger's disorder (APA, 2013:53). Rett's disorder is now diagnosed as a separate disorder (APA, 2013:57). Autism Spectrum Disorder also presents very high co-morbidity with other impairments, conditions and factors, which are recorded with the disorder. For example, when clinical diagnosis is made, any accompanying impairment (i.e. intellectual or language impairment) or associated conditions (i.e. genetic or medical condition or environmental factor, neurodevelopmental, mental or behavioural disorders) are specified (APA, 2013:51).

The exact cause of ASD still remains unclear; however, a combination of factors have been considered to be associated with ASD, such as environmental, genetic and physiological factors (Guillem *et al.*, 2006:900; Bilder *et al*., 2009:1293; APA, 2013:56-57; Froehlich-Santino *et al*., 2014:100; Maramara *et al*., 2014:1; Mevel *et al*., 2014:1). New technologies and advanced medical health care have seen some additional risk factors surface in recent years (Guinchat *et al*, 2013:51) identified as prenatal, neonatal and perinatal developmental risk factors. These developmental risk factors are defined and described below in Table 2.1.

Several studies present conflicting results on the prenatal, neonatal and perinatal risk factors associated with ASD, with most results being inconclusive (Juul-Dam *et al*., 2001:1; Matson *et al*., 2011:2306; Mamidala *et al*., 2013:3005). In 2009 a meta-analysis was conducted which investigated prenatal factors associated with autism. It was found that advanced parental age at birth, maternal medication use, gestational bleeding and diabetes (both independent factors), birth order and having a mother born in a foreign country were all associated with elevated risks of autism (Gardener *et al*., 2009:11). More recently, Mrozek-Buzyn *et al*. (2013:425) also found positive associations between advanced parental age and autism. They found that descendants from men above the age of 35 years were more likely to develop autism compared to the offspring of younger men, however no relationship was found between maternal age and autism. Though, in contrast to the above mentioned findings, a twin study revealed that none of these factors (maternal age, paternal age, maternal medication use, bleeding or prematurity) were found to be associated risk factors for ASD (Froehlich-Santino *et al*., 2014:104). Therefore, the exact causes of ASD are still uncertain, but contributing factors do exist.

TABLE 2.1: **PRENATAL, NEONATAL AND PERINATAL DEVELOPMENTAL RISK FACTORS**

DEVELOPMENTAL RISK FACTORS	DEFINITION AND DISCRIPTION
Prenatal	This period is the development before birth. It includes conception and gene processes (Louw & Louw, 2007:47). Certain factors may disturb normal development, affecting a child's psychological and physical development, such as; age of the parents, nutrition of the mother, radiation, diseases of the pregnant woman, use of medication and drugs, and emotional state of the mother (Louw & Louw, 2007:69).
Neonatal	The period between birth and four weeks (Louw & Louw, 2007:81). It includes assessments made after birth such as, the Apgar scale (Louw & Louw, 2007:82).
Perinatal	This is a combination of prenatal and neonatal factors which involve: parental, pregnancy, delivery and new-born characteristics (Larsson *et al*., 2005:917).

Autism Spectrum Disorder is a complex neuro-developmental disorder that is behaviourally defined through the observations from parents, teachers and practitioners (Kuenssberg *et al.*, 2011:2184). Individuals diagnosed with ASD commonly exhibit delays in reciprocal social communication (i.e. verbal and non-verbal) and social interaction, as well as restrictive and repetitive forms of behaviour, interests or activities (Loftin *et al*., 2008:1124; APA, 2013:50,53; MacDonald, 2013:272). Furthermore, the severity of these delays should be noted separately to the diagnosis (APA, 2013:52). These core characteristics are recognized during the first two years of life. As the child develops into adolescence, the majority of symptoms improve, but these symptoms continue to affect and limit every day functioning (APA, 2013:56). Although not a core characteristic of ASD (Landa, 2007:19; Provost *et al.*, 2007:327; Jeste, 2011:1; Liu & Breslin, 2013:1244; Gowen & Hamilton, 2013:323; Travers *et al*, 2013:1569), motor delays are widely reported and it is conceivable that persons with ASD do experience a decline in their motor skill abilities overtime (APA, 2013:55).

The following section will investigate social skill development of children diagnosed with ASD.

SOCIAL SKILLS AND AUTISM SPECTRUM DISORDER

Typically developing infants are born into the world with the motivation and capacity to establish social relationships with their caregivers (Grossman *et al*., 1999:442) however this does not occur in

individuals with ASD (Volkmar, 2011:432). A dominant feature to this neurodevelopmental disability is the constant impairment in social functioning (Laushey & Heflin, 2000:183; Baron-Cohen & Belmonte, 2005:110; Vernazza-Martin *et al*., 2005:91; Loftin *et al*., 2008:1124; Cappadocia & Weiss 2011:70; Flynn & Healy, 2012:432; Kaat & Lecavalier, 2014:16).

Social dysfunctions among persons with ASD are varied and involve language, linguistic conventions and social interaction (White *et al*., 2007:1858). The most frequent symptoms reported by parents during the early stages of development are those in social communication and social development (Grossman *et al*., 1999:441; Chawarska *et al*., 2007:69; Landa *et al*., 2007:853; Volkmar, 2011:429). In children who are considered high functioning, social difficulties with peers are apparent during the early developmental years of preschool. As a child develops, these problems become more distinct as he or she start to engage in more complex peer interactions (Paul, 2003 & Chamberlain *et al*., 2007 cited in De Rosier *et al*., 2011:1033; Hua *et al*., 2011:8).

Understanding the social domain within ASD is a challenging task, due to the variability that exists within the core features of this disorder (Lord, 2011:166; Pelphery *et al*., 2011:631). For example, social impairment may vary from an individual having a lack of interest in interacting with others to problems in managing more complex social interactions which requires an individual understanding other people's goals, intentions and social gestures. Some individuals with ASD also have an absence of basic speech ability, whereas others may have mild language discrepancies. Furthermore, the majority of individuals suffering from ASD will to some degree have an intellectual impairment which may vary from severe to above average intellect (Pelphery *et al*., 2011:631).

The idea that ASD is a syndrome of brain development is extensively recognised (Vissers *et al*., 2012:605) by the effect it has on brain growth and function (Pierce, 2011:163). Researchers have used the term 'the social brain' when describing the social abnormalities which exist in ASD (Pelphrey *et al*., 2011:633; Gotts *et al*., 2012:2). In order to understand why infants, adolescents and adults with ASD experience social dysfunction, one has to look at the abnormalities found in autistic brain development (Figure 2.1).

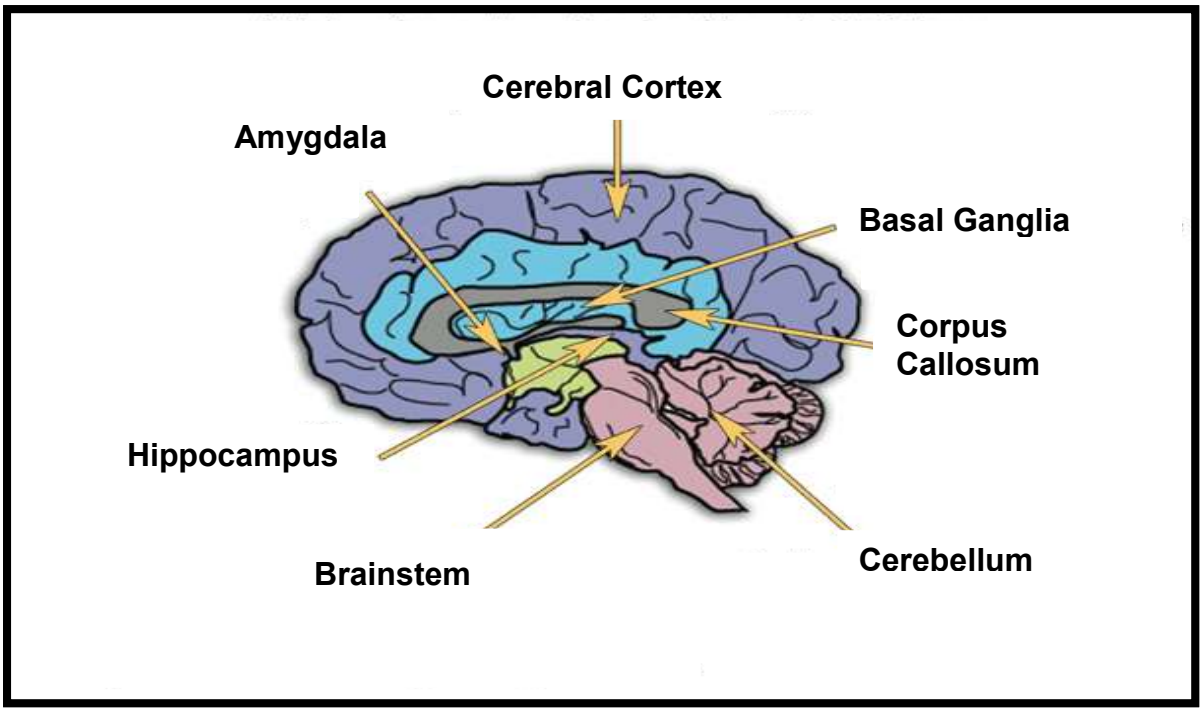

FIGURE 2.1: **PARTS OF THE BRAIN AFFECTED BY AUTISM**

SOURCE: **Adapted from Pediaspeech.com**

Researchers have noted discrepancies within the Cerebral Cortex (Schmitz *et al*., 2006:14) and Cerebellum (Sparks *et al*., 2002:189; Hazlett *et al*., 2005:1371), as well as the Basal Ganglia (Turner *et al*., 2006:7; Qui *et al*., 2010:546), the Corpus Callosum (Stigler *et al*., 2011:155), the Brain Stem, Hippocampus and Amygdala (Sparks *et al*., 2002:190; Neuhaus *et al*., 2010:742), in individuals diagnosed with ASD (Figure 2.1). Each part of the brain is responsible for certain psychological, social and physical functions, which are described in Table 2.2.

The exact areas and structures of the brain that are affected in individuals with ASD have been a continued topic throughout the literature. The most consistent finding from magnetic resonance imaging (MRI) cross-sectional studies in autism has been abnormal brain volume, specifically cerebral cortex enlargement, during early childhood development (Sparks *et al*., 2002:189; Courchesne *et al*., 2003:341; Hazlett *et al*., 2005:1371). However, several studies using brain imagery have detected abnormal brain physiology and functioning in a number of brain areas (McAlonan *et al*., 2005:272; Schmitz *et al*., 2006:12; Stanfield *et al*., 2008:289,296; Gotts *et al*., 2012:4), as well as decreased connectivity between these brain regions (Belmonte *et al*., 2004:9230; Mostofsky *et al*., 2009:2420; Pelphrey *et al*., 2011:632; Vissers *et al*., 2012:623). It has been suggested that these abnormalities found within the neural system may contribute to impaired motor skill acquisition, communication and social development impairments (Mostofsky *et al*.,

2009:2422). For example, recently, Gotts *et al*. (2012:3, 7, 11) compared natural resting brain activity using functional MRI observations on 60 adolescents with and without ASD (12 to 23 years old). The results indicated a decrease in brain connectivity between the social regions of the brain amongst individuals with ASD, with the largest decreases observed in the 'limbic-related' brain regions, which are thought to be associated with emotional aspects of social behaviour, as well as other areas of the brain associated with language/communication and motor-linked aspects.

Although evidence has supported decreased brain connectivity in ASD, there have however, been inconsistent findings throughout the literature on the specific brain regions. Vissers *et al.* (2012:621) suggest that this may be due to the diverse focus of studies conducted, for example; the use of different age groups, cognitive states or processes and specific frequency bands.

TABLE 2.2: **THE FUNCTIONS OF THE BRAIN REGIONS AFFECTED BY ASD**

BRAIN AREA	FUNCTION
The Cerebral Cortex	Most advanced area of the brain, which supports complex actions such as; language, vision and motor skills (Keenan, 2002:78).
The Basal Ganglia	Supports the motor dysfunction in autism and plays an essential role in initiating and facilitating movements (Rinehart *et al*., 2006:819).
The Corpus Callosum	The fibres of the brain connecting the hemispheres of the brain (Keenan, 2002:90).
The Cerebellum	Involved in motor control and locomotion (Bass *et al*., 2009:1266).
The Brainstem	Involved in functions such as; attentiveness, arousal, sensory and autonomic procedures (Martino *et al*., 2011:850).
The Hippocampus	Plays a crucial role in memory and emotion (Otsuka *et al*., 1999:518).
The Amygdala	Responsible for the behavioural reactions to emotional stimuli and learning (Kluver & Bucy, 1938 cited in Sparks *et al*., 2002:191; Mitchell, 2009:247).

The following section will examine the motor development of typically developing children and then more specifically the motor development of children with ASD.

MOTOR DEVELOPMENT

> *"Human development is an extremely complex process emerging from tightly coupled physical, genetic, neural and environmental factors"* (Kuniyoshi & Sangawa, 2006:590).

Human development is a process of change overtime, which begins during early childhood and continues throughout one's lifespan (Gallahue & Donnelly, 2003:36; Haywood & Getchell, 2009:4). Development occurs within several areas, such as biological (i.e. the physical body), social (i.e. relationships) and cognitive (i.e. thought patterns) domains (Keennan, 2002:2). Within each of these developmental domains, patterns of change occur which contribute to the overall growth and wellbeing of an individual (Pienaar, 2009:50).

During the early phases of life, typically developing toddlers begin to progress through organised stages of motor development (e.g. sitting, standing, crawling and walking) and non-motor development (e.g. first word and first phrase) (Deli *et al*., 2006:6; Matson *et al*. 2010:244) frequently referred to as developmental milestones (Cheatum & Hammond, 2000:19; Haywood & Getchell, 2005:75). These stages of development involve sequential changes, caused by the interactions produced both inside the child and between the child and his/her environment. In other words, one stage influences and leads to the next stage (Haywood & Getchell, 2009:4). Motor milestones are often used as indicators of atypical development, as they may provide practitioners with the relevant clues about a child's developmental health (Haywood & Getchell, 2005:78; Gerber *et al*., 2010:267). Children need to progress through a series of developmental phases in order to accomplish motor proficiency later in life (Barnett *et al*., 2009:252).

According to Gallahue and Donnelly (2003:62), children progress through four phases of movement skill development. These phases are termed, the reflexive, rudimentary, fundamental and specialised motor skill phase. It is crucial for all children to move through these phases of motor skill acquisition to prevent future dysfunction in everyday life. The reflexive and rudimentary motor skill phases develop simultaneously and occur within the first two years of life, when information is encrypted and reflexes are inhibited (Gallahue & Donnelly, 2003:62). Reflexes are considered involuntary actions which someone will make in response to a specific stimulus. The primitive reflexes emerge during the first few months of life in a set order. These reflexes are important because they help prepare children for more advanced movement patterns. Once these reflexes have become integrated and have disappeared, skilled voluntary movements and motor skills will replace those reactions (Cheatum & Hammond, 2000:59).

The third phase of motor development is the fundamental motor skill (FMS) phase, which occurs when children learn basic FMS. Fundamental Movement Skills are skills which develop during the first seven years of life, emerging after the ability to walk (Burton & Miller, 1998:58; Gallahue & Donnelly, 2003:62; Staples & Reid 2010:209; Haibach *et al*., 2011:95; Sheikh *et al*., 2011:1723). According to Keenan (2002:77) and Gallahue and Donnelly (2003:52), FMS are a set of elementary movement patterns which involve the use of a combination of two or more body parts. These skills include locomotor movements including walking, running, jumping, hopping, skipping and climbing; object control or manipulative movements such as catching, throwing and kicking, and stability movements which involve static and dynamic balancing skills. These skills serve as building blocks for the development of more advanced, sport-specific skills and establish a foundation for the participation in physical activity, reinforcing an active lifestyle (Van Beurden *et al*., 2002:244; Todd, 2012:32; Jaakkola & Washington, 2013:493). Goodway *et al*., (2003:299,300) states that,

> *"Fundamental motor skills emerge within a dynamic system consisting of a specific task, performed by a learner with given characteristics, in a particular environment. The resulting performance is a product of the interaction within and between the many cooperating subsystems a child possesses."*

In other words, there are a number of subsystems which may impact a child's motor development (Goodway *et al*., 2003:299,300). These include motivation, strength, equipment and prior experiences. These subsystems are considered constraints which may hinder the development of FMS during early childhood among special populations. Children recognized as being at risk of developmental delays fall within this special population, as they present factors that may limit their motor performance.

Fundamental motor skill development has been categorised into a sequence of age-linked phases. These phases are known as the initial, elementary and mature phases of motor skill achievement (Gallahue & Donnelly, 2003:63). For example, during the initial phase of FMS development, typically developing toddlers between the ages of two and three years old, begin attempting basic motor tasks, however are unsuccessful in the execution of the preliminary movement. Movement during this phase may seem uncoordinated and unfinished. Once the child has reached the age of three to five years old, essentially the child's motor performance should have improved as he or she has reached the elementary stage of fundamental movement. The child is able to gain control over his or her movement abilities, however there may still be an absence of rhythm and maturation in the movement itself. Finally, during the mature phase children between the age of six and seven

years are able to achieve fluent, well-coordinated and effective forms of motor patterns (Gallahue & Donnelly, 2003:63).

The last phase a child progresses into is the specialized motor skill phase which normally begins at around seven years, when most children start to develop an interest in sport. This phase involves the development of sport-specific skills which are based on the development of the FMS previously learnt. While these specialised skills begin to develop when a child is young, sport skills development typically continue throughout one's lifetime. This phase of movement can be divided into a further three stages, which include the transitional stage, the application stage and finally the lifelong utilization stage (Gallahue & Donnelly, 2003:64).

The transitional stage usually extends from ages seven to 10 years; when children begin to take an interest in specific sports. However at this stage, children lack any actual skill mastery. It is important for children to have developed mature skills during the fundamental movement phase, avoiding any motor proficiency barrier which may hinder the learning of sport skills. Therefore, continued practice of FMS during physical activity is important, in order for children to develop and refine mature skills and learn basic sport skills (Gallahue & Donnelly, 2003:64-65). During early adolescence, when children are approximately 11 to 13 years old, they move into the application stage of specialized movement skill. Here, typically developing children have mastered adequate skill and knowledge in specific sport games and start to recognise their full potential, by discovering their strengths and weakness both physiologically and psychologically. Furthermore, children begin to practice the more complex skills, methodologies and guidelines which are important in acquiring performance success (Gallahue & Donnelly, 2003:66). Lastly, the lifelong utilization stage is based on previously learnt skills, which continues throughout life, contributing to an individual's overall growth and wellbeing through regular participation in selected activities (Gallahue & Donnelly, 2003:66).

It has been suggested that children need motor skills necessary to participate in physical activity. Regular physical activity is essential for children to attain significant motor milestones and improve their health and fitness levels (Cooper *et al*., 1999:143; Cheatum & Hammond, 2000:45; Janssen & LeBlanc, 2010:11; Kantomaa *et al*., 2011:1; Cohen *et al*., 2014:19), both physically and mentally (Baranek, 2002:414). Thus, there is a positive relationship which exists between FMS competency and physical activity in children and adolescents (Okely *et al*., 2001:1902; Barnett *et al*., 2008:8; Lubans *et al*., 2010:13). Barnett *et al.* (2009:257) agree that there is a positive relationship between

childhood movement success and adolescent physical activity behaviour. More specifically, they determined that children who mastered movement skills, particularly object control skills during their schooling years, would be more likely to participate in physical and recreational activities during adolescents and adulthood, (Hardy *et al*. 2010:508).

Studies have found that adolescents with ASD participate in physical exercise less often than typical children (Pan & Frey, 2006:603; Pan, 2008:1296). This may be because; young children with learning or behavioural problems often hear more negative than positive feedback regarding their motor abilities from parents and teachers. This then leads to self-esteem problems which lead to children avoiding physical exercise (Cheatum & Hammond, 2000:47), consequently influencing the learning and mastering of skills (Haywood & Getchell, 2005:209).

Physical activity has shown to be beneficial to the general population. Therefore providing children with ASD opportunities to take part in physical exercise programmes which utilize motor skills could also prove to be beneficial in many ways and should be investigated further (Todd & Reid, 2006:168; Sowa & Meulenbroek, 2012:47). For example, physical exercise has shown positive effects on stereotypical motor behaviours (Yilmaz *et al*., 2004:626), social mannerisms (Pan, 2010:26; Pan *et al*., 2011:496; Sowa & Meulenbroek, 2012:56), academics (Nicholson *et al*., 2011:212) and sensory integration (Bass *et al*., 2009: 1266) in children with ASD.

Motor skills and Autism Spectrum Disorder

> *"Movement is a fundamental component of human life, with the ability to make precise controlled movements being so much part of daily living."* (Chambers & Sugden, 2002:158)

Motor skills are the physical components which facilitate movement (Haibach *et al*., 2011:27), contributing to a child's overall functioning (Cummins *et al*., 2005:437; Liu, 2012:323). One area of development frequently overlooked is the motor skills of children with ASD (Lloyd *et al*., 2013:1). Nevertheless, research has clearly indicated that across all age groups, individuals with ASD have motor skill ability which is poor in quality (Dawson & Watling 2000:416; Fournier *et al*., 2010:123).

Children diagnosed with ASD develop motor skills in the usual developmental sequence, but at a slower and less efficient rate than typically developing children (Mahoney *et al*., 2001:154). Therefore, motor development delays are noticeable at a young age, compared to typically (Provost *et al*. 2007:322; Lloyd *et al*. 2011:142; Liu, 2012:320) and atypically developing children (Matson *et al*., 2010:244).

Many studies have identified gross and fine motor impairments in children with ASD (Manjiviona & Prior, 1995:34). Gross motor skills are movements which require the use of the large muscles or limbs of the body, helping a child move around successfully in his or her surroundings, such as crawling and walking (Keennan, 2002:76; Gallahue & Donnelly, 2003:68), as well as climbing and running (Louw & Louw, 2007:150). These motor skills are difficult, requiring precise coordination, accurate motor planning and control over one's movements (Lloyd *et al*., 2013:7). However, for children and adolescents with ASD, gross motor functions are uncoordinated and clumsy (Kanner 1943:248; Cox 1991:259; Bauman 1992 cited in Mari *et al*., 2003:393; Ghaziuddin & Butler 1998:46; Fourier *et al*., 2010:1235), which are observable through unusual gait abnormities.

Ming *et al*. (2007:566,568), reported on the prevalence of motor delays of 154 children with ASD between the ages of two and 18 years of age. Ming and co-workers found that children and adolescents with ASD exhibit motor delays in terms of poor coordination. Similarly, Jansiewicz *et al*. (2006:614,615,619) examined the motor functioning of 40 boys with ASD and 55 boys without disabilities (six to 17 years old) using the Physical and Neurological Exam for Subtle Signs (PANESS). The results revealed greater difficulties in balance, gait and clumsiness in the ASD group compared to controls. After examining 398 twin pairs (ages eight to 17 years), Moruzzi *et al*. (2011:1670), also confirmed that clumsiness and poor coordination are related to ASD. Clumsiness and poor coordination of movements may affect the mastery of specific motor skills, which can explain how studies continue to find impairments of specific skills such as balance (Liu & Breslin, 2013:1247) locomotion (Vernazza-Martin *et al*., 2005:99), and object-control (Staples & Reid, 2010:215) in young and school-aged children with ASD.

Fine motor skills are smaller and precise movements of the body, which usually involve the use of one's hands, such as reaching, grasping and handwriting (Keennan, 2002:76; Gallahue & Donnelly, 2003:68). Fine motor deficits are also commonly reported in persons with ASD (Liu & Breslin, 2013:1247). A possible relationship between fine motor competency, academic achievement and social skills in children with ASD has been suggested. For example, in children with ASD, fine motor impairments may impact handwriting and/or typing ability, which could lead to challenges in communication (Liu & Breslin, 2013:1245).

A variety of standardised motor tests have been used on school-aged children with developmental disabilities including the Test of Gross Motor Development (TGMD), the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) and the MABC-2. For example, Berkeley *et al*. (2001:408, 413)

used the TGMD to evaluate the locomotor and object control skills of 15 high functioning children (six to eight years old) with autism. They discovered that all girls and 70% of the boys showed delays in their locomotor skills. Object control skill delays were also observed in 2% of the girls and in 30% of the boys. Their results demonstrated that children with high functioning autism have difficulties with motor tasks.

In 2007, Dewey *et al*. (2007:246, 254) examined the motor abilities of children five to 18 years of age with ASD, Attention Deficit Hyperactivity Disorder (ADHD), Developmental Coordination Disorder (DCD) and a group of typically developing controls, using the BOTMP (short form). They found that all children were significantly impaired in motor coordination skills when compared to typically developing controls. It was noted however that not all children with ADHD showed impairments in motor function and that 41% of the ASD group did not meet the criteria for motor deficiencies on the BOTMP short form. In addition it was concluded that although motor skill delays are apparent across the spectrum of ASD, it is not worldwide. Importantly, the researchers in the above mentioned study proposed that an alternative measure of motor skill proficiency such as the MABC-2 could have been used which might have shown different results (Dewey *et al*., 2007:253). Similarly, Pan *et al*. (2009:1700) compared the movement skills of 91 children (six to 10 years old) with ASD, ADHD and those without disabilities all of whom had an average IQ using the TGMD. They also found that children with ASD and ADHD showed poor motor skill ability when compared to their typically developing controls; however, they also found that not all the children with disabilities had shown motor difficulties. They confirmed Dewey's findings, that even though motor skill deficits are observed along the spectrum, these delays are not universal (Pan et al., 2009:1701).

Green *et al*., (2009:313,315) used the MABC-2 to explore the motor deficiencies of 101 children aged 11 to 14 years of age diagnosed with ASD with a wide range of IQs. The results revealed that 79% had definite motor impairments, 10% had borderline problems and 11% showed no impairment in motor ability. They also found that movement impairments were more severe in children with a lower IQ score than children with higher IQ's. This was consistent with previous research, which also showed that children, who had more severe intellectual impairments, would display more severe motor difficulties (Ghaziuddin & Butler, 1998:46). On the other hand, Smits-Engelsman and Hill, (2012:955) disagrees, reporting that motor delays can be found across all IQ levels, signifying that intellectual functioning could not explain motor impairments. Their findings suggest; that this relationship is complex and is in need of further investigation.

Mari *et al*. (2003:395) describe how individuals with ASD have shown movement disturbances on three levels. The first level includes movements which affect posture, muscle tone, movements that usually combine with other actions and unimportant, non-purposeful movements such as tics. The second level involves impairments of movement associated with motor planning, repetitive movements and language. The final level of motor disturbance occurs when movements affect an individual's behaviour, where actions are uncontrollable and pervasive. What is most important to note, is that there may be a connection between social dysfunction and the neurological motor symptoms of persons with ASD (Lary & Hill 1996:44; Mari *et al*., 2003:395).

Therefore, the next section will provide more detail regarding the relationship between motor and social skill development, and the implications thereof.

THE RELATIONSHIP BETWEEN MOTOR AND SOCIAL SKILLS IN ASD

> *"To fully engage in social interaction, an individual requires a full repertoire of movement behaviours for use in communication and for understanding the communicative nature of other's movements"* (Bhat *et al*., 2011:1122).

Recent research has proposed a relationship between motor skills and social skills in the development of young children (Lloyd *et al*., 2011:142; Bremer, 2014:159); that may be linked to severity of ASD symptomology. For example, MacDonald *et al*. (2013:271) used the TGMD-2 to examine whether FMS of 35 children with high-functioning ASD (six to 15 years old) could predict social communication skills. Teachers completed a rating scale called the Social Skills Improvement System (SSIS) rating scale which is a valid measure of social skill performance. A calibrated ASD severity score (CSS) was also calculated (MacDonald *et al*., 2013:274). MacDonald and colleagues found that locomotor scores and total raw scores did not predict ASD severity; however, object control raw scores significantly predicted calibrated ASD severity ($p=0.04$); pointing out that school-aged children with ASD whose object control skills were deficient were likely to have more severe ASD symptomology. Additionally, locomotor and object control skills did not predict homogeneous social skill, measured by the SSIS (MacDonald *et al*., 2013:276).

This was further highlighted when MacDonald *et al*. (2014:97) conducted another study using 159 children with ASD and developmental delays (14 to 33 months), to determine the relationship of motor skills and social communicative skills as indicated by calibrated ASD severity scores. The Mullen Scales of Early Learning (MSEL) was used to determine gross and fine motor skills and ASD symptomology was determined by the Autism Diagnosis Observation Schedule (ADOS) (MacDonald *et al*., 2014:97-98). Results revealed that gross ($p<0.05$) and fine ($p\leq0.01$) motor skills

both predicted calibrated ASD severity. This means that children with lower gross and fine motor skills had higher ASD symptomology (MacDonald *et al*., 2014:99,100). Further investigations are needed as to whether improved motors skills can also improve social skills.

There has also been research conducted on the relationship between motor skills, language (Whyatt & Craig, 2012:1805; LeBarton & Iverson 2013:815) and cognitive development (Pienaar *et al*., 2011:114; Westendorp *et al*., 2011:2773). Iverson, (2010:254) argues that the motor system contributes to language development in two ways. First, obtaining motor skills provides children with opportunities to practice skills associated with language development, and then learning new motor skills changes young children's experiences with objects, people and themselves which is relevant for social communication and language development. Bhat *et al*. (2012:838) confirmed that early motor development predicted later language and communication development when they compared the gross motor development of 24 high risk infant siblings with ASD to 24 typically developing low risk infant siblings at three and six months of age, in addition to examining the effect motor development had on communication at 18 months of age. Bhat and co-workers found that the ASD group showed more motor delays than compared to the typically developing children at three and six months of age (Bhat *et al*., 2012:841,842). Moreover, it was also found that there was a significant relationship between communication delays at 18 months and motor delays at three ($p=0.04$) and six ($p=0.1$) months in siblings with ASD (Bhat *et al*., 2012:843). Similarly, LeBarton and Iverson (2013:815) examined the relationship between fine motor skills and expressive language skills of 34 infants at risk for autism diagnosis from 12 to 36 months of age. The results showed that infants at risk of autism exhibited early fine motor delays between 12 and 24 months of age and expressive language delays at 36 months of age (LeBarton & Iverson, 2013:815,821). Furthermore, it was found that fine motor delays were related to later language delays at 36 months of age (LeBarton & Iverson, 2013:824). These results emphasize the importance of motor skills and its effect on the developing child's social skill and academic competency.

Individuals with ASD, who are higher functioning, need the gross motor skills necessary to participate in educational and social settings (Berkely *et al*., 2001:414). For example, attaining gross motor skills can increase the chances of peer interactions, because children will be asked to join in activities which require the use of one's motor skill ability during playground activities. Therefore, it is important that facilitators provide children with opportunities to learn and master relevant gross motor skills to initiate social and communication development (Berkely *et al*., 2001:414). In agreement with Berkely and co-workers, Hawkins *et al*. (2014:146) states that increasing gross

motor skills could increase a child's desire to participate in more recreational and leisure activities with their peers, which in turn may promote continued engagement in social interaction and physical activity which has significance for total health and wellbeing. Bremer (2014:45) reinforces this by suggesting that offering motor skill interventions for youths with ASD could improve motor skill abilities and provide the mechanisms needed to engage in active-play, which sequentially could result in the improvement of other developmental areas such as communication and social skills through activity-based interactions with peers and adults.

A group intervention programme allowing children to practice motor and social skills was used in the current study. Thus, the final section of this chapter will discuss different types of interventions used for children with ASD and the importance thereof.

INTERVENTIONS

Children who lack motor competence may struggle to achieve academically and so become socially isolated, which could develop into a variety of difficulties later in life (Henderson *et al*., 2007:3). It is therefore important to identify and assess children who may have a movement delay as early as possible, so that proper intervention can be implemented to prevent or minimise these problems. Thus, interventions which are performed during early childhood have proven to be the most beneficial (Flinchum, 1988:64; Rogers & Vismara, 2008:36; Logan *et al*., 2011:307).

According to Grantham-McGreggor *et al*. (1999:5), interventions which begin during the early stages of development and occur more frequently, generally have much larger developmental benefits. Corsello (2005:82) reviewed a variety of intervention studies using early intervention techniques on children with ASD. Those studies revealed that children make greater improvements when they begin interventions at a young age. Mahoney *et al*. (2001:161) found a significant intervention effect related to the number of sessions children received. Children receiving a motor skill session once a week showed a greater gain in motor development than children only receiving one session every three or four weeks. Pless and Carlsson (2000:397) agree that the more frequent the intervention programme occurs, the greater the results will be. Therefore, it is important to take into account certain factors such as the age of the child or children, the length of the intervention and the frequency of sessions when planning an intervention programme. It is important to provide ample time for practicing skills, because continued practice of relevant skills will reinforce one's neurological pathways in the brain so that motor skills become involuntary (Cheatum & Hammond, 2000:47), which results in movement and social success.

A variety of therapy interventions have been suggested to improve ASD symptomology (Ospina *et al*., 2008:2). According to current researcher's knowledge, most interventions were focused on improving social skills independently of motor skills, even though there is evidence in the literature suggesting that there is a connection between motor and social skill development. For instance, numerous literature reviews have confirmed the effectiveness of social skill interventions on improving social abilities in children and adolescents with ASD (Hwang & Hughes, 2000:331; Rogers, 2000:399; McConnell, 2002:351; Bellini *et al*., 2007:153; White *et al*., 2007:1859; Rao *et al*., 2008:353; Reichow & Volkmar, 2010:149; Flynn & Healy, 2012:431). However, there is limited research on the effectiveness of motor skill interventions on motor and social skill development in ASD (Hawkins *et al*., 2014:136).

Determining the most effective type of intervention to address motor and social development in ASD has been a continued goal for most researchers' (De Bruin *et al*., 2013:521). Individuals with ASD have a variety of developmental problems which can be addressed through individual or group intervention practices. Individual or one-on-one intervention sessions seem to be the intervention type most frequently used (Pless & Carlsson, 2000:396) to produce benefits. Individual therapy provides a learner with a more specialized programme, accommodating to the developmental needs of each individual (Schultheis *et al*., 2000:162) as well as preventing any misunderstandings amongst peers (Sowa & Meulenbroek, 2012:48). However, Walker *et al*. (2010:306) states that there may be a downside to individual therapy, as it does not offer social contact with peers, which stands as an important practising tool for children with ASD to develop social and communication skills.

Group-based interventions have also proven to be beneficial, as they provide opportunities to improve target skills, such as social interaction and communication (White *et al*., 2007:1859; Walker *et al*., 2010:306). Hemphill and Littlefield (2001:839) also found that group therapy had a positive impact on the reduction of behavioural problems as well as increasing social skills in school aged children. Sharkey *et al*. (2008:544) similarly found that verbal and non-verbal communication seemed to increase and social anxiety was also significantly reduced after an eight week period of group therapy. In addition to social skill improvement, group interventions have also resulted in improvements in motor skill performance. For example, Apache, (2005:1090) conducted a 15-week group activity-based intervention for 28 pre-schoolers (three to six years old) with disabilities. Instruction was provided three times per week and the TGMD was used at pre and post-test. Results showed that the 15-week group intervention significantly improved fundamental motor skills,

specifically locomotor and object-control skills. This section has shown that motor skill group interventions provide benefits in the development of social and motor skills.

SUMMARY

Movement is an important component of life, as typically developing children learn through movement by exploring the environment. Children with ASD struggle with movement throughout life, which can affect many aspects of their lives. Motor development is beneficial to all children as it teaches children the necessary academic and social skills. One area of development frequently overlooked is the motor skills of children with ASD. It has been suggested that children need motor skills necessary to participate in physical activity. Regular physical activity is essential for children to attain significant motor milestones and improve their health and fitness levels, both physically and mentally. Therefore, providing children with ASD opportunities to take part in physical exercise programmes which utilize motor skills could prove to be beneficial in many ways and should be investigated further.

Children with ASD also struggle to connect socially with their caregivers, which are seen during the early stages of development. The idea that ASD is a syndrome of brain development is extensively recognised by the effect it has on brain growth and function which have been a continued topic throughout literature. Recent research has proposed a relationship between motor skills and social skills in the development of young children, hence, it is important that facilitators provide children with opportunities to learn and master relevant gross motor skills to initiate social and communication development. Therefore the current study used a group intervention programme which allowed children the opportunity to practice motor and social skills.

The following chapter will provide a detailed discussion regarding the research methodology of the current study, including descriptions of the subjects, the measurement instruments and the intervention programme.

CHAPTER THREE

METHODOLOGY

INTRODUCTION

According to Allison *et al*. (1996:3,4), research can be used in two different ways. Research can be used on a personal level, where individuals personally search for information affecting their everyday lives. For example, if one wanted to buy a car, you would read magazines and search the internet for information about that specific car before purchasing it. Research can also be used on a professional level, where a researcher has to conform to standards and the research is presented to the public. Research where researchers have to follow such guided research methodology is challenging and methodical. The following definition describes these characteristics.

> *"Research is a systematic enquiry which is reported in a form which allows the research methods and the outcomes to be accessible to others"* (Allison *et al*., 1996:4).

The current study attempted to conduct research in a professional manner, as it tried to analytically answer the research problem by following the steps in the methodology. The following section describes the research methodology.

PROBLEM STATEMENT

The main purpose of the current study was to determine whether or not a specialised group intervention programme could improve the gross motor and social skills of selected children diagnosed with Autism Spectrum Disorder (ASD) between the ages of eight and 13 years.

The current study examined the following specific aims:

1. To establish the level of overall gross motor and social skills of a selected group of children with ASD.
2. To determine whether a group intervention programme could improve gross motor skills.
3. To determine whether a group intervention programme could improve social skills.

METHODOLOGY

Research design

A quasi-experimental design was used for the current study, because the sample consisted of pre-existing groups in the form of two classes. The participants could not be randomly assigned to

treatment or experimental conditions and the school would not permit the changing or separation of the participants in the classes (Thomas *et al*., 2011:345).

Subjects

A governmental primary school for autistic learners was recruited from the Cape Town area. This school was selected because the population was a sample of convenience and because of financial and logistical considerations.

At the school, 2 classes (N=14) were assigned by the occupational therapist to take part in this study. Five subjects' whose parents/legal guardians did not sign consent and 2 subjects, who did not complete the study, were excluded from the current study. Therefore, the final sample size consisted of 7 participants (6 boys and 1 girl) between the ages of 8 and 13 years. One class formed the experimental group (n=4) and the other formed the control group (n=3). Participants' in the control group received pre- and post- testing only, while the experimental group participated in the researcher-designed group intervention programme. The control group continued with their usual academic work and recreational activities. All the children were at a similar level of autistic function according to the occupational therapists at the school.

Inclusion and exclusion criteria

All children recruited had to be in one of the participating classes of the selected school. All participants were diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision (DSM-IV-TR) (APA, 2000:69). Any child who presented physical injuries was excluded from the study. If a participant did not wish to participate in the intervention programme, they were not forced and were excluded. The child of any parent or guardian who did not give consent for their child to participate was also excluded and the child of any parent or guardian, who did not complete the Social Responsiveness Scale-2 questionnaire, was excluded from the study.

Place of study

The study took place on the grounds of the school. The motor assessment test was performed in an assigned occupational therapy room, psychology room or assessment room. The group intervention programme was performed in the available assessment room, occupational therapy room or staff room.

Ethical approval

The researcher submitted a research proposal which clearly defined the aims and objectives of this study and detailed the procedures within a methodology to the ethics committee at Stellenbosch University for approval (#HS1015/2013). Permission to perform this study was obtained from the Western Cape Education Department (WCED). The principal of the selected school provided the researcher and the WCED with written consent to conduct the study at the recruited school.

Consent forms were sent out to all parents or legal guardians of each child recruited to take part in this study. Parents or legal guardians provided written informed consent for their child to participate in the current study and the teachers provided written informed consent, allowing their class to participate in the current study, before any testing procedures were conducted. Once these forms had been returned, an assent form was given to each child. All participants were asked to volunteer to take part in this study. The researcher verbally explained to each child the procedures of the study and what they would do if they chose to participate. Children were given the opportunity to ask questions and any uncertainty was addressed by the researcher. Each child then signed the assent form if they agreed to participate. Any participant, who did not wish to take part in the study, was not forced to do so. All the data that was collected in relation to this study remains confidential and will only be released with permission from the parents or legal guardians or as required by law. All information collected will be kept for a maximum of 3 years at the Department of Sport Science at Stellenbosch University on a password protected computer. All data and questionnaires will be stored in a file in a locked office that only the researcher and the study leader will have access to during the study.

Any obstacles and equipment that may have caused injuries was removed from the area where the group intervention programme and testing took place. The participants were supervised at all times during the intervention as well as the testing, by the investigator who is a qualified Kinderkineticist (01/013/02/1314/005) with a Level One First Aid qualification. A teacher or occupational therapist was present during the motor assessment and an occupational therapist was on call at all times. The researcher who performed the test had competent knowledge of the relevant test being conducted. If any injuries occurred, the school's protocol regarding injuries was immediately followed.

Statistical procedures

The data collected was statistically analysed by Prof M. Kidd of the Centre for Statistical Consultation at Stellenbosch University. The possible effects of the intervention were tested using

mixed model repeated measures ANOVA with group and time as fixed effects and the participants as random effects. Post hoc testing was done using Fisher least significant difference (LSD) testing. The group-time interaction effect was investigated to determine if the experimental group showed a different effect from the control group over time. The results were summarised and reported as means and standard deviations and the level of significance was set at ($p<0.05$). The 2 assessments conducted in this study will now be discussed.

Testing procedures

One developmental assessment and one screening questionnaire were completed. The developmental assessment was completed by the selected group of children with ASD who voluntarily participated in the study and the screening questionnaire was completed by the relevant teachers and parents or guardians of the participating children.

Both the experimental and control group performed a developmental assessment called the Movement Assessment Battery for Children-2 (MABC-2) (Henderson *et al.*, 2007) and the teachers and parents or guardians of consented participants completed a questionnaire called the Social Responsiveness Scale-2 (SRS-2) previously named the Social Reciprocity Scale (Constantino & Gruber, 2005) during the pre- and post-tests. The group intervention programme lasted 12 weeks and was developed using information from a range of literature (Cheatum & Hammond, 2000:80-307) and personal experience as a qualified Kinderkineticist. The experimental group participated in the group intervention programme, while the control group did not perform any gross motor activities besides their normal physical and recreational activities at school. During the 12-week group intervention programme there were 2-weeks where children had school holidays. During one of the weeks a home programme was sent to the parents or legal guardians and during the other week the researcher used this as a forced retention period where no home programme was sent home with the children. Only the experimental group performed the MABC-2 again, before and after this period of no intervention to determine if this natural retention had an effect on the learnt skills. Two researcher-designed questionnaires (Appendix G) along with the SRS-2 were completed by parents or guardians of the participants to indicate relevant information regarding the participants' medical and physical activity history, as this may have influenced the results. A participant may have had an injury or illness which the researcher needed to be aware of during the testing or intervention periods. In addition, the researcher needed to be aware of how many additional motor activities the participants were involved in, as this may have altered the results.

The Movement Assessment Battery for Children-2 (MABC-2) (Henderson *et al.*, 2007)

The MABC-2 is a result of an accumulation of research which began in 1966 (Henderson *et al*., 2007:113). This test of motor competence is an improved version of the Movement Assessment Battery for Children (MABC) (Henderson & Sugden, 1992, cited in Henderson *et al*., 2007:113), which was revised from a test called the Test of Motor Impairment (TOMI) (Stott *et al*., 1972, cited in Brown & Lalor, 2009:88).

The MABC-2 is used for the identification of movement difficulties in clinical examinations, planning of an intervention, programme evaluation and as a research instrument in experimental studies (Henderson *et al*., 2007:5). This test battery is one of the most widely used measures of motor proficiency (Chow & Henderson, 2003:574 & Holm *et al*., 2013:795), and has been extensively used to examine children with (Whyatt & Craig, 2012:1801; Liu & Breslin, 2013:1245) and without (Wagner *et al*., 2011:675; Holm *et al*., 2013:796), ASD in school environments.

The MABC-2 is often used with several different groups of children who have observable movement difficulties such as children with Attention Deficit Hyperactivity disorder (ADHD), children who are classified as “at risk" who are suffering from Foetal Alcohol Spectrum Disorder (FASD), children with genetic disorders such as Tourette’s Syndrome, Williams Syndrome, Turner Syndrome and Fragile X Syndrome, and lastly, children with Developmental Coordination Disorder (DCD) (Henderson *et al*., 2007:6-9). Children with ASD, like children with DCD have been recognised as being clumsy and uncoordinated (Ghaziuddin *et al.*, 1992:651). For this reason, the MABC-2 is an excellent test to use on the population chosen for this study.

The MABC-2 is made up of 2 complementary mechanisms: the **Standardised Test** and the **Checklist**. The standardised test involves children having to perform a number of gross and fine motor tasks, which fall under 3 subtests (Henderson *et al*., 2007:3; Brown & Lalor, 2009:87). The 3 subtests are presented below in Table 3.1.

TABLE 3.1: **DESCRIPTION OF SUBTESTS OF THE MABC-2**

SUBTESTS	DESCRIPTION
Manual dexterity	One’s ability to work quickly and precisely with the hands and fingers (Kornatz *et al*., 2005:2073).
Aiming and catching	One’s ability to aim at a target, throw a ball and catch a moving object (Henderson *et al*., 2007:103).

Static and dynamic balance	One's ability to remain still while standing on one leg and one's ability to move in a forward or backward motion while on one foot (Henderson *et al*., 2007:17).

There are 3 age bands (AB) which are followed in the MABC-2 (Brown & Lalor, 2009:87):

- AB1: 3.0 to 6.11 years,
- AB2: 7.0 to 10.11 years and
- AB3: 11.0 to 16.11 years

In the current study, only AB2 and AB3 were used, because participants are between the ages of 8 and 13 years of age. Within each age band there are 8 tasks which fall under the different subtests of the MABC-2 (Henderson *et al*., 2007:4). The objectives of these tasks are described in Appendix A (page:114) and B (page:116).

The checklist component of the MABC-2 is a short questionnaire, which takes approximately 10 minutes to complete. It requires an adult such as a teacher, parent or a trained professional who is involved with the child to rate his/her motor performance. It focuses on how a child manages daily tasks at home and at school and is a quick method of assessing whether a child may have a movement problem (Henderson *et al*., 2007:4). The checklist contains a motor and a non-motor component which provides relevant information on factors that may directly or indirectly affect movement (Cools *et al*., 2009:155). The checklist and the standardised test ultimately provides investigators with an total motor score which then shows what "zone" a child may fall into through the use of a "traffic light" system. There are three traffic light zones in which a child may fall according to his or her performance test or checklist score (Henderson *et al*., 2007:4; Brown & Lalor, 2009:87:94). The colour zones are presented below in Table 3.2:

TABLE 3.2: **TRAFFIC LIGHT SYSTEM ZONES**

ZONE	DESCRIPTION
Green zone	Normal range of motor function.
Amber zone	"At risk"- a need for monitoring due to slight delay in movement.
Red zone	Definite motor impairment.

Source: Adapted from Henderson *et al*. (2007:4) and Brown and Lalor (2009:94).

All participants were tested according to the guidelines in the examiners manual of the MABC-2. When this test battery is administered, it is important to follow these administration guidelines in

order to ensure successful results. The tester should always make sure that there is enough space to perform the test. The testing room should be at least 6 meters long and 4 meters wide with at least one smooth, blank wall. All measurements should therefore, be set out prior to testing. This should take approximately 10 minutes to set up. The testing space should be quiet and free from any unnecessary interruptions that may impact the completion of the task at hand. A table should be provided that is suitable and at the level of the child being tested. All children being tested should have on clothing that ensures that movements are not restricted (Henderson *et al*., 2007:13-15).

Participants were tested individually and the test procedures took about 20 to 30 minutes to complete. The time, however, varied depending on the child's motor and intellectual functioning. Some children became tired and needed to have rest periods in between tasks; others struggled with the understanding of instructions and, therefore, took a little longer to complete a task.

Scoring of the MABC-2

There are 10 steps which are initially followed in the scoring process of the MABC-2. These steps should be systematically followed to achieve measurable results (Appendix C, page:118). Individuals are scored according to a Likert scale. Fore example, a low score will indicate more severe deficits in motor skill ability, whereas a higher score will indicate less severe to minimal motor dysfunction. The MABC-2 uses various scores to describe a child's motor performance. Percentile ranks, standard scores and total test scores are the most important scores to consider (Henderson *et al*., 2007:83). These will be discussed in the following sections.

Percentile ranks

> *"A percentile or percentile rank, indicates the percentage of children in the standardisation sample who obtained a score less than or equal to a given raw score"* (Henderson *et al*., 2007:83).

The percentile ranks are used to explain the results of the standardised test to parents and or other professionals. There are certain cut-off points which are used to indicate whether or not a child may have a motor impairment (Henderson *et al*., 2007:83). These cut-off points are indicated through the 'Traffic Light' system (Table 3.3).

TABLE 3.3: **PERCENTILE CUT-OFF POINTS**

ZONE	PERCENTILE CUT-OFF
Green zone	Up to the 85th percentile.
Amber zone	Between 85th and 94th percentile.

Red zone	At or above the 95th percentile.

Source: Adapted from Henderson *et al*. (2007:153).

Standard scores

> *"Standard scores are a normalised transformation of a distribution of raw scores and have a given mean and standard deviation"* (Henderson *et al*., 2007:83).

In the MABC-2, all the standard scores and total test scores are based on a distribution, with a mean of 10 and a standard deviation of 3 (Henderson *et al*., 2007:83,84). Data is sometimes presented in the form of standard scores and in a way standard scores become a necessity for inter-test comparisons or combinations (Sappenfield, 1947:638).

Total test scores

In the MABC-2, the total test scores comprise of the sum of all raw scores which are then converted into standard scores and then overall percentile ranks. Using the "Traffic Light" system described above, the child's movement zone is then determined (Henderson *et al*., 2007:83).

Reliability of the MABC-2

> *"The reliability of a test refers to the precision, consistency and stability of test scores across time and among examiners"* (Henderson *et al*., 2007:132).

The MABC has shown to be a reliable test, used by many clinical professionals (Chow & Henderson, 2003:577). Although there were many changes made to introduce the MABC-2, the studies which examined the reliability of the MABC should still be kept in mind (Henderson *et al*., 2007:132). For instance, Chow and Henderson (2003:574,576) examined inter-rater reliability and test-retest reliability of the MABC, using 2 trained individuals with different backgrounds and expertise. Results showed that the agreement between the testers was good with an overall mean Intra Class Correlation (ICC) of 0.96 for all items and 0.77 was reported for test-retest reliability. This demonstrates that the MABC is a highly reliable test of motor performance. A study done by Wuang *et al*. (2011:164) on children with Developmental Coordination Disorder (DCD), also demonstrated that the MABC-2 is a reliable and valid measure of motor impairment. The MABC-2 demonstrates excellent internal consistency (0.90) and excellent test– retest reliability for the total score. The intra-class correlation coefficient was 0.97. The standard error of measure (SEM) for the total test was 0.52 and the individual items ranged from 0.30 to 0.74 and the SEM for the subscales it ranged from 0.31 to 0.92. (Wuang *et al*., 2011:160,164). This confirms that the MABC-2 is also a reliable measure of motor proficiency.

Validity of the MABC-2

> *"Validity refers to the degree to which theory and evidence support the interpretation of a test's scores in relation to the stated aims of the test"* (Henderson *et al*., 2007:137).

Validity can be interpreted through 3 different categories, content validity, face validity and criterion-related validity. It is common to find that a child's profile varies across the 3 subtests in clinical settings. Therefore, these subtests have content validity and are functionally applicable (Schulz *et al*., 2011:1366). Henderson *et al*. (2007:142) acknowledge that in terms of face validity, children have enjoyed doing the MABC-2 as it is a short test, most of the tasks are age-appropriate in terms of the difficulty levels and the test scores contribute to the assessment procedure. According to Henderson *et al*. (2007:143), there were 3 studies conducted which provide evidence of excellent criterion-related validity of the MABC-2 test battery.

Social Responsiveness Scale-Second Edition (SRS-2) (Constantino & Gruber, 2012)

The Social Responsiveness Scale-2 (SRS-2) is the most recent version of the original instrument, the Social Responsiveness Scale. It is a 65-item, quantifiable measure of autistic traits and symptomology (Constantino & Todd, 2003:656; Constantino & Gruber, 2012:3). It is able to measure the severity of an individual's social impairment using a Likert-scale. It focuses on identifying impairments in social awareness, information processing, responses, motivation, communication and repetitive behaviours (Constantino & Gruber, 2012:35). This instrument is straightforward and takes approximately 15 to 20 minutes to complete. Adults observe children in their natural environment and then rate their social skills by completing a questionnaire.

The SRS-2 is used for several reasons. In research, this test may be used as a screener, for identifying possible social discrepancies in large populations; in clinical or educational settings when following the progression of the severity of a child's symptoms over time or as a function of response to an intervention programme (Constantino & Gruber, 2012:21,28).

This screening assessment encompasses 4 kinds of autoscore forms which vary according to age, and include: The pre-school form (ages 2.5 to 4 years), the school-age form (ages 4 to 18 years) and the adult form (ages 19 and upwards). The pre-school form and the school-age form may be completed by parents and or teachers, and the adult form is either completed by parents, spouses, other relatives or by themselves (self-report). Attached to each individual autoscore form is 2 profile sheets (1 for boys and 1 for girls), which provides the t-score results (Constantino & Gruber,

2012:3,7). No standard scores are used in this test. The raw scores are converted into t-scores, which determine symptom severity.

In this study, parents and teachers rated the participating individual's social skills by answering the 65-items on the autoscore form. They had to darken or colour in the circle that best described the child's behaviour over the past 6 months on the school-aged autoscore form for each individual item. Ratings were given on a scale from 1 (not true) to 4 (almost always true), which were based on how frequently they occurred (Constantino & Gruber, 2012:35). The researcher and a qualified clinical psychologist tallied up all the scores and interpreted the data. The procedures for scoring the SRS-2 will now be discussed in the following sections.

Scoring of the SRS-2

The SRS-2 makes use of treatment subscale raw scores and overall T-scores to describe a child's social skills. The treatment subscales are used in research or clinical settings designed to improve symptoms through treatment effects and the interpretation is only done when a treatment plan is involved (Constantino & Gruber, 2012:22). There are 7 critical steps which are followed in the scoring process of the SRS-2. These steps should be systematically followed to attain measurable results (Appendix D, page:121).

Interpretation of the scores

The SRS-2 produces a total test score for all 65 items, which serve as an indication of the severity of social deficits on the autism spectrum. There are total raw scores, which are used to quantify subjects in study groups and total t-scores which are used in the SRS-2 to communicate how a given score can indicate the degree of social communication deficit in an individual. A low score will indicate less severe symptoms of social dysfunction and a higher score will indicate a more severe deficit of social impairment (Constantino & Gruber, 2012:18). The t-scores have a mean of 50 and a standard deviation of 10 and are the ideal method of report for individual assessments in schools (Constantino & Gruber, 2012:17).

In the SRS-2, the T-scores are able to assist in determining if an individual fits a given criteria for autism or other ASD classifications (Constantino & Gruber, 2012:17). The SRS-2 is beneficial in identifying autism-associated components of social impairment through the use of interpretation text, which appears on the profile sheet and is used in reports (Constantino & Gruber, 2012:18). There are four categories in which a school-aged child may fall according to his or her social skills score (Constantino & Gruber, 2012:18-19). These categories are presented below in Table 3.4.

TABLE 3.4: **SCHOOL-AGE SOCIAL SKILL CUT-OFF POINTS**

CATEGORY	DESCRIPTION
59 T-scores and below	Within normal limits
60 to 65 T-scores	Mild range
66 to 75 T-scores	Moderate range
76 T-scores and higher	Severe range

Source: Adapted from Constantino & Gruber (2012:18-19).

Reliability of the SRS-2

There are variables which may affect the results of a single assessment on a specific day. Individuals may become tired when rating a child, certain events on the day may have disturbed the process or there could have been interruptions in the evaluation session (Constantino & Gruber, 2012:21). There may also be a disturbance to the child being rated. This would possibly affect the child's behaviour, which could cause an imbalance to the results. For this reason, the SRS-2 makes use of the standard error of measure (SEM). The standard error signifies "the variability of the sampling distribution" (Thomas *et al*., 2011:107).

According to Constantino and Gruber (2012:21), there is evidence to support the reliability of the SRS-2 scores, and findings of a standardisation study of the SRS-2 indicated good support for the reliability of the school-age form (Constantino & Gruber, 2012:46). Strong internal consistency (0.92 to 0.95) was also found in the standardisation study of the SRS-2, which is strongly supported by other clinical and non-clinical studies (Diehl *et al*., 2006:313; Contantino & Gruber, 2012:45,50,57). The test-retest reliability has also proven to be satisfactory (0.67) after a period of 6 weeks (Diehl *et al*., 2006:310), but, a longer retest interval has proven to show better results (0.88) (Bolte *et al*., 2008:358; Constantino & Gruber 2012:58).

Validity of the SRS-2

To determine if the SRS-2 is a valid measure of social impairment, it has been constantly compared to other social instruments (Constantino & Gruber 2012:61,62). In a study by Constantino *et al*. (2003:431,432), positive correlations were found between the SRS and the Autism Diagnostic Interview-Revised (ADI-R). Thus the SRS was shown to be a valid test when assessing clinically significant autistic traits (Constantino & Gruber 2012:60).

Bolte *et al*. (2008:359) also found moderate to good correlations ($p<0.01$) between all autism scales, and in comparing the SRS to the ADI-R. The convergent validity was 0.46 for social interaction,

0.40 for social communication and 0.38 for repetitive and stereotyped behaviours. The study also demonstrated that the SRS was able to significantly discriminate ASD from other mental disorders (Bolte *et al*., 2008:359).

The current study used a researcher-designed group intervention programme (Appendix F, page:140) which will be discussed in more detail in the following section.

Intervention: Gross motor programme

The group intervention programme was conducted by the researcher with children aged 8 to 13 years old, diagnosed with high functioning ASD. The focus of the programme was to improve specific gross motor, social interaction and communication skills, because children with ASD perform poorly in gross and fine motor skill activities (Fournier *et al*., 2010:1237) and show deficits in social skills (Scott, 2004:84). The gross motor skills selected as a focus were: balance and functional strength, ball skills such as throwing and catching, motor planning and body coordination. The social skills focused on were: social interaction and group work. Activities were fun and most games were repeated throughout the intervention programme, as children with ASD like structure and routine. The programme took place over a period of 12-weeks, which included a home programme during the participant's week of holiday, in the first and second term. The group intervention programme took place twice a week and each session lasted 45 minutes. The gross motor programme was either presented in the assessment room (6m x 8m) or the occupational therapy room (4m x6m) at the school.

During the first week of the intervention programme, the occupational therapist at the school was present to make sure the children felt comfortable with the researcher and to assist if needed. During the rest of the 12-week intervention, either the teacher or the teacher's assistant of the experimental group was present during the 45 minute sessions, which provided the researcher with valued assistance. Each week, the individual activities became more challenging as the participants skill increased with the activities. For example, smaller balls were used and additional balancing obstacles were added to activities, initiating progression within the intervention programme. The researcher used her knowledge in the field of Kinderkinetics as well as a range of literature to design the intervention programme (Cheatum & Hammond, 2000:80-307). The researched used the 'practice makes perfect' principle, therefore, all activities were repeated throughout the group intervention programme. Individuals with ASD favour structure and routine, therefore, the same warm-up and cool-down activities were used throughout the 12-week intervention programme.

The group intervention programme provided a supportive environment to optimize social interaction. Participants' often had to work together in groups of 2 or more which caused the children to naturally begin to socialize. The more opportunities children, with or without disabilities, have to interact with peers, the more social success is achieved. This is evident in a study done by Laushey and Heflin (2000:189), when they examined 2 groups of kindergarten children with and without autism. They made use of a buddy-system intervention and found that the social skills of the 2 children with autism had improved significantly over time.

Chapter 4 will report and discuss the current study's findings through the use of graphs and tables.

CHAPTER FOUR

RESULTS AND DISCUSSION

INTRODUCTION

> *"Statistics is one of the few ways that data can be reported uniformly to allow relevant, accurate conclusions and comparisons to be made. Statistics are methodical, logical, and necessary, not random, inconsistent, or terrifying"* (Thomas *et al.,* 2011:99).

Statistical analysis is necessary when the research information collected takes the form of numbers. This numerical material is known as data and the main objective of statistics is to organise, manipulate and analyse this information through the use of mathematical techniques, which helps social scientists answer questions and test theories (Healey, 2009:1). There are certain statistical techniques which are essential in helping scientists describe data, test relationships and measure differences amongst groups (Thomas *et al*., 2011:99,100).

According to Thomas *et al*. (2011:111), statistical techniques can be used in the testing of relationships either between or among variables in a single group of participants and in testing the variances between or among more than a single group of individuals. A variable is considered to be any given trait that can differ, such as gender, age and income. In science, variables are identified as causes known as independent variables and effects or results known as dependent variables (Healey, 2009:3). Descriptive statistics, such as means and standard deviations are usually provided in quasi-experimental studies and the statistics are reported for the differences amongst groups (Thomas *et al*., 2011:75).

The current study examined group-time interactions to determine whether any changes in gross motor skill proficiency and social skill competency occurred within and/or between the experimental and control groups over time. Thus, the current study aimed at examining whether a 12-week group intervention programme had any effect on the experimental group's performance in motor and social skill development.

DEMOGRAPHIC PROFILING

Two classes of the selected school for autistic learners took part in the current study. Both classes were selected based on the participants level of functioning and were provided by the occupational therapist at the relevant school. Children in the same class were at a similar level of autistic function, but, they were not of the same age. The overall age range was between 8 and 13 years. The relevant

dates of birth were provided by the teachers of the recruited classes indicating each child's chronological age. The classes were randomly selected and divided into an experimental and control group. Both boys and girls were included in this study (N=7), however, the majority of participants in the current study were boys (n=6). The experimental group (n=4) included 3 boys and 1 girl and the control group (n=3) consisted of only boys. Unfortunately, due to the small sample size and the use of a single school, gender was not considered a feasible variable. Gender will always be a limitation when working with autistic children.

Difficulty was encountered finding comparable studies emulating the features of the current study. Baranek (2002:415) investigated empirical literature on sensory and motor interventions. She found little data on the effects of developmental motor training in autism. MacDonald *et al*. (2013:277) agree that although there have been many descriptive studies which have shown motor impairments in school-aged children with Autism Spectrum Disorder (ASD), most studies have focused on using social skill development as a form of intervention and few motor skill interventions have been implemented.

The next section provides a detailed examination and discussion of the results obtained by the Movement Assessment Battery for Children-2 (MABC-2) and the Social Responsiveness Scale-2 (SRS-2). Pre- and post-test results are compared, providing evidence regarding the effectiveness of the group intervention programme on gross motor and social skills of selected children with ASD.

THE MOVEMENT ASSESSMENT BATTERY FOR CHILDREN-2 (MABC-2)

Total motor proficiency

The following section demonstrates the effect that a 12-week group intervention programme had on total motor skill proficiency as determined with the MABC-2 on 7 children aged eight to 13 years diagnosed with ASD. The MABC-2 helps researchers identify and describe relevant impairments in motor functioning (Henderson *et al*., 2007:3). Total motor skill proficiency means, standard deviations and mean differences were calculated and are summarised in Table 4.1.

TABLE 4.1: **TOTAL MOTOR SKILL MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS (PRE- AND POST-TESTS)**

Group	*Pre-test Mean ± SD*	*Post-test Mean ±SD*	*Differences within groups from pre- to post-test*
Experimental (4 participants)	4.25±2.21	7.00±1.15	2.75
Control (3 participants)	10.00±1.00	9.00±3.60	-1.00
Differences between pre- & post-test	-5.75	-2.00	-

A statistically significant difference was found over time between the experimental and control groups (p=0.05), suggesting that the intervention had a positive effect on the children's total motor proficiency. The experimental group improved by 2.75 scores, which was a significant change pre- to post-test (p=0.04), whereas the control group experienced a decline of 1 score point in total motor proficiency from pre- to post-test (Table 4.1). In other words the experimental group improved on average 3.75 standard score points more than the control group (Figure 4.1). This increase in scores may be the result of the experimental group participating in the 12-week group intervention programme. The motor intervention involved a variety of challenging motor activities which were frequently practiced. However, there were non-overlapping confidence intervals at pre-test between the 2 groups, which point to the experimental group having had significantly lower baseline scores in total motor skill proficiency than the control group.

Alphabet letters (Figure 4.1) have been placed on the graphs to indicate significant differences of 5% between and/or within the experimental and control groups. The letters will differ when a significant difference is found between and/or within the two groups, for example (a-b) or (b-a), and the letters which overlap or are the same at any point, for example (a-a) or (a-ab), indicates that there was no statistically significant difference from pre- to post-test.

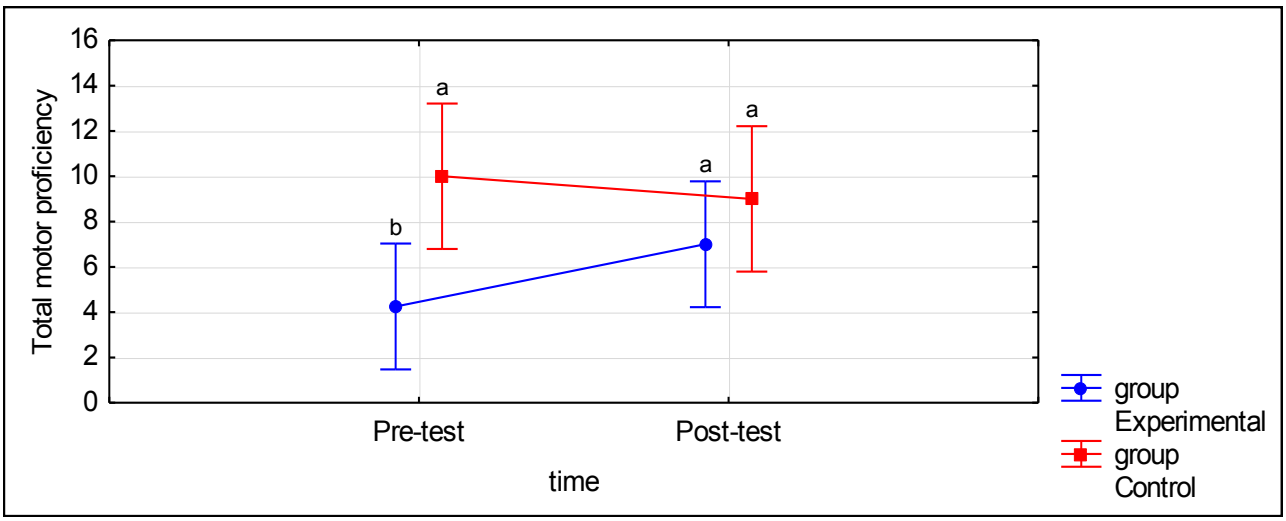

FIGURE 4.1: **THE RESPONSE TO INTERVENTION FOR TOTAL MOTOR PROFICIENCY (EXPERIMENTAL AND CONTROL GROUPS)**

A literature search could not find studies which matched the exact characteristics of the current study. Most studies compared different types of individuals' motor skill performance. Little gross and fine motor skill treatment studies were found. For example, Pan *et al*. (2009:1699) compared the movement capabilities of children diagnosed with ASD, ADHD and typically developing controls. They found that children (6 to 10 years) with ASD performed significantly worse than both the ADHD and typically developing control groups in locomotor ($p< 0.001$), object control ($p< 0.01$) and overall gross motor development quotient (GMDQ) ($p< 0.001$).

The total test scores and the movement zones for each individual in the experimental and control groups can be noted in Table 4.2(a) and 4.2(b) to better understand the significance of the improvements in total motor proficiency over time. The total test score indicates which "zone" a child may fall under in terms of movement performance. The MABC-2 includes 3 movement zones. The Green zone indicates that the child is in the normal range of motor proficiency, the Amber zone indicates that the child will be "at-risk" and may need to be monitored as there might be a slight delay in movement and finally, the Red zone indicates that the child will have a definite movement problem (Henderson *et al*., 2007:4; Brown & Lalor, 2009:87:94).

TABLE 4.2(a): **TOTAL MOTOR TEST SCORES AND MOVEMENT ZONES FROM PRE- TO POST-TEST (THE EXPERIMENTAL GROUP)**

PARTICIPANTS	TOTAL TEST SCORE		MOVEMENT ZONES	
	PRE	POST	PRE	POST
1	50	68	Red	Green
2	38	60	Red	Amber
3	35	60	Red	Amber
4	63	72	Amber	Green

As depicted in Table 4.2(a), each individual in the experimental group made considerable improvements in their total motor performance, by proceeding into the next zone in motor proficiency from pre- to post-test according to the MABC-2. One child (participant 1) even moved up 2 zones, which reflects the positive impact that the group motor skill intervention could have had on his/her fine and gross motor skills.

TABLE 4.2(b): **TOTAL MOTOR TEST SCORES AND MOVEMENT ZONES FROM PRE- TO POST-TEST (THE CONTROL GROUP)**

PARTICIPANTS	TOTAL TEST SCORE		MOVEMENT ZONES	
	PRE	POST	PRE	POST
1	81	78	Green	Green
2	83	87	Green	Green
3	72	51	Green	Red

As depicted in Table 4.2(b), two out of the three participants in the control group slightly improved in their total motor performance, and remained in the same zone of motor proficiency from pre- to post-test according to the MABC-2. This small improvement may have occurred, because individuals in the control group carried on with their usual recreational activities while the experimental group participated in the group intervention programme, which may have included some form of motor skill participation, such as judo or Eurhythmy. In addition, one child (participant 3) dropped down two zones, indicating a loss in his/her motor function.

What can also be noted is that a statistically significant difference was found at pre-test between the experimental and control groups for total motor skill proficiency in the MABC-2 ($p=0.01$) (Appendix E; page 126; Figure E1) but there was no statistically significant difference was found at post-test between the experimental and control groups for total motor skill proficiency in the MABC-2 ($p=0.27$) (Appendix E; page 126; Figure E2). This indicates that the control group

performed better than the experimental group at pre-test. However, at post-test the experimental group was at a closer level of total motor proficiency to the control group, because the experimental group had made greater improvements in total motor skill proficiency after the 12-week group intervention programme.

Pless *et al*. (2000:188) previously found a similar increase in overall motor skill ability within their experimental group, as well as the control group after a 10-week group motor skill intervention in children with definite and borderline motor difficulties. These findings provide supportive evidence that group-based motor interventions may possibly have an effect on motor skill performance in children who show signs of motor abnormalities, such as children with ASD. Similar results have also been found in studies using motor interventions on children with other disabilities and typically developing children.

In 2001, Mahoney *et al*. (2001:159,253) conducted a field-based investigation of the effects of 2 early motor intervention approaches - neurodevelopmental treatment and developmental skills treatment - on 50 children with Down syndrome and Cerebral palsy. Children's motor functioning was tested before and after a year of intervention. They found that the interactions of intervention and treatment, intervention and diagnosis, as well as intervention, diagnosis and treatment were all insignificant ($p>0.05$). However, they did find significant intervention effects from pre- to post-test on all 7 components of movement that were assessed. These findings suggest that, regardless of the type of motor intervention or diagnosis, all children made substantial gains in motor functioning and quality of movement overtime. Thus, intervention approaches, no matter the type, seem to improve overall motor skills in children with developmental delays.

Recently, Bardid *et al*. (2013:4575) conducted a study on the effectiveness of a 10-week fundamental motor skills programme on typically developing pre-schoolers with poor motor competence and likewise found that their intervention group had scored significantly better in locomotion ($p<0.001$) and overall gross motor development quotient (GMDQ) ($p<0.001$), than their control group at post-test. However, object control skills ($p=0.09$) did not progress overtime.

The following section will expand on the sub-components of the MABC-2 and illustrate the effects a group intervention programme may have had on skills such as manual dexterity, aiming and catching and balance.

Manual dexterity

The following section provides a brief overview of the effects that the 12-week group intervention programme may have had on the activities seen in the manual dexterity sub-component of the MABC-2. This subtest was included because it forms part of the MABC-2. This fine motor subtest assesses how accurately a child's hand and fingers work together in reaching, grasping and manipulating objects (Henderson *et al*., 2007:102). Manual dexterity means, standard deviations and mean differences were calculated and are summarised in Table 4.3.

TABLE 4.3: **MANUAL DEXTERITY MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS (PRE- AND POST-TESTS)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental (4 participants)	4.75±2.06	6.25±0.95	1.50
Control (3 participants)	10.33±1.52	9.00±5.00	-1.33
Differences between pre- & post-test	-5.58	-2.75	-

No significant difference was found over time between the experimental and control groups (p=0.24). Although not significant, the experimental group did experience a slight increase in their standard score points by 1.50 and the control group showed a decline of 1.33 points in the manual dexterity subtest of the MABC-2 from the pre- to post-test (Table 4.3). Therefore, the experimental group improved on average 2.83 standard score points more than the control group (Figure 4.2). This suggests that a possible change occurred over time within the experimental group, which did not occur in the control group. This may be due to the experimental group participating in object manipulation and fine motor activities during the 12-week group intervention programme. Therefore, a larger sample size, a longer period of intervention or having more specific activities may have shown more positive significant outcomes over time.

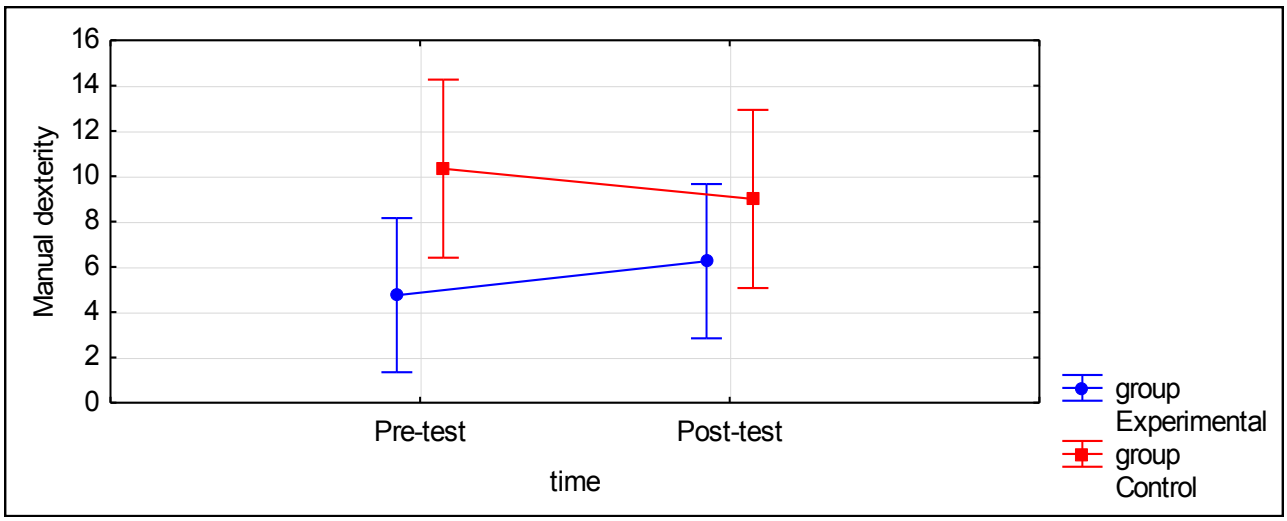

FIGURE 4.2: **THE RESPONSE TO INTERVENTION FOR MANUAL DEXTERITY (EXPERIMENTAL AND CONTROL GROUPS)**

What is important to note is that a statistically significant difference was found at pre-test between the experimental and control groups in the manual dexterity subtest of the MABC-2 (p=0.03) (Appendix E; page 127; Figure E3). There was no statistically significant difference found at post-test between the experimental and control groups in the manual dexterity subtest of the MABC-2 (p=0.23) (Appendix E; page 127; Figure E4). This indicates that the control group had a higher standard score compared to the experimental group at pre-test. However, at post-test the experimental group had made greater improvements in the manual dexterity subtest after the 12-week group intervention programme.

Evidence in the literature on the association between a gross motor skills intervention programmes and fine motor skills in persons with ASD was scarce. However, similar studies were found using different populations, methods or durations of intervention. Peens *et al*. (2008:320) found that 2 of their 4 experimental groups experienced an increase in manual dexterity proficiency from pre-test to the second re-test and no significant change in their control group after receiving a motor-based intervention programme of 8 weeks in children with DCD. Charles and Gorden (2007:772) found statistically significant increases in the hand speed and dexterity of children with hemiplegic cerebral palsy during the second follow-up test after a 10-day constraint-induced movement therapy programme. Although this increase showed that practiced movement has a positive effect on children with developmental disabilities, there was, however, no comparable control group.

There also seems to be a link between fine motor skills and social skills in children with ASD. For example, Sipes *et al*., (2011:294) found that the relationship between fine motor impairments and

social impairments is stronger amongst children with ASD and suggests that fine motor skills should in fact be separated from gross motor skills when analysing individuals with ASD.

Aiming and catching

The following section demonstrates the effect that a motor skills programme had on the activities involved in the aiming and catching subtest of the MABC-2. This motor component assesses the child's hand-eye coordination abilities and how a child responds to spatial demands (Henderson *et al*., 2007:103). Aiming and catching means, standard deviations and mean differences were calculated and are summarised in Table 4.4.

TABLE 4.4: **AIMING AND CATCHING MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS (PRE- AND POST-TESTS)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	3.00±2.00	6.75±2.21	3.75
Control	5.66±3.51	7.66±3.05	2.00
Differences between pre- & post-test	-2.66	-0.91	-

No significant difference was found from pre- to post-test between the experimental and control groups (p=0.42). Thus, both the experimental and control groups improved the same amount over time. However, the experimental group did showed significant improvements from pre- to post-test (p=0.04), by increasing 3.75 score points in the aiming and caching sub-component of the MABC-2 (Table 4.4). Thus, the experimental group improved on average 1.75 standard score points more than the control group (Figure 4.3). This improvement within the experimental group may be due to the 12-week group intervention programme. The control group also experienced a slight increase of 2 points from pre- to post-test, however this was not significant. The marginal increase in scores could be because individuals in the control group carried on with their usual recreational activities, which may have included some form of motor skill participation.

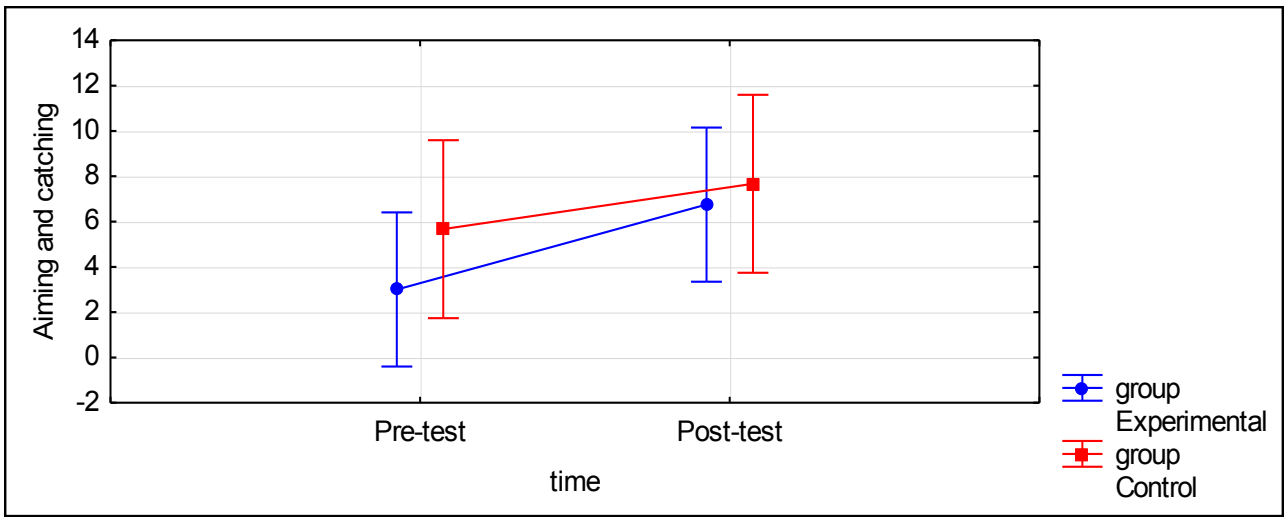

FIGURE 4.3: **THE RESPONSE TO INTERVENTION FOR AIMING AND CATCHING (EXPERIMENTAL AND CONTROL GROUPS)**

Additionally, what can be noted is that no statistically significant difference was found at pre-test between the experimental and control groups in the aiming and catching segment of the MABC-2 ($p=0.24$) (Appendix E; page 128; Figure E5) and no statistically significant difference was found at post-test between the experimental and control groups in the aiming and catching subtest of the MABC-2 ($p=0.66$) (Appendix E; page 128; figure E6). Therefore, both the experimental and control groups had similar standard scores at pre- and post-test.

Previous studies also report similar findings, where control groups had also revealed a significant increase in object control skills from pre- to post-intervention (Pless *et al*., 2000:188; Goodway & Branta, 2003:42). In the current study, there were also non-overlapping confidence intervals at pre-test for this subtest between the 2 groups, which point to the experimental group having a significantly lower baseline aiming and catching score than the control group.

Bennett *et al*. (1999:220,228) implemented a crossover transfer design in a group of 9 to 10 year old typically developing children. They found that repeated practice of catching a moving ball resulted in improvements in children's catching abilities from pre- to post-test. Goodway and Branta (2003:42) conducted a study on the effects of a 12-week fundamental motor skills intervention programme on developmentally at-risk pre-schoolers and also found a significant increase in object control skills ($p<0.001$) in their experimental group, which included specific skills such as throwing and catching. Revie and Larkin (1993:32,37) found a significant increase in the throwing distance at post-test of their experimental group compared to their control group, when they conducted a task-specific motor learning intervention of 4 weeks on 31 poorly coordinated children aged 5 to 9 years

old. This improvement in motor performance provides considerable evidence that motor skill programmes which involve repeated practice of specific skills, can improve targeted motor tasks.

These above findings however, conflict with what Bardid *et al*. (2013:4575) found, when they examined the effectiveness of a 10-week fundamental motor skills programme on typically developing pre-schoolers with poor motor competence. Bardid and co-workers found that object control skills (p=0.09) did not progress over time after the motor skill intervention.

Balance

The following section demonstrates the effect that a group intervention programme had on the activities involved in the balance subtest of the MABC-2. This motor component measures the child's ability to control his or her body parts in relation to one another, which are important in everyday life (Henderson *et al*., 2007:103). Balance means, standard deviations and mean differences were calculated and are summarised in Table 4.5.

TABLE 4.5: **BALANCE MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS (PRE- AND POST-TEST)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	6.75±2.21	10.00±3.36	3.25
Control	13.33±1.15	10.66±3.05	-2.66
Differences between pre- & post-test	-6.58	-0.66	-

A significant difference can be reported over time between the experimental and control groups (p=0.01) in the balance subtest of the MABC-2. The experimental group improved by 3.25 scores and the control group experienced a decrease of 2.66 points in balance skills, pre- to post-test (Table 4.5). Hence, the experimental group improved on average 5.91 standard score points more than the control group (Figure 4.4). The experimental group showed a significant improvement overtime for the balance subtest of the MABC-2 (p=0.02). This increase in scores may be due to the experimental group participating in the 12-week group intervention programme. This may be a reflection of the specialized programme developed, where the majority of activities incorporated static and dynamic balance tasks. Although the experimental group made greater improvements, there were non-overlapping confidence intervals at pre-test between the 2 groups, which point to the experimental

group having a significantly lower balance score at baseline than the control group. The control group showed a marked decline in their balance proficiency. This may be, because, balance skills were not constantly be practiced during their usual recreational activities.

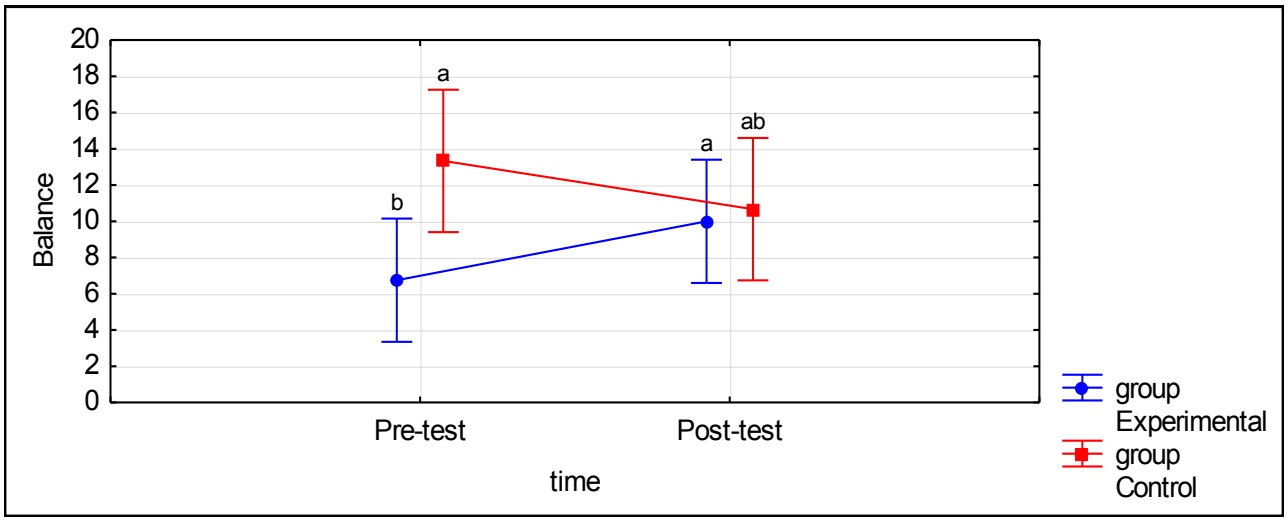

FIGURE 4.4: **THE RESPONSE TO INTERVENTION FOR BALANCE (EXPERIMENTAL AND CONTROL GROUPS)**

The current study's results revealed that a statistically significant difference was found at pre-test between the experimental and control groups for the balance subtest of the MABC-2 (p=0.02) (Appendix E; page 129; Figure E7) and there was no statistically significant difference found at post-test between the experimental and control groups in the balance subtest of the MABC-2 (p=0.75) (Appendix E; page 129; Figure E8). Thus, at pre-test, the control group performed higher on this subtest than the experimental group and at post-test the experimental group experienced a small increase in balance skills, while the control group experienced a decline in their balance abilities after the 12-week group intervention programme.

Travers *et al*. (2013:1568,1574) compared the static postural stability and symmetry of adolescents and adults with ASD with age- and IQ-matched typically developing individuals. The results indicated no significant group differences in postural stability when individuals stood on both feet; however, there were significant group differences during the one-legged standing position. This outcome suggests that persons with ASD are impaired during more complex balance tasks.

In a recent study conducted by Cheldavi *et al*. (2014:10,14) a 6-week balance training intervention programme on 20 boys diagnosed with high functioning autism (7 to 10 years) was implemented. They found that the experimental group had a significant improvement in balance skills compared to

the control group at post-test. Therefore, providing a well-designed intervention incorporating balance tasks can improve balance ability in children with ASD.

The following section provides a brief overview of the effectiveness that 1 week of no intervention had on the gross motor skills of children in the experimental group.

RENTENTION (NO INTERVENTION)

During the 12-week group intervention programme there were 2-weeks where children had school holidays. During one of the weeks a home programme was sent to the parents or legal guardians of the experimental group. During the other week the researcher used this as a forced retention period where no home programme was given. The control group did not receive the home programme and were not tested before and after the forced retention period.

As depicted in Figure 4.5, the experimental group increased in total motor skill proficiency, as well as in all 3 subtests of the MABC-2, after receiving only 6 weeks of the group intervention programme. This improvement after a short period shows the importance and benefits that motor skill interventions can have on children with ASD. After the week of no intervention, the experimental group was tested again, to attain whether or not the participants were able to retain the motor skills already learnt. The following graph illustrates the results found after a week of no intervention.

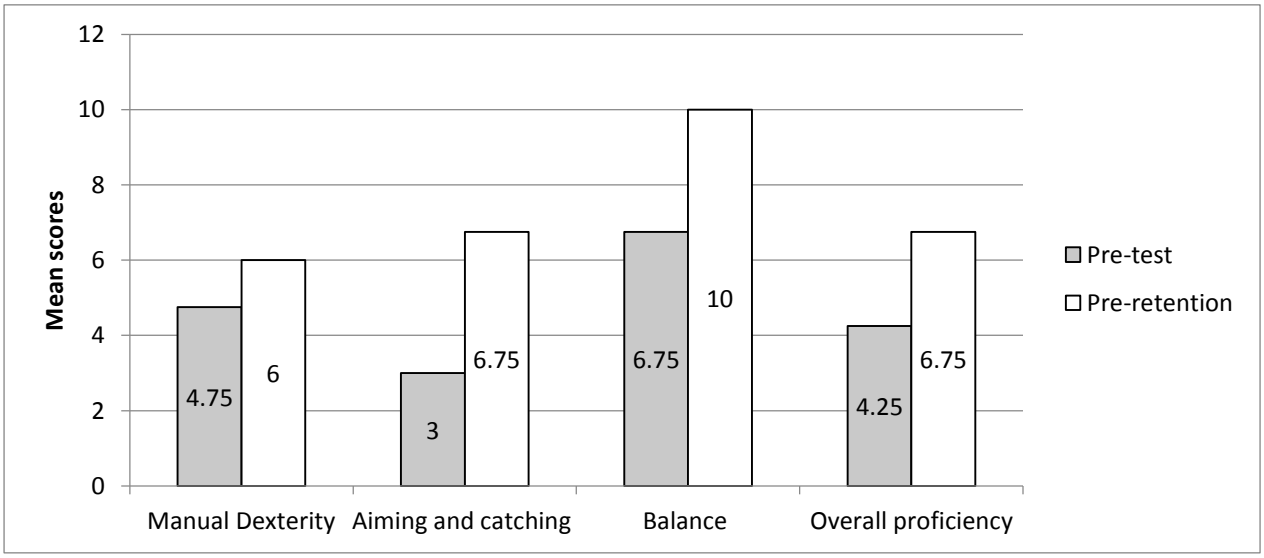

FIGURE 4.5: **SUBTEST MEAN SCORES AND TOTAL MOTOR PROFICIENCY FROM PRE-TEST TO PRE-RETENTION (EXPERIMENTAL GROUP)**

As illustrated in Figure 4.6, manual dexterity, balance and total motor proficiency was maintained after a short period of no intervention. However, aiming and catching showed a slight decrease. It is important that children maintain learnt skills, however, a 1-week retention period could in fact be too short, and therefore no effect can be observed.

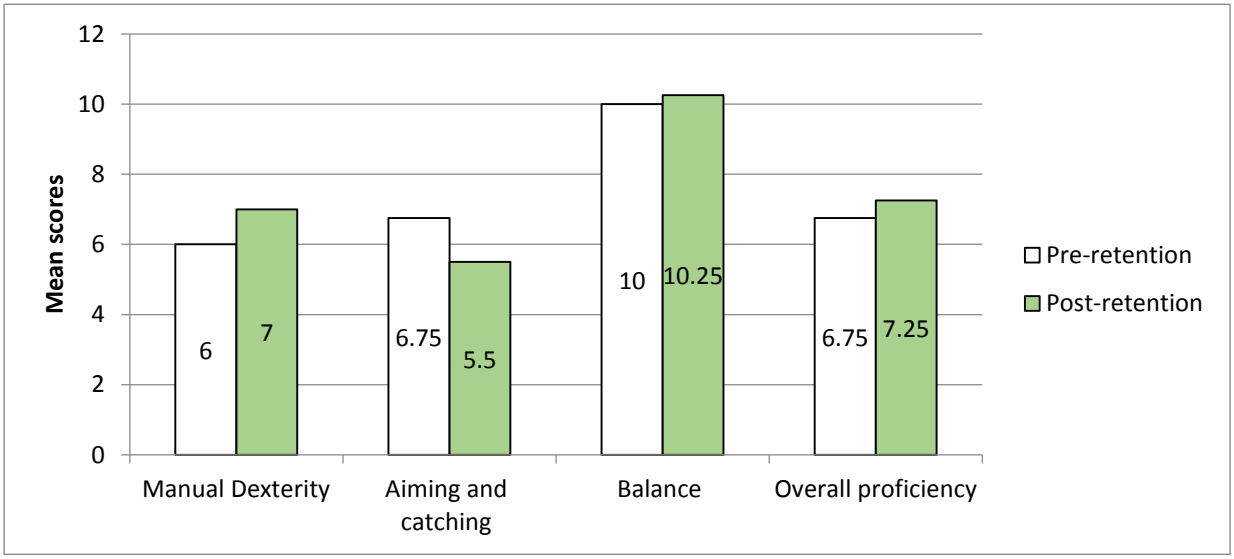

FIGURE 4.6: **SUBTEST MEAN SCORES AND TOTAL MOTOR PROFICIENCY AFTER RECEIVING NO INTERVENTION (EXPERIMENTAL GROUP)**

THE SOCIAL RESPONSIVENESS SCALE-2 (SRS-2) (Constantino & Gruber, 2012)

Despite the growing number of research studies involved in the improvements of social skills in children with ASD through group-based social skill interventions (Flynn & Healy, 2012:433), there is a significant gap in the literature related to the effects of gross motor skill interventions on these social domains (MacDonald *et al*., 2013:272). MacDonald *et al*. (2011:42) found that after children with ASD (11 to 16 years) learnt to ride a two-wheel bicycle, social generalisation and peer relationships had improved. They concluded that when children with ASD are given the necessary tools to practice age-appropriate motor behaviours, social success can be achieved through social practise. They also report that motor skills create a platform for social skills practice, positively affecting social development and that further research is needed to better comprehend the impact motor skills have on social success. No comparable studies were found which matched the exact characteristics of the current study.

Total social competence

The following section demonstrates the effect that the group intervention programme had on total social competence as analysed by the SRS-2. The SRS-2 helps researchers and clinicians measure

social symptomology (Constantino & Gruber, 2012:3). The total social skill competence means, standard deviations and mean differences were calculated and are summarised for both the parent- (Table 4.6) and teacher-responses (Table 4.7).

As illustrated in Table 4.6, although not significant the experimental and control groups experienced a small increase on average 3.25 and 4.66 score points respectively in total social skill competence according to parent-response.

TABLE 4.6: **TOTAL SOCIAL SKILL MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (PARENT)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	70.00±6.53	66.75±6.70	3.25
Control	60.66±6.65	56.00±2.00	4.66
Differences between pre- & post-test	9.33	10.75	-

As indicated in Table 4.7, although not significant the experimental and control groups improved on average 11.25 and 1.66 points respectively in total social skill competence according to teacher-response. Furthermore, the experimental group seemed to improve more than the control group, which could be because individuals in the experimental group participated in social interaction tasks during the 12-week intervention programme.

TABLE 4.7: **TOTAL SOCIAL SKILL MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (TEACHER)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	71.00±13.66	59.75±11.52	11.25
Control	57.00±8.18	55.33±3.78	1.66
Differences between pre- & post-test	14.00	4.41	-

Over time, no significant effect was observed in total social skill competency between the experimental and control groups according to the parent- (p=0.82) and the teacher- (p=0.34) responses (Figure 4.7 and 4.8). This indicates that the 12-week group intervention did not improve the total social skill competency in both groups.

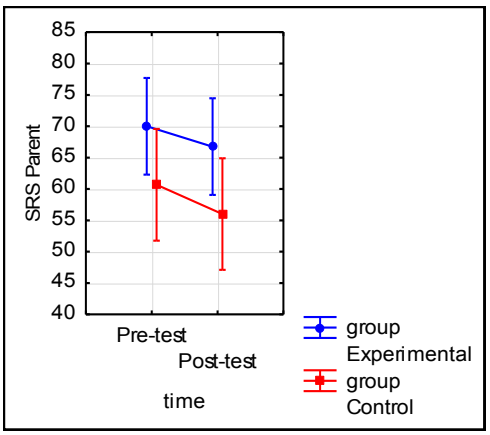

FIGURE 4.7: **THE RESPONSE TO INTERVENTION FOR TOTAL SOCIAL COMPETENCE FOR EXPERIMENTAL AND CONTROL GROUPS (PARENT)**

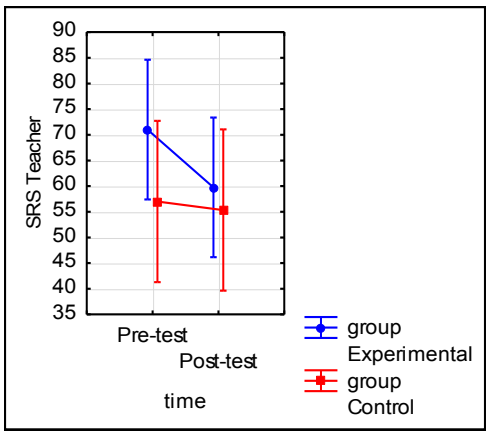

FIGURE 4.8: **THE RESPONSE TO INTERVENTION FOR TOTAL SOCIAL COMPETENCE FOR EXPERIMENTAL AND CONTROL GROUPS (TEACHER)**

In addition to finding no statistically significant difference at pre-test between the experimental and control groups for total social skill competency of the SRS-2 for both the parent- (p=0.09) and teacher- (p=0.14) responses (Appendix E, page 130, Figure E9 and E10), there was also no statistically significant difference found at post-test between the experimental and control groups for the total social skills of the SRS-2 for both the parent- (p=0.06) and teacher-responses (p=0.60) (Appendix E, page 131, Figure E11 and E12). This shows that both the experimental and control groups had similar score points at pre- and post-test.

Although the current study did not find significant improvements in overall social development after the specialised motor skills programme, recent literature provides evidence which supports the positive relationship between motor skills and social skills (MacDonald *et al*., 2011:42; MacDonald *et al*., 2013:279).

Pan *et al*. (2011:493,494,495) conducted a longitudinal study on the correlations of physical activity (PA) during physical education lessons and social engagement amongst children with and without ASD. Pan and colleagues found that social initiations and interactions between peers with and

without ASD, during physical education positively correlated with the different PA variables (moderate PA, vigorous PA and moderate to vigorous PA).

Bass *et al*. (2009:1262,1265,1266) investigated the effects of a 12-week therapeutic horseback riding intervention on the social functioning of children with ASD. They found that their experimental group's means significantly increased for the total social score on the SRS ($p=0.02$), while their control group's means remained the same ($p=0.92$). Group-time interactions revealed significant interaction effects for social motivation ($p=0.04$), however, no significant interactions were found for social cognition or social awareness. A positive change occurred overtime for the experimental group ($p<0.003$), but not for the control group ($p=0.78$). This increase in social functioning according to Bass *et al*. (2009:1266) was observed because therapeutic horseback riding is an activity which requires an individual to complete motor tasks, as well as engage socially. Thus, creating opportunities for children to practice motor tasks may form a window for social success. Bass *et al*. (2009:1261) describe how therapeutic horseback riding assists in the stimulation of multiple areas of function and is suitable for children who have neurological conditions which frequently present motor, cognitive and social disabilities.

The next section will expand on the sub-components of the SRS-2 and illustrate the effects the 12-week group intervention programme had on social domains such as social awareness, social cognition, social communication, social motivation, as well as restricted interests and repetitive behaviour.

Social awareness

Social awareness is one's ability to recognise social cues and signifies the sensory facet of reciprocal social behaviour (Constantino & Gruber, 2012:77). The social awareness means, standard deviations and mean differences were calculated and are summarised for both the parent- (Table 4.8) and teacher-responses (Table 4.9).

As indicated in Table 4.8 the control group marginally improved their social awareness by 0.66 points, whereas the experimental group experience a slight decrease by 3.50 points from pre- to post-intervention. In other words, the control group improved on average 4.16 scores more than the experimental group for social awareness according to parental-response.

TABLE 4.8: **SOCIAL AWARENESS MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (PARENT)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	66.25±10.34	69.75±10.84	-3.50
Control	56.00±4.58	55.33±12.58	0.66
Differences between pre- & post-test	10.25	14.41	-

Although not significant the experimental group improved by 12.00 score points, and the control group showed a decline in their social awareness scores by 2.33 points (Table 4.9). The experimental group, therefore, improved on average 9.67 scores more than the control group for social awareness according to teacher-response.

TABLE 4.9: **SOCIAL AWARENESS MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (TEACHER)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	67.25±13.47	55.25±10.17	12.00
Control	54.33±14.29	56.66±8.73	-2.33
Differences between pre- & post-test	12.91	-1.41	-

Over time, no significant effect was observed in social awareness for the experimental and control groups according to the parent- ($p=0.57$) and teacher- ($p=0.31$) responses (Figure 4.9 and 4.10). This means that social awareness was not improved after the 12-week group intervention programme. The 12-week group intervention programme may not have been sensitive enough to improve social awareness, since the intervention programme did not teach social awareness skills, it simply provided opportunities for the children to interact and communicate with one another in a group setting, therefore future studies should make sure that social awareness skills are taught during an intervention period in order to experience significant results.

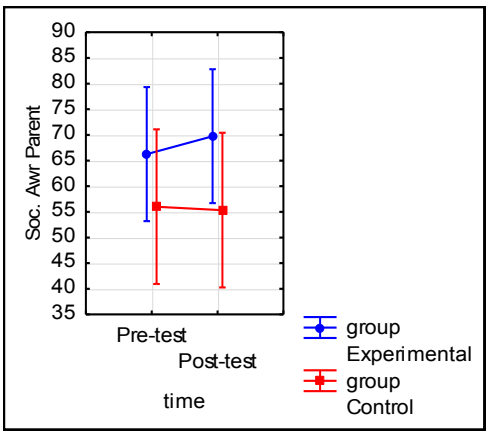

FIGURE 4.9: **THE RESPONSE TO INTERVENTION FOR SOCIAL AWARENESS FOR EXPERIMENTAL AND CONTROL GROUPS (PARENT)**

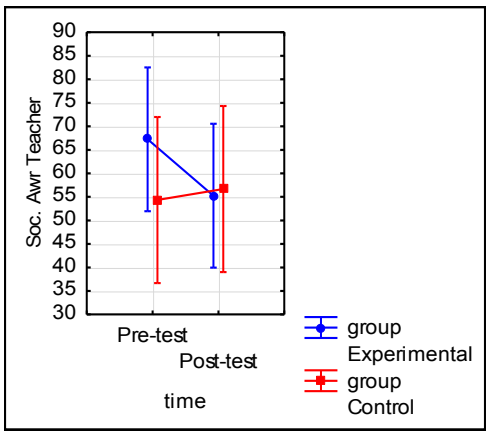

FIGURE 4.10: **THE RESPONSE TO INTERVENTION FOR SOCIAL AWARENESS FOR EXPERIMENTAL AND CONTROL GROUPS (TEACHER)**

What can also be noted is that at pre-test no statistically significant difference was found between the experimental and control groups in the social awareness treatment subscale of the SRS-2 for both the parent- (p=0.24) and teacher- (p=0.21) responses (Appendix E, page 132, Figure E13 and E14), nor was a statistically significant difference found at post-test between the experimental and control groups in the social awareness treatment subscale of the SRS-2 for both the parent- (p=0.12) and teacher-responses (p=0.88) (Appendix E, page 133, Figure E15 and E16). What can also be noted is that there were non-overlapping confidence intervals at pre-test between the 2 groups, which point to the experimental group having a significantly higher score at baseline than the control group.

To the researcher's knowledge, no literature using intervention approaches to improve social awareness exists therefore future studies should explore this further.

Social cognition

Social cognition is one's ability to understand social cues and it signifies the cognitive-interpretive facets of reciprocal social behaviour (Constantino & Gruber, 2012:77). The social cognition means, standard deviations and mean differences were calculated and are summarized for both the parent- (Table 4.10) and teacher-responses (Table 4.11).

Although not significant, the control group improved by 5.33 points and the experimental group showed a decrease in social cognition of 2.00 score points from pre- to post-test (Table 4.10).

Therefore, the control group scored on average 7.33 scores more than the experimental group for social cognition according to parent-response.

TABLE 4.10: **SOCIAL COGNITION MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (PARENT)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	69.00±7.61	71.00±11.46	-2.00
Control	71.33±6.11	66.00±5.56	5.33
Differences between pre- & post-test	-2.33	5.00	-

From the teacher-responses, the experimental group improved by 9.00 points and the control group showed a decrease of 7.33 points in their social cognitive skills (Table 4.11). Thus, the experimental group improved on average by 2.17 scores more than the control group for social cognition according to teacher- response. This was, however, statistically non-significant.

TABLE 4.11: **SOCIAL COGNITION MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (TEACHER)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	75.00±8.20	65.50±10.27	9.50
Control	59.00±9.84	66.33±2.30	-7.33
Differences between pre- & post-test	16.00	-0.83	-

There was also no significant effect found over time in social cognition for the experimental and control groups according to the parent- ($p=0.23$) and the teacher- ($p=0.13$) responses (Figure 4.11 and 4.12). Thus, the intervention had no effect on the social cognition of the participants.

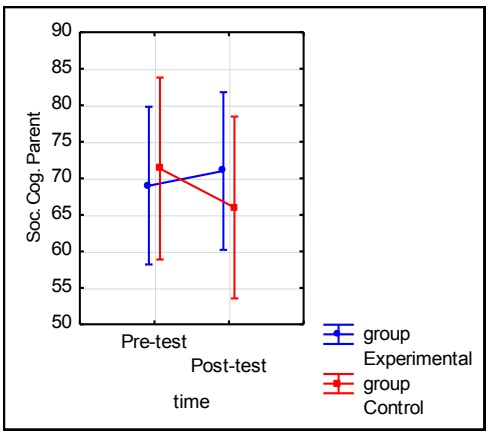

FIGURE 4.11: **THE RESPONSE TO INTERVENTION FOR SOCIAL COGNITION FOR EXPERIMENTAL AND CONTROL GROUPS (PARENT)**

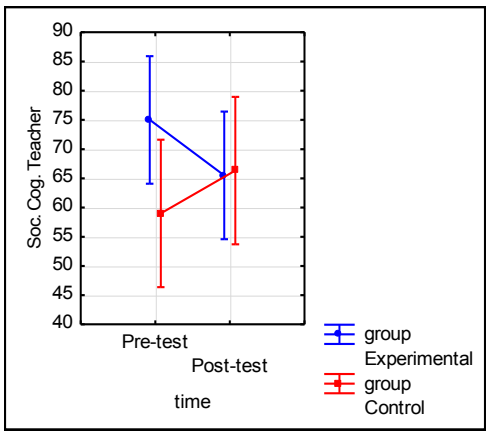

FIGURE 4.12: **THE RESPONSE TO INTERVENTION FOR SOCIAL COGNITION FOR EXPERIMENTAL AND CONTROL GROUPS (TEACHER)**

No statistically significant difference was found at pre-test between the experimental and control groups in the social cognition treatment subscale of the SRS-2 for both the parent- (p=0.73) and teacher- (p=0.06) responses (Appendix E, page 134, Figure E17 and E18). No statistically significant difference was found at post-test between the experimental and control groups in the social cognition treatment subscale of the SRS-2 for both the parent- (p=0.47) and teacher-responses (p=0.90) (Appendix E, page 135, Figure E19 and E20).

The researcher struggled to find comparable studies using motor programmes to enhance social cognition in children with ASD. To the researcher's knowledge, the only evidence which reports on the relationship between social cognition and motor skills is a study done by Gallese (2006:1,8) whom conducted a research report on the neurophysiology perspective on social cognition and its disruptions in autism. Gallese reported that the mechanisms involved in stimulating the sensory-motor system play a major part in social cognition. For that reason, future researched should investigate using sensory-motor interventions as this may improve social cognition in children with ASD.

Social communication

Social communication involves open communication and it represents the "motoric" features in reciprocal social behaviours (Constantino & Gruber, 2012:77). The social communication means, standard deviations and mean differences were calculated and are summarized for both the parent- (Table 4.12) and teacher-responses (Table 4.13).

In the current study the control group showed a slight increase in social communication skills at post-test, even though it was not significant and the experimental group showed a decline in scores by 2.25 points. The control group therefore improved on average 8.58 scores more than the experimental group for social communication according to parent-response (Table 4.12).

TABLE 4.12: **SOCIAL COMMUNICATION MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (PARENT)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	71.25±6.55	73.50±6.60	-2.25
Control	64.00±11.35	57.66±4.72	6.33
Differences between pre- & post-test	7.25	15.83	-

On the other hand, although not significant the experimental and control group marginally improved on average by 7 (experimental) and 5 (control) score points respectively for social communication according to teacher-response (Table 4.13).

TABLE 4.13: **SOCIAL COMMUNICATION MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (TEACHER)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	71.75±13.76	64.75±13.88	7.00
Control	62.00±8.88	57.00±7.00	5.00
Differences between pre- & post-test	9.75	7.75	-

There was, however, no significant effect found over time in social communication for the experimental and control groups according to the parent- ($p=0.27$) and the teacher- ($p=0.86$) responses (Figure 4.13 and 4.14). This shows that the group intervention programme had no effect on this treatment subscale of the SRS-2. This may be because of the small sample size, the duration of the intervention programme, specific social skills were not taught during the intervention

programme or because although children within the experimental group were at a similar level of function, they were all different ages.

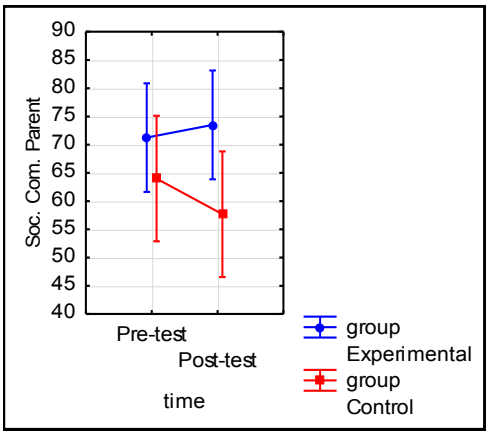

FIGURE 4.13: **THE RESPONSE TO INTERVENTION FOR SOCIAL COMMUNICATION FOR EXPERIMENTAL AND CONTROL GROUPS (PARENT)**

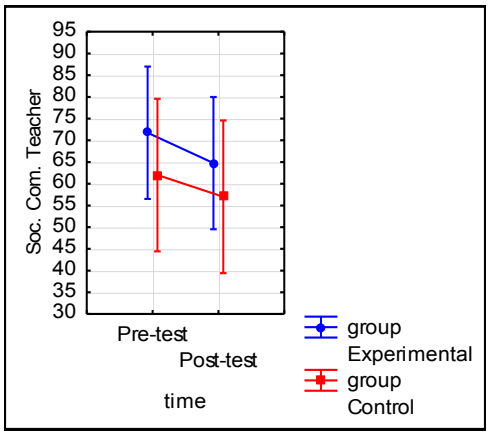

FIGURE 4.14: **THE RESPONSE TO INTERVENTION FOR SOCIAL COMMUNICATION FOR EXPERIMENTAL AND CONTROL GROUPS (TEACHER)**

No statistically significant difference was found at pre-test between the experimental and control groups in the social communication treatment subscale of the SRS-2 for both the parent- (p=0.26) and teacher- (p=0.33) responses (Appendix E, page 136, Figure E21 and E22). A statistically significant difference was found at post-test between the experimental and control groups in the social communication treatment subscale of the SRS-2 in the parent responses (p=0.03) (Appendix E, page 137, Figure E23), but no statistically significant difference was found at post-test between the experimental and control groups in the social communication treatment subscale of the SRS-2 in the teacher responses (p=0.43) (Appendix E, page 137, Figure E24).

Ventola *et al*. (2014:3,5), conducted a 4-month study, on the efficacy of pivotal response treatment (PRT) on social-communication and adaptive skills of 4 to 6 year old children diagnosed with ASD. The SRS-2 was completed by the parents of the participating children to establish whether the children had made improvements from pre- to post-test. Ventola and co-workers found that 80% (6 out of 8 participants) of the children made substantial improvements in social communication after receiving the treatment. The above-mentioned study provides evidence which confirms that giving children opportunities to interact through motor play, can contribute to overall social skill development.

Social motivation

Social motivation involves the degree to which an individual is motivated to socially interact in relational behaviour (Constantino & Gruber, 2012:77). The social motivation means, standard deviations and mean differences were calculated and are summarised for both the parent- (Table 4.14) and teacher-responses (Table 4.15).

The experimental and control group slightly improved on average 5.25 and 6.33 score points respectively for social motivation according to parent response (Table 4.14). This shows that the group intervention programme may have had a small effect on the social motivation of participants according to parental-response.

TABLE 4.14: **SOCIAL MOTIVATION MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (PARENT)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	72.00±11.46	66.75±9.10	5.25
Control	62.33±10.50	56.00±6.00	6.33
Differences between pre- & post-test	9.66	10.75	-

As indicated in Table 4.15, although not significant the experimental and control group improved on average by 7.75 and 8 standard score points respectively for social motivation according to teacher-response.

TABLE 4.15: **SOCIAL MOTIVATION MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (TEACHER)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	68.00±12.27	60.25±13.81	7.75
Control	58.66±7.57	50.66±2.51	8.00
Differences between pre- & post-test	9.33	9.58	-

Over time, no significant effect was observed in social motivation for the experimental and control groups according to the parent- (p=0.84) and the teacher- (p=0.97) responses (Figure 4.15 and 4.16). This unfortunately shows that the specialised intervention had no effect over time on social motivation pre- to post-test. This may be because the school assigned a new teacher to the experimental group at post-test; therefore, a different teacher completed the SRS-2 at pre- and post-test. This unfortunately was out of the researcher's control, thus forms part of the limitations to the current study.

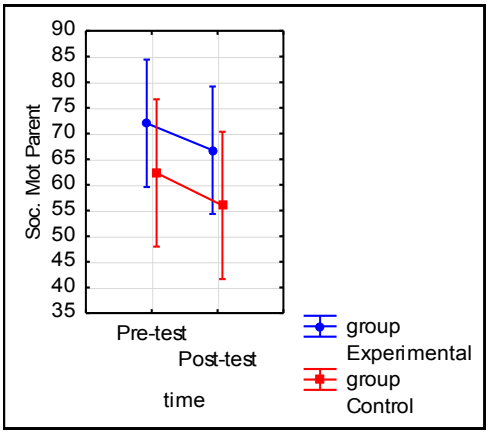

FIGURE 4.15: **THE RESPONSE TO INTERVENTION FOR SOCIAL MOTIVATION FOR EXPERIMENTAL AND CONTROL GROUPS (PARENT)**

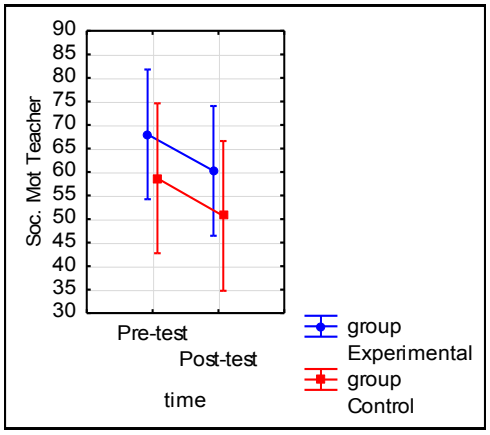

FIGURE 4.16: **THE RESPONSE TO INTERVENTION FOR SOCIAL MOTIVATION FOR EXPERIMENTAL AND CONTROL GROUPS (TEACHER)**

No statistically significant difference was found at pre-test between the experimental and control groups in the social motivation treatment subscale of the SRS-2 for both the parent- (p=0.24) and teacher- (p=0.30) responses (Appendix E, page 138, Figure E25 and E26). No statistically significant difference was found at post-test between the experimental and control groups in the social motivation treatment subscale of the SRS-2 for both the parent (p=0.20) and teacher responses (P=0.29) (Appendix E, page 139, Figure E27 and E28).

Restricted interests and repetitive behaviours

The following section demonstrates the effect that the group intervention programme had on the restricted interests and repetitive behaviours treatment subscale of the SRS-2. This subtest of the SRS-2 includes a variety of stereotypical behaviours or limited interests (Constantino & Gruber, 2012:77). The restricted interests and repetitive behaviours means, standard deviations and mean

differences were calculated and are summarised for both the parent- (Table 4.16) and teacher-responses (Table 4.17).

According to the parent report, although not significant the experimental and control group marginally improved on average by 1.75 and 1.33 points respectively for restricted interests and repetitive behaviours (Table 4.16).

TABLE 4.16: **RESTRICTED INTERESTS AND REPETITIVE BEHAVIOURS MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (PARENT)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	77.50±8.88	75.75±9.42	1.75
Control	67.66±6.11	66.33±3.78	1.33
Differences between groups for the pre- and post-test	9.83	9.41	-

The experimental group improved on average by 11 points, although it was not significant, where the control group decreased by 1.33 points (Table 4.17). The experimental group improved on average by 9.67 scores more than the control group for restricted interests and repetitive behaviours according to teacher-response.

TABLE 4.17: **RESTRICTED INTERESTS AND REPETITIVE BEHAVIOURS MEANS, STANDARD DEVIATIONS AND MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS FROM PRE- TO POST-TEST (TEACHER)**

Group	***Pre-test Mean ± SD***	***Post-test Mean ±SD***	***Differences within groups from pre- to post-test***
Experimental	73.00±5.35	62.00±11.60	11.00
Control	58.66±10.69	60.00±13.22	-1.33
Differences between groups for the pre- and post-test	14.33	2.00	-

Over time, no significant effect was observed for the restricted interests and repetitive behaviours subcomponent of the SRS-2 for the experimental and control groups according to the parent- (p=0.86) and the teacher- (p=0.22) responses (Figure 4.17 and 4.18). This indicates that the group intervention programme had no effect over time on restricted interests and repetitive behaviours pre- to post-test.

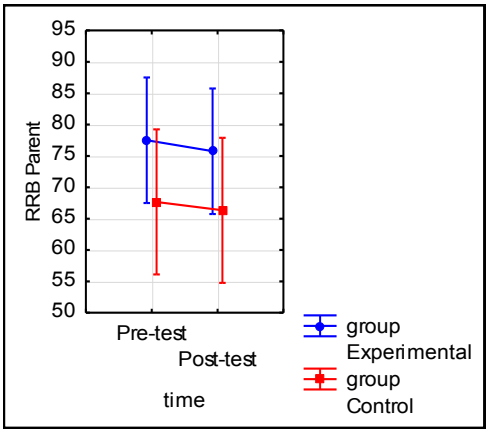

FIGURE 4.17: **THE RESPONSE TO INTERVENTION FOR RESTRICTED INTERESTS AND REPETITIVE BEHAVIOURS FOR EXPERIMENTAL AND CONTROL GROUPS (PARENT)**

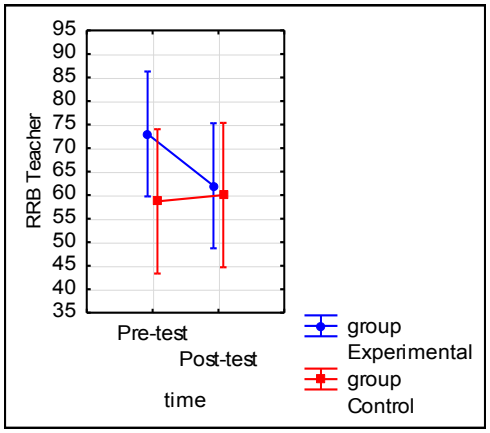

FIGURE 4.18: **THE RESPONSE TO INTERVENTION FOR RESTRICTED INTERESTS AND REPETITIVE BEHAVIOURS FOR EXPERIMENTAL AND CONTROL GROUPS (TEACHER)**

No statistically significant difference was found at pre-test between the experimental and control groups in the restricted interests and repetitive behaviours treatment subscale of the SRS-2 for both the parent- (p=0.15) and teacher-responses (p=0.12) (Appendix E, page 140, Figure E29 and E30). No statistically significant difference was found at post-test between the experimental and control groups in the restricted interests and repetitive behaviours treatment subscale of the SRS-2 for both the parent (p=0.17) and teacher responses (p=0.81) (Appendix E, page 141, Figure E31 and E32).

Research has suggested that treatments for stereotypical behaviours seem to be problematic (Ringdahl *et al*., 2002:43). Therefore the researcher struggled to find viable intervention treatments targeting restricted interests and repetitive behaviours. Nuzzolo-Gomez *et al*., (2002:85) conducted an experimental study on 3 children with moderate to severe ASD. The aim of the study was to teach children to choose to play with a toy rather than continue with repetitive stereotypical behaviours. Nuzzolo-Gomez and colleagues found that the conditions which were associated with

toy play resulted in decreased stereotypical behaviours. These results showed that when children are taught to participate in additional play activities, stereotypical behaviours may be reduced.

SUMMARY OF RESULTS

Total motor proficiency

A statistically significant intervention effect was found between the experimental and control groups. These results indicate the possible effectiveness of the 12-week intervention programme on the motor skills of children with ASD. No significant difference was found for the control group overtime. The control group however showed higher baseline scores compared to the experimental group at pre-test.

Manual dexterity

There was no significant difference found over time between the experimental and control groups. However, the experimental group did show improvements in the fine motor tasks standard score points after the group intervention programme. This shows the need for a larger sample size. For this subtest, the control group did however show higher baseline scores compared to the experimental group at pre-test.

Aiming and catching

Between the experimental and control groups, no statistically significant difference was found from pre- to post-test. The experimental group did however show significant improvements within the group over time in the aiming and catching subtest. This may be because of the 12-week group intervention programme incorporated the practicing of throwing and catching skills which were repeated throughout the intervention.

Balance

A statistically significant difference was reported over time between the experimental and control groups in the balance subtest of the MABC-2. The control group showed a decline in balance skills, whereas the experimental group showed significant improvements over time. These results indicate the positive effects that a 12-week motor skill intervention can possibly have balance skills in children with an ASD.

Retention

The experimental group showed improvements in total motor skill proficiency, as well as in all 3 subtests of the MABC-2 after receiving only 6-weeks of intervention. This shows the effectiveness of the group intervention programme on children with ASD after only a short period of intervention. After receiving 1-week of no intervention, results indicated that total motor proficiency hand not been affected, with children having retained the skills learnt. The retention period also had no effect on manual dexterity or balance; however a slight decrease in mean scores was shown for the aiming and catching task. A 1-week retention period could in fact be too short, and therefore no effect can be observed.

Total social competency

No significant effect was found overtime for total social skill competency between the experimental and control groups according to the parent- and the teacher-responses. However, both the experimental and control groups experienced a non-significant improvement in their social skill competency score points according to the parents and teachers. This shows that the 12-week group intervention could have showed significant improvements in total social skill competency if the intervention programme had taught specific social skills, if there was a larger sample size or if the intervention occurred over a longer period of time.

Social awareness

There was no significant difference found between the experimental and control groups overtime according to both parent and teacher responses. This shows that social awareness unfortunately was not positively affected by the group intervention programme. What can also be noted is that both teacher and parent responses showed different results. The parent response indicated that control group slightly improved in social awareness compared to the experimental group, and according to the teacher response, the experimental group improved and the control group declined from pre- to post test in social awareness skills.

Social cognition

There was also no significant effect found overtime in social cognition for the experimental and control groups according to the parent- and the teacher-responses, thus, the intervention had no important effects on the social cognition of participants. However the scores did reveal that the control group improved slightly and the experimental group decreased according to the parent

response and the teacher response showed that the experimental group improved and the control group decreased in their social cognition points.

Social communication

The current study reported that there was no significant effect observed between the experimental and control groups overtime according to the parent- and the teacher-responses. Therefore the 12-week group intervention caused no improvements in social communication skills. According to the parent response, the control group did however show slight improvements in their scores, and the experimental group did not. According to the teacher response, the both groups showed a small improvement after the 12-weeks of intervention in social communication.

Social motivation

Between groups, no statistically significant difference was found from pre- to post-test in social motivation according to both teacher and parent responses. Both groups did, however, show a marginal improvement in their social motivation skills, which may be due to the intervention programme.

Restricted interests and repetitive behaviours

No significant difference was observed overtime between the experimental and control groups for both parent and teacher responses. According to the parent response, both groups performed better at post-test, indicating that the intervention may have had effect on this subtest. The teachers however reported that the experimental group showed improved restricted interests and repetitive behaviours and the control group decreased. This shows us how different parent and teacher views are.

Chapter 5 will discuss the conclusions of the findings above, discuss the limitations of the current study and provide future recommendations.

CHAPTER FIVE
CONCLUSION

INTRODUCTION

The purpose of the current study was to implement a specialised group intervention programme to improve the gross motor and social skills of selected children diagnosed with Autism Spectrum Disorder (ASD) between the ages of eight and 13 years.

The current study had the following specific aims:

1. To establish the level of overall gross motor and social skills of a selected group of children with ASD.
2. To determine whether a group intervention programme could improve gross motor skills.
3. To determine whether a group intervention programme could improve social skills.

CONCLUSION

The Movement Assessment Battery for Children-2 (MABC-2) and the Social Responsiveness Scale-2 (SRS-2), were used in the current study to determine the gross motor and social skills of children with ASD and to test the effect of the motor intervention. Conclusions will now be made regarding the impact that the 12-week group intervention programme had on these two test scores. The following conclusions reflect on the discussion presented in chapter 4.

THE MOVEMENT ASSESSMENT BATTERY FOR CHILDREN-2 (MABC-2)

Total motor proficiency

Children with ASD have been found to have poorer motor skill proficiency than children with other disabilities or typically developing children (Pan *et al*., 2009:1299), yet, there have not been many motor skill interventions conducted on children with ASD.

The current study found statistically significant improvements in total motor proficiency, as well as in balance skills over time between the experimental and control groups. It shows that the 12-week group intervention programme helped improve the total motor proficiency and balance skills of children with ASD. The experimental group made significant improvements in total motor skills after receiving the 12-week group intervention programme, whereas the control group showed a slight decrease in scores at post-test, although they showed higher baseline scores compared to the experimental group at pre-test. Standard scores reflected the improvements made by the

experimental group. At pre-test three out of four participants fell into the red zone and one participant fell into the amber zone of movement capabilities according to the MABC-2. Post-test found that every participant in the experimental group had made considerable improvements in total motor performance by proceeding into the next zone. One participant even moved up two zones. These results demonstrate the importance of motor skill interventions in children with ASD.

Pless *et al*. (2000:188) also found similar results after implementing a 10-week group motor skill intervention in children with definite and borderline motor difficulties. Studies implementing motor skill interventions on children with other disabilities and typically developing children have also found similar results (Mahoney *et al*., 2001:159,253; Bardid *et al*., 2013:4575).

Manual dexterity

The manual dexterity subtest was not the main focus of the current study; but, it is just as important as gross motor skills because children with ASD also experience delays in fine motor ability which affects other aspects of development such as academics.

Unfortunately, the current study did not find any statistically significant improvements in manual dexterity from pre- to post-test between the experimental and control groups. The experimental group did, however, show slight improvements in standard score, although not significantly, in the fine motor tasks after receiving the 12-week group intervention programme while the control group showed a small decrease in fine motor skills. The control group, however, presented higher baseline scores compared to the experimental group at pre-test; therefore, there was relatively more improvement for the experimental group.

These results indicate that the 12-week group intervention programme could have improved fine motor skills significantly over time, if there was a larger sample size. The small gain in scores within the experimental group may have been because every cool-down activity within the gross motor programme consisted of activities which involved precise and accurate movements of the hands and fingers, which are used during fine motor tasks. Furthermore, the children may have struggled with understanding instructions of the MABC-2 tasks, and therefore, this might have contributed to the children scoring poorly.

Literature on the effectiveness of a motor intervention programme on fine motor precision in children with ASD has yet to appear. Nevertheless, studies have found significant improvements in fine motor performance in children with other developmental delays and disabilities after receiving movement programmes (Charles & Gordern, 2007:772; Peens *et al*., 2008:320).

Aiming and catching

Finding that here has been limited research conducted on the effects of motor skill interventions on aiming and catching skills of children with ASD. Therefore, the current study has tried to bridge that gap.

Unfortunately the current study found no statistically significant improvements in aiming and catching over time between the experimental and control groups after the 12-week group intervention programme, however, statistical significance was observed within the experimental group which did not occur within the control group. This shows that if the current study had a larger sample size, significant results may have been found over time between the groups.

These results indicate that the 12-week group intervention programme which incorporated the practicing of throwing and catching skills in a supportive and fun environment could have the power to positively impact on the object control skills of children with ASD, therefore, larger sample sizes should be used in future research. The small increase scores of the control groups might have been observed because individuals in the control group carried on with their usual recreational activities, which may have included some form of object control skill participation. Similar studies have also found that control groups also showed improvements in object control skills (Pless *et al*., 2000:188; Goodway & Branta, 2003:42).

The significance observed within the experimental group in the aiming and catching subtest might be, because the 12-week group intervention programme allowed children to practice throwing and catching tasks. Corresponding results however, have been found by Goodway and Branta (2003:42), after implementing a 12-week fundamental motor skills intervention programme amongst developmentally at risk pre-schoolers. Similar results have also been found after typically developing children received motor interventions to improve throwing and catching skills (Revie & Larkin, 1993:32,37; Bannett *et al*., 1999:220,228). However, there have been conflicting results found amongst typically developing children (Bardid *et al*., 2013:4575). Therefore, further research is needed as to the extent to which motor skill interventions improve object control skills across all children.

Balance

Children with ASD have been found to be impaired in complex balance tasks which require accuracy and precision (Travers *et al*., 2013:1568,1574). Hence, these children need opportunities to practice balance skills, since other areas of development may be affected.

Statistically significant improvements in balance were found in the current study from pre- to post-test between the experimental and control groups. These results show that the 12-week group intervention programme made positive changes in balance skills over time in children with ASD. This signifies the importance of motor skill interventions on balance proficiency in children with ASD. The control group showed a decline in their balance skills, as this group did not have the opportunity to practice these skills twice a week for 12-weeks. Although the experimental group showed significant improvements it is important to acknowledge that the control group again scored higher at pre-test on the balance subtest of the MABC-2, therefore there was relatively greater improvements within the experimental group. Cheldavi *et al*. (2014:10,14) found similar improvements in balance after a 6-week balance training intervention programme on 20 boys diagnosed with high functioning autism.

RETENTION

There was a forced retention period within the intervention programme; where after 6-weeks of practicing the intervention programme the children had a one-week school holiday break. The experimental group showed improvements in total motor proficiency, as well as in all three of the subtests of the MABC-2 after 6-weeks. After the week of forced retention tests on the experimental group revealed that total motor proficiency had not been affected, with children having retained the learnt skills. Nor was there a decline in manual dexterity or balance skills after the forced retention period. The aiming and catching subtest, however, showed a slight decrease in mean scores. A week of retention is not long enough to show significant retention effects, and future studies should look at testing children after a longer period with no intervention.

THE SOCIAL RESPONSIVENESS SCALE-2 (SRS-2)

Total social competency

Research clearly indicates a relationship between motor and social skill development in children with ASD (MacDonald *et al*., 2011:42; MacDonald *et al*., 2013:279). Therefore, improved motor skills should result in improved social skills.

After a 12-week group intervention programme involving motor skill activities, the current study found no statistically significant difference over time between the experimental and control groups. According to the parent- and teacher-responses, however, both the experimental and the control group showed a small improvement in their total social competency score points from pre- to post-test. The SRS-2 is a subjective assessment, which may have affected the results as it only reflects the

opinions of the parents and teachers regarding the social competency of the relevant child. These results show that the 12-week group intervention programme could have improved the total social skill competency if there was maybe a larger sample size, if social skills were taught throughout the intervention programme and if the intervention occurred over a longer period of time. Other studies have, however, found that children with ASD improved in social functioning after participating in activities involving movement, with others in a group over a short period (Bass *et al*., 2009:1262,1265,1266; MacDonald *et al*., 2011:42; Pan *et al*., 2011:493,494,495). Therefore, future research needs to investigate the effects of a longitudinal group intervention involving the teaching of not only motor skills, but also social skills in a larger group of children with ASD.

Social awareness

No significant improvements in social awareness were shown over time between either group in the current study, indicating that the intervention had no significant effect over time according to both parent- and teacher-responses. However, there was a difference between the teacher and parent scores from pre- to post-test. The parent response indicated that the control group slightly improved in their social awareness score points compared to the experimental group, and according to the teacher response, the experimental group improved and the control group declined in score points from pre- to post test in social awareness skills.

These results indicate the importance of obtaining different points of view. Social awareness may not have been improved significantly, because the intervention did not specifically aim at improving social awareness as an independent factor, social skills were not taught, the sample size was small and the intervention was only 12-weeks long. There has also been no research done targeting specific social awareness skills and the researcher was not able to find any comparable studies which showed that motor skill interventions affect social awareness.

Future research may want to explore the use of motor interventions which specifically target social awareness skills.

Social cognition

The current study, unfortunately did not find significant intervention effects with regards to social cognition between the experimental and control groups over time. Thus, the intervention had no important effect on the social cognition skills of participants. Yet again, the parental reports showed that the control group improved slightly and the experimental group decreased in social cognition skills, but this was not statistically significant. The teachers reported that the experimental group

improved and the control group decreased in social cognition skills from pre- to post-test, this, however, was also not significant. These results indicate that the 12-week intervention showed no benefits toward improved social cognition from pre- to post-test which may be due to the small sample size, the short intervention period or the fact that social cognitive skills were not taught during the intervention period.

Motor programmes have not yet specifically target social cognitive skills. Gallese (2006:8), however, reports that there seems to be a link between the sensory-motor system and social cognition. Therefore, further research investigating the effects of motor, specifically sensory-motor programmes on the social cognition of persons with ASD needs to be conducted.

Social communication

There were no significant effect shown between the experimental and control groups over time according to the parent- and the teacher-responses. Therefore, the 12-week group intervention caused no improvements in social communication skills. Parental reports indicated that the control group showed slight improvements in social communication, but the experimental group did not. Teachers, however, reported that both groups improved slightly in social communication. This may be due to the 12-week intervention programme, where the children were given the opportunity to naturally socialize during group activities. The non-significant results may be due to the short intervention period, the small sample size or the fact that social communication skills were not a specific target during the group intervention programme. Ventola *et al*. (2014:3,5), on the other hand found that after children participated in a pivotal response treatment (PRT) programme, social communication skills improved. This PRT treatment programme is a naturalistic treatment approach which involves mechanisms which help to improve a child's social motivation through the use of play-based sessions. The sessions had children playing with toys such as balls and play-dough, which contributed to fine and gross motor development. Therefore, if children are provided with opportunities to interact socially through motor play, social communication skills may improve. This study, however, was conducted on younger children over a longer period of time, which could be the reason for the positive results.

Social motivation

No statistically significant difference was found between the experimental and control groups from pre- to post-test in social motivation according to both teacher- and parent-responses. Although not significant, both groups did, however, show a marginal improvement in their social motivation score

points according to both responses which indicates that the 12-week intervention programme may have had a positive effect on this social skill. Significant results may have been found if the small sample size was larger, the intervention period was longer or specific social motivational skills were a target.

No research literature which focused on improving social motivation through intervention was found.

Restricted interests and repetitive behaviours

Regarding restricted interests and repetitive behaviour, there was no significant difference observed over time between groups for both parent- and teacher-responses. The parent-response, however, revealed that both groups performed better at post-test, by improving slightly in score points. The teachers, however, did report that the experimental group showed improved restricted interests and repetitive behaviours which were not significant and the control group decreased. This indicates that the intervention had no effect on the restricted interests and repetitive behaviour of children with ASD.

The researcher struggled to find comparable studies using motor interventions to reduced restricted interests and repetitive behaviours. Nuzzolo-Gomez *et al*. (2002:85), however, did find that when children were taught to play with a toy, that these behaviours were decreased. Therefore, providing children with opportunities to participate in other types of play may in fact reduce these behaviours. Thus, future research should examine different interventions aimed at improving the repetitive behaviours associated with ASD.

GENERAL SUMMARY

After the 12-week group intervention programme, statistically significant improvements were made in total motor skill proficiency, as well as in the balance subtest of the MABC-2 in children with high-functioning ASD. Fine motor skill improvements were not an aim of the current study, but these skills do contribute to total motor skill proficiency, and so the manual dexterity subtest was included. The children's manual dexterity scores, however, did not significantly improve after the 12-week group intervention programme. This shows that children with ASD may have difficulties with movement tasks which are more complex in nature such as the timed peg-board tasks which require more accuracy and speed. Green *et al*. (2009:315) also suggested that the complexity of tasks may affect performance. The participants in the current study were often distracted by the stop watch, and this may have affected the results on the timed activities especially the manual dexterity

tasks of the MABC-2. Although, no significant improvements were shown over time between the experimental and control groups in the aiming and catching subtest of the MABC-2, the experimental group did show significance overtime within the group, which was not observed in the control group, which indicates that the 12-week group intervention programme made a significant impact on these children's aiming and catching skills, as these skills were practiced throughout the 12-weeks. Although the motor skill intervention of the current study resulted in several significant effects of motor skill proficiency, greater improvements may have been observed if an alternative style of intervention was used. For example, the current study focused on practicing a variety of motor skills during each session, which may have hindered motor skill improvements. Interventions which provide a session focus on one specific skill may have resulted in a better outcome over time. In addition, significant improvements may have been found if there was perhaps a larger sample size or the intervention had occurred over a longer period of time.

Unfortunately, after the 12-week group intervention programme the current study found no significant improvements in total social skill competency, or in any of the subtests of the SRS-2 in children with high-functioning ASD. Although the current study found no positive social skill outcomes, group activities are important for all children. Flinchum (1988:63) confirms this by stating that movement activities in a group setting creates a setting where children learn to play alone within a group and cooperate with one another through partner games allowing children to learn responsibility for one another. In addition, significant improvements might have been found if the intervention programme was longer than 12-weeks, if sessions occurred more frequently or the sample size was larger.

The researcher found that the small group functioned well, limited the disruptions if too many children were involved, yet still provided opportunities for social interactions to take place. Furthermore, social skills were not specifically focused on or taught in the current study; therefore, if specific social skills were taught, peer interactions and positive social outcomes might have been found. This is confirmed by DisSalvo and Oswald (2002:201), who emphasises that teaching peers specific social skill strategies helps facilitate better social interactions amongst children with autism.

In terms of the specific aims of the current study, gross motor and social skills in children with ASD were determined. The current study also provides conclusions regarding the effectiveness of a 12-week group intervention programme on the gross motor skills of children with ASD. However, the 12-week group intervention programme was not effective on social skill improvement, which

suggests that social skills might need to be taught in conjunction with motor skills over a longer period of time, in order to produce positive outcomes in both domains.

Since children with ASD show impairments in social and motor skill development, it is imperative that both skill domains are improved through therapy interventions. Sipes *et al*. (2011:294) found that children with ASD, who had greater gross motor skills, had fewer social skill impairments. This demonstrates that if gross motor skills are improved through intervention, this could possibly result in the improvement of social skill ability. Therefore, future research should investigate how motor and social skill development is related, as well as consider interventions which may improve both skills in conjunction with one another.

Limitations of the current study and recommendations for future research are described in the following sections.

LIMITATIONS

- The greatest limitation of the current study was the sample size which affected the statistical results. Children whose parents did not provide consent for their children to participate or who did not complete the SRS-2 assessment were excluded from the current study. Therefore, there were only 7 participants overall, with only 4 participating in the group intervention programme and 3 in the control group. That limited the researcher's ability to identify any significant effects and make generalizations. However, the fact that significant effects were found is promising with regards to the effectiveness of the motor skills intervention programme for children with ASD.
- Before the testing procedures could begin, the researcher had to wait for the SRS-2 to arrive in South Africa. This took an additional 6 weeks, which radically reduced the group intervention period, causing the intervention to be reduced to a 12-week instead of the original 17-week intervention, which may have impacted results.
- The SRS-2 is a subjective assessment tool. Therefore, the variability of the SRS-2 as a 'before' and 'after' assessment measure could have possibly affected the results.
- Due to a lack of finances and time constraints, the researcher was the only person who conducted the motor assessment. The MABC-2 has a subjective scoring aspect to it, therefore, bias may have come into question.
- Only one female participated in the current study, but ideally, the researcher would have liked an equal number of males and females in order to compare genders.

- Baseline IQ scores were not measured in the current study, and this could possibly have been a confounding factor for the participant's motor skill measurements, because IQ is associated with motor skill performance according to some researchers. Moreover, IQ may have also had an influence on the children's ability to understand the instructions of specific tasks, by hindering intervention outcomes.
- The experimental group seemed to always perform worse than the control group at baseline, allowing more room for improvements in the experimental group, which may have affected results.
- Term dates of the relevant school resulted in time constraints for the group intervention programme, and it was not possible to include an intervention for longer than 12-weeks.
- Half way through the study, the experimental groups' teacher left the relevant school and a new teacher was appointed to the experimental group. Therefore, at post-test a different teacher completed the SRS-2, which may have affected the results.
- The sample was a sample of convenience meaning that failure to randomize group assignment was a limitation to the current study.
- Participants in the current study were enrolled in classrooms which only included children with ASD within one school. Therefore, it was difficult for the researcher to make generalisations about different types of classrooms or school environments.
- The unpredictability of the young participants was a limitation. Participants may not have put forth their maximal effort during the testing and intervention periods and their short attention span may have influenced participation during the testing and intervention tasks, which in turn could have prevented them from improving in their motor and social skills.
- Although the researcher optimized the testing environment, the assessment was still implemented during school hours where there were distractions from other children which could have affected the results.
- During the 12-week group intervention programme, there were two week-long holidays. During one of the holiday weeks, children were given a home programme to do which entailed gross motor activities. The researcher, however, was not able to control whether or not the children did the activities with their relevant families, which may have disrupted the intervention programme and affected the results.

RECOMENDATIONS

Future research needs be conducted over a longer period of time, with sessions occurring more frequently while using a larger sample of participants so that generalisations can be made. Research studies should also enforce the randomization of groups and incorporate more girls, so that gender comparisons can be made. What the current study suggests is that a variety of different schools or classrooms should be considered in future research, encompassing different environments. In addition, future research may want to consider using an alternative style of intervention where one motor skill is taught during one session. Alternative measures of social skill impairments might produce different results, and comparisons between different social skills measurements should be investigated. The current study did not teach specific social skills as the group intervention merely provided participants with the opportunity to naturally socialize in a group setting. Future research should include Educational psychologists to teach specific social skills together with Kinderkinetisists teaching motor skills. The current study tested children during school hours. Future research could investigate the differences resulting from testing children at different times of the day. The effects of a 12-week group intervention programme on children with other disabilities and typically developing children needs to be explored further, as it could produce different results. Future research might also explore the effects of combining group and individual intervention programmes in children with ASD which might produce more effective results.

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APPENDIX A

TABLE A: **THE DIFFERENT TASKS FOR AGE BAND 2**

AGE BAND 2	
MANUAL DEXTERITY	
Placing pegs	Objective is to insert pegs one at a time into holes on a peg board as fast as he/she can.
Threading lace	Objective is to thread lace back and forth through holes of lacing board as fast as he/she can.
Drawing trail 2	Objective is to draw a continuous line in between boundary lines (no time limit).
AIMING AND CATCHING	
Catching with two hands	Objective is to throw a tennis ball onto a wall from a marked distance and catch it with two hands. The ball is allowed to bounce for children 7-8 years only.
Throwing beanbag onto mat	Objective is to throw a beanbag onto the target portion of the mat from a marked distance.
BALANCE	
One-board balance	Objective is to stand on one leg on a balance board for a period of time.
Walking heel-to-toe forwards	Objective is to walk forwards on a marked line heel-to-toe.
Hopping on mats	Objective is to hop on one leg forward on mats.

Source: Adapted form Henderson *et al*., (2007:41-57).

APPENDIX B

TABLE B: **THE DIFFERENT TASKS FOR AGE BAND 3**

AGE BAND 3	
MANUAL DEXTERITY	
Turing pegs	Objective is to turn pegs over one at a time so that the other colour of the peg is showing as fast as he/she can.
Triangle nuts and bolts	Objective is to construct a triangle using nuts and bolts as fast as he/she can.
Drawing trail 3	Objective is to draw a continuous line in between boundary lines (no time limit).
AIMING AND CATCHING	
Catching with one hand	Objective is to throw a tennis ball at a wall from a marked distance and catch it with one hand without letting it bounce on return.
Throwing at a wall target	Objective is to throw a tennis ball at a wall target from a marked distance and catch it with one hand without letting it bounce on return.
BALANCE	
Two-board balance	Objective is to stand heel-to-toe on a balance board from a period of time.
Walking toe-to-heel backwards	Objective is to walk toe-to-heel backwards on a marked line.
Zig-zag hopping	Objective is to hop on one leg diagonally from one mat to the next.

Source: Adapted from Henderson *et al*. (2007:59-75).

APPENDIX C

TABLE C: **10 STEPS TO FOLLOW TO COMPLETE THE RECORD FORM OF THE MABC-2**

STEP	PROCEDURES
1	**Completing the demographic data:** Before you begin with administration of the standardized test, the relevant information should be filled out on page one of the record sheet. This includes the child's name, age, gender, address, school, and grade; your name and reason for referral; and the testing date. Then calculate the child's chronological age.
2	**Scoring the individual items:** After a clear demonstration of each task to the child, the examiner should record the exact raw scores for each task on the form. The raw data might vary for each task but will be one of the following: • Record number of seconds, steps or catches • An 'F' which indicates that the child was unable to perform the task correctly • An 'R' which indicates that the child refused and did not want to perform the task • An 'I' which indicates that the task was inappropriate for the child
3	**Complete the qualitative data on each motor task:** The examiner must make observational recordings of the child's behaviours during the testing procedures. The examiner records how the child approaches and completes the tasks, and how the child responds to success or failure.
4	**Score the drawing trail after all eight items are complete:** The examiner records the number of errors according to the Appendix A in the MABC-2 manual. In this case the error would be recorded if the child drew the line out of the boundaries at any point. There are different ways in which a child can cross the boundary lines.
5	**Transfer raw scores to front cover of record form:** The best effort of the child is recorded into the appropriate boxes on the record form.
6	**Convert raw scores of each item into a standard score:** The standard scores are based on the calculated age of the child and in Table 1 of Appendix B in the MABC-2 manual you can locate these standard scores for each test item. The child's age in years will determine the exact table that will be used from Appendix B of the MABC-2 manual. Therefore, for each item you will locate

	the child's raw score in the table and then read across to the standard score column. These standard scores are then recorded into the table on the front page of the record form.
7	**Determine standard scores and percentiles for the three components of the test: Manual Dexterity, Aiming and Catching and Balance**: In Table 2 of Appendix B of the MABC-2 manual, the standard scores and percentile ranks may be seen. To calculate the component scores, the standard scores need to be added up. Then to get the standard score equivalents, look at Table 2. The component standard score is then seen when one reads across to the left and the percentile rank is seen to the right.
8	**Determine total test score, its standard score equivalent and percentile:** The total test score can then be determined in Table 3 of Appendix B of the MABC-2 manual by adding together the eight item standard scores. The appropriate standard score can then be seen when reading to the left of table 3 and the percentile ranks may be determined when reading to the right of table 3.
9	**Summarise qualitative observations:** The qualitative observations that are recorded throughout the test may then be summarised.
10	**Complete assessment summary and intervention plan**

Source: Adapted from Henderson *et al*. (2007:79-83).

APPENDIX D

TABLE D: **7 STEPS TO FOLLOW WHEN SCORING THE SRS-2 AUTOSCORE FORMS**

STEPS	PROCEDURES
1	Once a rater has filled out the 65-item autoscore form, an examiner can then remove the perforated strip on the right hand side of the form and take out the carbon tissue. A scoring worksheet will then be visible, which has the responses to each individual item transferred onto it. This is then used to calculate the scores. Treatment subscale raw scores are calculated first and then all the other raw scores are calculated. This is done by first entering the response value (0,1,2 or 3) in the box in the same row as that item.
2	If no response was given for an item, then the median value (the number in bold) is filled into the corresponding treatment subscale box.
3	The item response values are then totalled up at the bottom of the each page for each treatment subscale column (This then provides a total raw score value for each individual treatment subscale).
4	Calculate the SCI (Social Communication and Interaction) scale by tallying up the scores of the first four treatment subscales.
5	Calculate the SRS-2 total raw score by adding up all 5 treatment subscale columns
6	Next, transfer all the raw scores from the scoring worksheet to the corresponding profile sheet.
7	Finally, look up T-scores from the transferred raw scores. This is done by looking at the tables on the profile sheet. Mark the raw score value and find the corresponding T-score in the scale for the total raw score, the treatment subscales and the DSM-5 compatible scales.

Source: Adapted from Constantino & Gruber (2012:6,7).

APPENDIX E

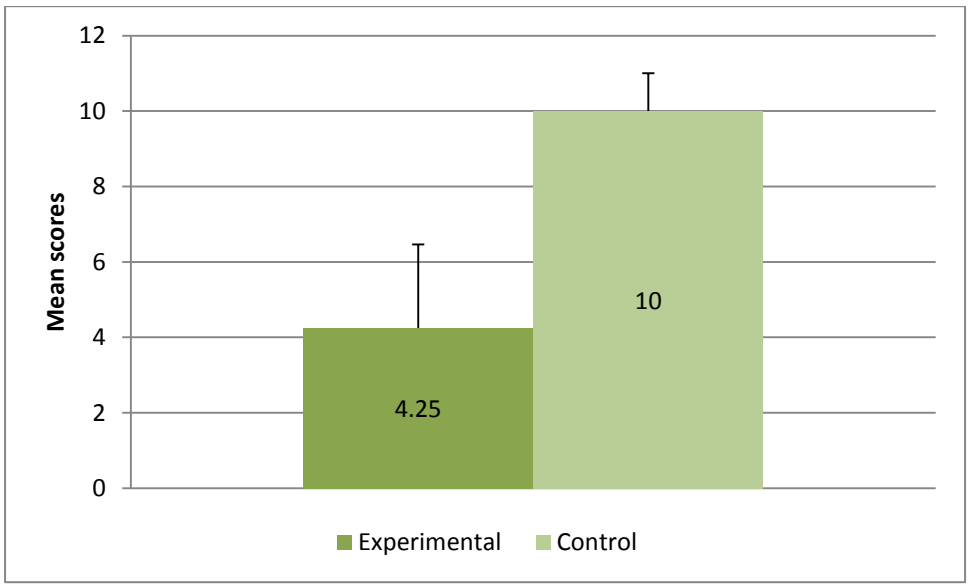


FIGURE E1: **TOTAL MOTOR SKILL PROFICIENCY AT PRE-TEST FOR EXPERIMENTAL AND CONTROL GROUPS**

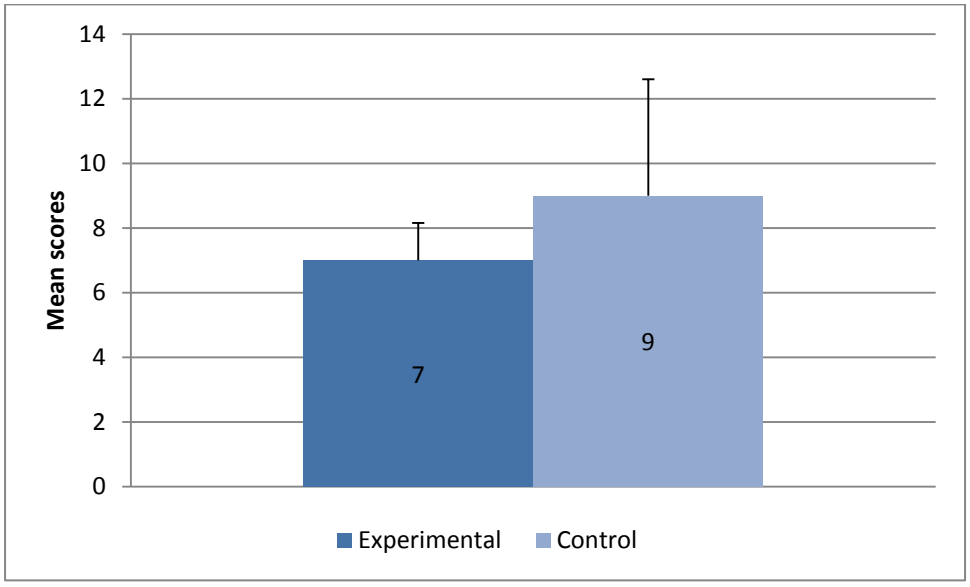


FIGURE E2: **TOTAL MOTOR SKILL PROFICIENCY AT POST-TEST FOR EXPERIMENTAL AND CONTROL GROUPS**

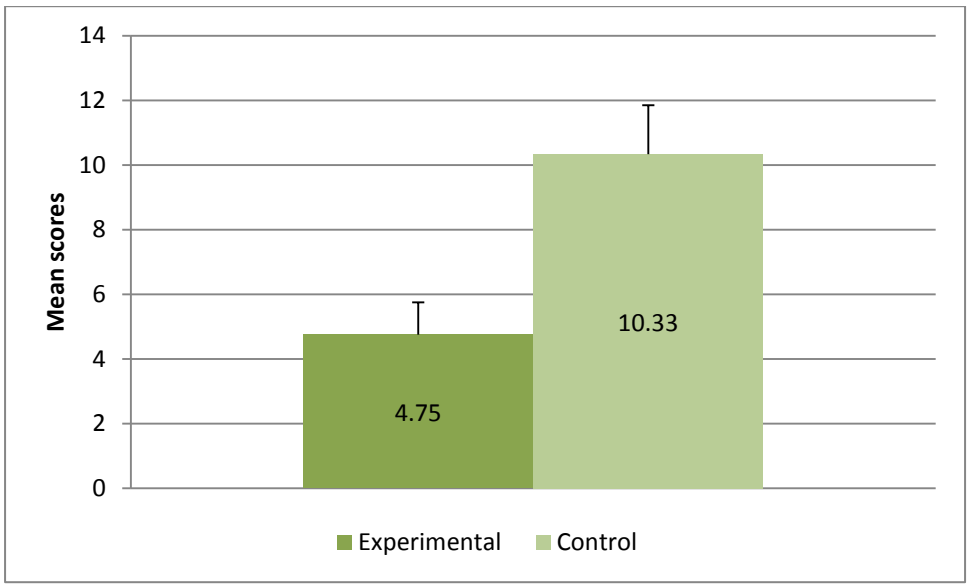


FIGURE E3: **PRE-TEST RESULTS FOR EXPERIMENTAL AND CONTROL GROUPS FOR MANUAL DEXTERITY**

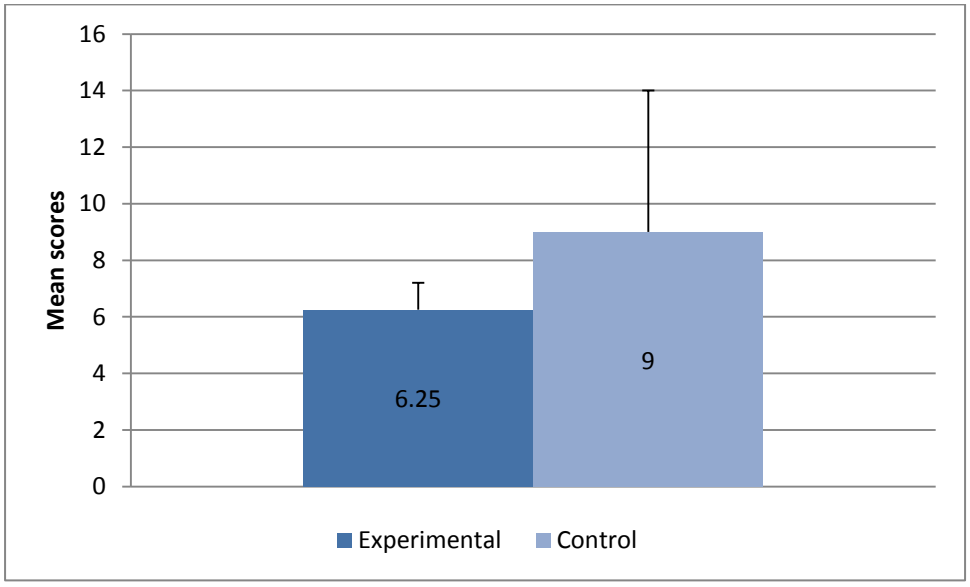


FIGURE E4: **POST-TEST RESULTS OF EXPERIMENTAL AND CONTROL GROUPS FOR MANUAL DEXTERITY**

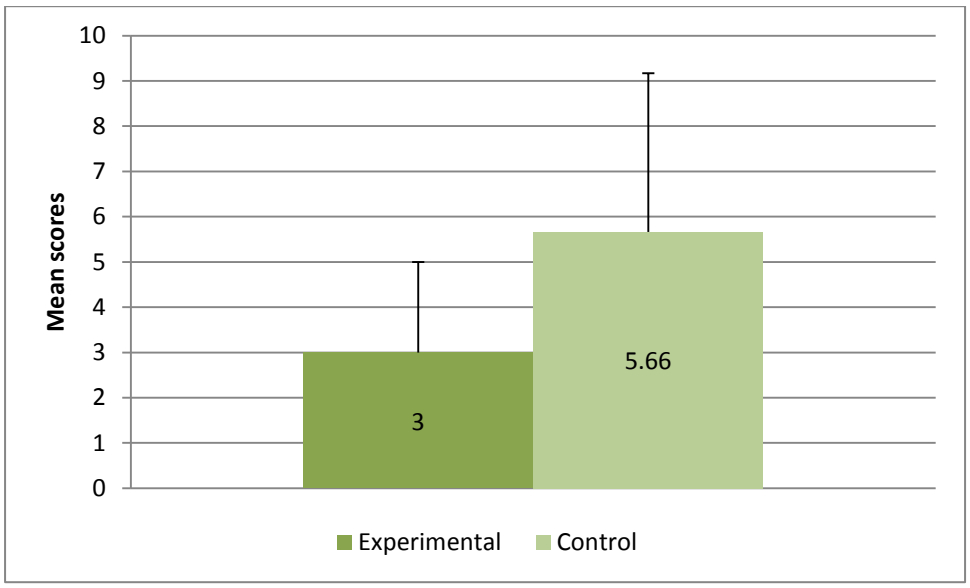


FIGURE E5: **PRE-TEST RESULTS OF EXPERIMENTAL AND CONTROL GROUPS FOR AIMING AND CATCHING**

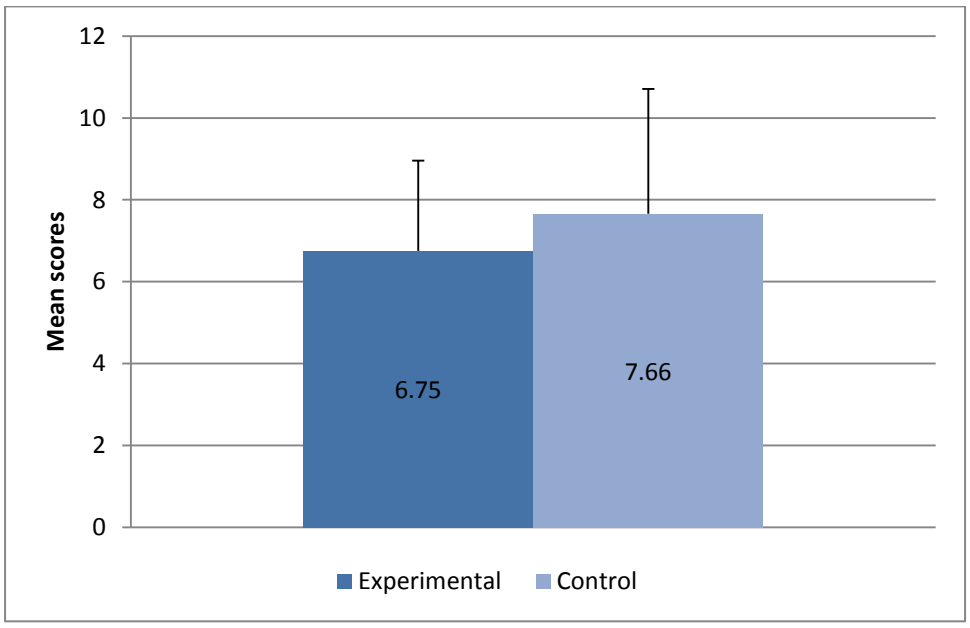


FIGURE E6: **POST-TEST RESULTS OF THE EXPERIMENTAL AND CONTROL GROUPS FOR AIMING AND CATCHING**

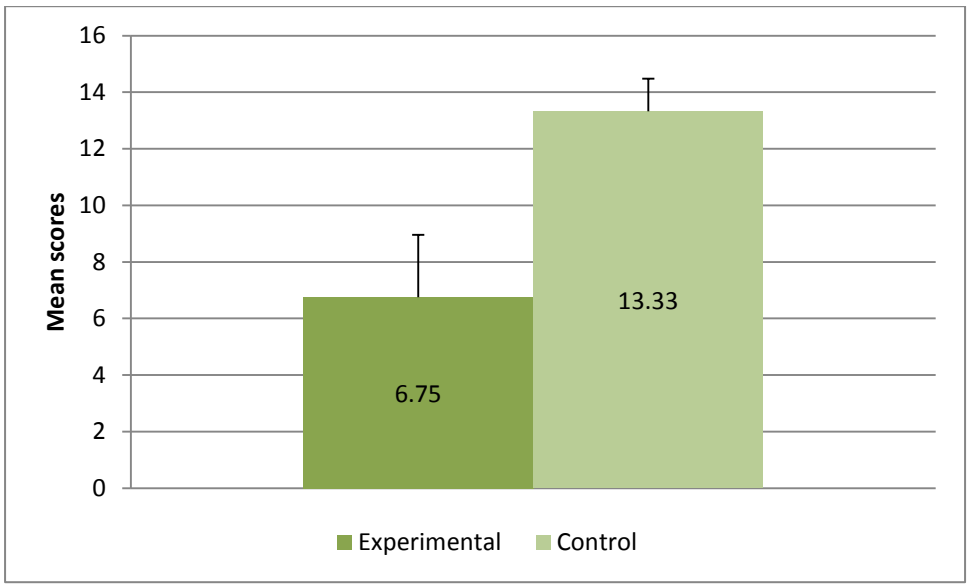


FIGURE E7: **PRE-TEST RESULTS OF THE EXPERIMENTAL AND CONTROL GROUPS FOR BALANCE**

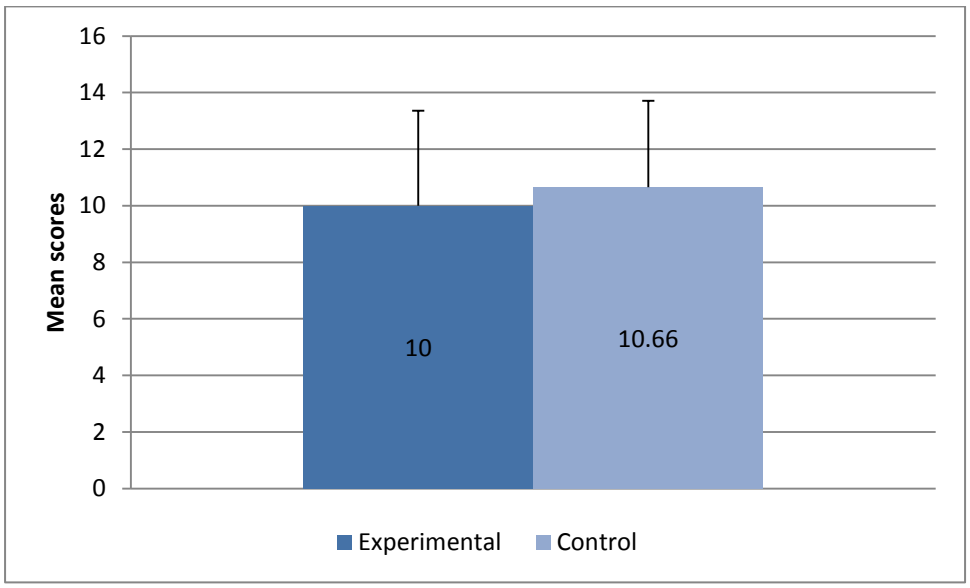


FIGURE E8: **POST-TEST RESULTS OF THE EXPERIMENTAL AND CONTROL GROUPS FOR BALANCE**

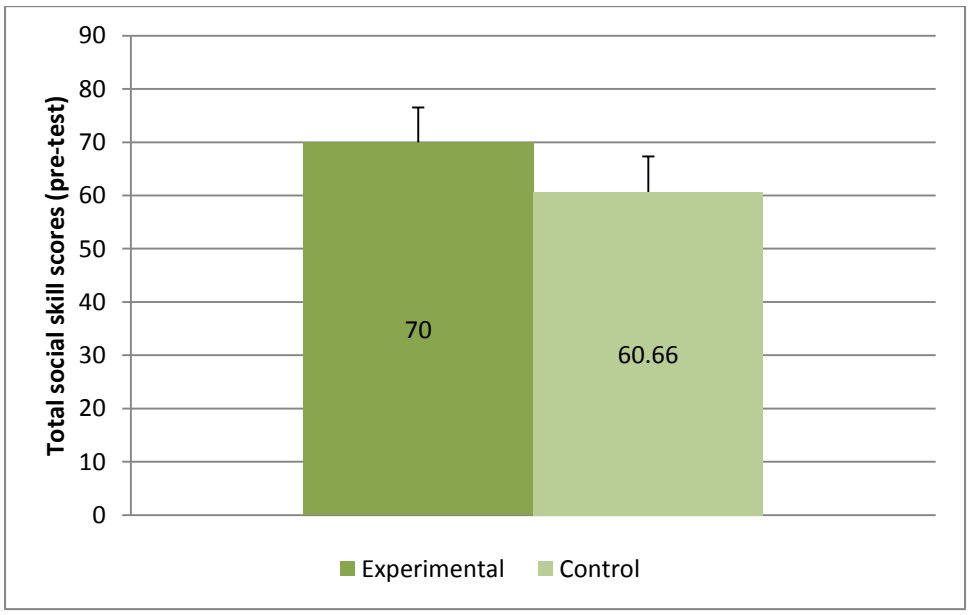


FIGURE E9: **PRE-TEST RESULTS FROM THE PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR OVERALL SOCIAL SKILL COMPETENCE**

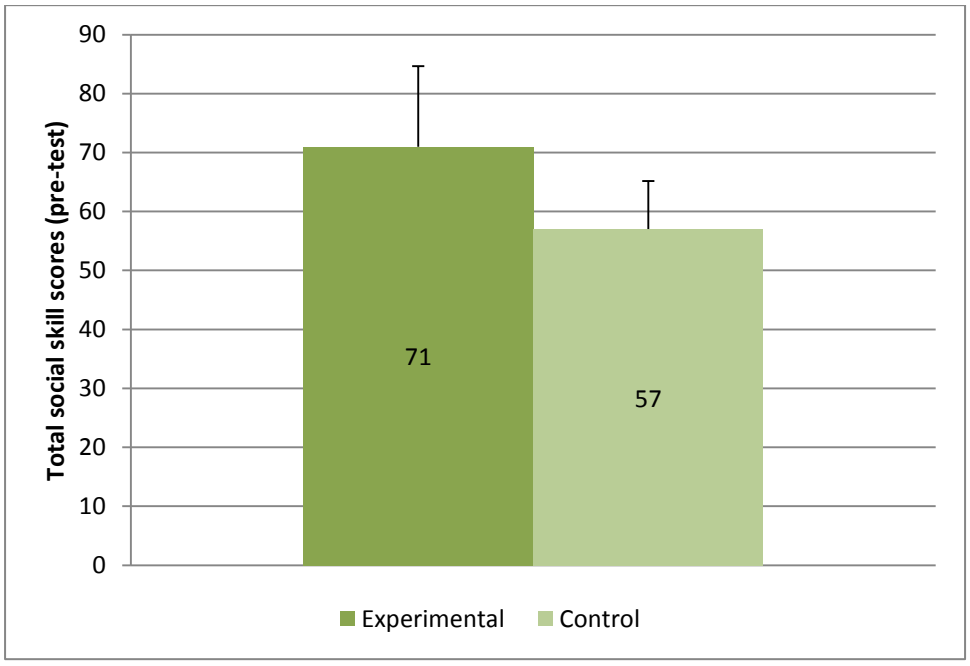


FIGURE E10: **PRE-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR OVERALL SOCIAL SKILL COMPETENCE**

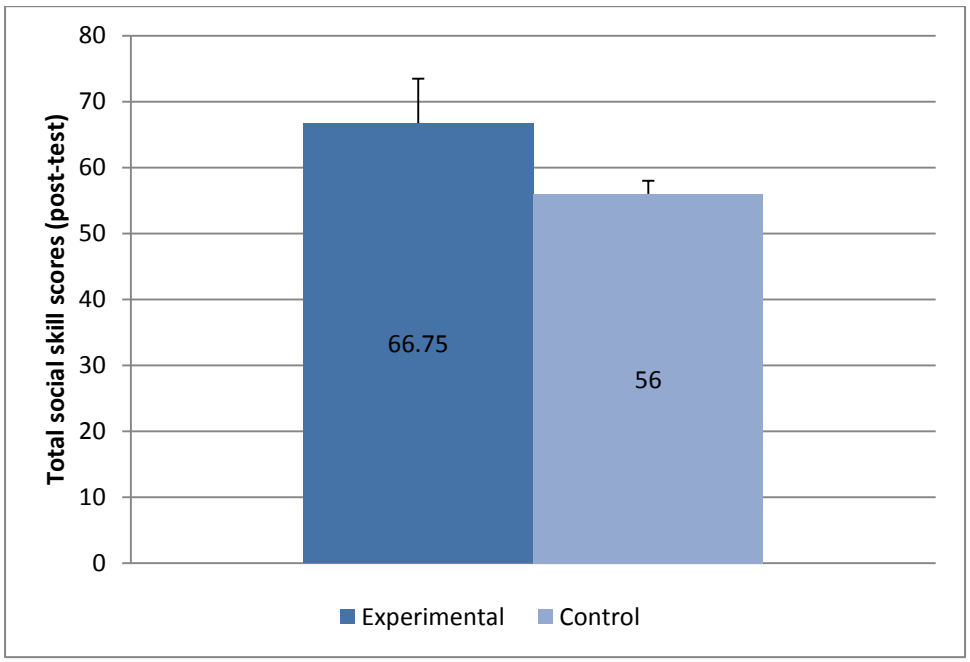


FIGURE E11: **PRE-TEST RESULTS FROM THE PARENT REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR OVERALL SOCIAL SKILL COMPETENCE**

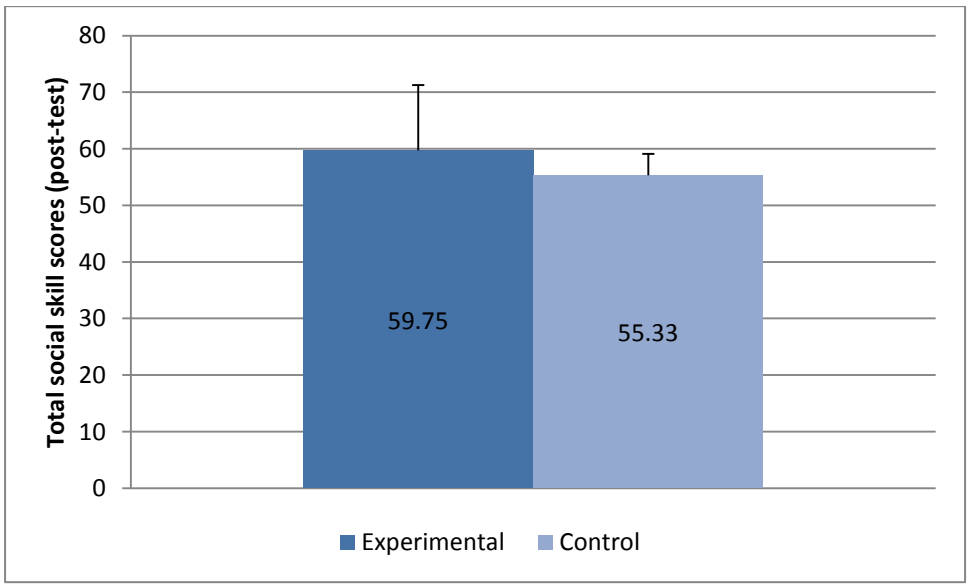


FIGURE E12: **PRE-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR OVERALL SOCIAL SKILL COMPETENCE**

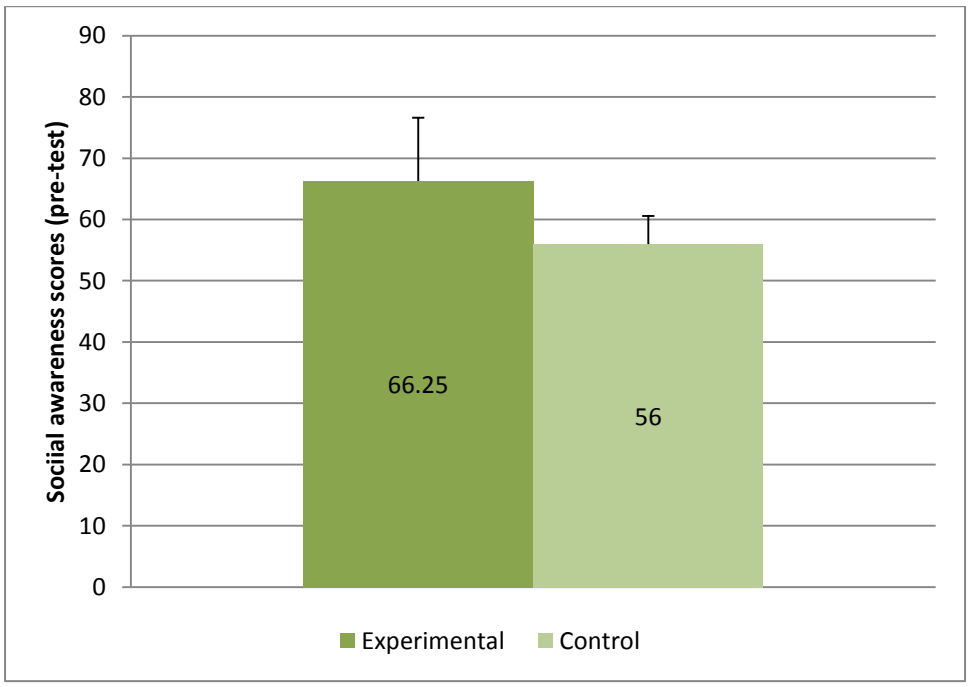


FIGURE E13: **PRE-TEST RESULTS FROM PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL AWARENESS**

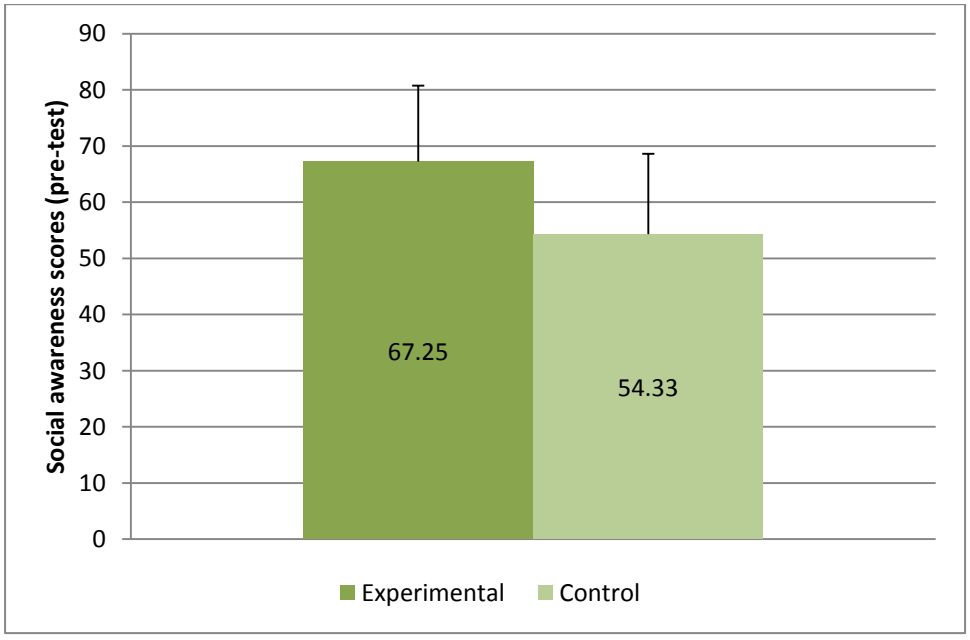


FIGURE E14: **PRE-TEST RESULTS FROM TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL AWARENESS**

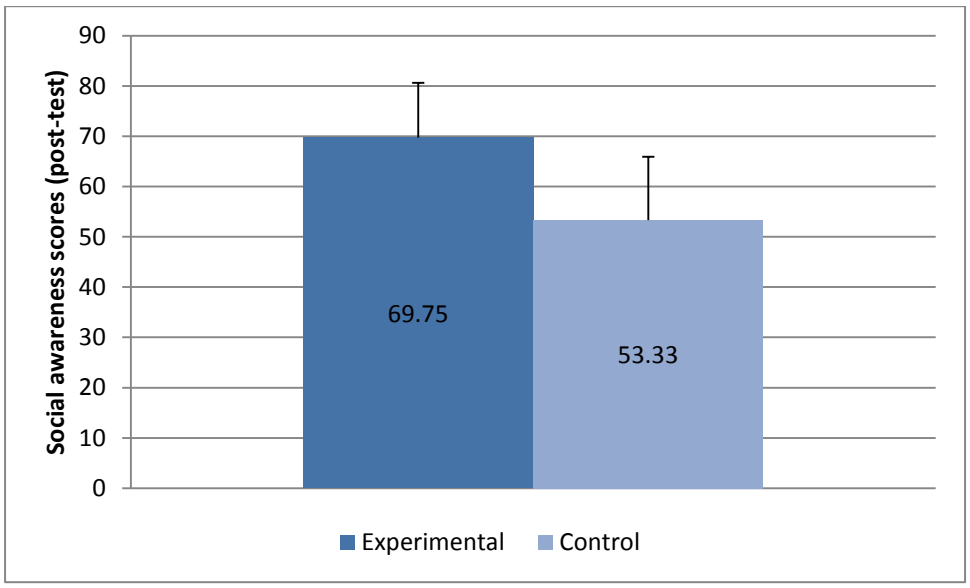


FIGURE E15: **POST-TEST RESULTS FROM THE PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL AWARENESS**

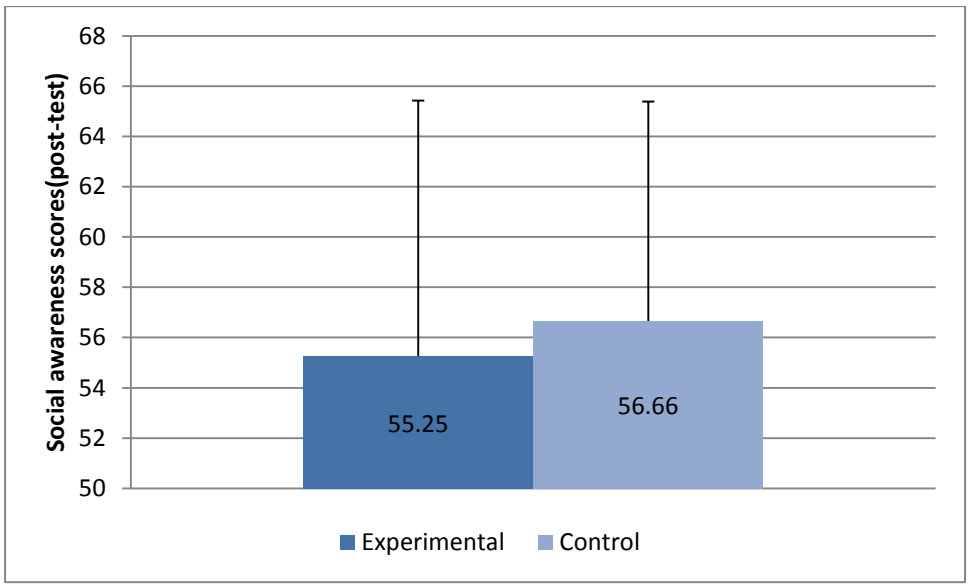


FIGURE E16: **POST-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL AWARENESS**

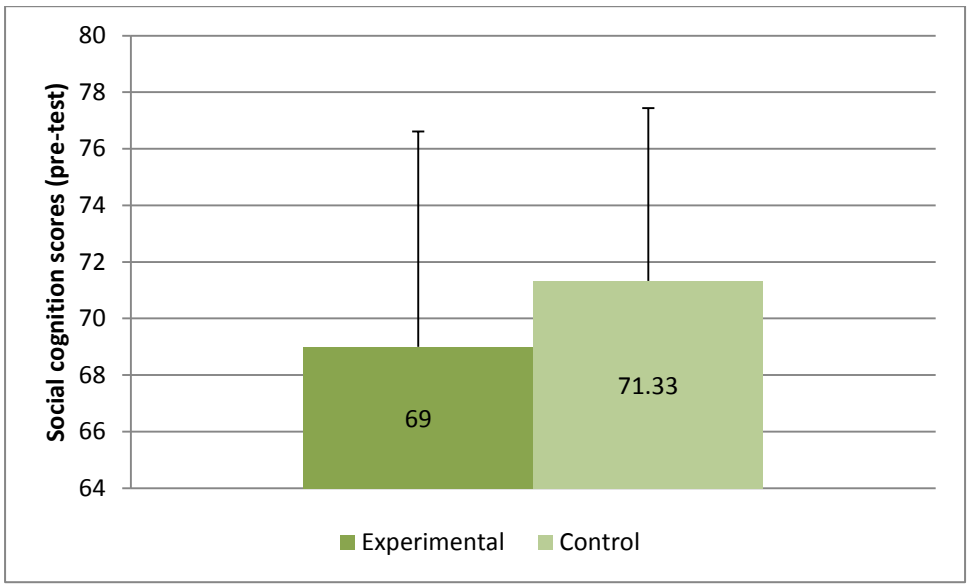


FIGURE E17: **PRE-TEST RESULTS FROM THE PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL COGNITION**

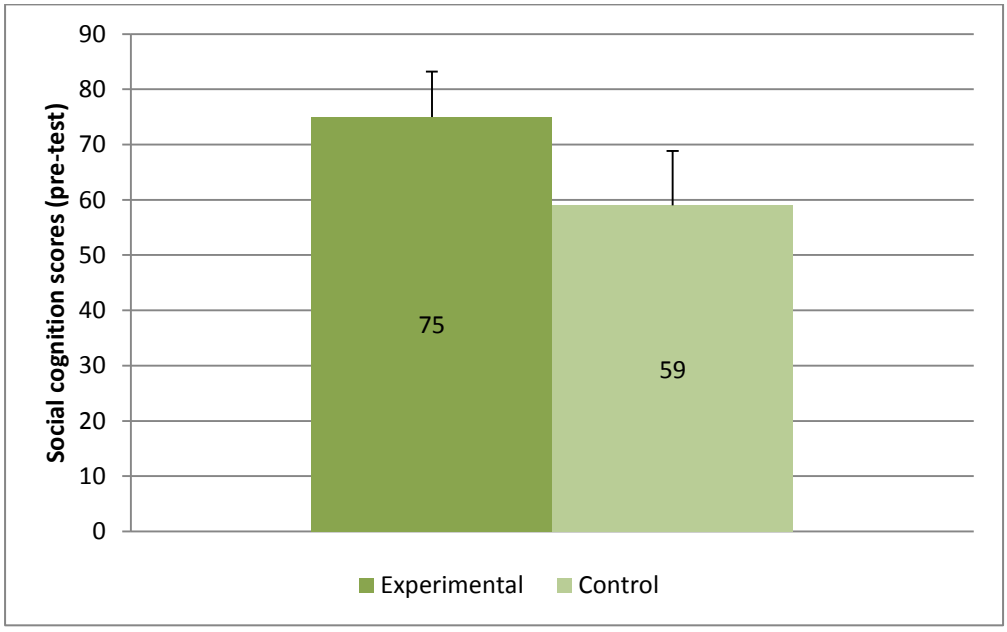


FIGURE E18: **PRE-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL COGNITION**

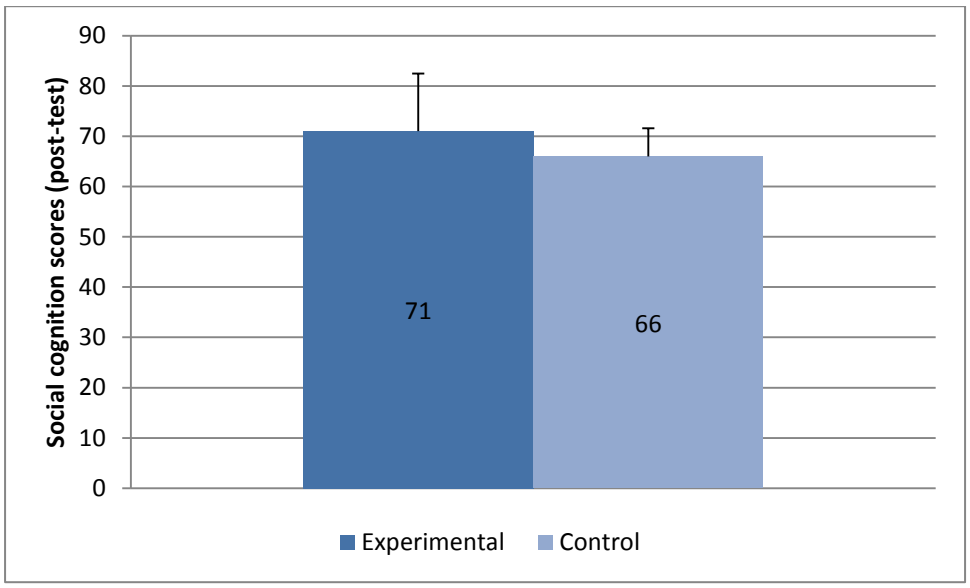


FIGURE E19: **POST-TEST RESULTS FROM THE PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL COGNITION**

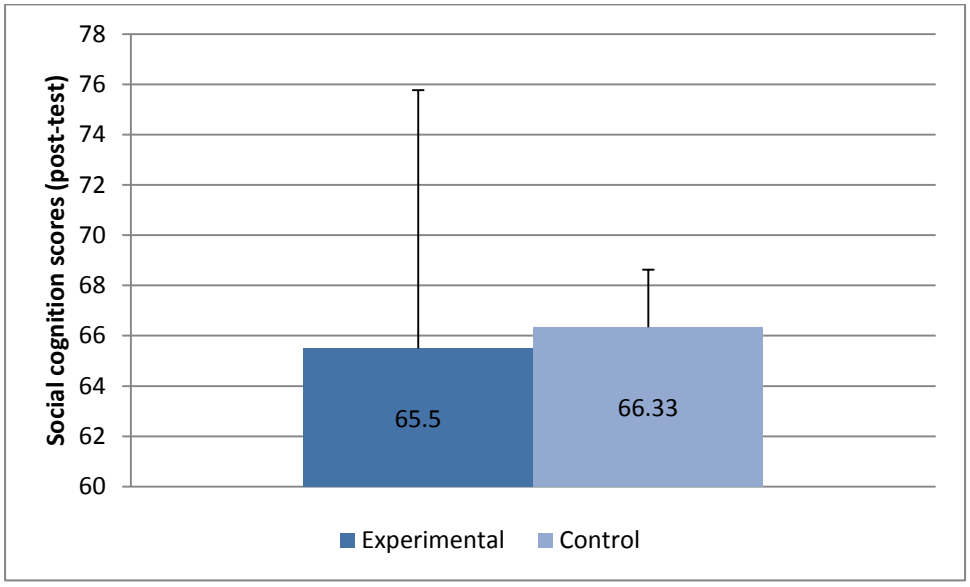


FIGURE E20: **POST-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL COGNITION**

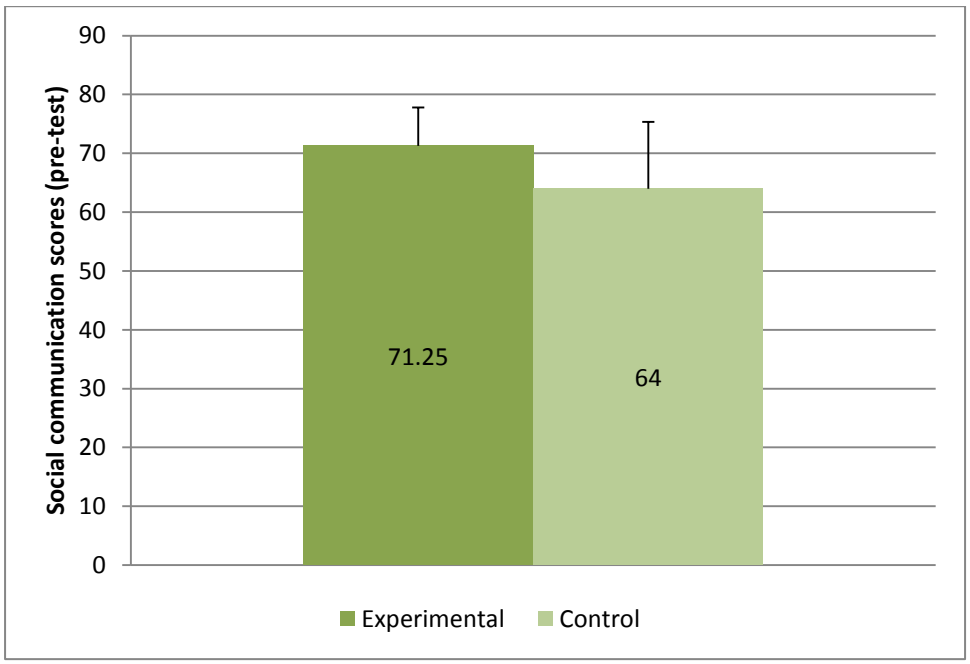


FIGURE E21: **PRE-TEST RESULTS FROM THE PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL COMMUNIATION**

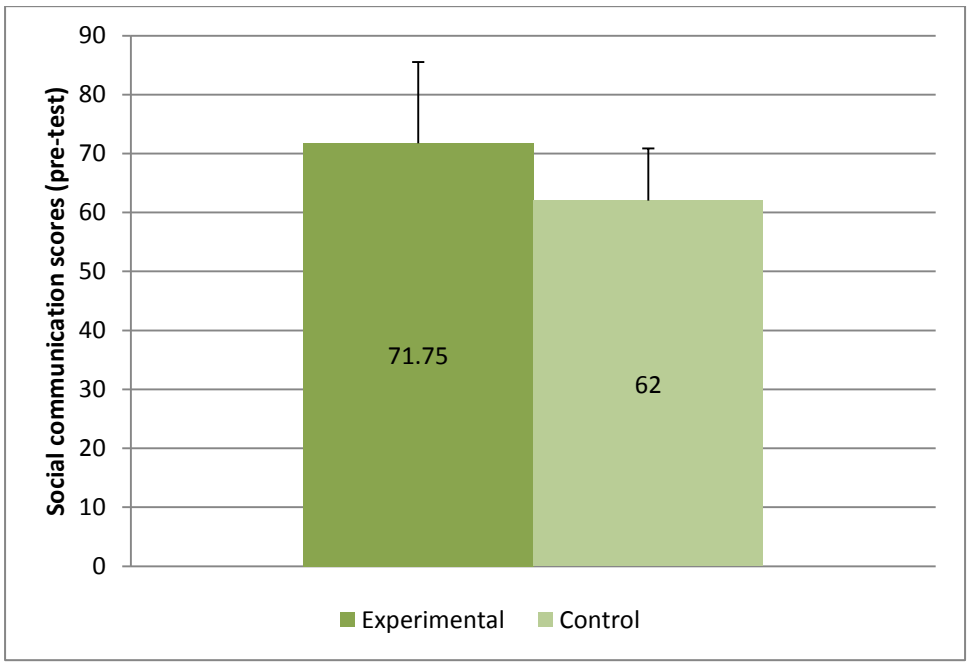


FIGURE E22: **PRE-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL COMMUNICATION**

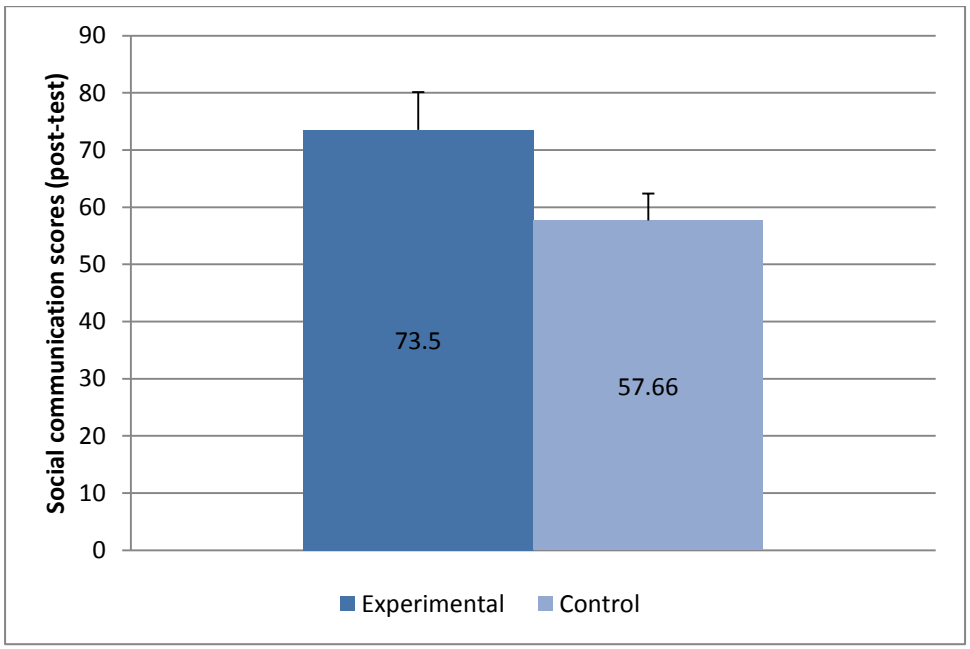


FIGURE E23: **POST-TEST RESULTS FROM THE PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL COMMUNICATION**

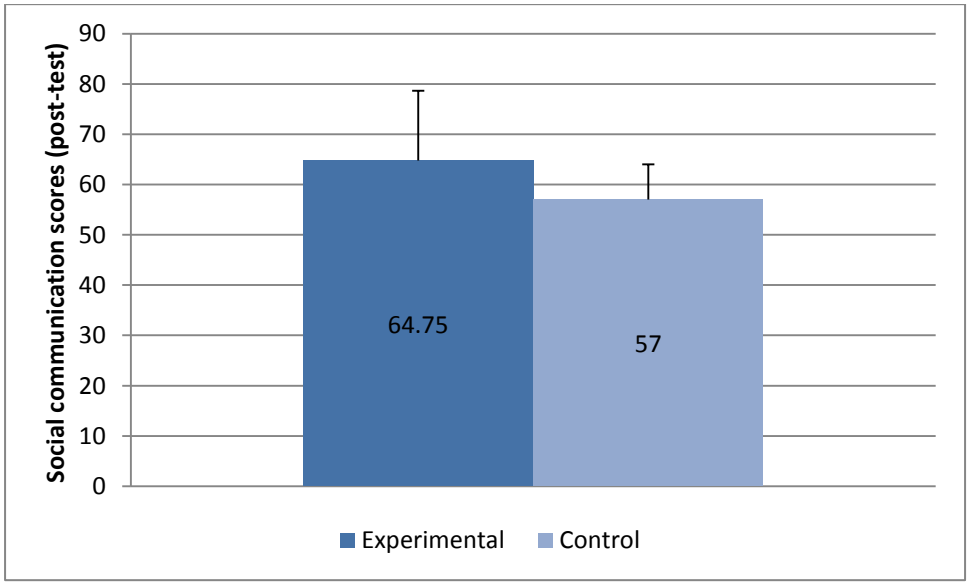


FIGURE E24: **POST-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL COMMUNICATION**

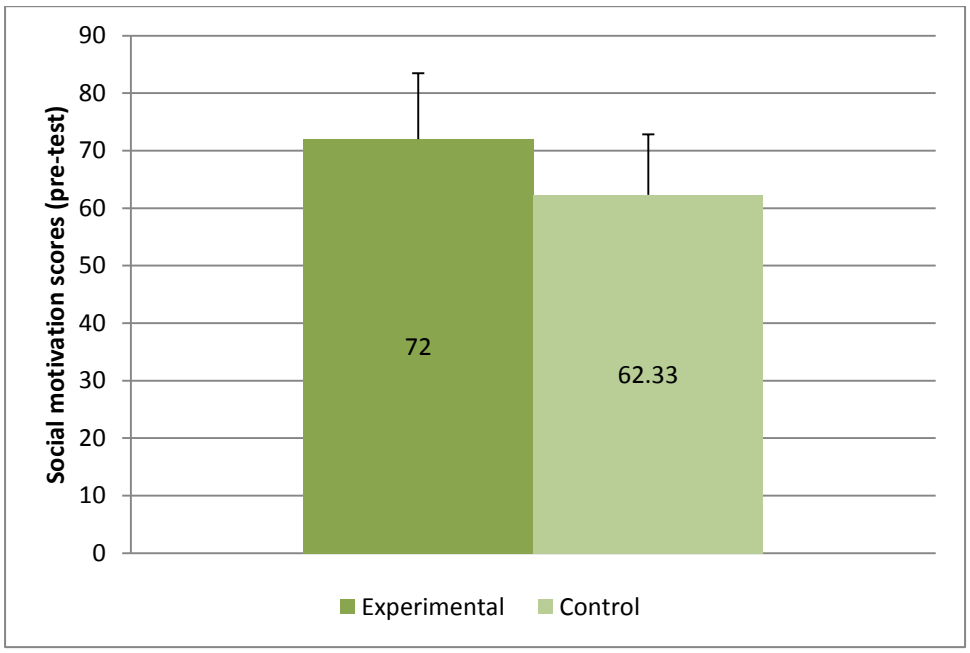


FIGURE E25: **PRE-TEST RESULTS FROM THE PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL MOTIVATION**

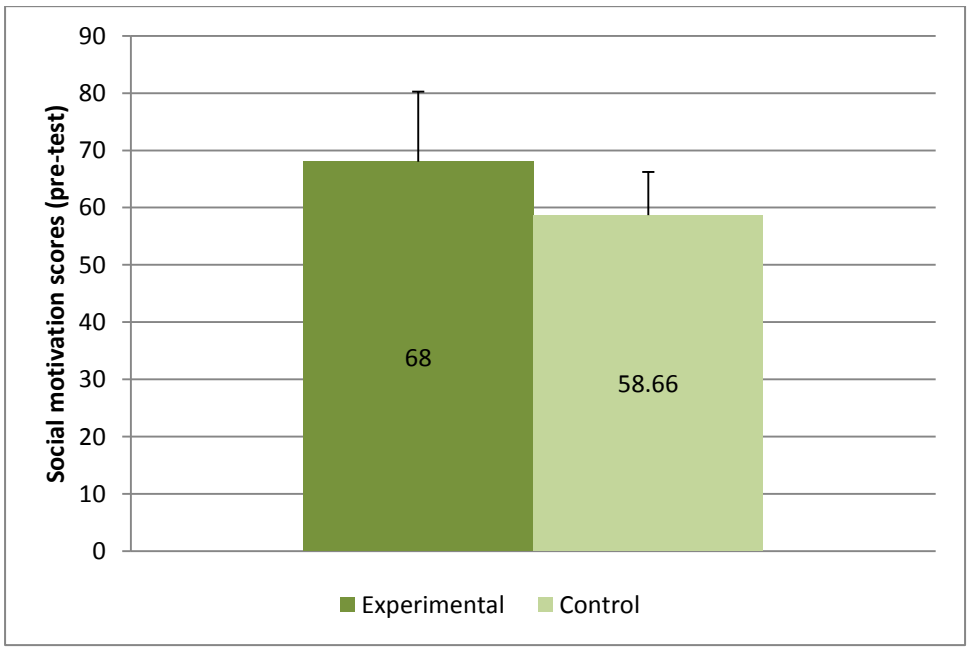


FIGURE E26: **PRE-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL MOTIVATION**

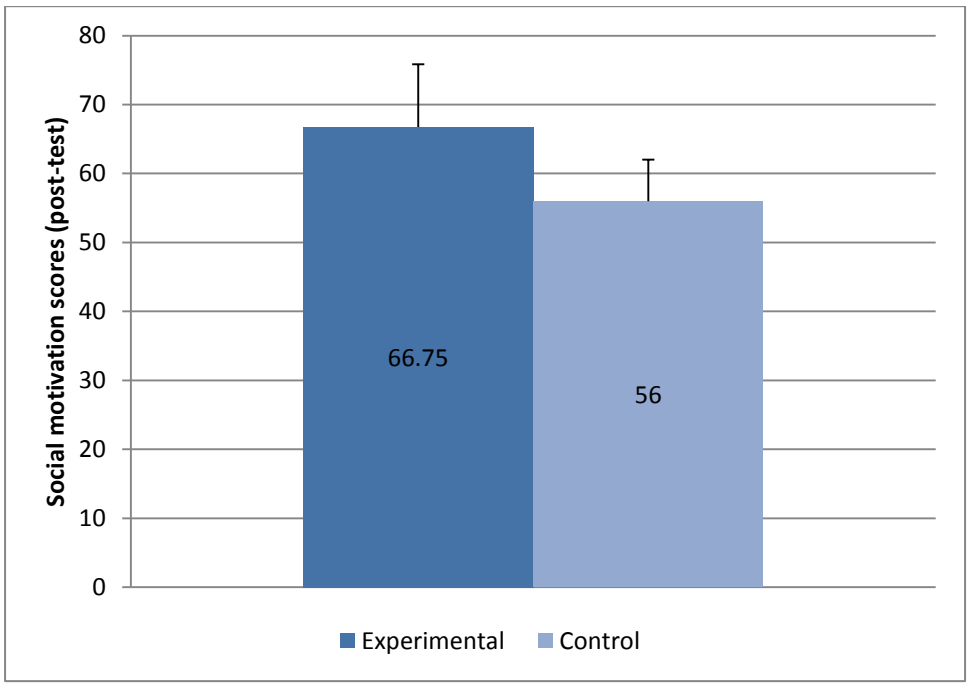


FIGURE E27: **POST-TEST RESULTS FROM THE PARENT REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL MOTIVATION**

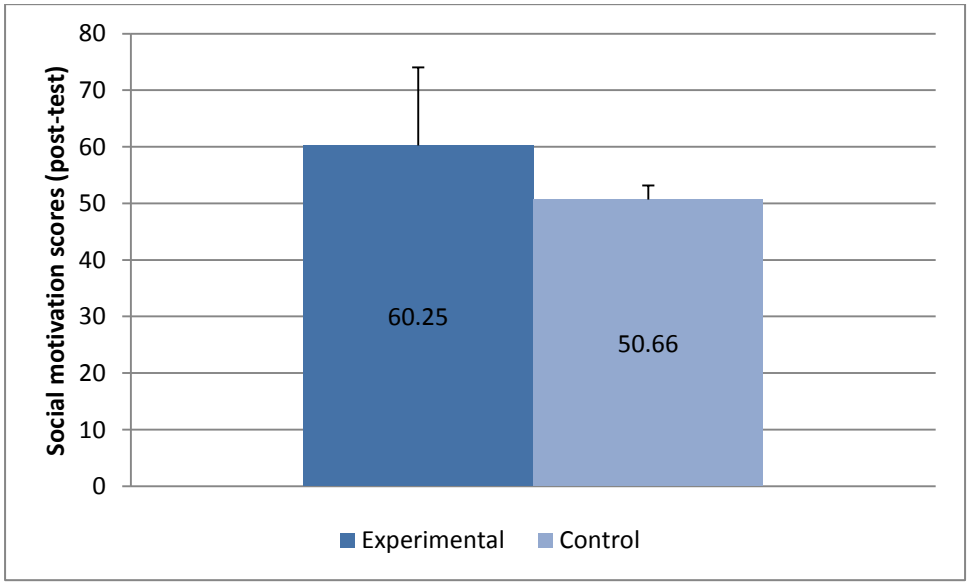


FIGURE E28: **POST-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR SOCIAL MOTIVATION**

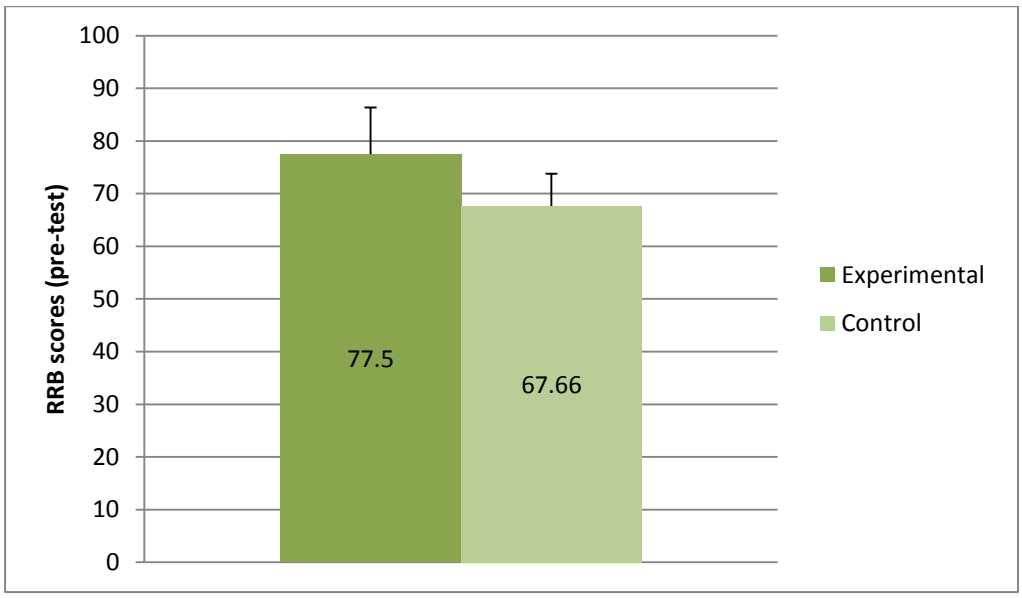


FIGURE E29: **PRE-TEST RESULTS FROM THE PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR RESTRICTED INTERESTS AND REPETITIVE BEHAVIOURS**

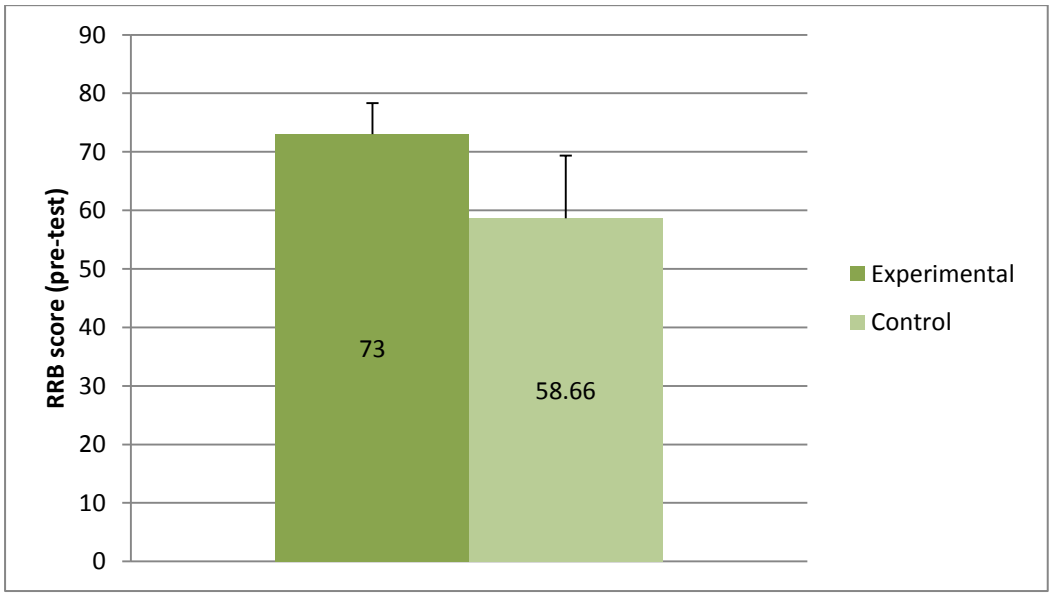


FIGURE E30: **PRE-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR RESTRICTED INTERESTS AND REPETITIVE BEHAVIOURS**

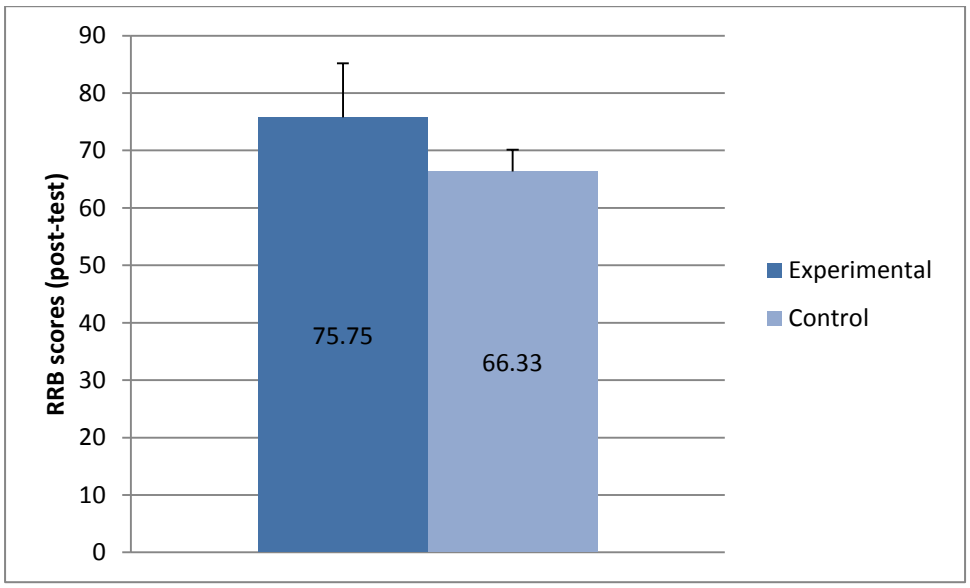


FIGURE E31: **POST-TEST RESULTS FROM THE PARENTAL REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR RESTRICTED INTERESTS AND REPETITIVE BEHAVIOURS**

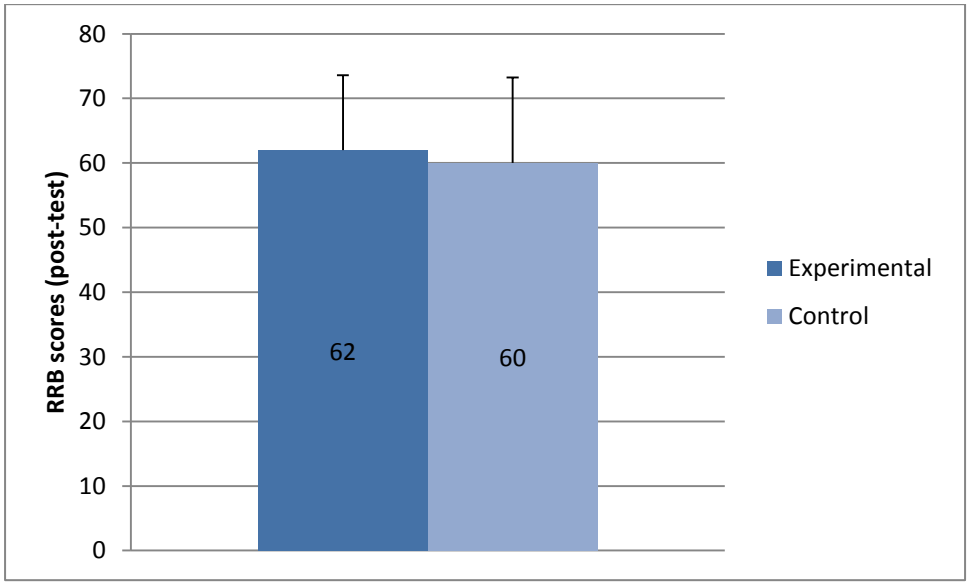
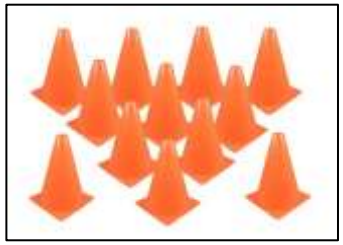
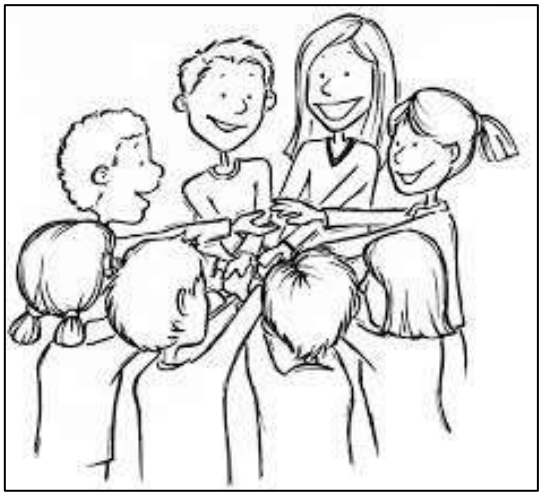


FIGURE E32: **POST-TEST RESULTS FROM THE TEACHER REPORT OF THE EXPERIMENTAL AND CONTROL GROUPS FOR RESTRICTED INTERESTS AND REPETITIVE BEHAVIOURS**

APPENDIX F

GROSS MOTOR PROGRAMME
12 WEEKS

<table>
<tr><td colspan="4">During the 12 week group-based motor skill intervention, the researcher used only a couple of different warm-ups and cool-downs which were repeated. This was done, because autistic children are known to like structure and routine, therefore the researcher decided to administer similar exercises. Throughout the intervention programme it can also be seen that most activities were repeated, so that the children could practice the skill being taught and to keep a routine during most sessions. Change occurred when new activities were introduced.</td></tr>
<tr><td colspan="4">WEEK 1
SESSION 1
Duration: 45 minutes</td></tr>
<tr><td colspan="4">AIM OF SESSION: Bilateral coordination and body awareness</td></tr>
<tr><td>ACTIVITY</td><td>INSTRUCTIONS</td><td>FOCUS</td><td>EQUIPMENT</td></tr>
<tr><td>Warm-up: (5 min)
• Builders and diggers</td><td>Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.
  </td><td>• Endurance</td><td>• Whistle
• 20 x traffic cones</td></tr>
<tr><td>1. Wheel barrow races (10 min)</td><td>Children are divided into groups of no more than 2. Both teammates stand 1 behind the other in preparation. The child standing in front bends down forwards onto his/her hands, while the teammate at the back grabs hold of the front child’s legs, making the shape of a makeshift wheelbarrow. The child in front must start walking forwards on his/her hands. The first team to cross the finish line at the end of the room wins. The activity is repeated to allow for the teammates to swop places.</td><td>• Team cooperation
• Body coordination
• Core strength</td><td>• Whistle</td></tr>
</table>

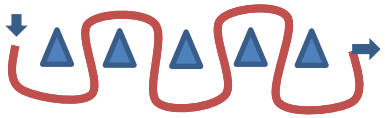
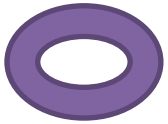
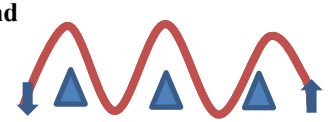
			
2. Human knot (10 min)	Children work together as a group of 4 (not more than 10). The children stand in a circle formation, facing each other. Everyone puts their hands into the middle of circle and joins hands with 2 other members (never the same person). The children have to talk to one another to figure of how to untangle the 'knot" to create 1 big circle with every1 holding hands. The children are not allowed to let go of each other's hands at any given time. (This activity was assisted by the researcher). 	• Static balance • Team cooperation • Social communication and interaction	• None

3. Ball pass (10 min)	The children stand behind one another in a row. A ball is passed backwards from 1 end of the line to the opposite end and then back to the front. The ball is then passed: Over and under – children in the row alternate passing the ball overhead or through the legs to the next person in line. The ball is first passed backwards, then moves forwards back towards the front of the line.  Left and right – children in the row alternate passing the ball to the left- or right side to the next the person in line (pass ball on the left side to the next person in line). The ball is first passed backwards, then moves forwards, towards the front of the line. *Progression:* Use smaller and/or heavier balls. Add multiple balls.	• Bilateral coordination • Team work	• 1 x netball/dodge ball • 1 x medicine ball • 1 x tennis ball
Cool-down: (10 min) • Build a puzzle	The children sit on the floor in a circle, facing towards the middle of the circle. A puzzle is placed in front of the group. As a group, the children must complete the puzzle to make a picture. During the puzzle build the children must engage in conversation. The researcher asks each child to tell a story while completing the puzzle.	• Social interaction • Manual dexterity	• 1 x picture puzzle

WEEK 1
SESSION 2

Duration: 45 minutes

AIM OF SESSION: Balance and core strength

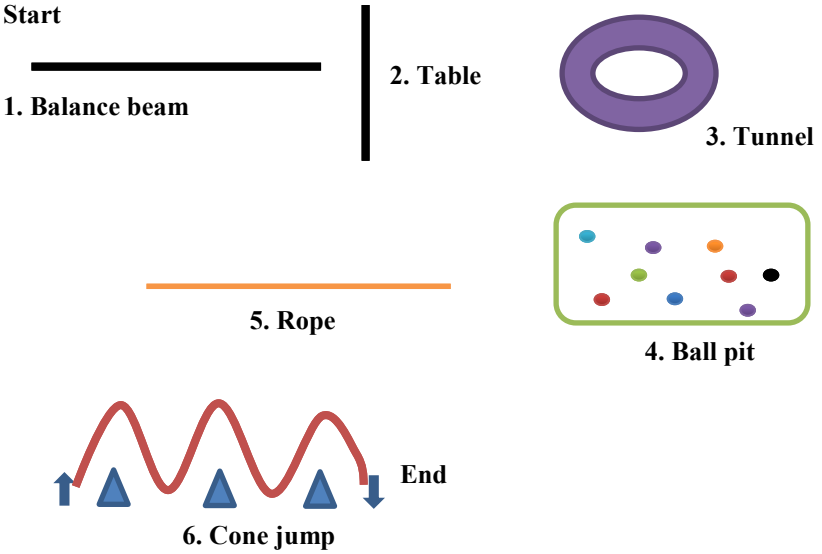
ACTIVITY	INSTRUCTIONS	FOCUS	EQUIPMENT
Warm-up: (5 min) • Builders and diggers	Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.	• Endurance	• Whistle • 20 x traffic cones
1. Obstacle course (15 min)	**Start**  **1. Traffic cones** **2. Balance beam**  **3. Tunnel** **End**  **6. cone jump** **5. Table**  **4. Ball pit** One at a time each child moves through the obstacle course (Repeat 2 times) 1. Child runs in between the traffic cones. 2. The child walks heel-toe over the balance beam. 3. The child crawls through the tunnel into the ball pit. 4. Child walks through the ball pit and climbs out of pit. 5. The child bends down forward and crawls on his/her hands and knees under the table. 6. Lastly the child hops over the 3 cones. Child places 2 feet (ankles) together, bends knees slightly and accelerates off the floor, landing with 2 feet on the other side of the cone.	• Dynamic balance • Proprioception • Motor planning	• 8 x traffic cones • 1 x balance beam • 1 x tunnel • 1 x ball pit • 1 x table

2. Ball skills (10 min)	Children divide into groups of 2. Children stand opposite each other in their groups. The researcher instructs the children to perform the following tasks: • Throw a soft ball to one another using 2 hands (10 times). Progression: Use smaller balls and catch with 1 hand. • Bounce a netball ball to one another, catching the ball with both hands (10 times). • Kick a soccer ball to one another (10 times). • Hit a ball with a tennis racket to one another (10 times).	• Hand-eye coordination • Kicking • Aiming • Throwing • Catching	• 2 x soft balls • 2 x tennis balls • 2 x netball balls • 2 x soccer balls • 4 x rackets
3. Animal walking (10 min)	Children stand in a group on a line 1 next to the other. When the whistle blows the children must walk to the other side of the room according to instruction: • Elephant: Child walks forwards by stretching his/her legs and arms wide apart, at the same time, stomping hard on the ground with feet like an elephant. • Crab: Child must sit on the ground with hands behind body. The child lifts his/her buttocks in the air, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times.  • Frog: The child sits on his/her haunches with arms between legs. On the whistle the child jumps forwards into the air and lands in the same starting position (on haunches, arms between legs). • Ostrich: Child bends forwards to hold onto ankles. The child's knees are slightly bent. The child walks forwards while holding ankles (the child must not let go ankles at any time). • Caterpillar: Children start by bending down forwards onto their haunches. The child walks slowly through 3 phases. Phase 1: The child walks forwards with hands into a push-up position. Phase 2: The child holds the	• Dynamic balance • Body coordination and awareness • Core strength • Proprioception • Motor planning	• None

	push-up position for 1 second. Phase 3: The child walks slowly with his/her feet only back haunches. The 3 movements are repeated.		
Cool-down: (5 min) • Simon says	Children stand in a circle of not less than 3. Each child gets a turn to instruct the rest of the children to perform certain movements such as: • Stand on 1 leg • Touch your toes • Put your hands on your head • Do star jumps • Wave your hands in the air • Put your right hand on your left foot • Touch your elbows • Hop on 1 leg	• Body awareness • Auditory stimulation	• None

WEEK 2 SESSION 3 **Duration:** 45 minutes			
AIM OF SESSION: Balance and bilateral coordination			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (5 min) • Builders and diggers	Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.	• Endurance	• Whistle • 20 x traffic cones
1. Target game (10 min)	Children are divided into groups of 3. The children must stand heel-to-toe in a row (±2m apart) facing each other. The middle partner holds a hoop and the outside partners take turns to throw bean bags through the hoop (the partner's alternate positions). *Progression:* • The researcher now instructs all partners to balance on their dominant leg. • Change the ball sizes.	• Static balance • Aiming and catching	• 2 x hoops • 2 x soft large balls • 2 x tennis balls
2. Ball pass (10 min)	The children stand behind one another in a row. A ball is passed backwards from one end of the line to the opposite end and then back to the front. The ball is then passed: Over and under – children in the row alternate passing the ball overhead or through the legs to the next person in line. The ball is first passed backwards, then moves forwards, towards the front of the line. Left and right – children in the row alternate passing the ball to the left- or right side to next the person in line (pass ball on the left side to next person in line). The ball is first passed backwards, then moves forwards, towards the front of the line. *Progression:* Use smaller and/or heavier balls. Add multiple balls.	• Bilateral coordination • Team work	• 1 x netball/dodge ball • 1 x medicine ball • 1 x tennis ball
3. Group sit (5 min)	Children participate together (not more than 10 in a team). The children need to stand behind and relatively close to each other in a straight line. On the whistle, all the children in the group have to sit down slowly and at the same time. The children need to sit backwards onto the knees of the child behind them (except person at back of row). *Progression*: Increase the group sizes.	• Static balance • Body awareness • Team work	• None
4. Team stand up (10 min)	The children are divided into groups of 2. Each team sits back to back. On the whistle, the partners need to link arms together. The partners have to help each other get off the floor without using their arms and without breaking the link. This is repeated. *Progression:* All the children get together in a group to do a group stand up. The children start by sitting in circle formation, facing outwards. The children link arms together to form a chain. Everyone needs to try stands up at same time without using their arms and without breaking chain. This is repeated.	• Static balance • Team work • Counter balance • Core strength	• None

Cool-down: (5 min) • Traveling hoop	Children stand in a circle and hold hands. A hoop is placed between 2 of the children. One by one each child needs to climb through the hoop using their body parts. At no point may the children let go hands. The hoop needs to travel once around to the right and once around to the left. 	• Bilateral coordination • Body awareness • Motor planning	• 1 x hoola hoop (hoop)

<table>
<tr><td colspan="4">WEEK 2
SESSION 4
Duration: 45 minutes</td></tr>
<tr><td colspan="4">AIM OF SESSION: Body awareness and balance</td></tr>
<tr><td>ACTIVITY</td><td>INSTRUCTIONS</td><td>FOCUS</td><td>EQUIPMENT</td></tr>
<tr><td>Warm-up: (5 min)
• Builders and diggers</td><td>Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.</td><td>• Endurance</td><td>• Whistle
• 20 x traffic cones</td></tr>
<tr><td>1. Obstacle course (15 min)</td><td>Start
 

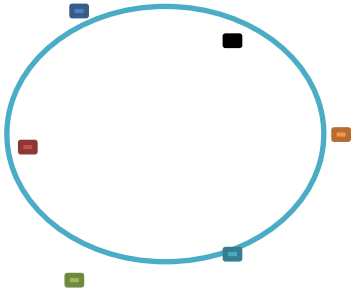
One at a time each child moves through the obstacle course (Repeat 2 times)
1. The child walks heel-toe over the balance beam.
2. The child bends down forward and crawls on his/her hands and knees under the table.
3. The child crawls through the tunnel into the ball pit.
4. Child walks through the ball pit and climbs out of pit.
5. The child walks heel to toe along a thin rope.
6. Lastly the child hops over the 3 cones. Child places 2 feet (ankles) together, bends knees slightly and accelerates off the floor, landing with 2 feet on the other side of the cone.</td><td>• Dynamic and static balance
• Body awareness
• Proprioception
• Motor planning</td><td>• 1x balance beam
• 1 x table
• 1 x tunnel
• 1 x ball pit
• 2 x ropes
• 3 x traffic cones</td></tr>
</table>

2. Animal walking (10 min)	Children stand in a group on a line one next to the other on one side of the room. When the whistle blows the children must walk to the other side of the room according to instruction: • Elephant: Child walks forwards by stretching his/her legs and arms wide apart, at the same time, stomping hard on the ground with feet like an elephant. • Crab: Child must sit on the ground with hands behind body. The child lifts his/her buttocks in the air, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times. • Frog: The child sits on his/her haunches with arms between legs. On the whistle the child jumps forwards into the air and lands in the same starting position (on haunches, arms between legs). • Ostrich: Child bends forwards to hold onto ankles. The child's knees are slightly bent. The child walks forwards while holding ankles (the child must not let go ankles at any time). • Caterpillar: Children need to start by bending down forwards onto their haunches. The child needs to walk slowly through 3 phases. Phase 1: The child walks forwards with hands into a push-up position. Phase 2: The child holds the push-up position for 1 second. Phase 3: The child walks slowly with his/her feet only back haunches. The 3 movements are repeated.	• Dynamic balance • Body coordination and awareness • Core strength • Proprioception • Motor planning	• None
3. Human knot (10 min)	Children work together as a group of 4 (not more than 10). The children stand in a circle formation, facing each other. Everyone puts their hands into the middle of circle and joins hands with 2 other members (never same person). The children have to talk to one another to figure of how to untangle the 'knot" to create 1 big circle with everyone holding hands. The children are not allowed to let go of each other's hands at any given time.	• Static balance • Team cooperation • Social communication and interaction	• None
Cool-down: (5 min) • Simon says	Children stand in a circle of no less than 3. Each child gets a turn to instruct the rest of the children perform certain movements such as: • Stand on 1 leg • Touch your toes • Put your hands on your head • Do star jumps • Wave your hands in the air • Put your right hand on your left foot • Touch your elbows • Hop on 1 leg	• Body awareness • Auditory stimulation	• None

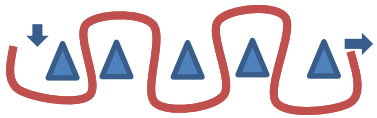
<table>
<tr><td colspan="4">WEEK 3
SESSION 5
Duration: 45 minutes</td></tr>
<tr><td colspan="4">AIM OF SESSION: Balance and body awareness</td></tr>
<tr><td>ACTIVITY</td><td>INSTRUCTIONS</td><td>FOCUS</td><td>EQUIPMENT</td></tr>
<tr><td>Warm-up: (5 min)
• Sleeping giants</td><td>The children must run around the room, being careful not to bump into one another. When the researcher shout “sleeping giants”, the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again.</td><td>• Endurance
• Spatial awareness</td><td>• None</td></tr>
<tr><td>1. Ball and ring throw (15 min)</td><td>Children line up one behind the other to wait on a turn to do the activity. Children are instructed to throw 5 bean bags into a basket 2m away. The task is completed once every child has had a turn.
Progression: Balls are used instead of beanbags.
Children line up again one behind the other. Each child must throw a ring over a cone placed 2m away.
Progression: Increase the distance of the cone away from the child.</td><td>• Aiming
• Waiting to take turns</td><td>• 1 x basket
• 5 x bean bags
• 5 x tennis balls
• 5 x rings
• 1 x traffic cone</td></tr>
<tr><td>2. Hop scotch (10 min)</td><td>The children stand in a line one behind the other in front of a hoop formation. Children must complete the hop scotch pattern 1 at a time.
 Hop with 2 feet for the first round (2 feet in the hoop marked 1 and 1 foot in each hoop marked 2) .
 Hop with 1 foot in hoops marked 1 and 1 foot in each marked 2.

Start 2 2 2 1 1 1 1 1 Finish

Progression:
 Throw bean bag in a selected hoop and instruct the children that this hoop may not be used.</td><td>• Dynamic and static balance
• Motor planning
• Spatial awareness
• Hand-eye coordination</td><td>• 11 x hoops
• 4 x bean bags</td></tr>
</table>

3. Rope walking (10 min)	5 ropes are placed on the floor in an open area in the shape of a circle. Bean bags are placed on the inside and outside, next to the rope along the entire circle:  The children are instructed to walk heel-to-toe along the rope. When the child reaches a bean bag, the child must slowly bend his/her knees to pick up the bean bag and place it on the other side of the rope. The child proceeds to walk the entire rope. (Repeat 2 times).	• Dynamic and static balance • Midline crossing	• 5 x ropes • 6 x bean bags
Cool-down: (5 min) • Simon says	Children stand in a circle of no less than 3. Each child gets a turn to instruct the rest of the children perform certain movements such as: • Stand on 1 leg • Touch your toes • Put your hands on your head • Do star jumps • Wave your hands in the air • Put your right hand on your left foot • Touch your elbows • Hop on 1 leg	• Body awareness • Auditory stimulation	• None

WEEK 3 SESSION 6 **Duration:** 45 minutes			
AIM OF SESSION: Balance, aiming and catching			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (10 min) • Sleeping giants • The farmer and the rabbit	a) The children must run around the room, being careful not to bump into 1 another. When the researcher shouts "sleeping giants", the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again. b) The children sit in a circle. 2 medicine balls are passed around the circle according to a story. The farmer (medicine ball 1) chases the rabbit (medicine ball 2) because the rabbit is eating all his veggies. When the farmer catches the rabbit the game is over (Repeat to both left and right sides).	• Endurance • Upper body strength • Midline crossing	• None • 2 x medicine balls (1 larger than the other)
1. Throwing and catching (10 min)	Children are divided into groups of 2. The children need to stand opposite their partners 2m apart. The children need to throw a tennis ball (under arm) to 1 another (making sure that they do not drop the ball) and catch it with 2 hands. *Progression:* Catch with 1 hand (left and right hand) and increase the distance. Children line up 1 next to each other, facing a wall (2m away). The children are instructed to throw the tennis ball (over arm) against the wall, catching it on return with 2 hands. *Progression:* Catch with 1 hand (left and right hands done) and increase the distance from the wall.	• Throwing and catching skills • Hand-eye coordination	• 2 x tennis balls
2. Partner rope races (3 leg race) (10 min)	Children are divided into groups of 2. The partners stand next to 1 another. Their inner legs are tied together with a rope. The partners have to work together as a team to walk around the room. *Progression:* Have a race to make it exciting.	• Team cooperation • Social interaction • Body coordination • Bilateral coordination • Dynamic balance •	• 2 x ropes

3. Obstacle course (10 min)	**Start**  **1. Ladder jump**  **2. Traffic cones**  **4. Hopping** **3. Rope** One at a time each child moves through the obstacle course (Repeat 2 times) 1. Children must jump with 2 feet through the ladder. 2. The child jumps over the traffic cones with 2 feet. 3. The child walks heel-to-toe along the rope. 4. The child hops on 1 leg inside the hoops.	• Motor planning • Dynamic and static balance	• 1 x ladder • 5 x traffic cones • 1 x rope • 7 x hoola hoops (hoops)
Cool-down: (5 min) • Heel-to-toe balance and thread	Children are divided into teams of 2. The children are instructed to stand heel-to-toe opposite one another (1m apart). Threading beads are placed on the floor in between the partners. Each partner has a string in his/her hands. one at a time, the partners need to slowly bend their knees to pick up a bead 1 at a time. The child stands up straight, still remaining in the heel-to-toe position and threads the bead on the string. The game is completed once all the beads have been threaded. (Repeat 2 times)	• Static balance • Manual dexterity	• Beads • Thread

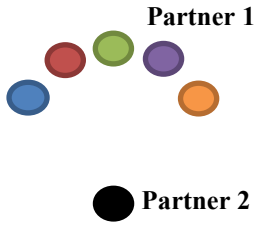
WEEK 4
HOME PROGRAMME

During this week the children were on holiday. A home programme was given to the parents/guardians to do with their children. The parents/guardians were instructed to choose 3 activities to do twice during that week.

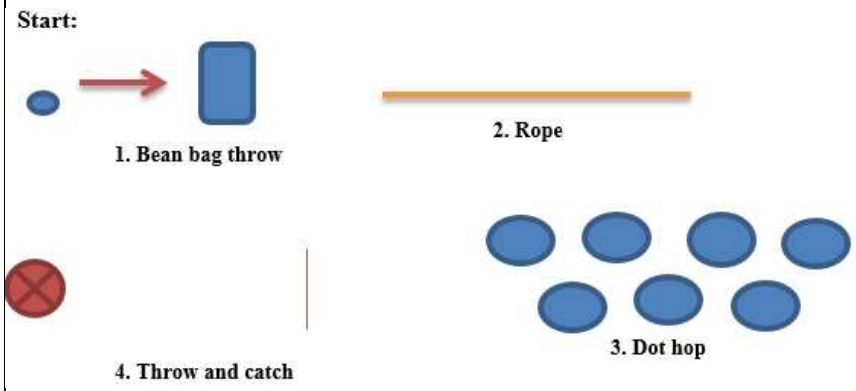
ACTIVITY	INSTRUCTIONS	FOCUS	EQUIPMENT
1. Building a puzzle (15 min)	Have the whole family sit down and build a puzzle. While you are building the puzzle, talk to your child and ask him/her to tell the whole family a story. Then have another family member tell a story and make sure your child not only listens to the story without interrupting, but interacts and asks questions about your story.	• Social communication and interaction • Manual dexterity	• 1 x puzzle
2. Throwing and catching (10 min)	Use any type of ball (start with a larger ball and move on to a smaller ball such as a tennis ball). Stand about 2m away from your child. Throw a ball (using 2 hands first and then using 1 hand) to your child 10 times (repeat 3 times). *Progression*: Have your child stand in front of a clear wall. Instruct your child to throw the ball at the wall (throwing underarm) and without letting it bounce he/she must catch the ball in his/her hands (start with 2 hands and if you notice that he/she can complete the task, you can move on to catching with 1 hand), 10 times (repeat 3 times). *Progression*: If you find your child is advancing, you can instruct your child to stand on 1 leg while catching and throwing the balls.	• Throwing and catching • Object manipulation • Static balance	• 1 x soft ball • 1 x tennis ball
3. Hop scotch (10 min)	Place hoops out in the same pattern as this diagram or draw the circles using chalk on the ground or place colour dots on the floor.  **Hopping** Your child must start at 1 point and move over the hoops to the	• Dynamic balance • Motor planning	• 7 x hoola hoops (hoops) • 1 x ball

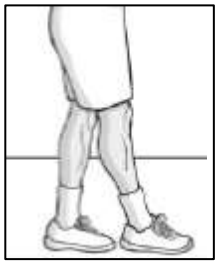
	other side. Instruct your child to hop with 1 foot in the hoops that are single and hop with 2 feet in the hoops that lie next to 1 another. The activity is complete once your child has completed all the hops (repeat 3 times). *Progression:* Your child hops through the hoops and when you say stop, your child must freeze where he/she is and catch a ball that you throw at him/her (repeat 3 times).		
4. Walking heel-to-toe and pick up bean bags (10 min)	Place a rope on the floor in a straight line or draw a line (4m) on the floor. Place bean bags or small toys along the side of the rope/line. Instruct your child to walk heel to toe on the line, when your child gets to a bean bag/toy, they must pick the beanbag/toy up with their 1 hand and place it on the other side of the line/rope. (Repeat 3 times.) *Progression:* Throw a ball to your child every time they get to the beanbag/toy. They must catch the ball and throw it back to you. 	• Static and dynamic balance • Throwing and catching	• 1 x rope • 6 x bean bags/ toys • 1 x ball
5. Twister (10 min)	This is an activity where the whole family can get involved. Place numbers or coloured dots in rows of 4 in an open area on the floor. One family member is in charge of instructing everyone else. Instruct your child to follow your verbal commands: • Place left foot on number 3 or a colour dot. • Place right arm on number 5 or colour dot. The game is complete when the last person falls to the ground and cannot hold themselves up any longer.	• Static balance • Core strength	• 1 x twister board • Coloured dots
6. Relay races (15 min)	This is an activity which can be done by the whole family. Do this activity in groups of 2/3 (the more participants the better). Activity 6.1: Monkey races:	• Team cooperation • Social interaction • Body coordination	• 1 x rope • 1 x soft ball

	Everyone has to hold a ball between their legs (as if they are walking like monkeys). One at a time children run to the other side of the room, while holding the ball between your legs. The team that has completed the run first wins. *Progression:* Place obstacles out in the garden or in the house (such as running in-between things). Activity 6.2: Three legged races : Have everyone get into groups of 2. (Matching an adult with a child keeps things fair and interesting.). Using a bandanna or a rope, each pair ties 1 partner's right ankle to the other's left ankle (see picture): When the whistle blows, all of the pairs, assembled side-by-side at the starting line, race to the finish line. The first team whose pairs all cross the finish line wins. 	• Bilateral coordination	

<table>
<tr><td colspan="4">WEEK 5
SESSION 7
Duration: 50 minutes</td></tr>
<tr><td colspan="4">AIM OF SESSION: Core strength and balance</td></tr>
<tr><td>ACTIVITY</td><td>INSTRUCTIONS</td><td>FOCUS</td><td>EQUIPMENT</td></tr>
<tr><td>Warm-up: (5 min)
• Builders and diggers</td><td>a) Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.</td><td>• Endurance</td><td>• Whistle
• 20 x traffic cones</td></tr>
<tr><td>• The farmer and the rabbit</td><td>b) The children sit in a circle. Two medicine balls are passed around the circle according to a story. The farmer (medicine ball 1) chases the rabbit (medicine ball 2) because the rabbit is eating all his veggies. When the farmer catches the rabbit the game is over. (Repeat to both left and right sides.)</td><td>• Upper body strength
• Midline crossing</td><td>• 2 x medicine balls (1 larger than the other)</td></tr>
<tr><td>1. Colour crawl (10 min)</td><td>Children are divided into groups of 2. Colour dots are placed on the floor in the following pattern:
 

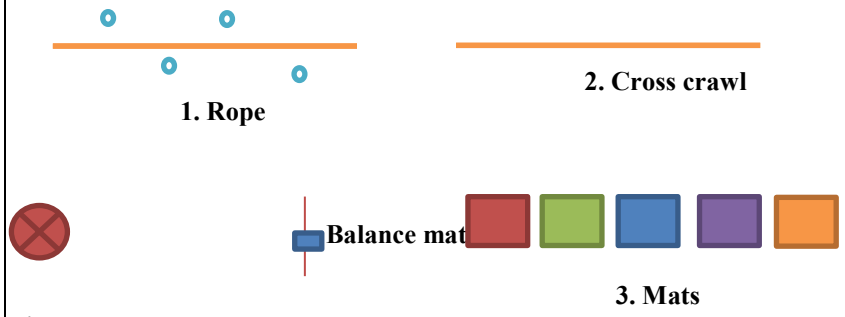
One partner from each group stands on the black dot (starting point) and the other partner stands in front of the circles facing partner number 1. Partner 2 must bend down on his/her haunches and wait for instructions from partner 1. Partner 1 will instruct partner 2 to crawl with his/her arms forwards to a specific colour (his/her feet may not move off the black dot). Partner 2 will hold the position on the colour dot for 3 seconds, and return to his/her haunches by crawling backwards with his/her hands. This is repeated until all the colours are done. The partners then swop places.
Progression: Have the children hold the position for 5 seconds</td><td>• Core strength
• Social interaction
• Balance</td><td>• 6 x colour dots</td></tr>
<tr><td>2. Partner rope races (3 leg race) (10 min)</td><td>Children are divided into groups of 2. The partners stand next to one another. Their inner legs are tied together with a rope. The partners have to work</td><td>• Team cooperation</td><td>• 2 x ropes</td></tr>
</table>

	together as a team to walk around the room. *Progression:* Have a race (creates a fun environment).	• Social interaction • Body coordination • Bilateral coordination • Dynamic balance	
3. Obstacle course(10 min)	 One at a time each child moves through the obstacle course (Repeat 2 times) 1. Children throw bean bags into a basket (*progression:* use small balls) 2. Children walk heel-to-toe on a rope. The researcher throws a ball at the child. The child must catch the ball, throw it back and carry on to the end of the rope. 3. Children jump on 1 leg onto the dots. 4. Children stand behind a line in front of a target on the wall ±2m away. The child throws a tennis ball at the target and catches it with 2 hands (5 times).	• Aiming and throwing • Dynamic balance • Catching • Motor planning	• 5 x bean bags • 2 x ropes • 7 x colour dots • 1 x tennis ball
4. Animal walking (10 min)	Children stand in a group on a line one next to the other. When the whistle blows the children must walk to the other side of the room according to instruction: • Elephant: Child walks forwards by stretching his/her legs and arms wide apart, at the same time, stomping hard on the ground with feet like an elephant. • Crab: Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk side ways, keeping his/her buttocks off the ground at all	• Dynamic balance • Body coordination and awareness • Core strength	• None

	times. • Frog: The child sits on his/her haunches with arms between legs. On the whistle the child jumps forwards into the air and lands in the same starting position (on haunches, arms between legs). • Ostrich: Child bends forwards to hold onto ankles. The child's knees are slightly bent. The child walks forwards while holding ankles (the child must not let go ankles at any time). • Caterpillar: Children need to start by bending down forwards onto their haunches. The child needs to walk slowly through 3 phases. Phase 1: The child walks forwards with hands into a push-up position. Phase 2: The child holds the push-up position for 1 second. Phase 3: The child walks slowly with his/her feet back onto his/her haunches. The 3 movements are repeated.		
Cool-down: (5 min) • Balance heel-to-toe and thread	Children are divided into teams of 2. The children are instructed to stand heel-to-toe opposite one another (1m apart). Threading beads are placed on the floor in between the partners. Each partner has a string in his/her hands. One at a time, the partners need to bend their knees, to pick up a bead one at a time. The child stands up straight, still remaining in the heel-to toe position, and threads the bead on the string. The game is completed once all the beads have been threaded. (Repeat 2 times.) 	• Static balance • Manual dexterity	• Beads • Thread

WEEK 5 SESSION 8 **Duration:** 45 minutes			
AIM OF SESSION: Bilateral coordination and throwing and catching			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (5 min) • Sleeping giants • The farmer and the rabbit	a) The children must run around the room, being careful not to bump into one another. When the researcher shout "sleeping giants", the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again. b) The children sit in a circle. Two medicine balls are passed around the circle according to a story. The farmer (medicine ball 1) chases the rabbit (medicine ball 2) because the rabbit is eating all his veggies. When the farmer catches the rabbit the game is over. (Repeat to both left and right sides.	• Endurance • Upper body strength • Midline crossing	• None • 2 x medicine balls (1 larger than the other)
1. Weight pass (10 min)	The children stand behind one another in a row. A 1kg weight is then passed backwards from 1 end of the line to the opposite end and then back to the front. The weight is then passed: □ Over and under – children in the row alternate passing the weight overhead or through the legs to the next person in line. The weight is first passed backwards, then moves forwards, towards the front of the line. □ Left and right – children in the row alternate passing the weight to the left or right side to next the person in line (pass ball on the left side to next person in line). The weight is first passed backwards, then moves forwards, towards the front of the line. *Progression:* Use heavier weights. Add multiple weights.	• Bilateral coordination • Team work • Upper body strength	• 1 x 1kg weight • 1 x medicine ball • 1 x 2kg weight
2. Ball skills (15 min)	a) Children are divided into groups of 2. The children need to stand opposite their partner's ±2m apart. The children need to throw a tennis ball (under arm) to 1 another and catch it with 2 hands. *Progression:* Throw the ball over arm and catch with 1 hand (left and right hand) and increase the distance apart. b) The children line up 1 next to the other, facing a wall (2m away). The children are instructed to throw the tennis ball (under arm) against the wall, catching it on return with 2 hands. *Progression:* Throw ball over arm and catch with 1 hand (left and right hands) and increase distance away from wall. c) The children all receive a tennis racket and a tennis ball. Each child	• Throwing and catching skills • Hand-eye coordination	• 2 x tennis balls • 2 x tennis rackets

	needs to stand still and try to balance the tennis ball on the racket for 30 seconds. *Progression:* Have the children walk around the room slowly, while still trying to balance the ball on the bat. d) The children are instructed to stand still and hit the tennis ball onto the ground (bouncing) 10 times. *Progression:* Have the children bounce the ball up into the air with the racket.		
3. Animal walking (10 min)	Children stand in a group on a line one next to the other. When the whistle blows the children must walk to the other side of the room according to instruction: • Elephant: Child walks forwards by stretching his/her legs and arms wide apart, at the same time, stomping hard on the ground with feet like an elephant. • Crab: Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times. • Frog: The child sits on his/her haunches with arms between legs. On the whistle the child jumps forwards into the air and lands in the same starting position (on haunches, arms between legs). • Ostrich: Child bends forwards to hold onto ankles. The child's knees are slightly bent. The child walks forwards while holding ankles (the child must not let go ankles at any time). • Caterpillar: Children need to start by bending down forwards onto their haunches. The child needs to walk slowly through 3 phases. Phase 1: The child walks forwards with hands into a push-up position. Phase 2: The child holds the push-up position for 1 second. Phase 3: The child walks slowly with his/her feet back onto his/her haunches. The 3 movements are repeated.	• Dynamic balance • Body coordination and awareness • Core strength	• None
Cool-down: (5 min) • Placing pegs • Ring squeeze	a) The children are instructed to sit in a circle on the floor. In the middle of the circle is a peg board with pegs. The children are instructed to make a picture by placing pegs into the peg board. Allow the children to talk. The researcher should ask the group questions, provoking social interaction and communication. b) Therapy rings are passed round the circle. One at a time the children have to squeeze the rings in the palms of their hands 5 times for each hand. There are 3 sets of rings. Each set is harder than the next.	• Social skills • Grip strength	• 1 x ring set • 1 x peg board and pegs

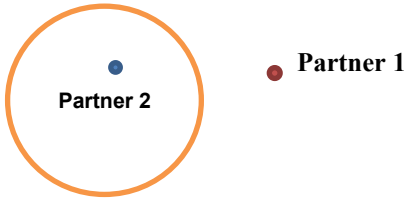
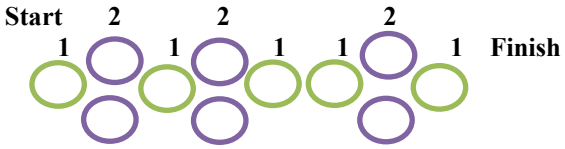
<table>
<tr><td colspan="4">WEEK 6
SESSION 9
Duration: 45 minutes</td></tr>
<tr><td colspan="4">AIM OF SESSION: Balance and body coordination</td></tr>
<tr><td>ACTIVITY</td><td>INSTRUCTIONS</td><td>FOCUS</td><td>EQUIPMENT</td></tr>
<tr><td>Warm-up: (5 min)
• Sleeping giants</td><td>The children must run around the room, being careful not to bump into one another. When the researcher shout “sleeping giants”, the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again.</td><td>• Endurance</td><td>• None</td></tr>
<tr><td>1. Partner rope races (3 leg race) (10 min)</td><td>Children are divided into groups of 2. The partners stand next to one another. Their inner legs are tied together with a rope. The partners have to work together as a team to walk around the room.
Progression: Have a race (creates a fun environment).</td><td>• Team cooperation
• Social interaction
• Body coordination
• Bilateral coordination
• Dynamic balance</td><td>• 2 x ropes</td></tr>
<tr><td>2. Obstacle course (15 min)</td><td>Start
 

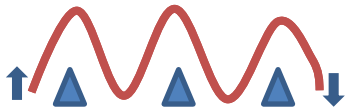
4. Throw and catch

One at a time each child moves through the obstacle course (Repeat 2x)
1. The child must walk heel-to-toe along the rope. When the child reaches a ring on the ground, the child bends his/her knees and pick up the ring, squeezing it 3 times in each hand and place it back on the ground.
2. The child walks along the rope like a model, making sure to crossover the rope. The right leg steps on the left side of the rope</td><td>• Dynamic and static balance
• Aiming and catching
• Midline crossing</td><td>• 2 x ropes
• 3 x rings
• 5 x colour mats
• 1 x balance mat
• 1 x target
• 1 x tennis ball</td></tr>
</table>

	and the left leg steps on the right side of the rope. 3. The child hops on 1 leg over the colour mats. 4. The children need to stand on a balance mat and throw a tennis ball at a target on the wall, while catching the ball on return.		
3. Balance heel-to-toe and thread	The children are instructed to stand heel-to-toe in front of a table. Threading beads are placed on the table. Each child has a string in their hands. The children need to thread all the beads, while remaining in the heel-to-toe stance. *Progression:* Have the children stand on 1 leg and thread. The game is completed once all the beads have been threaded (Repeat 2 times).	• Static balance • Manual dexterity	• Beads • Thread
Cool-down: (5 min) • Placing pegs • Ring squeeze	c) The children are instructed to sit in a circle on the floor. In the middle of the circle is a peg board with pegs. The children are instructed to make a picture by placing pegs into the peg board. Allow the children to talk. The researcher should ask the group questions, provoking social interaction and communication. d) Therapy rings are passed round the circle. 1 at a time the children have to squeeze the rings in the palms of their hands 5 times for each hand. There are 3 sets of rings. Each set is harder than the next.	• Fine motor • Social skills • Grip strength	• 1 x ring set • 1 x peg board and pegs

WEEK 6 SESSION 10 **Duration:** 45 minutes			
AIM OF SESSION: Core strength			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (5 min) • Builders and diggers	c) Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.	• Endurance	• Whistle • 20 X traffic cones
• The farmer and the rabbit	d) The children sit in a circle. Two medicine balls are passed around the circle according to a story. The farmer (medicine ball 1) chases the rabbit (medicine ball 2) because the rabbit is eating all his veggies. When the farmer catches the rabbit the game is over. (Repeat to both left and right sides.)	• Upper body strength • Midline crossing	• 2 x medicine balls (1 larger than the other)
1. Ladder walking (10 min)	Children divide into groups of 2. Each group stands one behind the other behind a ladder. One at a time, the children must get into a push up position perpendicular to the ladder. The child must walk with his/her hands along the ladder. The child places his/her hands inside a section of the ladder and places his/her hands below the ladder. The child will walk in this push-up position until the end of the ladder. Children walk like a caterpillar. (Repeat to the left and right.) 	• Core strength • Upper and lower body coordination	• 2 x ladders

2. Pass and run (15 min)	Children are divided into pairs of 2. Each pair must stand opposite to one another round a circle of rope. One person will stand inside the circle and the other on the outside of the circle. The pairs have to throw a ball to 1 another. Each partner needs to catch the ball with 2 hands at first. If the ball is dropped, both partners must leave their spot and run around the big circle and get back to their spot. They start throwing the ball to each other again. *Progression*: Have the children catch with 1 hand, have the children stand on 1 leg while throwing or use different types of balls.  	• Hand-eye coordination • Throwing and catching	• 1 x tennis ball • 1 x soft ball • 4 x ropes
3. Hop scotch (10 min)	The children stand in a line one behind the other in front of a hoop formation. Children must complete the hop scotch pattern one at a time. □ Hop with 2 feet for the first round (2 feet in the hoop marked number 1 and 1 foot in each hoop marked number 2). □ Hop with 1 foot in hoops marked 1 and 1 foot in each marked 2.  *Progression*: □ Throw bean bag in a selected hoop and instruct the children that this hoop may not be used.	• Dynamic and static balance	• 11 x hoola hoops (hoops) • 4 x bean bags
Cool-down: (5 min) • Traveling hoop	Children stand in a circle and hold hands. A big hoop is placed between 2 of the children. Each child needs to climb through the hoop by using their bodies as the hoop is moved around the circle. The children may not let go hands. *Progression:* Use a smaller hoop.	• Bilateral Coordination • Body awareness • Social interaction	• 1 x small hoola hoop (hoop) • 1 x big hoola hoop (hoop)

<table>
<tr><td colspan="4">WEEK 7
SESSION 11
Duration: 45 minutes</td></tr>
<tr><td colspan="4">AIM OF SESSION: Balance</td></tr>
<tr><td>ACTIVITY</td><td>INSTRUCTIONS</td><td>FOCUS</td><td>EQUIPMENT</td></tr>
<tr><td>Warm-up: (5 min)
• Sleeping giants</td><td>The children must run around the room, being careful not to bump into one another. When the researcher shout “sleeping giants”, the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again.</td><td>• Endurance</td><td>• None</td></tr>
<tr><td>1. Obstacle course (15 min)</td><td>Start
 
1. Rope
 
2. Cone jumping
 
4. Star jumps
 
3. Mats
End
 
5. Tunnel

One at a time each child moves through the obstacle course (Repeat 2x)
1. The child walks along the rope heel-to-toe. When the child reaches a therapy ring, the child bends down slowly and picks up the ring on the side of the rope and squeezes it 3 times in each hand.
2. The child jumps over the cones with 2 feet together.
3. The child hops on 1 leg over the colour mats.
4. The child does 10 star jumps.
5. The child crawls through the tunnel to the finish.</td><td>• Dynamic and static balance
• Body awareness
• Bilateral coordination</td><td>• 2 x rope
• 3 x ring set
• 4 x traffic cones
• 5 x colour mats
• 1 x tunnel</td></tr>
<tr><td>2. Animal walking (10 min)</td><td>Children stand in a group on a line one next to the other. When the whistle blows the children must walk to the other side of the room</td><td>• Dynamic balance
• Body</td><td>• None</td></tr>
</table>

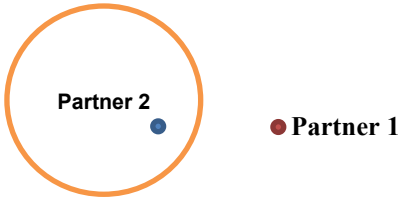
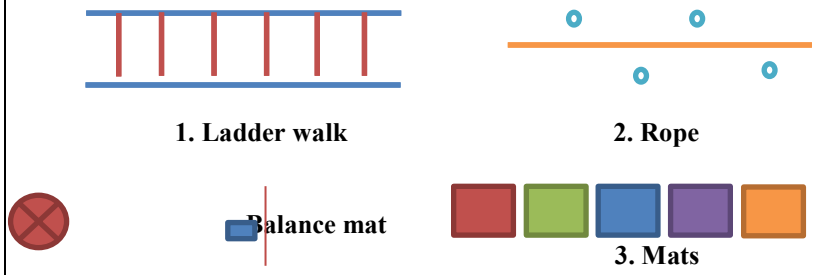
	according to instruction: • Seal: Each child must lie on the floor on his/her stomachs. The children lift up the front of their bodies by using their hands. The children need to walk on their hands, pulling their body and dragging their legs behind them. • Crab: Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times. • Frog: The child sits on his/her haunches with arms between legs. On the whistle the child jumps forwards into the air and lands in the same starting position (on haunches, arms between legs). • Ostrich: Child bends forwards to hold onto ankles. The child's knees are slightly bent. The child walks forwards while holding ankles (the child must not let go ankles at any time). • Caterpillar: Children need to start by bending down forwards onto their haunches. The child needs to walk slowly through 3 phases. Phase 1: The child walks forwards with hands into a push-up position. Phase 2: The child holds the push-up position for 1 second. Phase 3: The child walks slowly with his/her feet back onto his/her haunches. The 3 movements are repeated.	coordination and awareness • Core strength	
3. Under the parachute (10 min)	The children are divided into teams of 2. Each group represents a colour. There is a parachute on the floor with different colours on it. The children stand on the edge of parachute next to his/her colour (groups have the same colour). All the children are instructed to grab hold of the parachute, lifting it up into the air. The children are instructed to slowly lift the parachute up over their heads and back down again (hip height). The researcher will shout out a colour. The partners that represent that colour will run under the parachute when it is up in the air and swop places. *Progression:* Once all partners have had 3 turns swopping places, The researcher places small balls (pretend popcorn) on top of the parachute. The children need to gently lift the parachute up into the air and back down again, making sure the balls do not fall out of the parachute.	• Body schema	• 1 x parachute • 6 x small balls

	 		
Cool-down: (5 min) • Balance heel-to-toe and thread	Children are divided into teams of 2. The children are instructed to stand heel-to-toe opposite one another (1m apart). Threading beads are placed on the floor in between the partners. Each partner has a string in their hands. one at a time, the partners need to bend their knees, to pick up a bead one at a time. The child stands up straight, still remaining in the heel-to toe position, and threads the bead on the string. The game is completed once all the beads have been threaded. (Repeat 2 times.)	• Static balance • Manual dexterity	• Beads • Thread

<table>
<tr><td colspan="4">WEEK 7
SESSION 12
Duration: 45 minutes</td></tr>
<tr><td colspan="4">AIM OF SESSION: Balance and spatial/body awareness</td></tr>
<tr><td>ACTIVITY</td><td>INSTRUCTIONS</td><td>FOCUS</td><td>EQUIPMENT</td></tr>
<tr><td>Warm-up: (5 min)
• Builders and diggers</td><td>CONEs are placed all over an area. The children are divided into 2 teams. 1 team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.</td><td>• Endurance</td><td>• Whistle
• 20 X traffic cones</td></tr>
<tr><td>1. Walking bean bag balance (10 min)</td><td>Children are each given a bean bag. On instruction the children begin to walk around the room with the bean bag placed on their heads. The children need to balance the bean bag while slowly walking. Make the game harder by giving further instructions:
• Walk fast
• Walk backwards
• Walk heel-to-toe
• Walk on tip toes
• Walk on heels
The children all receive a tennis racket and a tennis ball. Each child needs to stand still and try to balance the tennis ball on the racket for 30 seconds.
Progression: Have the children walk around the room slowly while still trying to balance the ball on the racket. Then the children are instructed to stand still and hit the tennis ball onto the ground with the racket (bouncing) 10 times.</td><td>• Dynamic balance
• Ball skills</td><td>• 4 x bean bags
• 4 x tennis rackets
• 4 x tennis balls</td></tr>
<tr><td>2. Body letters (10 min)</td><td>Children are divided into teams of 2 or more. The groups are instructed to make certain letters by using their bodies. The children lie on the floor and form the shape of the letter for example; P, B, S, N, L. See picture below:</td><td>• Body awareness (Laterality and Directionality)
• Social interaction and communication</td><td>• None</td></tr>
</table>

			
3. Crab soccer (15 min)	Children are divided into two teams of 3. Each team is instructed to shoot their goals on the opposite side of the room through 2 marked cones. Children are instructed to walk like crabs, only using their feet to kick the ball (no hands). Crab walk: Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times. 	• Core strength • Body coordination • Dynamic balance • Team play • Spatial awareness	• 4 x traffic cones • 6 x colour bibs • 1 x mini soccer ball
Cool-down: (5 min) • Traveling hoop	a) Children stand in a circle and hold hands. A big hoop is placed between 2 of the children. Each child needs to climb through the hoop by using their bodies as the hoop is moved around the circle. The children may not let go hands.	• Bilateral Coordination • Body awareness	• 1 x small hoola hoop (hoop) • 1 x big hoola hoop (hoop)

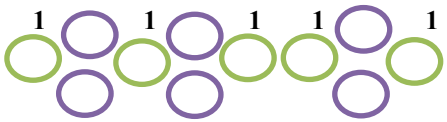
• Farmer and the rabbit	*Progression:* Use a smaller hoop. b) The children sit in a circle. Two medicine balls are passed around the circle according to a story. The farmer (medicine ball 1) chases the rabbit (medicine ball 2) because the rabbit is eating all his veggies. When the farmer catches the rabbit the game is over (Repeat to both left and right sides)	• Upper body strength • Midline crossing	• 2 x medicine balls (1 larger than the other)

<table>
<tr><td colspan="4">WEEK 8
SESSION 13
Duration: 45 minutes</td></tr>
<tr><td colspan="4">AIM OF SESSION: Balance and throwing and catching</td></tr>
<tr><td>ACTIVITY</td><td>INSTRUCTIONS</td><td>FOCUS</td><td>EQUIPMENT</td></tr>
<tr><td>Warm-up: (5 min)
• Builders and diggers</td><td>Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.</td><td>• Endurance</td><td>• Whistle
• 20 X traffic cones</td></tr>
<tr><td>1. Pass and run (15 min)</td><td>Children are divided into pairs. Each pair must stand opposite to one another round a circle of rope. One person will stand inside the circle and the other on the outside of the circle. The pairs have to through a ball to one another. Each partner needs to catch the ball with 2 hands at first. If the ball is dropped, both partners must leave their spot and run around the big circle and get back into their spot. They start throwing the ball to each other again.
Progression: Have the children catch with 1 hand, have the children stand on 1 leg while throwing or use different types of balls.
 
</td><td>• Hand-eye coordination
• Object manipulation</td><td>• 1 x tennis ball
• 1 x soft ball
• 4 x ropes</td></tr>
<tr><td>2. Stations (10 min)</td><td>Start:
 
</td><td>• Core strength
• Dynamic and static balance
• Aiming and catching
• Endurance</td><td>• 1 x ladder
• 2 x rope
• 3 x set of rings
• 5 x colour mats
• 1 x balance mat
• 1 x wall target
• 1 x traffic cone</td></tr>
</table>

	 **5. Star jumps** Each child begins at a station. After 2 minutes, the children rotate until each child has completed 2 minutes of each activity. 1. The child must get into a push-up position perpendicular to the ladder. The child must walk with his/her hands along the ladder. The child places his/her hands inside a section of the ladder and places his/her hands below the ladder. The child will walk in this push-up position until the end of the ladder. The child walks like a caterpillar. (Repeat to the left and right.) 2. The child walks along the rope heel-to-toe. When the child reaches a therapy ring, the child bends down slowly and picks up the ring on the side of the rope and squeezes it 3 times in each hand. The child places the ring back on the ground next to the rope and carry's on walking heel-to-toe. 3. The child hops over the mats on 1 leg. 4. The child stands on the balance mat with 2 feet and throws a tennis ball at the target on the wall, catching the ball with 2 hands on return. 5. The child must complete star jumps until the 2 minutes are up (they can have rests).		
4. Under the Parachute (10 min)	The children are divided into teams of 2. Each group represents a colour. There is a parachute on the floor with different colours on it. The children stand on the edge of parachute next to his/her colour (each team has the same colour). All the children are instructed to grab hold of the parachute, lifting it up into the air. The children are instructed to slowly lift the parachute up over their heads and back down again (hip height). The researcher will shout out a colour. The partners that represent that colour will run under the parachute when it is up in the air and swop places. *Progression:* Once all partners have had 3 turns swopping places, The researcher places small balls (pretend the balls are popcorn) on top of the parachute. The children need to gently lift the parachute up into the air and back down again, making sure the balls do not fall out of the parachute.	• Body schema	• 1 x parachute • 6 x small balls
Cool-down: (5 min) • Balance heel-to-toe and thread	Children are divided into teams of 2. The children are instructed to stand heel-to-toe opposite one another (1m apart). Threading beads are placed on the floor in between the partners. Each partner has a string in their hands. 1 at a time, the partners need to bend their knees, to pick up a bead 1 at a time. The child stands up straight, still remaining in the heel-to-toe	• Static balance • Manual dexterity	• Beads • Thread

	position, and threads the bead on the string. The game is completed once all the beads have been threaded (Repeat 2 times).		

WEEK 8 SESSION 14 **Duration:** 45 minutes			
AIM OF SESSION: Body awareness and balance			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (5 min) • Sleeping giants	The children must run around the room, being careful not to bump into one another. When the researcher shout "sleeping giants", the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again.	• Endurance	• None
1. Animal walking (10 min)	Children stand in a group on a line one next to the other. When the whistle blows the children must walk to the other side of the room according to instruction: • Seal: Each child lie on the floor on his/her stomach. The children lift up the front of their bodies by using their hands. The children need to walk on their hands, pulling their body and dragging their legs behind them. • Crab: Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times. • Frog: The child sits on his/her haunches with arms between legs. On the whistle the child jumps forwards into the air and lands in the same starting position (on haunches, arms between legs). • Ostrich: Child bends forwards to hold onto ankles. The child's knees are slightly bent. The child walks forwards while holding ankles (the child must not let go ankles at any time). • Caterpillar: Children need to start by bending down forwards onto their haunches. The child needs to walk slowly through 3 phases. Phase 1: The child walks forwards with hands into a push-up position. Phase 2: The child holds the push-up position for 1 second. Phase 3: The child walks slowly with his/her feet back onto his/her haunches. The 3 movements are repeated.	• Dynamic balance • Body coordination and awareness • Core strength	• None
2. Hop scotch (10 min)	The children stand in a line one behind the other in front of a hoop formation. Children must complete the hop scotch pattern 1 at a time. □ Hop with 2 feet for the first round (2 feet in the hoop marked 1 and 1 foot in each hoop marked 2). □ Hop with 1 foot in hoops marked number 1 and 1 foot in each marked number 2.	• Dynamic and static balance	• 11 x hoola hoops (hoops) • 4 x bean bags

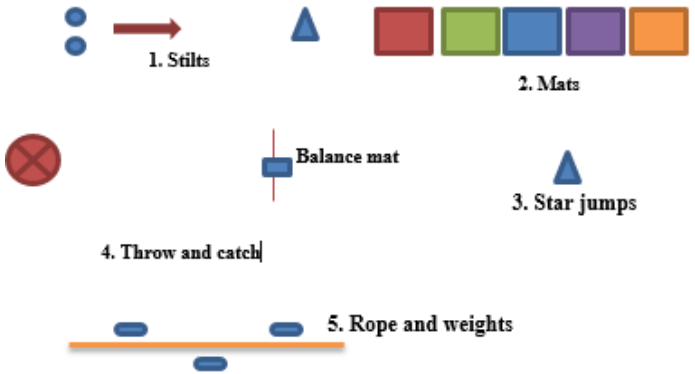
	Start 2 2 2 **Finish** 1 1 1 1 1  *Progression*: Throw bean bag in a selected hoop and instruct the children that this hoop may not be used.		
3. Crab soccer (15 min)	Children are divided into 2 teams of 3. Each team is instructed to shoot their goals on the opposite side of the room through 2 marked cones. Children are instructed to walk like crabs, only using their feet to kick the ball (no hands). A crab walk: Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times.	• Core strength • Body coordination • Dynamic balance • Team play	• 4 x traffic cones • 6 x colour bibs • 1 x mini soccer ball
Cool-down: (5 min) • Body draw	Children are divided into groups of 2. Each child receives a large piece of paper. One partner lies on the paper on his/her back, hands flat on the floor, while the other partner outlines the first partner's body with a crayon. Once the first child is done, the children swop places. Once each child has a life size drawing of themselves, they need to draw on clothes, facial features etc. to complete the drawing. 	• Body awareness • Fine motor (hand writing) • Social interaction	• 1 x large paper • 1 x set of crayons

<table>
<tr><td colspan="4">WEEK 9
SESSION 15
Duration: 45 minutes</td></tr>
<tr><td colspan="4">AIM OF SESSION: Balance and body awareness</td></tr>
<tr><td>ACTIVITY</td><td>INSTRUCTIONS</td><td>FOCUS</td><td>EQUIPMENT</td></tr>
<tr><td>Warm-up: (5 min)
• Sleeping giants

• The farmer and the rabbit</td><td>c) The children must run around the room, being careful not to bump into 1 another. When the researcher shout “sleeping giants”, the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again.

d) The children sit in a circle. Two medicine balls are passed around the circle according to a story. The farmer (medicine ball 1) chases the rabbit (medicine ball 2) because the rabbit is eating all his veggies. When the farmer catches the rabbit the game is over (repeat to both left and right sides).</td><td>• Endurance

• Upper body strength
• Midline crossing</td><td>• None

• 2 x medicine balls (1 larger than the other)</td></tr>
<tr><td>1. Stations (10 min)</td><td> 

Each child begins at a station. After 2 minutes, the children rotate until each child has completed 2 minutes of each activity:
1. The child stands on the stilts (1 foot on each stilt). The child needs to walk forward slowly on the stilts, around the cone and back to the start. (Repeat until 2 minutes are up.)
2. The child hops on 1 leg over the mats (repeat until 2 minutes are</td><td>• Depth perception
• Core strength
• Dynamic and static balance
• Aiming and catching
• Body coordination</td><td>• 1 x stilts
• 2 x traffic cones
• 5 x colour mats
• 1 x balance board
• 1 x wall target
• 2 x ropes
• 3 x 1.5 kg weight
• 1 x tennis ball</td></tr>
</table>

	up). 3. The child performs star jumps. 4. The child stands on the balance mat with 2 feet and throws a tennis ball at the target on the wall, catching the ball with 2 hands on return. 5. The child walks heel-to-toe on the rope. When he/she reaches a weight placed next to the rope, the child picks the weight up and places it on the other side of the rope (repeat until 2 minutes are up).		
2. Body letters (10 min)	Children are divided into teams of 2 or more. The researcher instructs the groups to make certain letters by using their bodies. The children lie on the floor and form the shape of the letter for example: P, B, S, N, L, C, D.	• Body awareness • Social interaction and communication	• None
5. Under the Parachute (10 min)	The children are divided into teams of 2. Each group represents a colour. There is a parachute on the floor with different colours on it. The children stand on the edge of parachute next to his/her colour (each team has the same colour). All the children are instructed to grab hold of the parachute, lifting it up into the air. The children are instructed to slowly lift the parachute up over their heads and back down again (hip height). The researcher will shout out a colour. The partners that represent that colour will run under the parachute when it is up in the air and swop places. *Progression:* Once all partners have had 3 turns swopping places, The researcher places small balls (children pretend the balls are popcorn) on top of the parachute. The children need to gently lift the parachute up into the air and back down again, making sure the balls do not fall out of the parachute.	• Body schema	• 1 x parachute • 6 x small balls
Cool-down: (5 min) • Body draw	Children are divided into groups of 2. Each child receives a large piece of paper. 1 partner will lie on the paper on his/her back, hands flat on the floor, while the other partner outlines the first partner's body with a crayon. Once the first child is done, the children swop places. Once each child has a life size drawing of themselves, they need to draw on clothes, facial features etc.; to complete the drawing.	• Body awareness • Fine motor (hand writing) • Social interaction	• 1 x large paper • 1 x set of crayons

WEEK 9 SESSION 16 **Duration:** 50 minutes			
AIM OF SESSION: Ball skills and balance			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (5 min) • Builders and diggers	Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.	• Endurance	• Whistle • 20 X traffic cones
1. Walking bean bag balance (10 min)	Children are each given a bean bag. On instruction the children begin to walk around the room with the bean bag placed on their heads. The children need to balance the bean bag while slowly walking. Make the game harder by giving further instructions: • Walk fast • Walk backwards • Walk heel-to-toe • Walk on tip toes • Walk on heels The children all receive a tennis racket and a tennis ball. Each child needs to stand still and try to balance the tennis ball on the racket for 30 seconds. *Progression:* Have the children walk around the room slowly, while still trying to balance the ball on the racket. The children are instructed to stand still and hit the tennis ball onto the ground with the racket (bouncing) 10 times.	• Dynamic balance • Ball skills	• 4 x bean bags • 4 x tennis rackets • 4 x tennis balls
2. Ladder walking (10 min)	Children divide into groups of 2. Each group stands one behind the other behind a ladder. One at a time, the children must get into a push up position perpendicular to the ladder. The child must walk with his/her hands along the ladder. The child places his/her hands inside a section of the ladder and places his/her hands below the ladder. The child will walk in this push-up position until the end of the ladder (repeat to the left and right). The children walk like caterpillars.	• Core strength • Upper and lower body coordination	• 2 x ladders
3. Partner rope races (3 leg race) (10 min)	Children are divided into groups of 2. The partners stand next to one another. Their inner legs are tied together with a rope. The partners have to work together as a team to walk around the room. *Progression:* Have a race (to make it more exciting).	• Team cooperation • Social interaction • Body coordination • Bilateral	• 2 x ropes

		coordination	
4. Human knot (10 min)	Children work together as a group of 4 (not more than 10). The children will stand in a circle formation, facing each other. Everyone puts their hands into the middle of circle and joins hands with 2 other members (never same person). The children have to talk to one another to figure of how to untangle the 'knot" to create 1 big circle with everyone holding hands. The children are not allowed to let go of each other's hands at any given time.	• Static balance • Team cooperation • Social communication and interaction	• None
Cool-down: (5 min) • Body draw	Children are divided into groups of 2. Each child receives a large piece of paper. 1 partner will lie on the paper on his/her back, hands flat on the floor, while the other partner outlines the first partner's body with a crayon. Once the first child is done, the children swop places. Once each child has a life size drawing of themselves, they need to draw on clothes, facial features etc. to complete the drawing.	• Body awareness • Fine motor skills (hand writing) • Social interaction	• 1 x large paper • 1 x set of crayons

WEEEK 10 SESSION 17 **Duration:** 45 minutes			
AIM OF SESSION: Catching and balance			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (5 min) • Sleeping giants	The children must run around the room, being careful not to bump into one another. When the researcher shout "sleeping giants", the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again.	• Endurance	• None
1. Catapult catch (10 min)	Each child stands next to a catapult. The children are instructed to place a bean bag at the end of the catapult. On the whistle, the children hit the other end of the catapult with their foot, shooting the beanbag up into the air. The children need to catch the bean bag with 2 hands (10 catches). *Progression:* Catch bean bag with 1 hand. The children are now given a tennis ball and they are instructed to do the same (10 catches). *Progression:* Catch ball with 1 hand.	• Hand eye coordination • Catching	• 4 x catapults • 4 x bean bags • 4 x tennis balls
2. Under the Parachute (10 min)	The children are divided into teams of 2. Each group represents a colour. There is a parachute on the floor with different colours on it. The children stands on the edge of parachute next to his/her colour. (each team has the same colour) All the children are instructed to grab hold of the parachute, lifting it up into the air. The children are instructed to slowly lift the parachute up over their heads and back down again (hip height). The researcher will shout out a colour. The partners that represent that colour will run under the parachute when it is up in the air and swop places. *Progression:* Once all partners have had 3 turns swopping places, The researcher places small balls (children pretend the balls are popcorn) on top of the parachute. The children need to gently lift the parachute up into the air and back down again, making sure the balls do not fall out of the parachute.	• Body schema	• 1 x parachute • 6 x small balls
3. Balance heel-to-toe and thread (10 min)	Children are divided into teams of 2. The children are instructed to stand heel-to-toe opposite one another (1m apart). Threading beads are placed on the floor in between the partners. Each partner has a string in their hands. One at a time, the partners need to bend their knees, to pick up a bead one at a time. The child stands up straight, still remaining in the heel-to-toe position, and threads the bead on the string. The game is completed once all the beads have been threaded. (Repeat 2 times).	• Static balance • Manual dexterity	• Beads • Thread

Cool-down: (10 min) • Body draw	Children are divided into groups of 2. Each child receives a large piece of paper. One partner will lie on the paper on his/her back, hands flat on the floor, while the other partner outlines the first partner's body with a crayon. Once the first child is done, the children swop places. Once each child has a life size drawing of themselves, they need to draw on clothes, facial features excreta; to complete the drawing.	• Body awareness • Fine motor (hand writing) • Social interaction	• 1 x large paper • 1 x set of crayons

WEEK 10
SESSION 18

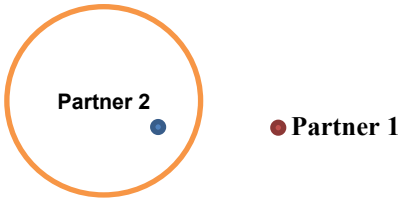
Duration: 45 minutes

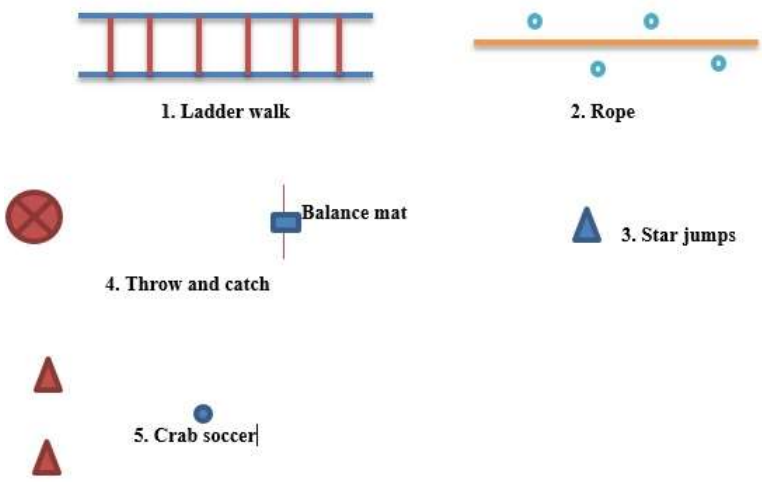
AIM OF SESSION: Balance and body coordination

ACTIVITY	INSTRUCTIONS	FOCUS	EQUIPMENT
Warm-up: (5 min) • Builders and diggers	Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.	• Endurance	• Whistle • 20 X traffic cones
1. Head push (10 min)	Children are divided into 2 teams. Five traffic cones are placed in a line in front of each group. Each group is given a soccer ball. One at a time, the children race each other. Each child bends down onto his/her hands and knees. The child has to push the soccer ball in between the cones with his/her head (no hands or feet allowed). The first team to have all the children do the push twice, wins.	• Proprioception • Motor planning • Body coordination	• 10 x traffic cones • 2 x soccer balls
2. Stations (10 min)	 **1. Balance and thread**  **2. Mats**   **Balance mat**  **3. Racket and ball** **4. Throw and catch**  **5.Rope and weight** Each child begins at a station. After 2 minutes, the children rotate until each child has completed 2 minutes of each activity: 1. Beads are placed on the floor. The child stands on 1 leg, bends	• Core strength • Dynamic and static balance • Aiming and catching	• 2 x traffic cones • 5 x colour mats • 1 x balance board • 1 x wall target • 2 x ropes • 3 x 1.5 kg weight • 2 x tennis ball • 1 x tennis racket • 1 x thread and beads

	his/her knees and picks up a bead 1 at a time to thread it (repeat until 2 minutes are up). 2. The child hops on 1 leg on the mats (repeat until 2 minutes are up). 3. The child hits a tennis ball up into the air with a tennis racket as long as he/she can for 2 minutes (child stands still). 4. The child stands on the balance mat with 2 feet and throws a tennis ball at the target on the wall, catching the ball with 2 hands on return. 5. The child walks heel-to-toe on the rope. When he/she reaches a weight placed next to the rope, the child picks the weight up and places it on the other side of the rope (repeat until 2 minutes are up).		
3. Crab soccer (15 min)	Children are divided into 2 teams of 3. Each team is instructed to shoot their goals on the opposite side of the room through 2 marked cones. Children are instructed to walk like crabs, only using their feet to kick the ball. (No hands) A crab walk: Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times.	• Core strength • Body coordination • Dynamic balance • Team play	• 4 x traffic cones • 6 x colour bibs • 1 x mini soccer ball
Cool-down: (5 min) • Farmer and the rabbit	The children sit in a circle. Two medicine balls are passed around the circle according to a story. The farmer (medicine ball 1) chases the rabbit (medicine ball 2) because the rabbit is eating all his veggies. When the farmer catches the rabbit the game is over (repeat to both left and right sides).	• Upper body strength • Midline crossing	• 2 x medicine balls (1 larger than the other)

WEEK 11 SESSION 19 **Duration:** 45 minutes			
AIM OF SESSION: Body awareness and catching			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (5 min) • Builders and diggers	Cones are placed all over an area. The children are divided into 2 teams. One team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.	• Endurance	• Whistle • 20 X traffic cones
1. Catapult catch (10 min)	Each child stands next to a catapult. The children are instructed to place a bean bag at the end of the catapult. On the whistle, the children hit the other end of the catapult with their foot, shooting the beanbag up into the air. The children need to catch the bean bag with 2 hands (10 catches). *Progression:* Catch bean bag with 1 hand. The children are now given a tennis ball and they are instructed to do the same (10 catches). *Progression:* Catch ball with 1 hand.	• Hand-eye coordination • Catching	• 4 x catapults • 4 x bean bags • 4 x tennis balls
2. Body letters (10 min)	Children are divided into teams of 2 or more. The researcher instructs the groups to make certain letters by using their bodies. The children lie on the floor and form the shape of the letter for example, P, B, S, N, L, C, D	• Body awareness • Social interaction and communication	• None
3. Crab soccer (15 min)	Children are divided into 2 teams of 3. Each team is instructed to shoot their goals on the opposite side of the room through 2 marked cones. Children are instructed to walk like crabs, only using their feet to kick the ball (no hands). A crab walk: Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times.	• Core strength • Body coordination • Dynamic balance • Team play	• 4 x traffic cones • 6 x colour bibs • 1 x mini soccer ball
Cool-down: (5 min) • Traveling hoop	Children stand in a circle and hold hands. A big hoop is placed between 2 of the children. Each child needs to climb through the hoop by using their bodies as the hoop is moved around the circle. The children may not let go hands. *Progression:* Use a smaller hoop and the researcher places some weights onto the hoops to make this a little harder.	• Bilateral Coordination • Body awareness	• 1 x small hoola hoop • 1 x big hoola hoop

WEEK 11 SESSION 20 **Duration:** 45 minutes			
AIM OF SESSION: Catching and body coordination			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (5 min) • Sleeping giants	The children must run around the room, being careful not to bump into 1 another. When the researcher shout "sleeping giants", the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again.	• Endurance	• None
1. Pass and run (15 min)	Children are divided into pairs. Each pair must stand opposite to one another round a circle of rope. One person will stand inside the circle and the other on the outside of the circle. The pairs have to throw a ball to one another. Each partner needs to catch the ball with 2 hands at first. If the ball is dropped, both partners must leave their spot and run around the big circle and get back into their spot. They start throwing the ball to each other again. *Progression*: Have the children catch with 1 hand, have the children stand on 1 leg while throwing or use different types of balls.  	• Hand eye coordination • Object manipulation	• 1 x tennis ball • 1 x soft ball • 4 x ropes
2. Stations (10 min)		• Core strength • Dynamic and static balance • Aiming and catching • Bilateral coordination	• 1 x ladder • 2 x ropes • 1 x ring set • 3 x traffic cones • 1 x soccer ball • 1 x wall target • 1 x balance

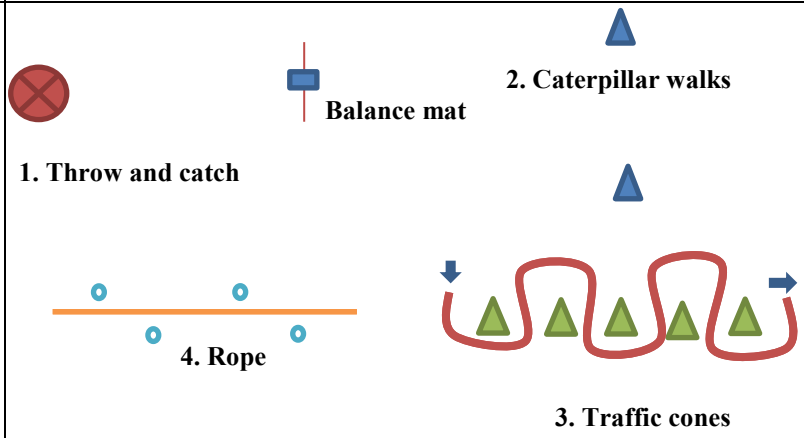
	 Each child begins at a station. After 2 minutes, the children rotate until each child has completed 2 minutes of each activity: 1. The child must get into a push-up position perpendicular to the ladder. The Child must walk with his/her hands along the ladder (The child walks like a caterpillar). The child places his/her hands inside a section of the ladder and then places his/her hands below the ladder. The child will walk in this push-up position until the end of the ladder. (Repeat to the left and right). 2. The child walks along the rope heel-to-toe. When the child reaches a therapy ring, the child bends down slowly and picks up the ring on the side of the rope and squeezes it 3 times in each hand and places the ring back next to the rope to continue walking. 3. The child performs star jumps until the 2 minutes are finished (may rest). 4. The child stands on the balance mat with 2 feet and throws a tennis ball at the target on the wall, catching the ball with 2 hands on return. 5. The child gets into the crab position. Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times) and kicks a soccer ball through a set of traffic cones (repeat).		board

3. Animal walking (10 min)	Children stand in a group on a line one next to the other. When the whistle blows the children must walk to the other side of the room according to instruction: • Seal: Each child lay on the floor on his/her stomachs. The children lift up the front of their bodies by using their hands. The children need to walk on their hands, pulling their body and dragging their legs behind them. • Crab: Child must sit on the ground with hands behind body. The child lifts his/her buttocks in the air, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times. • Frog: The child sits on his/her haunches with arms between legs. On the whistle the child jumps forwards into the air and lands in the same starting position (on haunches, arms between legs). • Ostrich: Child bends forwards to hold onto ankles. The child's knees are slightly bent. The child walks forwards while holding ankles (the child must not let go ankles at any time). • Caterpillar: Children need to start by bending down forwards onto their haunches. The child needs to walk slowly through 3 phases. Phase 1: The child walks forwards with hands into a push-up position. Phase 2: The child holds the push-up position for 1 second. Phase 3: The child walks slowly with his/her feet back onto his/her haunches. The 3 movements are repeated.	• Dynamic balance • Body coordination and awareness • Core strength	• None
Cool-down: (5 min) • Balance heel-to-toe and thread	Children are divided into teams of 2. The children are instructed to stand heel-to-toe opposite 1 another (1m apart). Threading beads are placed on the floor in between the partners. Each partner has a string in his/her hands. 1 at a time, the partners need to bend their knees, to pick up a bead 1 at a time. The child stands up straight, still remaining in the heel-to-toe position, and threads the bead on the string. The game is completed once all the beads have been threaded (Repeat 2 times).	• Static balance • Manual dexterity	• Beads • Thread

WEEK 12
SESSION 21

Duration: 45 minutes

AIM OF SESSION: Core strength and body awareness

ACTIVITY	INSTRUCTIONS	FOCUS	EQUIPMENT
Warm-up: (5 min) • Sleeping giants	The children must run around the room, being careful not to bump into one another. When the researcher shout "sleeping giants", the children must all lie on the floor on their stomachs and pretend to sleep. When the researcher claps his/her hands, the children must get back up and start to run again.	• Endurance	• None
1. Simon says	Children stand in a circle of no less than 3. Each child gets a turn to instruct the rest of the children top perform certain movements such as: • Stand on 1 leg • Touch your toes • Put your hands on your head • Do star jumps • Wave your hands in the air • Put your right hand on your left foot • Touch your elbows • Hop on 1 leg	• Body part awareness • Listening skills	• None
2. Body letters (10 min)	Children are divided into teams of 2 or more. The researcher instructs the groups to make certain letters by using their bodies. The children lie on the floor and form the shape of the letter for example, P, B, S, N, L	• Body awareness • Social interaction and communication	• None
3. Stations (10 min)		• Dynamic and static balance • Core strength • Body coordination • Proprioception • Motor planning	• 7 x traffic cones • 1 x balance board • 1 x wall target • 1 x tennis ball • 5 x colour mats • 1 x soccer ball • 3 x ring set

	 **5. Mats** Each child begins at a station. After 2 minutes, the children rotate until each child has completed 2 minutes of each activity: 1. The child stands on a balance mat with 2 feet. The child throws a tennis ball at a wall target and catches the ball again with 2 hands (repeat). 2. Caterpillar walks: The child starts by bending down forwards onto his/her haunches. The child needs to walk slowly through 3 phases. Phase 1: The child walks forwards with hands into a push-up position. Phase 2: The child holds the push-up position for 1 second. Phase 3: The child walks slowly with his/her feet back onto his/her haunches. The 3 movements are repeated. The child will crawl like this from 1 cone to the next cone and back again. 3. The child bends down onto his/her hands and knees. The child has to push the soccer ball in between the cones with his/her head (no hands or feet allowed) (repeat). 4. The child walks along the rope heel-to-toe. When the child reaches a therapy ring, the child bends down slowly and picks up the ring on the side of the rope and squeezes it 3 times in each hand and the ring is placed back next to the rope and the child continues walking. 5. The child hops on 1 leg on the mats (repeat).		
Cool-down: (5 min) • Balance heel-to-toe and thread (10 min)	Children are divided into teams of 2. The children are instructed to stand heel-to-toe opposite 1 another (1m apart). Threading beads are placed on the floor in between the partners. Each partner has a string in their hands. 1 at a time, the partners need to bend their knees to pick up a bead 1 at a time. The child stands up straight, still remaining in the heel-to toe position, and threads the bead on the string. The game is completed once all the beads have been threaded (repeat 2 times).	• Static balance • Manual dexterity	• Beads • Thread

WEEK 12 SESSION 22 **Duration:** 45 minutes			
AIM OD SESSION: Core strength and body coordination			
ACTIVITY	**INSTRUCTIONS**	**FOCUS**	**EQUIPMENT**
Warm-up: (5 min) • Builders and diggers	CONEs are placed all over an area. The children are divided into 2 teams. 1 team represents the diggers and the other the builders. The diggers must knock all the cones over and the builders must place all the cones upright. When the researcher blows the whistle, all children freeze and the researcher counts how many cones are down and how many are up. The team with the most cones wins.	• Endurance	• Whistle • 20 X traffic cones
1. Under the Parachute (10 min)	The children are divided into teams of 2. Each group represents a colour. There is a parachute on the floor with different colours on it. The children stand on the edge of parachute next to his/her colour (each team has the same colour). All the children are instructed to grab hold of the parachute, lifting it up into the air. The children are instructed to slowly lift the parachute up over their heads and back down again (hip height). The researcher will shout out a colour. The partners that represent that colour will run under the parachute when it is up in the air and swop places. *Progression:* Once all partners have had 3 turns swopping places, The researcher places small balls (the children pretend the balls are popcorn) on top of the parachute. The children need to gently lift the parachute up into the air and back down again, making sure the balls do not fall out of the parachute.	• Body schema	• 1 x parachute • 6 x small balls
2. Colour crawl (10 min)	Children are divided into groups of 2. Colour dots are placed on the floor in the following pattern: **Partner 1**  **Partner 2** 1 partner from each group stands on the black dot (starting point) and the other partner stands in front of the circles facing partner number 1. Partner 2 must bend down on his/her haunches and wait for instructions from partner 1. Partner 1 will instruct partner 2 to crawl with his/her arms forwards to a specific colour (his/her feet may not	• Core strength • Social interaction • Balance	• 6 x colour dots

	move off the black dot). Partner 2 will hold the position on the colour dot for 3 seconds, and return to his/her haunches by crawling backwards with hands. This is repeated until all the colours are done. The partners then swop places. *Progression:* Have the children hold the position for 5 seconds.		
3. Crab soccer (15 min)	Children are divided into 2 teams of 3. Each team is instructed to shoot their goals on the opposite side of the room through 2 marked cones. Children are instructed to walk like crabs, only using their feet to kick the ball (no hands). A crab walk: Child must sit on the ground with hands behind body. The child lifts his/her buttocks from the ground, forming a table with his/her body. The child must walk sideways, keeping his/her buttocks off the ground at all times.	• Core strength • Body coordination • Dynamic balance • Team play	• 4 x traffic cones • 6 x colour bibs • 1 x mini soccer ball
Cool-down: (5 min) • Traveling hoop • Farmer and the rabbit	c) Children stand in a circle and hold hands. A big hoop is placed between 2 of the children. Each child needs to climb through the hoop by using their bodies as the hoop is moved around the circle. The children may not let go hands. *Progression:* Use a smaller hoop. d) The children sit in a circle. Two medicine balls are passed around the circle according to a story. The farmer (medicine ball 1) chases the rabbit (medicine ball 2) because the rabbit is eating all his veggies. When the farmer catches the rabbit the game is over (repeat to both left and right sides).	• Bilateral Coordination • Body awareness • Upper body strength • Midline crossing	• 1 x small hoola hoop • 1 x big hoola hoop • 2 x medicine balls (1 larger than the other)

APPENDIX G

EXERCISE INFORMATION FORM

TITLE OF RESEARCH PROJECT: The effects of a group intervention programme on social interaction and gross motor skills of selected autistic children

RESEARCHER: Nicola Fannin

CONTACT NUMBER: 0727121396

1. CHILDS EXERCISE/ACTIVITY INFORMATION:

Just tick ✓ the appropriate box:

1.1 How much **exercise** does your child get every day?

☐ Less than 30 minutes ☐ 30 minutes to 1 hour ☐ Over 1 hour

1.2 How many hours of **TV** does your child watch every day?

☐ Less than 1 hour ☐ 1-3 hours ☐ More than 3 hours

1.3 How many hours does your child spend on a **computer** every day?

☐ Less than 1 hour ☐ 1-3 hours ☐ More than 3 hours

☐ Does not have a computer

1.4 How many hours does your child **spend playing outside** every day?

☐ Less than 1 hour ☐ 1-3 hours ☐ More than 3 hours

1.5 Does your child participate in any exercise/physical activity **during school hours**?

☐ Yes ☐ No

1.5.1 If yes to question 5, what **exercise/physical activity** do they participate in at school?

(Check ✓ all that apply)

☐ Judo ☐ T-ball/baseball ☐ Dance/movement ☐ Horse riding

☐ Karate ☐ Eurhythmy ☐ Soccer ☐ Playing a musical instrument

☐ Playing with friends ☐ Too young to be involved in activities

1.6 Does your child participate in exercise/physical activity **after school**?

☐ Yes ☐ No

1.7 What **exercise/activities** is your child involved in after school?

(Check ✓ all that apply)

☐ Riding bike	☐ T-ball/baseball	☐ Dance/movement	☐ Skate boarding
☐ Karate	☐ Video games	☐ Girl Scouts/Boy Scouts	☐ Judo
☐ Soccer	☐ Playing a musical instrument		☐ Yoga
☐ Reading	☐ Playing with friends	☐ Eurhythmy	☐ Horse riding
☐ Too young to be involved in activities			

1.8 How many times per week do they **participate in exercise/ physical activity after school**?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ more than 5

MEDICAL INFORMATION FORM

TITLE OF RESEARCH PROJECT: The effects of a group intervention programme on social interaction and gross motor skills of selected autistic children

RESEARCHER: Nicola Fannin

CONTACT NUMBER: 0727121396

Participant's code: ***(for office use only)*** ☐☐☐☐☐

1. CHILD AND PARENT/GUARDIANS PERSONAL INFORMATION:

1.1 Who is filling out this form?
(Just tick ✓ the appropriate box):

☐ Mother

☐ Father

☐ Other guardian (please explain relationship to child) _____

_____

☐ Other (please explain) _____

_____

Parent/ Guardians Telephone (home) _____(cell)_____

Parent/ Guardians E-mail address: _____

Child's date of birth:_____

Age: _____ Sex:_____

Child's body mass: (kg)_____ Child's body length: (cm)_____

2. CHILD'S MEDICAL/NEUROLOGICAL BACKGROUND:

2.1 **Milestone development:**

2.1.1 At what age did the child begin to **crawl**? _____

2.1.2 At what age did the child begin to **roll over**? _____

2.1.3 At what age did the child begin to **walk**? _____

2.1.4 At what age did the child begin to **sit up**? _____

2.1.5 At what age did the child begin to **talk**? _____

2.1.6 At what age did the child begin to cycle on a **bicycle**? _____

2.1.7 At what age did the child begin to cycle on a **tricycle**?_____

2.1.8 At what age did the child begin to **skip**? _____

3. BIRTH TRAUMA:

(Just tick ✓ the appropriate box):

The following questions are about the mother of the child during pregnancy and birth.

3.1 What was the general **health of the mother** during pregnancy?

☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Unknown

3.2 Were any of the following used **during pregnancy**?

☐ Cigarettes

☐ Alcohol

☐ Illegal drugs (which ones?) _____

☐ Prescription drugs (which ones?) _____

☐ None of the above

3.3 Did the mother have any of the following **conditions or problems during pregnancy**?

☐ Preeclampsia (high blood pressure) ☐ Diabetes (sugar)

☐ Emotional stress ☐ Injury or serious illness

☐ Unexpected bleeding or spotting ☐ Other _____

3.4 Was the **birth**:

☐ On the due date

☐ Before the due date by how much _____

☐ After the due date by how much _____

3.5 Was the mother in **labour** for more than 12 hours?

☐ Yes ☐ No

3.6 Was the **birth**: ☐ Normal ☐ C-Section /caesarian (surgical cut in the tummy?)

3.7 Were any of the following used?

☐ Pain medicine during birth (epidural)

☐ Tool to help pull baby out (forceps or vacuum)

☐ None

3.8 Were there any **problems during the birth**?

☐ Yes ☐ No

3.8.1 If yes to question 3.8, please explain: _____

_____

_____

3.9 What was the **weight** of your child at birth? _____

3.10 Was the baby **breeched**? (When the baby's buttocks or feet, instead of the head, are the first to present into the birth canal)

☐ Yes ☐ No

3.11 Was the baby **premature**?

☐ Yes ☐ No

3.11.1 If yes to question 11, please indicate the **birth weight** of the child and **how premature**?

_____

_____

3.12 What was the **circumference** of the head of the baby**?** _____

3.13 Was the child **breastfed**?

☐ Yes ☐ No

3.13.1 If yes to question 13, how long? _____

3.14 In the first **2 months after birth**, did the child have:

☐ Jaundice (yellow skin)

☐ Colic (upset stomach, crying)

☐ Breathing problems

☐ Other _____

☐ None of the above

3.15 How would you rate your **child's health in his or her first year** of life?

☐ Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Poor ☐ Unknown

3.16 At what age did the child get his/her **first tooth**? _____

3.17 At what age did the child began to **say words** (mama, mommy, dada, daddy_____

_____

3.18 Was the baby exposed to any **toxic gases** or **chemicals after birth**?

☐ Yes ☐ No

4. DISEASES AND INFECTIONS:

(Please check ✓ any of the following medical problems that your child has ever had):

Has your child ever had:	
Ear infections	☐ Yes ☐ No
Nose problems (sinus infections, nose bleeds)	☐ Yes ☐ No

Eye problems (blurry vision, need to wear glasses)	☐Yes ☐ No
Hearing problems	☐Yes ☐ No
Mouth or throat problems (Strep throat, swallowing problems)	☐Yes ☐ No
Diarrhea (having frequent and runny bowel movements)	☐Yes ☐ No
Constipation (problems having a bowel movement (BM))	☐Yes ☐ No
Throwing up (vomiting)	☐Yes ☐ No
Problems **peeing** (bed wetting, pain when peeing)	☐Yes ☐ No
Back problems (crooked back, back pain)	☐Yes ☐ No
Growing pains (bone or body pains due to growing)	☐Yes ☐ No
Muscle and bone problems (weak muscles, pain in joints)	☐Yes ☐ No
Skin problems (acne, flaking skin, rashes, hives)	☐Yes ☐ No
Seizures (shaking fits)	☐Yes ☐ No
Sleeping problems (falling or staying asleep)	☐Yes ☐ No
Breathing problems (cough, asthma)	☐Yes ☐ No
Warts	☐Yes ☐ No
Jaundice (yellow skin)	☐Yes ☐ No
Anemia (iron deficiency)	☐Yes ☐ No
Asthma	☐Yes ☐ No
Diabetes	☐Yes ☐ No
Epilepsy	☐Yes ☐ No
Meningitis	☐Yes ☐ No
Physical abnormalities (please list)	☐Yes ☐ No

5. ADDITIONAL INFORMATION:

5.1 What medicines does your child take regularly?

(Check ✓ all that apply)

☐ Vitamins (please list) _____
☐ Herbal medicine (please list) _____
☐ Other (please list) _____
☐ None, my child does not take any medicines regularly

5.2 Does your child have any allergic reaction (bad effect) from any of the following?

(Check ✓ all that apply)

☐ Outside or indoor allergies (for example: grass, pollen, cats …)

☐ Food allergies (for example: peanuts, milk, wheat …)
☐ Medicine or shots (immunization) (Please list below.)
☐ No, my child has no allergies that I know of.

Medicine child is allergic to	**What happens when the child take that medicine**

5.3 Has your child had any of the following?
(Check ✓ all that apply)

Measles	☐ Yes	☐ No
Mumps	☐ Yes	☐ No
Chicken Pox	☐ Yes	☐ No
Whooping Cough	☐ Yes	☐ No
Rubella	☐ Yes	☐ No
Rheumatic Fever	☐ Yes	☐ No
Scarlet Fever	☐ Yes	☐ No

5.4 Does your child have any current medical condition that may influence his/her participation in the study or that the researcher should be aware of, even if the child is not taking any medication for the condition?

_____

_____

5.5 Please list what your child typically **eats and drinks in a day** for:

Breakfast (7h00 – 8h00) _____

_____

Lunch (13h00 – 14h00) _____

_____

Dinner (18h00 – 19h00) _____

_____

Snacks (throughout the day) _____

_____