The impact of play-informed caregiver-implemented home-based intervention on the academic learning outcomes for HIV positive children (aged 5 years to 8 years) on Antiretroviral Therapy (ART) living in low income conditions: A Randomized Control Trial

by

Student: Caraleigh Otto

DWLCAR001

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DECLARTION

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ABSTRACT

BACKGROUND: The academic learning of HIV positive children is often negatively impacted by cognitive and learning deficits associated with HIV, and usually leads to poor performance at school. Occupational therapy, a profession that promotes and enhances participation in meaningful occupations, has yet to demonstrate its impact in promoting the occupation of academic learning in HIV positive children on ART.

OBJECTIVES: This study investigates and compares the impact of two occupational therapy interventions; conventional one-on-one occupational therapy (control group) and play-informed caregiver-implemented home-based intervention (PICHIBI) (experimental group), in promoting academic learning for HIV positive children aged 5 to 8 year olds on ART.

METHODS: The research project followed a pragmatic, single-blinded, randomised baseline, mid and post-test control-group design. From a possible population of 60 dyads who attend the Groote Schuur Hospital (Cape Town, South Africa) ARV clinic, 27 child-caregiver dyads (n=27) were recruited. One dyad was excluded from the study, due to home circumstances, leaving 26 dyads that went through the randomisation and allocation process into the two intervention groups. Randomisation was carried out by a central computer system, before the start of the intervention period. The final total sample (n=23) completed the intervention, a slight decrease from the recruited sample size. Four dyads were lost to follow up after the baseline test. This resulted in 12 dyads in the control group and 11 dyads in the experimental group. Baseline, mid (after 5 months of the intervention) and post (after 10 months of intervention) test data was collected using the Griffiths Mental Developmental Scales-Extended Revised (GMDS-ER) and the short form Beery-Buktenica Visual Motor Integration test , 5th edition (Beery-VMI) as outcome measures.

RESULTS: Following randomisation there were minimal variations in the baseline demographics and measurements for the two groups, with the exception of a significant difference in time on ART (p=.021). The majority of each group had suppressed viral loads. The total sample showed delays in all the performance components linked to academic learning at baseline, that is, low for visual motor integration and visual perception, below average for motor coordination, borderline delay in language, and practical reasoning, and low average in eye hand co-ordination, performance and the overall level of functioning (general quotient). Severe delays (<70) were detected in the control group at baseline for visual perception, and at post test for language. Average scores (90-109) at post test for visual perception and motor co-ordination were only seen in the experimental group.

No statistical significance was noted for between-group differences at baseline, mid and post test. For within-group changes, statistically significant improvements were observed in the following performance components linked to academic learning: in the experimental group, visual motor integration from baseline to mid test (p=.019); in the control group, visual perception from baseline to post test (p=.009) and visual perception baseline to mid test (p=.001), and in performance from baseline to mid test (p=.027). Following interventions the overall GMDS-ER quotient scores for both groups improved with 70% of the experimental group and 58.3% of the control group scoring more than -2 z-score. In the total sample, the level of severe delay at baseline (68.2%) improved to only 8 out of the 23 (36.4%) of the total sample showing a severe overall delay post intervention. These scores still classified the groups as below average (90-109) under the GMDS-ER UK classifications. Despite these scores, 95.7% of the total sample progressed to the next grade during intervention, with only one child repeating a grade.

CONCLUSION: Improvements were seen in both groups from baseline to post test. The advantage of PICHIBI however is that it is better suited for expanding access to occupational therapy services in a context where the occupational therapist/patient ratio in the public health sector is low. The continued underperformance of both groups in academic learning outcomes post intervention, displays the need for ongoing intervention for HIV-infected school going children. This information will inform occupational therapy practice, guide policies and legislations relating to academic learning for children with HIV on ART, in South Africa. It is recommended that future research look into using a larger sample size for generalisability of findings, consider conducting a longitudinal study linking results with school report outcomes and comparing the effects of the intervention at various levels of health care.

TRIAL REGISTRATION NUMBER: The study was approved by the South African National Department of Health (DOH-27-0115-4892), and was given ethical approval by the Facility of Health Sciences Human Research Ethics Committee (HREC/REF: 560/2013; Renewal: 772/2014).

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PRESENTATIONS

A presentation was given at the International Society for Child Indicators (ISCI) conference in Cape Town, South Africa, in September 2015.

ABBREVIATIONS USED

DBE - Department of Basic Education

OT - Occupational Therapy

GSH - Groote Schuur Hospital

KP - KidzPositive Family Fund

CAPS - Curriculum and Assessments Policy Statements

PICHIBI - Play-informed caregiver-implemented home-based intervention

ART - Antiretroviral Therapy

GMDS-ER	- Griffiths Mental Developmental Scale- Extended Revised Version
BEERY VMI	- BEERY Buktenica Visual Motor Integration Test
RCCWMH	- Red Cross Children's War Memorial Hospital
VMI	- Visual motor Integration
VP	- Visual Perception
MC	- Motor Co-ordination

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DEFINITIONS OF TERMS

- **Occupation of academic learning**: In this study the occupation of academic learning is defined as a childhood occupation impacted on by a child's performance in the following performance components: visual motor integration, visual perception, motor co-ordination, language, eye hand co-ordination, performance and practical reasoning. These performance components) contribute to the academic learning performance skills of writing, copying, reading, mathematics that take place in the school context.
- **Child:** In this study, a child is a young human being who is between the ages of 5 to 8 years of age.
- **Play:** Is seen as one of a child's main occupations and is presented in this study as the medium that was applied in an intervention programme to elicit participation, increase motivation, and improve learning in children (Bundy, 1991; Parham & Primeau, 1997).
- **Caregiver**: In this study, this refers to an adult who spends seven hours or more per week with a child.
- **Visual motor integration:** The degree to which an individual can integrate visual perception and finer-hand movements in a well co-ordinated manner (Beery, 2006). In this study visual motor integration is one of the performance components making up academic learning.
- **Visual perception**: The transitional step between visual motor integration and motor co-ordination, displaying the ability to attend to, receive and interpret visual information (Beery, 2006; Schneck, 2005). In this study it is a performance component impacting academic learning.
- **Motor coordination**: Is defined by Beery (2006) as the mass action following an "increased differentiation and subsequent integration of movement" (Beery VMI Manual, 5th Ed, pg.11), requiring the effective use of visual motor integration and visual perceptual components. In this study is a performance component impacting academic learning.
- **Eye hand co-ordination:** Is defined as the fine motor skills, manual dexterity and visual motor skills (Luiz et al., 2006), all performance components making up academic learning in this study.
- **Language**: Consists of both receptive (understanding and following instructions) and expressive (verbalising and expressing oneself) language (Luiz et al., 2006), a performance component making up academic learning in this study.
- **Low income conditions:** Are conditions where households are living below the food poverty line.

- **Practical reasoning:** The ability to solve practical problems, understanding of basic mathematical concepts and understanding of moral issues (Luiz et al., 2006), a performance component making up academic learning in this study.
- **Performance components:** Are the elements of performance that occupational therapists assess and, when needed, address to improve occupational performance (retrieved from www.agescota.com/ot/ut.pdf on 16 July 2016). Performance components are viewed as components of visual motor integration, visual perception, motor co-ordination, language, eye hand co-ordination, performance and practical reasoning, that are required for successful engagement in performance skills (reading, writing, mathematics) and childhood occupations (academic learning and play).
- **Performance skills:** A chain of actions allowing a person to engage in their chosen occupation (Fisher, 2006). These skills are made up of performance components, which allow a child to select, interact with, and engage in chosen childhood occupations.
- **Antiretroviral Therapy (ART):** A combination of antiretroviral (ARV) drugs used to maximally suppress the HIV virus and stop the progression of the HIV disease (WHO, 2016).
- **Curriculum Assessment Policy Statement (CAPS):** The national curriculum statement used to guide educators in South Africa, as they teach learners attending Department of Education government schools.

CHAPTER 1: INTRODUCING THE STUDY

1.1. Introduction

This chapter will introduce the study by outlining the problem statement and rationale for the study. The research question, aim and objectives will be expanded on, highlighting the significance and importance of this study.

Global studies, including those carried out in Africa, have documented that early rehabilitation and intervention programmes for HIV positive children are vital (Bagenda et al., 2006; Botha & Pienaar, 2008; Chase et al., 2000; Dobrova-Krol, Ijzendoorn, Bakermans-Kranenburg & Juffer, 2010; Guo, Li & Sherr, 2012). Occupational therapists aim to promote a child's ability to participate and engage in the occupation of learning at school (Brown, Rodger, Brown & Roever, 2006; Hinojosa & Kramer, 1993) and they value the use of play as a means to address barriers related to the academic learning of children (Dankert, Davies & Gavin, 2003). This study presents the design and impact of a play-informed caregiver-implemented home-based occupational therapy intervention (PICIHBI) on the academic learning outcomes of South African HIV+ children, living in low socio-economic conditions. PICIHBI aimed to improve performance components supporting the childhood occupation of academic learning, using play as a medium and the child's caregivers as a means to support the promotion of the child's academic performance.

1.2. Problem statement and rationale for the study

The number of people living with HIV has risen from an estimated 9.0 million in 1990 to approximately 36.7 million in 2015 (UNAIDS, 2016). The 2015 Mid-year Population Estimates from Statistics South Africa show that there are an estimated 6.19 million people living with HIV in South Africa. This translates to 11.2% of the total South African population being infected with HIV. In the City of Cape Town nestled in the Western Cape Province of South Africa, where this study was based, a statistically high HIV prevalence has been noted (Shisana et al., 2014). Out of the 36.7 million people living with HIV globally, two million of these are new HIV infections, with 220 000 of these are newly infected children, and 190 000 of these newly infected children were in Sub-Saharan Africa. Overwhelmingly, South Africa has more people on HIV treatment (3.4 million) than any other country globally (UNAIDS, 2016).

Children with HIV are now living longer and reaching school-going age (Potterton, Hilburn & Strehlau, 2016), this is due to the provision of antiretroviral therapy (ART) via programmes such as the prevention of mother-to-child transmission programme (PMTCT). The children in Potterton et

al., (2016) study had started combination antiretroviral treatment (cART) at a mean age of 8.1 months. The majority of the children were virologically suppressed and did not present with wasting or stunting. Severe overall developmental delay (z-scores < -2SD) was detected in 55.88% of children. Developmental facets related to language, cognition and perception were the most severely affected.

Mother-to-child transmission (MTCT) of HIV, refers to the vertical transmission of HIV from an HIV-positive woman to her child during pregnancy, labour, delivery or breastfeeding. PMTCT was introduced in South Africa in 2001 and is offered in 95% of public antenatal and maternity facilities country wide (Goga, Dinh & Jackson, 2012; Wachsler-Felder & Golden, 2002). PMTCT aims to reduce HIV infection in women of childbearing age, prevent transmission from mother to child and educate mothers on HIV (Department of Health, 2015). However despite the medical intervention of ART, HIV has a continued negative effect on their children (Wachsler-Felder & Golden, 2002). Some children continue to display negative effects of HIV even after five consecutive years on ART (Cotugno, Douagi, Rossi, & Palma, 2012).

In South Africa the occupation of academic learning is significantly compromised by various barriers to learning[1]. The pandemic of Human Immunodeficiency Virus (HIV) infection described above, presents a dominant barrier to the success of children in their occupation of academic learning (Blanchette, 2002). These challenges refer specifically to delays observed in their motor and cognitive functioning, as well as in their academic achievements (Baillieu & Potterton, 2008; Burns, Hernandez-Reif, & Jesse, 2008; Potterton et al., 2009; Puthanakit et al., 2013; van Rie et al., 2009). The degree of fallout in each child is dependent on the extent of the neurological involvement, the CD4 count[2], the stage of the HIV infection and the presence of opportunistic infections (Shanbhag et al., 2005).

Occupational therapists are experienced observers of human occupations and they play an important role in identifying and addressing barriers to academic learning. This includes their role in identifying and treating various intrinsic performance component barriers to learning, including

[1] A barrier to learning is anything that stands in the way of a child being able to learn effectively. A learner may experience one or more barriers to learning throughout his or her education. A child with a disability will experience that disability as an intrinsic barrier to learning and will require varying levels of support to accommodate their disability in order to reach their full academic potential. Barriers to learning are not limited to intrinsic barriers. They can also be societal/environmental barriers. For example extreme poverty, abuse or neglect will all act as barriers to a child's learning. Retrieved from http://www.included.org.za/R2ecwdsite/docs/Factsheet%206.pdf on 9 December 2015.

[2] One's CD4 count is the number of CD4 T lymphocytes (CD4 cells) in a sample of blood. If one's CD4 cell count falls, then the viral load (the amount of HIV in your blood) increases, making the risk of becoming ill due to HIV greater. Retrieved from http://www.aidsmap.com/Viral-load/page/1327496/ on 16 July 2016.

amongst others, visual motor integration, visual perception, motor coordination, language, performance, eye hand coordination and practical reasoning (Beery, 2006; Luiz et al., 2006; Case Smith, 2005).

In addition to the negative intrinsic effects of HIV on academic learning, most HIV-infected South African children live in low socio-economic households situated in impoverished communities, where there is often inadequate child nurturing and stimulation. This social disadvantage combined with HIV exerts a negative impact on the child's cognitive functioning (Hochhauser, Gaur, Marone & Lewis, 2008). Potterton, Stewart, Cooper and Becker (2010) explain that academic learning and academic school achievement is often gained and fostered through stimulation at home, and that this stimulation is often best provided by the main caregiver. Unfortunately caregivers do not always have the skill, knowledge or time to attend to their child's academic learning needs, usually due to being a victim of a low income household, personal illness or employment restrictions.

In conjunction with the child's intrinsic barriers to academic learning, occupational therapists see it as crucial to address the extrinsic barriers to child academic learning too, and believe that in order to improve a child's functioning, caregiver involvement (Schurgers et al., 2010), guided caregiver practice with feedback and caregiver teaching (Peterson, Eshbaugh, Jeon & Kantz, 2007; Trivette & Dunst, 2005) are essential for effective interventions. Occupational therapists should include caregivers into their child's intervention. Play and playfulness should be central elements of any occupational therapy intervention for children (Bross, Ramugondo, Taylor & Sinclair, 2008). These two constructs can be used as means to promote academic learning (Case-Smith, 2005; Schurgers et al., 2010).

1.3. Background to the study

Working within the domain of paediatrics has always been my passion, especially the opportunity to work with vulnerable, at risk, and chronically ill children. Victoria Hospital, Wynberg, boasts of a dedicated paediatrics team, with passion, expertise and skill. Five years of working in this secondary hospital in the Occupational Therapy department provided me with a better understanding of the local population, their struggles, their needs and their challenges. My field of work streamlined during my five clinical years of practice, from a general Occupational Therapist to treating and managing HIV+ children and their caregivers, as I joined the KidzPositive Family Fund (KP) team. KP is a registered Non-Profit organisation (NPO) which arose out of a growing medical, social and educational needs of the HIV positive Cape Town population in 2001. Here health support, counselling and additional therapies (occupational therapy, psychology etc.) were not always available to those that were HIV-infected and their HIV infected children. In many cases community

health centres, district hospitals and at times tertiary facilities, were not always able to provide the opportunity for HIV+ children to access occupational therapy services, which provide support to those experiencing fallouts due to their diagnosis. In a population where poverty and a low socio economic status often overpower the households represented at these health facilities, a need for a HIV positive targeted intervention was becoming a growing demand.

Children with HIV require a great deal of support, not only while they are infants, but more so as they start attending formal schooling. At this level, it has been my experience that their status is often kept hidden from educators due to the stigma HIV carries, which results in educators being unsympathetic to why these learners are often absent from school, either due to monthly clinic visits or long periods of poor health. These learners require additional attention that educators are not always able to provide, due to the high density of learners in their class. This translates into struggling learners continuing to struggle, and being pushed through their foundation phase of basic education, without attaining the required mastery of performance skills, due to the inadequate progression performance components.

Home programmes were readily given out as a form of intervention for this population, as children are usually only seen on a monthly basis. But the outcome of these home programme intervention strategies showed poor execution and minimal commitment, from their carergivers, and slow progression of the child. It was queried why caregivers were not completing the home programmes provided to them, that were intended to work on the performance components and skills with which the specific child was struggling (i.e. cutting, copying, handwriting, etc.). The simple answer from caregivers was “we don’t have scissors, or pencils, or paper at home”. It dawned on me that we have been expecting our caregivers to complete tasks and activities that require a fair level of socio-economic status, to purchase scissors, pencils, paper, crayons and similar items. Without these items, home programmes become ineffective, compromised and impractical.

Together with Dr. Gill Schermbrucker (HOD paediatrics, Victoria Hospital), we started issuing individual home programme stimulation packs, tailored to the individual child. Caregivers sat in on the monthly Occupational Therapy sessions, and were guided and trained in how to use each item in their packs, in order to ensure effective execution. Although this form of Occupational Therapy intervention seemed to be more effective, practically the time required in sourcing, purchasing and formulating individual home programme stimulation packs was becoming unrealistic. Coupled with these impracticalities, the large population requiring this form of Occupational Therapy intervention made the implementation challenging. A meeting with Dr. Gill Schermbrucker and Dr. Paul Roux (KP board member & GSH Paediatric HOD), confirmed the need for the development of some kind of

standardized Occupational Therapy intervention for this vulnerable population that could be rolled out on a larger scale. The concept of "Optimal Kidz" was thus born, with the idea that this type of standardised stimulation pack could assist children in this population to become optimal in their daily occupations.

This idea was taken back to the KidzPositive Occupational Therapists, which included A/Prof. Elelwani Ramugondo (KP board member & UCT OT HOD), for feedback, further brainstorming, fleshing out of constructs and theories, investigating current interventions for this specific HIV+ paediatric population and the re-framing of idea's. A/Prof. Elelwani Ramugondo, being firmly grounded in her research in the occupation of play, confirmed that play needed to be in the forefront of the intervention development. This was a pertinent finding from the undergraduate study completed by her fourth year occupational therapy students, looking at the role of play in HIV-infected children. Along with the incorporation of a play as a medium, and following an extensive review of the literature guiding best practice for interventions for children living in low-income contexts, it was decided to integrate caregivers as a means in this intervention. It was agreed that the stimulation pack, would be used as an intervention tool, but that there had to be a structured intervention programme that regularly guided the caregiver in the use of the tool, and the purpose behind the items in the stimulation pack. The term "GO Kidz" was given to this intervention, with the "GO Box" being the intervention tool. "GO" standing for "Guiding Opportunities", which is what we trust this intervention would do for each child-caregiver dyad. We identified several key elements from literature that needed to be included in our intervention, these being play, the caregiver, and the ability for this intervention to be carried out in the child's home environment. Thus the term play-informed caregiver-implemented home-based intervention (PICHIBI) was birthed.

The efficacy of PICHIBI on academic learning with HIV positive children receiving ART, has not yet been established. This study focused on determining the efficacy of this intervention by comparing it to conventional one-on-one occupational therapy (individual child-focused) intervention, drawing on the following research question.

1.4. Research question

Are there differences in the academic learning outcomes between HIV positive children on ART aged 5-8 years receiving conventional one-on-one occupational therapy intervention and HIV positive children on ART aged 5-8 years taking part in a play-informed caregiver-implemented home-based intervention?

1.5. Hypothesis

PICIHBI will have equivalent or greater effects on the academic learning outcomes than conventional one-on-one occupational therapy intervention for HIV positive children aged 5-8 years, on ART and living in low SES families, measured at 5 months and 10 months intervals.

1.6. Null Hypothesis

PICIHBI will have inferior effects, on the academic learning outcomes than conventional one-on-one occupational therapy intervention for HIV positive children aged 5 -8 years, on ART and living in low SES families, measured at 5 months and 10 months intervals.

1.7. Aim

The proposed study aims to determine the differences in the academic learning outcomes between HIV positive children on ART aged 5-8 years receiving conventional one-on-one occupational therapy intervention, and HIV positive children on ART aged 5-8 years taking part in a play-informed caregiver-implemented home-based intervention.

1.8. Objectives

1.8.1. Primary objectives

The primary objectives of the study will be to:

- determine and compare differences in the visual motor integration, visual perceptual and motor coordination skills (Beery VMI), between HIV positive children on ART aged 5-8 years receiving conventional one-on-one occupational therapy intervention, and HIV positive children on ART aged 5-8 years taking part in a play-informed caregiver-implemented home-based intervention.
- determine and compare differences in the language, eye hand co-ordination, performance, practical reasoning and total scores (GMDS-ER), between HIV positive children on ART aged 5-8 years receiving conventional one-on-one occupational therapy intervention, and HIV positive children on ART aged 5-8 years taking part in a play-informed caregiver-implemented home-based intervention.
- track successful progression to the next grade, making comparisons of successful progression between HIV positive children on ART aged 5-8 years receiving conventional one-on-one occupational therapy intervention, and HIV positive children on ART aged 5-8 years taking part in a play-informed caregiver-implemented home-based intervention.

1.8.2. Secondary objectives

The secondary objectives of the study will be to:

- investigate the relationship between scores in Language (subscale C) and Practical reasoning (subscale F), and comparing this relationship against participants that speak the same language at home and school, and those that speak different languages at home and school, in both the children receiving conventional occupational therapy and those receiving PICIHBI.
- determine the relationship between general GMDS-ER quotient (GQ) and participants' viral loads, in both the children receiving conventional one-on-one occupational therapy and those receiving PICIHBI.

1.9. Purpose of the study

The results of this study will fulfil multiple purposes, these being:

1.9.1. Building on research within the field of perinatal HIV infection and the occupation of academic learning

Early detection of functional and development problems in children is essential (Laughton, 2010). Blanchette, Smith, King, Fernandes-Penney and Read (2002) recommend that research should investigate the educational and vocational needs of HIV infected school age children, using the lens of a remedial and preventative focus. The results of this study will add to the body of research knowledge describing difficulties in performance components supporting child academic learning in one cohort of the South African HIV school-going child population, aged 5-8 years, receiving ART and living in low income conditions.

For the HIV child population the need for a suitable intervention to address developmental and cognitive outcomes has been stated (Cohen et al., 2015; Guo, Li, & Sherr, 2012; Hejoaka, 2009 & Richter et al., 2009). It has been proposed that occupational therapy interventions to support both caregiver and child, could help to diminish the long term consequences of HIV and equip HIV positive children with productive life skills and future functioning (Schurgers et al., 2010). Several studies have investigated the effects HIV has on school-going children, with a wide age band ranging from 6 to 17 years. The main purposes of these studies was either to investigate the neurological functioning of HIV-infected children (Koekkoek et al., 2008; Nachman et al., 2012; & Smith, Adnams & Eley, 2008) or to draw comparisons between the cognitive functioning of HIV-infected children and their non HIV-infected peers (Puthanakit et al., 2013; Ruel et al., 2012). Other studies have investigated the effect HIV has on younger children, ranging from birth to 4 years (Baillieu, 2005; Boivin et al., 2013; Potterton et al., 2010). None of these studies have explored the impact of an

occupational therapy intervention on academic learning outcomes, in a South African sample of school-going HIV-infected children in the age range of 5-8 year olds.

1.9.2. Guiding Occupational Therapy service delivery

This will be the first study exploring the impact of an occupational therapy intervention on academic learning of HIV positive school-going children living with low income conditions in South Africa. This information will guide paediatric occupational therapy practitioners working with this population of the most effective way of supporting child academic learning outcomes, in contexts where poverty, stigma and poor literacy levels may be prevalent.

In the South African context there is a low occupational therapist to population ratio, especially in the public sector, and the expectations to see large numbers of patients are present (Cullinan, 2006). In addition to this, practitioners may lack experience in this specific area and resources for providing the required services are often limited (Duncan & Alsop, 2006). PICHIBI is designed to be used as a cost effective occupational therapy intervention that benefits not only the child in isolation, but encourages the engagement and inclusion of their caregiver in this process. It is versatile and can be adapted according to specific contexts, cultures, languages and races. It fosters a group format which is more efficient in reaching larger numbers than occupational therapists are normally able to see, due to time limitations imposed when treating individual clients. The intervention (PICHIBI) has been designed to be efficient in delivering a service that is practical and cost effective for the South African patient and child attending government HIV clinics.

1.10. Significance of the study

1.10.1. Impact on policies and legislation

"Children are often denied a voice at policy or redress levels and as such can only be represented when they are advocated for" (Sherr, 2005, p.37). This research is significant in that it will advocate for recognition of and address of the academic learning needs of children with HIV.

Schooling is the universal key to educational opportunity and access to schooling is internationally seen as a right of every child. The South African Constitution (1996) and various educational policies such as The National Education Policy Act 27 of 1996 and Education White Paper 6 (2001) guarantees the right of all children, inclusive of children affected by HIV, to access basic education. The South African Children's Act (2005) also recognises and encourages the need for a child to learn in an enabling environment which responds to the needs of a child with a chronic illness, such as HIV. In South Africa attendance of formal education is compulsory from the year a child turns 7 until they are 15 years of age (Reviews of National Policies for Education: South Africa, 2008). Policy

pertaining to the education of children with HIV needs to be adequately informed, as their academic learning support needs are often extensive (Potterton, Hilburn & Strehlau, 2016). HIV may hinder their access to and success at school for a variety of reasons. Directly poor health and illness may pose a barrier, and indirectly parental ill health, destitution or disappearance may impede access to school and consistent attendance. This study will also provide evidence based results to support both HIV positive learners and guide their teachers, by illustrating how academic learning related performance components and performance skills in HIV infected learners may be affected and how they can be fostered. This information can be used to inform the South African national curriculum document CAPS (2001) ensuring that the necessary attention to specific curriculum outcomes for HIV positive learners can be included.

The National Strategic Plan on HIV, STI's and TB 2012-2016, states that the main goal of research is to provide scientific evidence to enhance and guide a country's response to these problems. Relevant and recent research assists in guiding departments and sectors, such as the South African Departments of Health and Education in the best way forward. This research will assist in providing answers for questions around effective and appropriate occupational therapy intervention for children infected with HIV. The results of the research will describe the academic learning needs of a population of HIV positive children, how an occupational therapy intervention was designed for this population, and the effect of the intervention. This proposed model of intervention can be further explored for implementation at local clinics, situated close to community schools, allowing departments of education and health to work together. This is a desire expressed in Education White Paper 6 (2001).

1.10.2. Impact on Occupational Therapy Scope of Practice

The need for evidence based intervention for school aged HIV infected children is ever growing (Brackis-Cott et al., 2009; Cohen et al., 2015; Guo et al., 2012; Hejoaka, 2009; Richter et al., 2009; Sherr et al., 2014), as the HIV infection rate in South Africa continues to climb, despite efforts of the national government and local communities to reduce the spread of HIV (UNAIDS, 2016). Therapists are required to gather relevant information through research in order to provide evidence as to why they have chosen to use a specific intervention, or treatment protocol. How we as Occupational Therapist's enable, equip, support and remediate this specific population is unclear as there are no position papers or discussion papers available to guide occupational therapy interventions for HIV infected children on ART, living in low income conditions. The Occupational Therapy Association of South Africa (OTASA) is a professional organisation dedicated to the advancement of the profession of occupational therapy and the improvement of its services. This association functions as an effective platform to inform and share valuable research information with fellow colleagues on best

practice for this vulnerable population, which is often overlooked. This study will generate evidence based practice which can together with the support of OTASA, be used to compile position statements and/or discussion documents to guide the role of occupational therapy in addressing academic learning for HIV positive children living in South Africa.

1.11. Overview of the chapters

In **Chapter 2** literature will be reviewed in order to describe the occupation of academic learning in South Africa. An Occupational Therapy perspective of the determinants of academic learning will be explained by describing the effectiveness of Occupational Therapy in addressing barriers to learning. Furthermore, the effects HIV has on a HIV positive childs' academic learning will be explored and interventions needed to address possible academic learning fallouts will be examined.

Chapter 3 presents the research methodology, inclusive of the research design, the two types of intervention implemented, the research setting, the study population and the instruments used to measure variables. The pilot study will be explained, as well as the method of data collection, data and safety monitoring and ethical considerations taken into account.

The data analysis and results thereof will be investigated in **Chapter 4**, by looking at each objective and the results that came from the analysis of the final data.

Chapter 5 will discuss the main results from this research study, by relating it to current and available literature. Limitations and recommendations of the study will be provided, and possible implications for future practice in clinical settings will be presented.

Chapter 6 will conclude by highlighting future recommendations and will provide an overall summary of the study.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter will start by contextualising the occupation of academic learning in South Africa, highlighting the challenges that HIV poses to the academic progress of South African children. Literature exploring the impact of HIV on these performance components and child academic learning will be presented. The review will highlight the paucity of interventions to address the academic learning challenges of HIV-infected children. The impact of the key performance components defined as impacting on child academic learning, namely visual motor integration, visual perception, motor co-ordination, language, eye hand co-ordination, performance, and practical reasoning will be presented. The potential effectiveness of occupational therapy interventions in addressing these internal barriers to learning will be motivated. Extensive searches have been completed on all the above key components and these can be seen in the Literature Review Map (Appendix O).

2.2. The occupation of child academic learning in South Africa

Section 29 of the South African constitution establishes the right of every South African child to access to basic and further education (Constitution of South Africa, 1996). The role of occupational therapists in schools is strongly rooted in the concept of equal rights promotion with emphasis on access and support within the learning environment, and promoting academic learning via interventions targeting an improvement in performance components supporting academic learning (AOTA, 2016). Education White Paper 6 on Inclusive Education (2001) is a specific policy aiming to facilitate the inclusion of vulnerable learners, inclusive of those with HIV, by reducing barriers of learning. South African children enter formal schooling in Grade R in the year that they turn six years old. The National Curriculum and Assessment Policy Statement (CAPS, 2011) is the formal curriculum followed in public South African schools. There are no formal assessment tasks for Grade R learners in this curriculum, but children in Grade R, 1, 2 and 3, are required to meet a variety of academic learning outcomes within the following subjects of Mathematics, Home Language, First additional language and Life Skills (CAPS, 2011).

Various factors affect academic learning throughout the world (Valero et al., 2012). In the United States race is foregrounded while in the United Kingdom, Europe and Australia, socio-economic status is a key factor for differentiation. In many European countries home language and ethnicity is a fundamental factor while in China rurality is an essential factor. South African research identifies with all these factors, as academic learning success in South Africa continues to be limited by various

elements of social disadvantage linked to the remnants of the Apartheid[3] era. Although the abandonment of Apartheid has paved the way for redress, many South African children, especially children of colour living in low income conditions still struggle to meet the demands of the academic school environment due to contextual factors linked to social disadvantage (Graven, 2013). This was evident in the Annual Performance Plan for the Western Cape Education Department 2014-2015, showing that 51% of Grade 3 learners only partially achieved in their Annual National Assessment numeracy testing in 2011.

Another challenge for many South African children is that of the language of instruction in schools. Since the evolution of the South African education landscape over the last few years and the abandonment of apartheid, a noticeable percentage of black learners moved from poorly resourced schools based in townships, to more advantaged suburban schools for white learners, as they were previously known under the apartheid era. The issue that has resulted from this shift in learners, is that language has become a complicated matter, with many schools determined to retain the English as the medium of instruction despite the change in the current learner profile (Makoe, 2014).

Perinatal HIV, a dominant South African concern, adds an additional negative impact on the already compromised academic learning of South African children (Wilson et al., 2005). Literature shows that children with long term or chronic illnesses, such as HIV, are at a higher risk of experiencing academic difficulties (Madan-Swain, Katz & LaGory, 2004; Nabors & Lehmkuhl, 2004) especially when cognitive fallouts are a direct consequence of their illness or medication (Cohen et al., 2015; van Loon, 2009). Cohen et al., (2015) found that cognitive performance of HIV-infected children between the ages of 8-18 years, was poor compared with that of SES-matched healthy controls.

Unfortunately HIV-infected children also go through periods of medical instability, due to illness or opportunistic infections and resulting in absenteeism (Beyers & Hay, 2011; Laughton et al., 2013). Even when they become medically stable, they are easily fatigued, making school going a challenging task (Nassen et al., 2014; Schrugers et al., 2010). Many children with HIV lack adequate preparation for school, due to having received little stimulation prior to entering the schooling environment (Schurgers, Sinyangwe, Burger, van Nieuwkerk, & Kamanga, 2010). Children facing these risks are often representative of a significant portion of those that drop out of school early and result in the inability to secure future employment (Cohen et al., 2015; Donald, Hoare, Eley, & Wilmshurst, 2014).

[3] Apartheid is the name of the racial institution that was established in 1948 by the National Party that governed South Africa until 1994. This term reflected a violently repressive policy created to ensure that whites, would continue to dominate the country. Apartheid formally ended in 1994 with the first election, allowing participation of all adult voters. The result of this election was the presidency of Nelson Mandela, the first black president of South Africa. http://www.blackpast.org/gah/apartheid-1948-1994#sthash.1IlaCcRD.dpuf

The above supports the compounding impact of HIV in addition to the impact on low income status on the academic learning outcomes of South African children. The specific impact of HIV interrelated with other variables, on child academic learning detailed in the literature review will be presented in the next section.

2.3. The HIV positive child and academic learning

Several variables affecting the HIV positive child have been highlighted in current literature, starting from gestation and birth, and extending to the child's viral load, duration the child has been on ART, socio-economic status, home environment, and child's caregiver's level of education. Sherr et al., (2014) conducted a global systematic review exploring studies from 2008-2013 related to how HIV effects children. It was noted that in addition to the above variables effecting children with HIV, 17 out of the 21 studies (81%) investigated reported some form of cognitive delay in the HIV-infected sample in comparison to their HIV-uninfected peers. It was also noted that along with delays in some domains of functioning, HIV-infected children have special educational needs. This finding, along with others, highlights the urgent need for provision of interventions catering to improve the specific academic learning needs of these children.

2.3.1. Prematurity, HIV and academic learning

HIV positive mothers are more likely to go into preterm labour compared to HIV negative mothers (Chase et al., 2000; Martin et al., 1997). This can result in premature birth, the probability of their infant having a low birth weight (Martin et al. 1997; Taha et al. 1995), and creates a higher risk for vertical transmission of HIV from mother to child (Cotton et al., 2015). Laughton (2010) states that prematurely born infants with very low birth weights have a high risk of neurodevelopmental problems and will require regular medical follow ups. A study conducted by Kirkegaard, Obel, Hedegaard and Henriksen (2006), compared gestational age, birth weights and school performance of 5319 ten year old HIV-uninfected children. An association between these three variables was found, highlighting that those born at 33-38 weeks were more likely to experience reading and spelling learning difficulties in comparison to their full term peers. Evidence of deficits in motor, perceptual motor and visual motor integration skills in HIV-uninfected children born preterm has also been documented (Goyen, Lui & Woods, 1998; Luoma, Herrgard & Martikinen, 1998; Marlow, Roberts & Cooke, 1993). These deficits have the potential to restrict handwriting abilities in school going years. Feder et al, (2005) found numerous challenges and barriers experienced in daily functional activities at school by children born preterm, specifically in the performance skill of handwriting. As infants born to mothers who are HIV positive have a higher risk of being born prematurely, and prematurity carries the increased risk of possible poor academic performance in

the child's school going years, whether the child is HIV infected or not. A child contracting HIV from his/her mother during pregnancy, birth or breastfeeding, and born prematurely, then carry multiple risks and barriers they will need to overcome as they enter various life stages, especially in in their school going years.

2.3.2. Viral load and Duration of time on ART and academic learning

A HIV positive child's viral load and duration on ART go hand in hand, as the effective use of ART is aimed at reducing ones viral load (Shisana et al., 2014). Chiribogo et al., (2005) found that prior to the introduction of ART, the incidence of neuroimaging abnormalities among children with HIV ranged between 35% and 50% as viral loads were higher. Fortunately the introduction of ART contributed to the diminishment of these findings (Nozyce et al., 2006). Five paediatric AIDS clinical trial study groups underwent a meta-analysis and demonstrated that viral loads were predictive of cognitive digression in children older than one year (Lindsey et al., 2000). Smith, Malee and Charurat (2000) and Smith et al, (2006) added to this by noting that a biomechanical factor such as a child's viral load can have an impact on one's intellectual ability and outcome.

Even though there is still a risk of HIV-infected children experiencing some form of central nervous system deficit (Martin et al., 2006), the use of ART has been shown to be highly effective in reducing the incidence of abnormal brain function among perinatally infected children and adolescents (Patel et al., 2009). Most children, therefore, if born to a HIV-infected mother will be treated with ART within the first few days of life (Cotton et al., 2015). And although ART does not reverse neurocognitive deficits, it has been found to protect against further neuro-developmental degeneration (Smith, 2006). Literature has also highlighted that it is important to remember that the amount of time a child has been on ART is not the only variable affecting their performance, but that the degree of fallout in each child is dependent on the extent of the neurological involvement, their CD4 count, the stage of the HIV infection and the presence of opportunistic infections (Shanbhag et al., 2005).

2.3.3. Socioeconomic status, home environments and caregiver's level of education effect on academic learning

Research has recognised that both socioeconomic status and aspects of the home environment account for a significant proportion of the inconsistency in cognitive functioning of children (Brooks-Gunn, Klebanov & Duncan, 1996). These aspects of a child's home environment and their associations with central nervous system factors may explain some of the variability in the cognitive functioning of HIV-infected children (Coscia et al., 2001). Poor socioeconomic status and low level of maternal education were factors apart from HIV infection that Boyede, Lesi, Ezeaka and Umeh

(2013) found were significantly associated with low cognitive function in school-aged HIV-infected Nigerian children. Furthermore in a study conducted by Molteno, Hollingshed, Moodie and Bradshaw (1991) it was found that a poor level of language achievement was linked to a lower level of caregiver education.

As children mature the effects of poverty begin to escalate and there may be a decline in cognitive and social/emotional progression. With higher family income being associated with a more cognitively stimulating home environments, decreased maternal emotional stress and a more positive parenting practices, which in turn are associated with higher cognitive outcomes (Linver & Brooks-Gunn, 2002).

2.3.4. The effects HIV has on academic learning

Along with the risk of prematurity, a child's viral load and duration on ART, home environment, socioeconomic household status, and the caregivers level of education, HIV itself has a large role to play in the academic learning abilities in children, as it often restricts a HIV-infected child's potential, especially seen in those entering the schooling environment.

Boyede et al., (2013) found that 56.5% of their school-age HIV-infected Nigerian sample scored below average performance in cognitive assessments and a study by Cohen et al., (2015) based in the Netherlands demonstrated that 35 HIV-infected children with a median age of 13.8 years, scored poorer in all cognitive domains including visual motor integration, when compared to their 37 uninfected peers. Blanchette, Smith, King, Fernandes-Penney & Read (2002) supported these findings from their Canadian study, where subtle motor impairments, fine motor and motor strength deficits in 14 vertically HIV-infected school age children were noted. The above studies are three of numerous studies showing that HIV-infected children show significant difficulties and/or differences in academic learning outcomes when compared to their HIV-uninfected peers (Linn, et al., 2015; Melgarejo, Pino, & Bassi, 2015).

Lowick, Sawry and Meyers (2012) conducted a study in Soweto, South Africa, using the Griffiths Mental Scale of Development (GMDS). The aim of the study was to compare the neurological functioning of 30 HIV-infected 5-6 year old children on ART, to their 30 HIV-uninfected peers. Neither of the groups were offered any type of intervention, but a primary and secondary analysis was administered at two separate time periods. Results showed that 90% of the HIV-infected sample displayed an overall severe delay (<-2 z-scores) compared to the 76.6% delay shown in the comparison group. The performance components showing the greatest concern in this study were those of language, performance and practical reasoning. At primary analysis 90% of this HIV-infected sample were severely delayed (<-2 z-score) in language, 63.3% in performance and 70% in practical

reasoning. A lower percentage of delay was seen in the HIV-uninfected sample, in these three performance components.

The impact of HIV on cognition and learning conducted by Baillieu & Potterton (2008) found that 40 HIV infected infants, ages 18-30 months, attending the Chris Hani Baragwana clinic in Gauteng, showed delays in motor, language and cognitive development. These cognitive delays or fallouts were accredited to disease progression and the structural damage to the brain, as well as socio-economic variables. Skeen et al, (2014) interviewed 979 children (4 -13 years) and their carers from South Africa and Malawi. A hundred and thirty five of the children interviewed were HIV positive, and results concluded that HIV-positive children showed to have a lower quality of life in their educational setting compared to their HIV-negative counterparts. A study by Puthanakit et al., (2013), validated the above findings by noting subtle, yet quantifiable deficits between their 284 HIV-infected participants compared to their 319 uninfected participants, ages 1-12 years. The HIV-infected participants showed deficits in language and fine motor co-ordination.

In South Asia Linn et al, (2015), conducted a study comparing the cognition in HIV positive and HIV negative orphans from two orphanages, by using a battery of cognitive tests. These tests comprised of performance of visio spatial skills, attention span, learning and memory, visual motor integration and fine motor dexterity (eye hand co-ordination) and speed (performance). Findings revealed that HIV-positive children performed significantly lower than their HIV-negative counterparts, in areas of visuospatial reasoning, eye hand co-ordination and visual motor integration. It should be noted that on subsequent follow up testing carried out a year later, found that both cohorts of children regardless of HIV status, showed improvements in several domains.

Although there are numerous intrinsic and extrinsic barriers that may assist in explaining the above results, a physiological explanation was found by Klingberg, Forssberg, & Westerberg (2002). They found that the parietal cortex is involved in the development of visuospatial skills such as writing, an important skill for school going children to master. The parietal cortex correspondingly is often affected by HIV before it disturbs the frontal and motor cortical areas of the brain (Olesen, Schendan, Amick, & Cronin-Golomb, 2007).

Literature resolves that children infected with HIV experience deficits in the performance components of visual motor integration, visual perception, motor co-ordination, eye-hand co-ordination, language abilities, performance, practical reasoning. Deficits in these performance components subsequently negatively affect their performance skills, resulting in often less than adequate execution of their occupation in academic learning. As HIV-infected individuals are more

than likely to have neurocognitive fallouts when compared to their HIV-uninfected peers, one could therefore expect that the academic learning in HIV infected children could be in jeopardy.

2.4. Occupational Therapy and child academic learning

2.4.1 Determinants of academic learning: An occupational therapy perspective

Academic learning inclusive of the foundational performance skills of reading, writing and mathematics (Ball, Paris & Govinda, 2014) can be defined as one of a child's main childhood occupations. Occupational therapists have formed a growing consensus that enabling meaningful occupation in daily contexts is our core business (Cantin & Polatajko, 2013).

Academic learning, for the purpose of this study, can be explained as the relationship between performance components and performance skills. Performance components form the core mechanisms required to enable a child to succeed in various performance skills (Case-Smith, 2000). The performance components looked at in this study comprise of visual motor integration, visual perception, motor co-ordination, language, eye hand co-ordination, performance and practical reasoning. The performance skills, being mathematics, language and life skills are those expected from the department of education for a foundation phase learners to master in order to achieve grade progression (CAPS, 2011). Some performance components play a larger role in certain performance skills than other as the difficulty of each performance skill increases from Grade R to Grade 3. As each performance skill is upgraded age appropriately in order to meet national educational requirements, so the levels of effectiveness of the performance components are simultaneously demanded. Figure 1 below explains the relationship between the performance components and performance skills linked to academic learning outlined by the CAPS curriculum (CAPS, 2011). The figure supports a rationale of how targeting the performance components aids in bringing out changes in academic learning outcomes in this study.

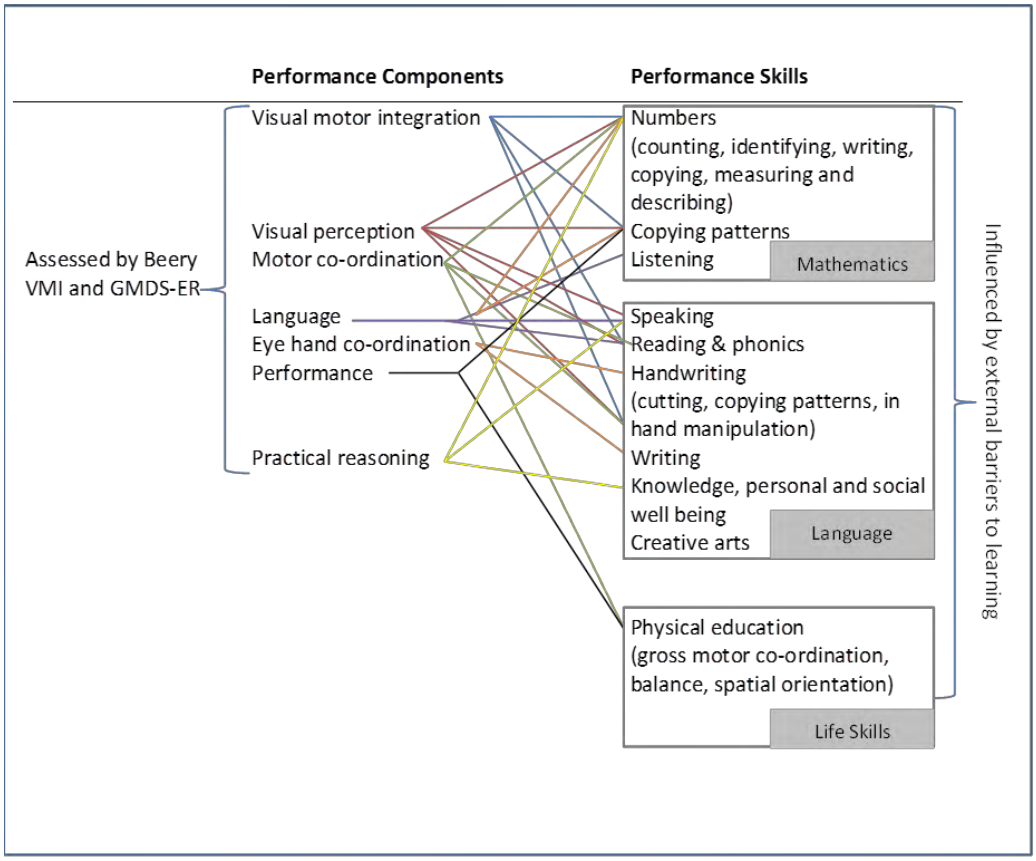

Figure 1: Academic learning (CAPS, 2011; Case-Smith, 2000; Case-Smith, 2005; CAPS, 2011; Kuhn, 2006; Laughton et al., 2013).

Visual motor integration has been identified as a positive contributor to academic performance (Case-Smith, Rodgers & Haas-Johnson, 1996; Goldstand, Koslowe & Parush, 2005; Pienaar, Barhorst, & Twisk, 2014; Sortor & Kulp, 2003). To perform adequately in academic learning tasks at school, children need to be equipped with well-developed visual motor integration abilities (Berry, 2006; Case-Smith, Richardson & Schultz-Krohn, 2005). Visual motor integration has been found to be a strong predictor and one of the most significant precursors of handwriting legibility (Beery & Beery, 2006; Daly, Kelley & Krauss; Volman, van Schendal & Jongmans, 2006; Weil & Amundson, 1994). Along with the importance of visual motor integration skills, literature has shown its support of the relationship between visual motor integration and visual perception, and the vital role it plays in a child's academic performance in performance skills like reading, handwriting (Case-Smith, Rodgers, & Haas-Johnson, 1996; Kimball, 1999; Schneck, 2005) and mathematics (Sortor & Kulp, 2003).

Lotz, Loxton and Naidoo (2005) carried out a study with 339 learners, grade 1-4 in a disadvantaged peri-urban community in South Africa, in order to determine their status of visual motor integration functioning using the Beery VMI and the Goodenough-Harris Drawing Test (GHD). Their key findings showed a significant correlation between the relationship between visual motor integration and intellectual functioning. These relationships form an important internal skill that children need in

order to engage in performance skills linked to copying and organising their written work (van Heerden et al., 2011).

The relationship between visual motor integration and writing, a pivotal component of academic learning and performance, was validated by Naidoo, Engelbrecht, Lewis and Kekana (2009) using the Beery Buktenica developmental Developmental test of Visual Motor Integration (2004) and Kaiser, Albaret and Doudin (2009). Clark (2010) used the Beery VMI (2006), the same assessment tool as Niadoo, Engelbrecht and Kekana (2009), to further associate between handwriting, reading, fine motor and visual motor skills, and found the relationship to be interconnected.

Another relationship that is widely acknowledged is the relationship between language proficiency and educational success (Hoff, 2013). A study conducted by Cekiso (2014) using 95 grade 3 learners from two schools, where their home language was isiXhosa but their language of instruction at school was English, concluded that learners performed better in a reading comprehension test in the language that was used as their medium of instruction, irrespective of their home language.

Interconnections and relationships between visual motor integration, visual perception, motor co-ordination, eye hand co-ordination, language, and performance and practical reasoning, and the impact they have on academic learning outcomes are present. Academic learning is seen as a childhood occupation, therefore one can draw a conclusion that occupational therapists are key role players in assisting those to actively engage in this meaningful, age appropriate occupation of childhood.

2.4.2 Efficacy of Occupational Therapy intervention in addressing barriers to learning

"The ultimate aim of occupational therapy is to promote children's competence and participation, at home, school, and in their communities" (Rodger, 2012, p.1971), as well as enabling and enhancing participation in chosen meaningful daily occupations (Law, 2002). Very few facilities in South Africa exist who offer educational support to children with barriers to learning, be it cognitive or physical impairments (Potterton et al., 2016). Occupational therapists' view individuals as holistic beings and all aspects of the person are taken into consideration when offering intervention (Anderson, Hinojosa, Bedell, & Kaplan, 1988). A systematic review carried out by Kreider, Bendixen, Huang and Lim (2014) examined research done on paediatric occupational therapy intervention, and it was found that interventions administered by occupational therapists reflect a holistic understanding of the interaction between the child, their environment and their occupations. This holistic lens used allows the treatment of the individual with appropriate and effective intervention, addressing the individual and their family as a whole. Literature has shown that the child's family members and

their home environment play a large role in the occupation and progression of learning, especially in children with HIV (Coscia et al., 2001).

Occupational therapists have a strong grounding in play, motor development, learning theories and perceptual motor frames of reference, which they draw on to address both intrinsic and extrinsic barriers to child learning (Schneck, 2005). Internal barriers to learning can be found in performance components and performance skills, as explained earlier, whereas external barriers to learning can be present in the child's school, home and play environments, effected by their current socio-economic status (SES). An extensive array of stressful external barriers may influence academic performance and academic learning in children. These could include frequent absenteeism from school for medical reasons, illness of parents or siblings, genetic factors, and/or cultural factors (Blanchette, Smith, King, Fernandes-Penney & Read, 2002). Bronfenbrenner (1992) explains the philosophy of his ecological model of learning and development, by stating that a child's characteristics are influenced by external systems, such as community, culture and socio-economic status. Vygotsky (1997) takes social ecological theory a step further and examines the importance of environments in which individuals are rooted. He notes that external variables, such as socio-economic status, can impact an individual's interactions within certain environments.

Occupational therapists are experts at assisting children to play optimally, especially those with health conditions (Bundy et al., 2008). This is important because the impact play has on therapeutic outcomes has been proved beneficial. This finding was made by Case-Smith (2000) when 44 pre-school-aged children with fine motor delays received occupational therapy in either a group or individual setting. The influence of play in addressing barriers to learning proved to have a powerful role, by focusing on play in intervention activities that enhance visual motor and fine motor performance. The inclusion of play and playfulness into occupational therapy interventions does not only improve performance components and performance skills, but it also improves motivation, elicits participation, maintains a child's attention and promotes learning (Blanche, 1997; Bundy 1991; Parham & Primeau, 1997). Pierce (1997) said that play can be used as a means to a therapeutic end, as it encourages the child to attempt an activity and motivates them to sustain their effort. Play additionally creates a feeling of joy and pleasure for the child, and therefore a positive relationship is formed with the activity at hand. Activities and tasks that a child enjoys, along with the generalization of the skills associated with play, are likely to be repeated with peers and in various environments. And because play consists of multiple components, such as social emotional (peers), affective, cognitive (imagination) and motor, it provides the child with opportunities to integrate new skills into their daily routine and tasks (Blanche, 1997; Bundy, 1991; Pierce, 1997).

The efficacy of occupational therapy was noted in a study conducted by Peterson & Nelson (2003) where 59 grade 1 learners from low socio economic schools in the U.S.A were recruited. A comparison was made between the effectiveness of that receiving occupational therapy intervention in writing, compared to a control group receiving no intervention. Occupational therapy intervention was found to be effective in improving academic outcome of writing in children, in light of their external barriers to learning. Dankert, Davies and Gavin's (2003) study echoed the effectiveness of occupational therapy intervention, by exploring the results of one hour of weekly occupational therapy input across the period of a year, for children aged 3-6 years (N=12). The results showed a statistically significant improvement in visual motor integration scores as measured by the Beery Buktenica Test of Visual Motor Integration (1997), due to the occupational therapy intervention received.

2.4.3. Intervention components to be considered

It appears to be a limitation to documented occupational therapy interventions that have been tested for their efficacy in improving academic learning outcomes, in school going children who are HIV-infected and on ART. Cantin and Polatajko (2013) highlight the need for occupation-based occupational therapy intervention approaches, focusing on addressing that which impacts on the occupational challenges of children.

Peterson and Nelson (2003), used an intervention based on an occupation framework that included teaching-learning strategies, biomechanical and sensorimotor strategies. The study consisted of 59 Grade 1 learners, who were from a low socio-economic elementary school-based health centre. Findings showed that the intervention group, who received occupational therapy, effectively improved their academic outcome of writing, in comparison to the control group that did not receive intervention. Dankert et al, (2003) used an intervention approach based on acquisition and developmental frames of reference, resulting in the improvement of visual motor skills in developmentally delayed pre-school children receiving both group and individual occupational therapy. Twenty four occupational therapy intervention studies were systematically reviewed by Case Smith, Frolek Clark & Schlabach (2013) investigating the promotion of motor performance in preschool children. Results showed that visual motor integration interventions for pre-school children with delays, usually resulted in short term effects on the child's visual motor performance. Intervention approaches that appeared to show more positive effects were those intervention approaches using occupational therapy that embed behavioural and learning principles.

In paediatric occupational therapy, regardless of diagnosis, the focus of intervention is on daily occupations of play, activities of daily living (ADL) and school (van Hartingsveldt, de Groot & Nijhuis-

van der Staaden, 2011). Colyvas, Sawyer and Campbell (2010) write about a participation-approach to intervention, in which early intervention professionals provide intervention for a child by teaching and equipping caregivers on how to use two primary types of child interventions to encourage their learning and participation. The first being adapting their environment, materials, activities and routine, and second is to embed individualized learning strategies within family routines. These approaches differ from the more traditional approaches, where the early intervention professional created learning opportunities for the child by working directly with the child, and the caregiver was merely an observer, not receiving any training from the provider.

Potterton et al, (2010) conducted a study using a longitudinal, randomised control trial of 122 HIV-positive children, coming from low SES, aged 30 months and younger. The experimental group (N=60) received a home programme which was updated every 3 months, and the comparison group (N=62) received no intervention. Assessments carried out using the Bayley Scales of Infant Development, 2nd edition, were carried out at 6 and 12 months. Findings showed that motor and cognitive learning was gained and nurtured through stimulation provided by the main caregiver in their home environment. Proving that with provided intervention therapy young HIV-infected children showed marked improvement in comparison to those that did not receive any intervention. Hejoaka (2009) added to this finding when exploring the care and secrecy of being a mother of a child living with HIV in Burkino Faso. It was observed that we tend to undervalue the vital and central role caregivers play in intervention, and that future research should integrate various approaches, emphasising the experience of not only HIV-infected children, but of their caregivers too. The vital role caregiver involvement plays within the effectiveness of intervention is key, along with evidence showing that caregivers fulfil an important role in promoting the fundamental childhood occupation of play and playfulness in a child's home environment (Skard & Bundy, 2008).

Research was conducted in eight low SES primary schools in the Western Cape, introducing and piloting their healthy living intervention, with eight similar schools not receiving intervention serving as controls. Intervention on this programme took place between 2009-2011, but was not as successful as anticipated. The key factors that were identified in future intervention included increased parental involvement, greater departmental support and 'buy in' from participating schools (de Villiers et al., 2015). Xaba (2015) recommended that advocacy in parental involvement in education begins with empowering the caregiver, and that these factors appear to be pertinent in the effective implementation of intervention for school going aged children.

Copley et al, (2008) investigated the factors influencing a therapist's intervention for children with learning difficulties. They found that both the child and the therapist were factors that informed

intervention approaches, and that intervention was often tailored according to the individuals need, and that intervention choice was often based on prior experience. In line with the continually evolving and developing occupational focused paediatric interventions mentioned, and the above literature exhibiting the risks posed to child academic learning success of children affected by HIV and relevant intervention approaches. It is evident that intervention for this HIV-infected population is suitably matched to be implemented by occupational therapists, and that intervention should include and encourage the engagement of the caregivers. This can be done by training and actively training caregivers on how to stimulate and engage with their children in their home environments, whilst promoting learning and play. The intervention designed for this study has endeavoured to encompass all of the above, in creating an intervention that would accommodate HIV infected 5-8 years olds and their caregivers, using an occupational focused approach.

2.5. Conclusion

The above literature has shown that occupational therapists are well suited to provide intervention to HIV positive children, in supporting them in the progress of the occupation of academic learning, by providing an intervention that is cost effective and inclusive of their care giver, and addresses their intrinsic and extrinsic barriers to learning.

It is clear that HIV positive children experience fallouts in areas of visual motor integration, visual perception, motor co-ordination, language, eye hand co-ordination and performance and practical reasoning far more significantly than their HIV negative peers. A specific occupational therapy intervention encapsulating HIV positive children's difficulties with academic learning and the remediation thereof, via any form of caregiver focused and/or home-based intervention was not found in current and available literature. Literature does provide some guidance for future intervention, by suggesting that intervention including the child's caregivers is of significance, that home programs have proved beneficial, and that intervention with HIV positive children is vital. Occupational therapists are a good fit between the needs presented by HIV positive learners and the gap in intervention options for this population. This study therefore aims to build on current information and investigate the most effective intervention for HIV-infected children, who are of school going age.

CHAPTER 3: METHODOLOGY

3.1. Introduction

Research has been referred to as a search for knowledge, or as the art of scientific or methodological investigation (Kothari, 2004). This chapter will explain the methodology in this "search for knowledge" by explaining the research design, the intervention design, the research setting, the characteristics of the research population, the sample size, and the instrumentation used. It will also look at the details surrounding the pilot study, the data collection methods, data safety and monitoring, data analysis and will highlight the ethical considerations related to this research. The CONSORT recommendations for reporting a RCT (Moher et al., 2010), were used to guide the descriptions of reporting this study.

3.2. Research Design

A pragmatic single-blinded, quantitative randomized pre-test post-test control-trial design was used in this study. Randomised control trails (RCT) are designed as experiments with a great ability to determine cause and effect relationships (Patsopoulos, 2011). An RCT was chosen for this study, as it is considered to be the best possible source of information guiding best interventions (Black, 1996; Ravaud & Tabach, 2005), and it is largely regarded to hold the highest level of evidence for the efficacy of interventions (Ravaud & Tubach, 2005). The study design is reflected below.

Table 1: Study design

Study design					
Experimental group	O_1	X	O_2	X	O_3
Control group	O_1	X	O_2	X	O_3

While a three armed study including a third arm including a group receiving no intervention was considered, this was not utilised for the following reasons:

- Including a third group, receiving no intervention, would have decreased each groups sample size. This in turn would have negatively impacted on the statistical significance of the finding.
- Ethical considerations relating to the potential risk of the children in the third group receiving no or delayed intervention.

The study design sought to assess equivalence or superiority of the impact of the new intervention received by the experimental group when compared to the impact of the conventional treatment received by the control group on their academic learning outcomes. The two interventions compared are described below.

The study was approved by the South African National Department of Health (DOH-27-0115-4892), and was given ethical approval by the Facility of Health Sciences Human Research Ethics Committee (HREC/REF: 560/2013; 772/2014 renewal).

3.3. Interventions

3.3.1. Experimental group: PICIHBI

Occupational Therapists develop various interventions by analysing the interactions between a child's skills, activities and occupations that they daily engage in, within the child's occupational context (Case-Smith, Richardson & Schultz-Krohn, 2005). Keeping this in mind, four occupational therapists worked together to design the play-informed caregiver-implemented home-based intervention (PICIHBI), by creating, developing, and adapting a 10 session standard intervention programme, over a 3 year period. This process was facilitated by Ms Pam Gretschel as part of her PhD (HREC/REF 605/2012) which aimed to explore the processes by which the group determined relevant principles and theories used for best practice, with a population where evidence for certain intervention was not found or is under-reported. The focus of the intervention specifically targeted families affected by HIV, living in low income conditions. In conjunction with the development of PICIHBI, the results from an unpublished undergraduate study (Ayliffe, Croney, van der Veen & Wishart, 2013) on caregiver knowledge and perceptions about play, further informed the development of this intervention. It was also essential to incorporate the caregiver in the intervention process, as literature highlighted the important role they play in the occupation of academic learning (Hejoaka, 2009; Potterton et al., 2010; Skard & Bundy, 2008).

The intervention process began by deciding on a structure outline for the intervention, this being the duration the intervention would be; how many sessions there would be; how long each session would be; who the specific participants would be; how many participants would be in a group; how the age bands would be divided; and the roles each OT member would play. This process was documented, and edited sessions and administrative tasks were uploaded onto Huddle, a cloud-based soft-ware that allows groups of people to collaborate and jointly give feedback on documents. In partnership with this structural intervention and sessional outline, the content of the intervention had to be decided on too. This was done by reviewing literature pertaining to children who were vertically infected by HIV, the fallouts that could be expected, what interventions had been already documented, and what recommendations were given by previous studies done in this field. This information was combined with the normal developmental milestones expected from children in the age bands we were working with. Keeping in line with this study, specific research was done into what literature reported around the fallouts that could be expected from 5-8 year olds that were HIV

infected; how possible fallouts could affect their performance at school; the role their caregivers played; and what performance components and performance skills were expected from this age group from Grade R until Grade 2.

Guided by literature (Boivin et al., 2013; Hochhauser et al., 2008; Kotchick, Summers, Forehand & Steele, 1997; Potterton et al., 2010), it was decided that PICHIBI would follow a 10 month programme, with monthly sessions for both the HIV positive child and their caregiver. Each session was allocated one and a half hours, with the first 45 minutes being care giver focused and the remaining 45 minutes being experiential, by including their children in the session. Each group consisted of approximately 5 dyads, an occupational therapist and a translator / facilitator. The age bands of each group decided on was 6 months-2 years 11 months, 3 years-5 years 11 months, and 6-8 years, according to life stages, and milestones expected. It is understood that learning takes place from birth, but that academic learning takes place from the time the child enters Grade R, age 5 years. Literature was used to guide how to define academic learning, what components were involved and how this information would inform the contents of each session.

The following skill focuses were decided on for the 6-8 year old age band, very similar skill focuses are used in the two younger age bands, that the content of this information simply varies according to age appropriate milestones (Table 1).

Table 2: GO Kidz Intervention programme, all 10 sessions for children 5-8 years of age.

Session	Skill focus 6y-8y
1	Introduction and Gross motor
2	Fine Motor Co-ordination
3	Literacy: Speaking and Listening
4	Numeracy
5	Shapes and Numeracy
6	Literacy
7	Numeracy
8	Literacy
9	Pre-numeracy Skills
10	Language and Literacy

Skill focuses were largely guided by the national curriculum statement (CAPS, 2011) which outlined the expectations anticipated from a national educational level. The CAPS document (2011) states that learners in Grade R – Grade 2 have four subjects that they are required to advance in, in order to progress to the next grade. These subjects are mathematics (copying, measuring, describing size and counting), home language and first additional language (reading and writing), and life skills (physical education, creative and well-being). Literature demonstrated that there are several performance components that are required in order to master the performance skills of reading, writing, copying, counting etc., and this information assisted in generating the skill focuses for each session, and guided grading and expectations for 5-8 years olds. In addition to these skill focuses, it was encouraged for caregivers to engage with their child in a playful manner when exploring various activities in their daily occupations (reference to play as a means). Caregivers were expected to implement the activities shown during the group session, in their home environment with their child. At the following group session, a time for feedback was given, where caregivers could share their compliance over the last month and their experience of the activities used. Feedback from the caregivers, who were present, was documented in the therapist's notes.

The monthly attendance of the dyad was documented at each session, and follow up dates for the following session were given at the end of each session, correlating with the dyads next monthly appointment with their doctor at the Groote Schuur Hospital (GSH) ARV clinic.

The 30 sessions were divided between the four occupational therapists to create and develop, using the framework decided on. Each session followed the same structure, in order to retain routine and familiarity for the participants. The structure was as follows: Welcome, feedback, introductory activity, introduction of skill, necessity of skill, what is expected at this age, activities to build the skills, experiential application with the child and closure. Along with the intervention programme itself, named "GO Kidz" (Guiding Opportunities), an intervention tool, named a "GO Box", was included in this intervention, in order to enhance the PICIHBI, as a take home tool kit. The GO Box was age band specific, meaning that each age bands' GO Box content varied according to age appropriateness (Appendix A).

The occupational therapist was provided with a "facilitator box", which included items needed for each session. These items included things like cups for refreshments, stars for participant's star charts; hangers and pegs for demonstrating how everyday items can be used to build a skill, cotton buds for activities etc.

After each monthly PICIHBI session was conducted at the research site, a follow on monthly feedback would be given to the group of occupational therapists from the occupational therapist administering PICHIBI. Here discussion around the successes, appropriateness, effectiveness and limitations of the session's content for all three age bands would be investigated. The sessions were then adapted accordingly, and changes were made to either up-grade, down grade or change the activities used in the sessions, to make them client centred and true to the objectives of the research. A GO Kidz manual contains the final sessions, all administrative documentation required, and guidelines on how to run a PICHIBI group in the local clinic setting.

3.3.2. Control Group: CONVENTIONAL ONE-ON-ONE OCCUPATIONAL THERAPY

Standard or conventional one-on-one occupational therapy intervention was the control treatment in this research study. This intervention followed the traditional paediatric occupational therapy approach, where the child is the main focus and direct recipient of the occupational therapy services, seen individually by the occupational therapist. The occupational therapist focused on the child-specific performance components that needed to be enhanced, based on assessment results using typically available methods, observations and caregiver interviews. Interactions and engagements with the caregiver were not the focus of this intervention; however caregivers were welcome to sit in on the therapy sessions. Each child in the control group was given a monthly appointment with the occupational therapist, but due to caregivers personal circumstances not all of the control group participants always attended all of their sessions. There were offered a total of 10 sessions, of 45-minutes each, over a 10-month intervention period, translating into 7.5 hours of therapy. Therapists had "Go Boxes" available, and used the tools appropriate for the child according to age in the individual sessions with the child. At the end of the 10 sessions, once post tests had been completed, the child was issued with a "Go Box" to take home with them.

3.4. Research setting

The study was conducted at the out-patient paediatric clinic for children on ART, based at the Groote Schuur Hospital (GSH), a tertiary hospital in Cape Town, Western Cape. This clinic is supported by KFF, a NGO that has partnered with the GSH HIV clinic. KFF supports the following services within the clinic: occupational therapy, counselling, human resources and beadwork projects for carers to engage in. GSH catchment area's include Gugulethu, Phillipi, Crossroads, Khayelitsha and Athlone, to name a few. The study participants came from a variety of these and other catchment area's.

Figure 2: Groote Schuur Hospital (above).

GSH is easily accessible to these patients and referrals are made to referring Allied Health Professionals, hospitals and / or clinics if needed. Dr. Paul Roux, the Head of paediatrics in this facility, noted a need for this kind of study from a growing awareness amongst paediatricians at the out-patient clinic that showed that as HIV positive children survived longer through access to ART. Health-care services are not always able to address the increasing concern that these children present with, such as performing poorly at school, and showing delayed development in comparison to their peers. As a result, many of these children get lost in the system, continue to struggle through school, and show poor academic performance which then translates to a low self-esteem.

3.5. Study Population

All HIV positive children aged 5 year 0 months - 8 years old, on ART and their caregivers who were regular attendees at the GSH out-patient paediatric clinic, were recruited for this study (N=60). Twenty seven dyads (n=27) fulfilled the inclusion criteria and were used as this study's sample. At baseline-test the sample size therefore consisted of 27 dyads (n=27), but one participant was transferred to a home of safety before a baseline assessment could be carried out, thus leaving 26 participants that underwent randomisation (n=26). This decrease in the anticipated research population was due to dyads not fulfilling inclusion and exclusion criteria, not wanting to be part of the study or not being contactable for assessment appointment dates. Two participants were lost to follow up after the baseline assessments, and one was transferred to a home of care, making the total sample (n=24) at the start of the mid assessment period. A further participant was lost after the mid assessment period, and a previous participant was tracked down and assessed in the post assessment period. Unfortunately a total of 4 participants were unable to have all three assessments administered. This was due to the researcher not being able to contact the participant's caregivers to give them assessment appointment date. Because of the participant's incomplete assessments, they were unfortunately excluded from the study. Thus leaving the total sample at the end of the study at 23 participants (n=23) (Figure 3).

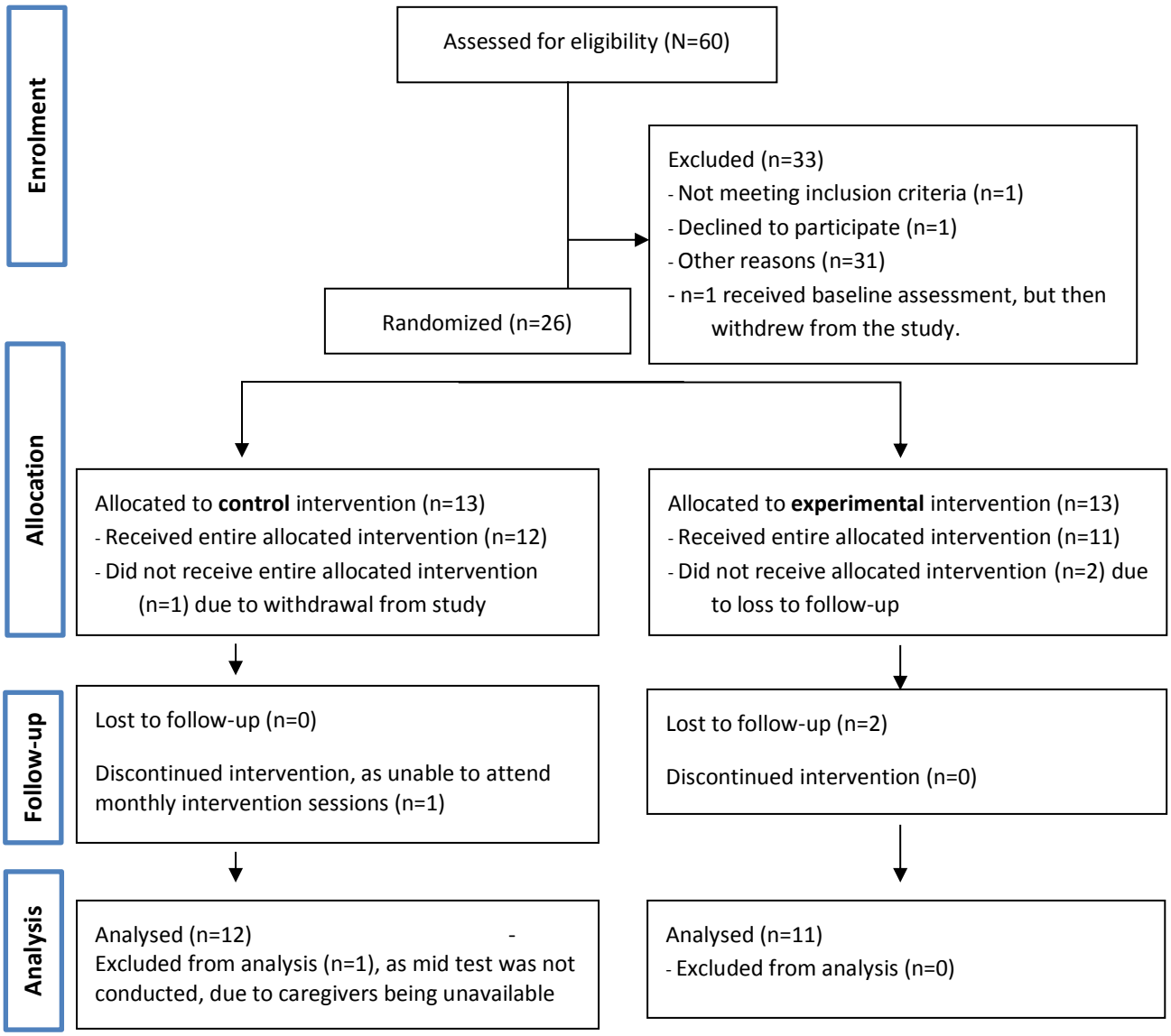

Figure 3: CONSORT (2010) Flow Diagram

The CONSORT procedure (2010) by Schulz, Altman and Moher (2009), was used in this study as it assisted the researcher in designing this RCT, it is internationally recognised and is regularly being updated and amended in line with global research findings.

3.5.1. Inclusion and Exclusion Criteria for Participants

For child participants:

Inclusion criteria

- Children who were HIV positive following vertical transmission, and on HAART
- Children who were aged between 5 years 0 months and 8years 0 months

Exclusion criteria

- Children with no identifiable regular care-giver

- Children whose regular caregiver did not spend at least 7 hours a week of one-on-one contact time with them

For caregivers:

Inclusion criteria

- Caregivers who had a 5 -8 year old HIV positive children on HAART who attend the paediatric out-patient clinic at GSH
- Caregivers who were able to spend at least 7 hours, one-on-one contact time, a week with the child
- Caregivers who were able to attend at least 5 out of the 10 intervention sessions

Exclusion criteria

- Caregivers with no legal authority to give consent (some caregivers who brought the children to clinic were not guardians and therefore were not able to give participation consent. In this case, we sought consent from the legal guardian telephonically, and the child and caregiver were then able to participate in the study).
- Caregivers who were unable to attend 5 out of the 10 intervention sessions, due to work, or other logistical concerns

3.5.2. Vulnerability

Child participants in this research are vulnerable as they were all under 18 years of age, and below the legal consenting age for research. Their participation in the research therefore depended on consent from their caregivers, who had to have legal guardianship to do so. If the caregiver was not the legal guardian of the child participant, consent was then attained by the legal guardian. In addition, assent was sought from children who are aged 7 years and above.

3.6. Sample Size

PS: Power and Sample Size Calculation version 3.1.2, 2014 (Dupont & Plummer) was used to determine the sample size in this study. PS is an interactive program for performing power and sample size calculations, and can be downloaded for free. Based on anticipated results, a convenient sample of 27 dyads (caregiver and child) was arrived at. By using PS, a 90% power at a non-inferiority difference of 6 points between groups with a standard deviation of 10 was arrived at. It was calculated that this power will be retained even after a 15% loss to follow-up.

3.7. Measurement instruments

The Griffiths Mental Development Scale-Extended Revised scale, manual 2-8 years, consists of 6 subscales, but was used to assess only four sub scales for the purpose of this study. It was used to

assess the performance components of language (subscale C), eye hand co-ordination (subscale D), performance (subscale E) and practical reasoning (subscale F). While the Beery-Buktenica Developmental Test of Visual Motor Integration (Beery VMI) (Beery, 2006) inclusive of the two sub tests Beery-Buktenica Developmental Test of Visual Perception (VP) and Beery-Buktenica Developmental Test of Motor Co-ordination (MC), was chosen to assess the performance components of visual motor integration, visual perception and motor co-ordination.

The above two assessment tools were chosen as they assess the multifaceted performance components that generate the foundation of performance skills, making up academic learning (see figure 1). These performance components are visual motor integration, visual perception, motor co-ordination, language, eye hand co-ordination, performance and practical reasoning. Guided by the objectives, comparisons were made between the experimental group (PICHIBI, group intervention) and control groups' (conventional one-on-one intervention) scores, for the Beery VMI and the GMDS-ER, from baseline to post test.

3.7.1. The Griffiths Mental Development Scale – Extended Revised scale (Appendix N)

The Griffiths Mental Development Scale-Extended Revised (GMDS-ER) scale is an inclusive developmental profile which assesses a child's motor and personal-social development and their cognitive and perceptual skills, making up academic learning skills. GMDS-ER explores the child's total development in six sub-scales: A: Locomotor, B: Personal/Social, C: Language, D: Eye hand co-ordination, E: Performance and F: Practical Reasoning. The completed GSMD-ER provides the child's raw score, which is calculated to give age equivalence, a z-score and a percentile for each sub-scale, including a general quotient. For this study the z-score and the quotient were used for analysis.

The original Griffiths Mental Development Scales was first published in 1954, by Ruth Griffiths, and only assessed five sub-scales, looking at the development of children aged zero to two years. In the 1960's it was then extended to cover birth to eight years and a sixth scale (Practical Reasoning) was added to the five scales. The first edition was published in 1970 and revised in 1984, and the third and most current edition was published in 2006, the Griffiths Mental Development Scale – Extended Revised version (GMDS-ER).

The GMDS-ER is widely used across South Africa on young children (Laughton et al., 2010), as well as internationally, showing that these scales are appropriate to use with children from various cultural groups and from a diversity of populations (Luiz et al., 2006; Laughton et al., 2010; Lowick et al., 2011; Potterton et al., 2016). Mothuloe, Richter, Barnes & Schoeman (1994) found this tool to be extremely valid and useful in psychometric testing for local children ages 5 years 9 months to 7 years 3 months, and that it was applicable for the assessment of South African. In a study conducted by

van Rooyen (2005), comparing British and South African children ages 4-7 years, it was found that British children usually performed better than South African children on the more intellectual subscales (Language and Practical Reasoning), and in the Hand and Eye Co-ordination sub-scale. Mixed results were however attained from the comparison between the two groups' performances in the performance sub-scale. Laughton et al, (2010), used the GMDS-ER to assess 31 infants from low socio economic backgrounds attending the Tygerberg Children's' Hospital, Cape Town, in a series of assessments at 10-12 months and again at 20-22 months. Findings showed that there was a decrease in all sub-quotients except for locomotor, and that the language sub-quotient was most affected. A further study conducted by Laughton et al., (2010) added to this finding by evaluating the effect of early versus deferred antiretroviral therapy (ART) on neurodevelopment of 64 infants from Cape Town. The results showed that infants initiated on early ART have significantly better Locomotor and General Scores on the GMDS at median age 11 months compared to infants on deferred ART, and that both infected and uninfected mean GMDS scores were within the average range.

Research has been carried out on the performance on the Griffiths Scales of normal children of different ages and different population groups (Bhamjee, 1991; Mothuloe et al., 1994). These pilot normative studies established that the original Griffiths Scales were applicable to pre-school and school going South African children providing guidelines for sound interpretation of child development in the South African context. Although the GMDS has been extensively used in South Africa (Cockroft, Amod & Soellart, 2008; Lowick et al., 2012), and cross-cultural construct validity in South Africa has been confirmed (Potterton et al., 2016), the GMDS has not been standardised in South African children as yet.

The GMDS-ER is used to assess the academic learning skills of children, and even with the development and introduction of new assessments, the GMDS-ER has still remained a useful assessment of eye-hand co-ordination, language, performance and practical reasoning, in children younger than 8 years (Bhamjee, 1991; Mothuloe et al., 1994).

Raw Scores were not used in comparing subscale C, D, E, F and total scores, as the participants in this sample were various ages at the time of testing. If raw scores were used as main descriptors, it would mean that the older participants would have had higher raw scores but not necessarily because they are higher functioning, but simply because they were older. Due to the nature of this sample, z-scores and quotients have been used to analyse data. The z-scores (standard scores) are used to assist in smoothing out age differences, and enable one to compare two scores that are from different normal distributions or groups. Quotients are meaningful comparisons as they are

corrected for age, with 100 as the mean and either 15 or 16 as SD (like IQ scores). The total z-score and total quotients (GQ) have been calculated according to the GMDS-ER manual using all six subscales, even though the subscales A and B were not independently analysed in this thesis.

In order for one to be endorsed to administer the GMDS-ER, a five day intensive course must be attended. Successful candidates are awarded the ARICD certificate of competence which allows the candidate to administer the GMDS-ER. The GMDS is a closed test, available only to certified users and only registered users may purchase the Equipment. The two research assistants who collected data using the GMDS-ER had been trained in the GMDS-ER by Professor Lorna Jacklin, in 2012 and 2014. And the researcher who scored and captured the GMDS-ER data was trained in 2010 by the same trainer, and received supervision from an accredited trainer, Dr. Barbara Laughton, during the duration of the research.

The Berry-Buktenica Developmental Test of Visual Motor Integration (full form) was found to be the most appropriate assessment for this study's sample (Blanchette et al., 2002; Clark, 2010; Coallier, Rouleau, Bara, & Morin, 2014; Dankert, Davies, & Gavin, 2003; Lotz, Loxton, & Naidoo, 2005) as it has been widely used in South Africa (Dunn, Loxton & Naidoo, 2006; Lotz et al., 2005; Pienaar, Barhorst &Twisk, 2014), and is recognised to have adequate cross-cultural validity (Beery, 2010; van Jaarsveld, Vermaak & van Rooyen, 2011; Venter & Bham, 2003). There are several tests that assess visual-motor integration but most of them were designed between the period of 1960-1974 (Schneck, 1996). The DTVMI-VMI/VP/MC was updated in 2010, making it the most current assessment tool to assess VMI, VP and MC (Beery, 2010).

The DTVMI, along with the two supplemental tests, can be administered to determine fallouts in visual-motor integration (VMI test), visual perception (the Supplemental test for visual perception) or fallouts in motor co-ordination (the Supplemental test for Motor co-oridination) (Beery, 1997). For the purpose of this study, both supplementary subtests were used (Appendices K & L) along with the DTVMI-VMI. The participants were required to complete all three assessment forms, and scoring ceilings were applied when calculating the number of successes achieved. The highest possible raw score is 50, with the mean standard score being 100, with a standard deviation of 15. Raw scores can be converted to standard scores, scale scores and percentiles. Standard errors of measurement were provided at a 95% CI, and do vary according to age group (Beery, 2010). This assessment tool proves suitable for this sample, as sufficient relationships have been identified between the DTVMI-VMI, the ability to write single letters (Daly, Kelley & Kraus, 2003), the performance area of mathematics in an educational setting, and reading and writing (Pienaar et al., 2014).

3.7.2.1 The Beery-Buktenica Developmental Test of Visual-motor Integration (5th edition, Revised) (VMI test)

This test consists of a developmental sequence of 27 geometrical forms, printed in the form of a booklet. The forms are copied in pencil, and can be administered in a group or individually within 10-15 minutes (Beery, 1997). The test has no time limit, and a child is given credit for each form passed until three consecutive failures appear.

3.7.2.2. The Beery-Buktenica Developmental Test of Visual Perception (VP subtest)

This supplemental test has one geometric form that is exactly the same as each stimulus, that needs to be chosen from among the other stimuli that are not the same. There are 27 stimuli that need to be completed, and a child has to simply point to their choices, making this a purely visual perceptual task. This test is three minutes, and is discontinued after three consecutive errors or after three minutes.

3.7.2.3 The Beery-Buktenica Developmental Test of Motor-co-ordination (MC subtest)

In this supplemental test the task is to trace the same 27 stimulus forms with a pencil without going outside the double-lined road. The test has a five-minute test period, and should not be stopped after three consecutive errors, but only once the time period allocated has lapsed. The test requires individual administration, and starting dots and roads serve as strong visual guides, allowing this test to assess motor performance.

3.7.2.4 Reliability and Validity of the Beery-Buktenica Developmental Test of Visual-motor Integration (5th edition, Revised) (VMI test)

The test has high reliability and validity across a 3-18 year age range, and across varying language and socio economic contexts (Beery, 1997).

For any test to be reliable and appropriate there should be uniformity in the tests content sampling (content of the test), time sampling (the individuals performance), and interrater (the scoring performed by different examiners) (Beery, 1997). The overall reliability of a test, used for research purposes, should be at least .70. Screening tests should be .80, and when making significant decisions about individuals, .90 or above is required.

The table below concludes that the VMI test and its supplemental tests are highly reliable (Beery, 1997).

Table 3: Summary of the Visual motor integration (VMI), Visual perception (VP) and motor co-ordination (MC) subtests reliabilities (Beery, 1997).

Test	VMI test	STVP	STMC
Content sampling	.96	NA	NA
Time sampling	.87	.84	.83
Interrater	.94	.98	.95
Average	.92	.91	.89

The VMI test, the STVP and the STMC all exhibit validity in the areas of content (the test assesses what it is designed to assess), concurrence (the test was compared with similar tests calculating similar abilities) and construct (the test assesses what it claims to assess) (Beery, 1997). In the manual it is proposed that the VMI test appears to be effectively culture-free (Beery, 1997), therefore making it an appropriate assessment tool for our study sample.

Prior to administration of the Beery VMI, all forms were copied and organised according to administration order, and assessors were briefed on the correct standardisation procedures involved in administration prior to baseline, mid and post tests. Scoring guidelines were re-visited by the assessors, to ensure cohesive scoring and administration. 10% of the scored 27 baseline-tests administered to the GSH research sample, were checked by one of the assessors, to ensure standardised marking and scoring. All Assessors were familiar and trained in administering the Beery VMI which is taught at under graduate level.

3.7.3. School progress reports (Appendix P)

School progress reports are a valuable source of information regarding a child's academic ability and a way to track a child's progress throughout the year. These reports explain the child's progress by use of numerical weighting, although Grade R children do not receive this kind of formal report until they are in Grade 1. Most children receive a quarterly report (April, June, September and December), but in some cases only a semester report is available (June and December). Each caregiver was asked to bring their child's available reports to all of their assessment periods (baseline, mid and post-tests). This information helped determine whether a child had passed a grade successfully or not, and assisted in highlighting key areas of concern within their learning occupation.

3.8. Pilot study

A pilot study was performed prior to baseline test at the occupational therapy outpatient clinic (supported by Kidzpositive) at Victoria Hospital (individual and institution permission gathered), where participants for the pilot study were recruited. Sixteen children (10%) of the larger study population number made up the pilot sample, 14 of these 16 children were the correct age for this

study's population. The children recruited were those already needing a GMDS-ER assessment and were being seen for individual occupational therapy by the Kidzpositive occupational therapist at Victoria Hospital, and/or by another medical professional. All five assessors who were part of the pilot study and who were involved in the research data collection, had completed the GMDS-ER course and were certified GMDS-ER administrators. The assessors took turns performing the GMDS-ER, observation of the child was done together, but scoring was done independently and scores were not discussed. The assessments took place at Red Cross Children's War Memorial Hospital (RCCWMH), where the use of one-way glass consultation rooms was made available. During this assessment period, certain items and scoring were clarified for the assessors to establish a consistent method of scoring for all future research assessments. The researchers checked all scores for accuracy and omissions. Clarification queries and common scoring errors were written in a document, and were accessible to all assessors as well as placed in each assessment kit.

3.8.1. Pilot study – Interrater reliability

Once all pilot study assessments had been completed, the raw scores of five assessors across the sixteen children were correlated to determine reliability. A minimum level of 90% agreement between all five assessors' scores was aimed for. Internal consistency coefficients using the Cronbach alpha coefficients was done on the standardisation sample, in the UK, and the coefficients all exceeded the value of 0.70, the acceptable minimum value of reliability (ARICD, 2006). An interclass correlation (two-way mixed) was used for this study as there were more than two assessors (Landers, 2015). Raw scores only ever differed by a maximum of 2-8 points between any two assessors. All assessors agreed on the age calculations a 100% of the time. The other GMDS-ER scores (quotient, age-equivalent, z-score, percentile) were calculated from the raw scores and were double checked by the researcher. The reliability measure varied between 0.99 and 1, meaning that 99-100% of the variance in the mean of the assessors is true. 99-100% of the variability in the raw scores captured represented the true score, and 0-1% represented a random variation. This implies that the five assessors had a high agreement across the pilot sample.

Assessors were constantly reminded about consistent marking throughout assessments, and were able to query these consistencies throughout the assessment period. This enabled informal monitoring of inter-rater reliability for the duration of the study.

3.9. Data Collection

3.9.1. Recruitment & Enrolment

Recruitment and enrolment for the research sample was conducted within the GSH paediatric HIV clinics, amongst children who were presently being followed up at monthly intervals for medical intervention and treatment. To reduce additional burden on caregivers and to avoid resulting attrition that could have occurred if unrealistic time demands were to be made, as far as possible, all baseline, mid and post-tests, interventions, and follow up assessments occurred within the existing clinic group schedules. This measurement instruments, GMDS-ER and the Beery VMI, were used at all assessments periods, baseline, mid and post test.

There were three simultaneous sub-studies taking place during this research period (Figure 4). The first study, this study, looked at the academic learning outcomes (being assessed by using GMDS-ER and Beery VMI), the second study looked at developmental changes (being assessed by GMDS and WEEFIM), the third study looked at the changes in a child's play (done on the same day as their assessment, by videoing the child playing while they await their appointment, using ToP), and the forth study looked at the caregiver self-efficacy (using the PSEMI, PSOC and GSE). All studies used the same demographic questionnaire, in order to determine the characteristics of this population. Children and caregivers seen within the clinics who met the inclusion criteria were invited to participate in the study by one of the co-researchers, who had no present involvement at the GSH clinic. As there were four co-researchers, each co-researcher was responsible for the recruitment of 25% of the total population.

All participants were required to attend monthly occupational therapy (either in the control or experimental group), whether they were part of one sub study or all three. Caregivers had the choice and freedom to decide if they would like to be part of one, two or all three sub-studies before consent was given.

An information letter in either isiXhosa, English or Afrikaans was provided and explained for those caregivers who were interested, and fell within the inclusion criteria. Consent was then acquired from the legal guardian of the child participant, at times this was different to from the adult participant, who would then also need to give consent to participate. As some of the population attend the clinic only every 3 months, they were recruited telephonically, and if after explanation of the research was given, they were willing to participate and give consent, an appointment for their baseline assessment was given. Verbal consent was confirmed and re-established in written form

when the dyad attended their baseline assessment appointment, and after the research had been re-explained clearly again in person, in their preferred language.

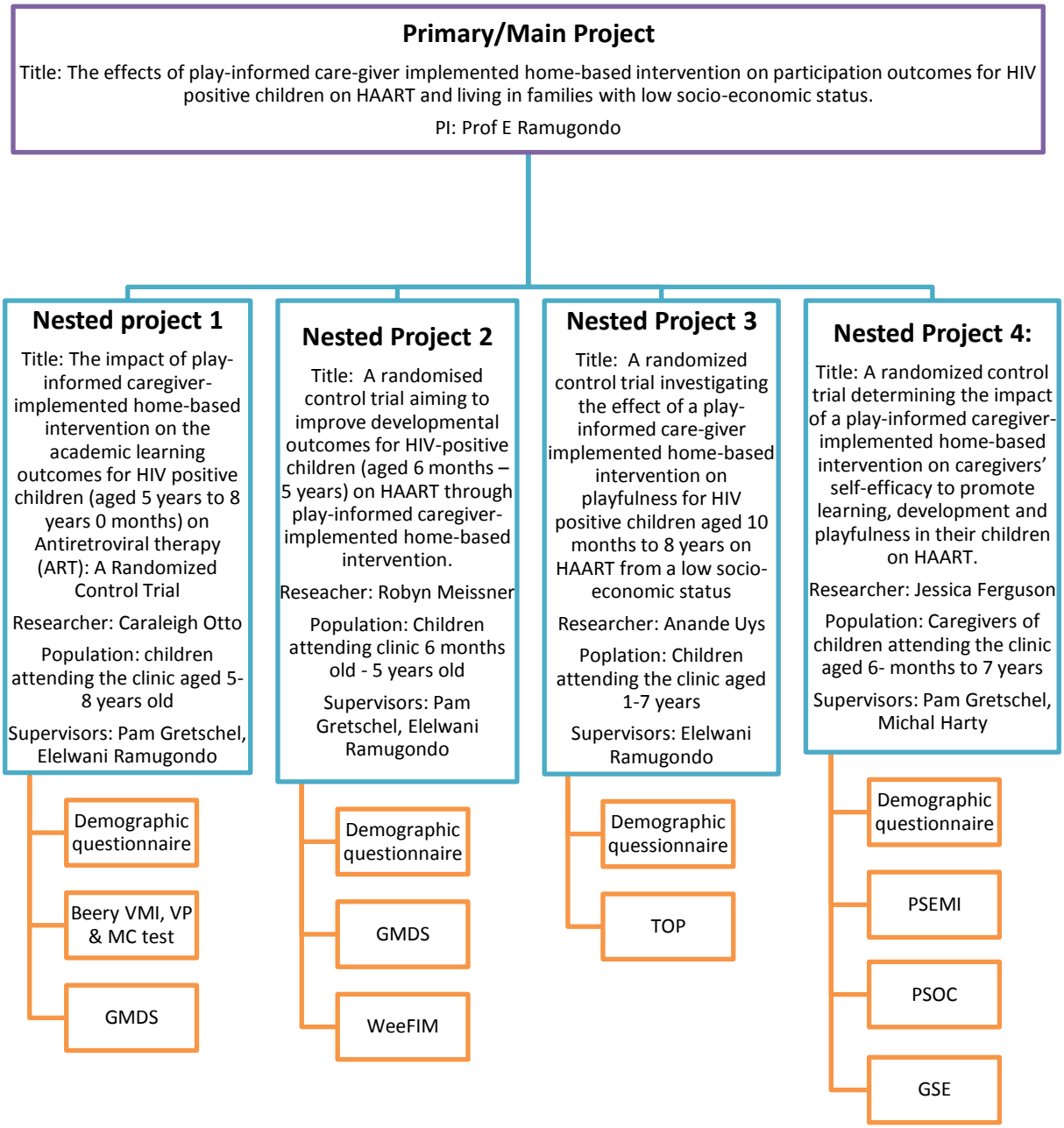

Figure 4: Larger Project Map

3.9.2 Demographic, Medical and Socioeconomic Questionnaire

A questionnaire was developed to gather demographic, social and medical information on each child participant. This questionnaire was translated, and back translated, from English to Afrikaans; and from English to isiXhosa. Most of the information in the questionnaire was self-reported by the

caregiver. Information relating to the child's birth history and medical history was obtained from the childs' Road-to-Health card, which caregivers were asked to bring with to the initial assessment, as well as information found in their hospital/clinic folder.

This questionnaire captured the following information:

Child's date of birth, gender, address, gestational age and birth weight, pre and post-natal complications, past illness of the child, hospitalization, treatments and/or diagnoses of the child, duration of time on ART, therapy they had attended, caregiver level of education, grade of the child, school the child is currently attending, what language the child speaks at home and what language they are taught in at school, marital status of the caregiver, employment status of the caregiver, and household income etc. This information was of great benefit in helping understand the child and the caregiver dyad holistically, as it gave a better understanding to the dyads socio economic circumstances, the child's clinical journey, and the caregivers level of educational understanding, which helped in clarifying information.

3.9.3. Blinding

The researcher was blinded to the allocation of participants to either the experimental or control group, and throughout the intervention period. Un-blinding occurred once all the post assessments had been completed and all assessments had been scored. The participants and their caregivers were not blinded to the intervention they received, but they were blinded to the hypothesis of the study. Those assessing the participants were also blinded as to which group the participants had been allocated to. Blinding was maintained through the use of codes, and assessment were not administered during intervention period 1 and 2, but rather before and after respectively.

3.9.4. Baseline Assessment

Once participants were recruited, which was done either in person or telephonically, they were given a baseline assessment appointment date. As far as possible their baseline assessment date was given on the same day as their doctor's appointment. This meant that the dyad would only be required to attend the GSH clinic once in a month, for their baseline assessment and their doctor's appointment. Twenty seven participants in age band two were assessed during the baseline assessment period, along with a translator. A translator was used when the assessor was not proficient in the child and caregivers' first language. All child participants were assessed using the GMDS-ER (all six subscales) and the Beery VMI (all three subtests), within the walls of the GSH ARV clinic. Each caregiver completed the demographic form, while completing their consent and assent forms (where applicable). If the caregiver had given consent to the other two studies as well, they would be given the relevant documentation and guidelines to follow for these studies. Each

participant's caregiver was given transport money on arrival at their appointment, in order to help assist them in covering their transport costs in getting to GSH for their appointment.

The baseline assessment period stretched from the April 2014 to the June 2014. All baseline assessment documentation was stored in a locked container, which was held in a locked room in the GSH ARV clinic, which only assessors and researcher's had access to. At the end of the baseline assessment period, the completed baseline assessment documentation was given to the researcher to score. Once all the baseline assessments were scored and the data captured in an excel spread sheet, a report detailing each child's performance was written and a copy of this report was placed in the participants' GSH folder at the clinic. These results were discussed with the caregiver at their following appointment date. If concern was raised in a participant's score, the participant was then referred to the relevant health care professionals in their catchment area. For example if a participant scored very poorly in their GMDS-ER Language subscale, they were referred to an audiologist for a hearing screening. The caregiver was notified telephonically of referral appointments made, and it was the responsibility of the caregiver to attend these relevant appointment dates. Feedback from the appointment was given to the assessor, as the referral agent, and was fed back to the co-researchers and the doctors at the GSH ARV clinic. One participant was transferred to a home of safety after baseline test and therefore no longer filled inclusion criteria, leaving the final sample to be randomized at 26.

3.9.5. Randomisation

Randomisation of the recruited research population (n=26) was completed after the participants had received their baseline assessments. Participants consisted of those born in January 2007 through to those born in December 2008. Research randomizer (Urbaniak & Plous, 2013) and Random Sequence Generator (https://www.random.org/) were the two programmes used to randomise the research population.

Fifty seven participants from all four sub-studies were stratified, and were divided into two age bands. The first age band had birthdays between January 2009 to January 2014, and the second age band had birthdays between January 2007 to December 2008. This initially resulted in 34 participants for age band one and 23 participants for age band two. Participants in age band two made up the sample (n=26) that was used to determine the academic learning outcomes in this research paper.

The Random Sequence Generator tool was used to generate randomisation codes. This was done in two batches for two stratified groups. Age band one was allocated numbers 1-34; 70-73 and 90-93, and age band two was allocated numbers 41-64; 80-81 and 100-101. Extra numbers were used in

case more are recruited and assessed. As it was not possible to do clinic allocation, where participants come to the clinic and pull out random numbers out of two hats, one for each group. A randomly assigned person who was not involved in research or at the clinic drew these numbers.

The randomly assigned numbers were placed in a column next to the participants name and their participant code. This information was blinded from the researchers, and was only revealed after post assessment had been completed. An additional number of unallocated random numbers were made available in order to allocate to new recruits to a group.

The Random Sequence Generator tool was used to create two columns/groups of numbers to divide into experimental or control groups. It was ensured, by the assistance of an outside party, that tool did not create duplicate numbers during this process. Two documents were thus created, one with participant names, stratified groups and random numbers next to each name, and a second document with group allocation, numbers in columns for either experimental or control groups.

Weekly checks were made to enquire if any new participants had been recruited, if so, they were randomised weekly and added to the already existing list. By the end of randomisation, 42 participants for age band one were randomised and 26 participants for age band two were randomised.

Intervention Period 1

At the end of the baseline assessment period, the sample was made aware of what group they had been allocated to, either the control or experimental group by the OT's that would be implementing the OT interventions. According to the group they had been allocated, intervention dates were given to them, which was as far as possible were aligned with their doctor's appointment date. Dyads were given transport money for attendance to all assessment periods and intervention sessions. Attendance registers were kept and completed at the start of each intervention session, monitoring the attendance of each dyad for both the control and experimental interventions. Intervention period 1 for both the control and experimental group started in July 2014, and ended November 2014.

3.9.6. Mid Assessment

Mid assessment followed the same process and protocol as in Baseline assessment. Each participants' caregiver was phoned near the end of intervention period 1 and was given a mid-assessment date that suited them. Ideally the mid assessment date was given the same day as their doctor's appointment date, but in some cases the dyad had to come on a separate days. Mid assessment took place between December 2014 and March 2015.

Intervention Period 2

Intervention period 2 followed the same procedure and protocols as intervention period 1. This intervention period ran from March 2015 to July 2015.

3.9.7. Post Assessment

Post assessment ran from the end of July 2015 to October 2015, and followed the same process as baseline and mid assessment. Once all scores were collated and captured a final report will be written to show the participants progress throughout the research period. This report was documented in the participants GSH clinic folder, available for their treating doctor to see. And again if any scores were of concern, a referral will be made to the relevant health care professional.

3.10. Data Safety and Monitoring

Data was first captured in hard-copy form in the assessment administration forms, it was then translated into an electronic format using an excel spread sheet, for both the pilot study at Red Cross War Memorial Hospital, and at research study at GSH HIV clinic. Hard-copies of the data were kept in a locked box, in a locked room at each site, and only left the site if placed in the researchers care. Access to the offices where the boxes were stored, were managed by the clinic manager and head nurse, and was only made accessible to the assessors and researchers. Hard-copies were destroyed at the end of the study. Electronic copies were retained for as long as further analysis was needed.

3.11. Data Analysis

The data in this study is cross sectional and was analysed in Statistical Package for the Social Sciences (SPSS) (2015). As per normal practice in social sciences, data was analysed at 95% Confidence Interval (Norušis, 2012). Following published procedures and clinical applications, the observed and the published cut off point for predicting performance below normal functional limits was a score <-2 SD or <70, for both assessment tools. Analysis was in three parts, namely univariate (descriptive), bivariate (correlations) and multivariate (regression) analyses.

All data was entered anonymously (codes were used instead of names) into an Excel database programme. The data from baseline, mid and post test were then exported for analysis into SPSS (2015). Descriptive statistical data was produced for all relevant variables as described in the objectives. Baseline characteristics of the experimental and control intervention groups were compared to verify randomisation and assess the need for controlling for any variable at a later stage of analysis.

As the total sample size was less than 50, (n=23), the Shapiro-Wilk Test of Normality was preformed using SPSS (2015), to determine the distribution of the sample. The majority of the data was normally distributed, apart from visual perception baseline test scores, performance baseline, mid and post test scores, and practical reasoning (subscale F) post test scores, which had unequal variances. Parametric tests were therefore used and the results were represented using means and standard deviations (SD).

2-Sample t-tests were carried out for the analysis of 5 and 10 month outcomes in order to determine if there was any statistical significance between the experimental and control group's mean standard scores at baseline, mid and post test. The Levene's Test for equality showed equal variances for all subscales during all three test periods, meaning that both groups had similar amounts of variability between their scores at each of the testing periods. Since there were no statistical significant differences between the groups using the 2-sample t-test (independent t-test), paired t-tests (dependent t-test) were conducted to determine whether any significant within-group changes had occurred. Multivariate analysis was conducted through the Analysis of Covariance (ANCOVA), where indicated, to establish which factors had the greatest relationships on variables of interest. A P value of ≤0.05 was considered significant. An independent statistician, a PhD student at the University of Pretoria, was consulted to assist in verifying data analysis, and to help with complex data analysis.

3.12. Ethical Considerations

The study adhered to the Declaration of Helsinki (2013). Ethical approval was obtained and gained through the University of Cape Town, Faculty of Health Sciences Human Research Ethics committee (HREC), before beginning with the study (HREC/REF:560/2013; 772/2014 renewal (Appendices B & C). Below are the detailed outlined summaries of the ethical considerations for this research, focusing on the principles of autonomy, confidentiality, referral, informed consent and accent, non-maleficence, beneficence, justice and risk.

3.12.1. Autonomy

The autonomy of each child and caregiver was honoured. No participants were coerced to participate in this research, and if at any time either the child or the care givers felt they no longer wanted to take part in the research, they were free to withdraw their participation from the intervention. The principles of informed consent and assent were adhered to, and all efforts were made to ensure the participants understood the purpose, risks, benefits and their right to decide whether or not they would like to participate in the study. Informed consent from caregivers was completed in person, even if consent was originally given telephonically. A translator who was skilled

in isiXhosa, and researchers who spoke Afrikaans, were available to ensure that the informed consent process was conducted in the language selected by the participant.

A GO Box was issued to each child participating in the experimental group and control group, and participants were allowed to keep this box even if they decided to no longer part take in the research (Please also refer to beneficence).

3.12.2. Privacy and Confidentiality

No names for either the child or the caregiver were captured as final data. Participants were identified using a participant code, using letters and numerals (e.g. E09), and assigned to either the experimental or control group. This data was safely stored on the University of Cape Towns' VULA site, where access was limited to the relevant assessors and researcher. Assessment data was first captured on hard-copy forms, which was stored in a locked box, in a locked office. These offices were only accessible to assessors and researchers and access to the offices was managed by the clinic manager and head nurse. Hard copy data was only removed from the property by a researcher, and then translated into electronic format on Excel. Hard-copies were destroyed at the end of the study, and electronic copies will be retained for as long as further analysis is needed.

3.12.3. Reimbursement for Participation

Participants were compensated for travel expenses in cash (R20 per appointment), covering both the caregiver and the child, for all assessment dates and intervention sessions. Cash was paid out on the day of the child's appointment.

3.12.4. Referral

While the intervention responded to deficits identified at baseline data collection, within the role and scope of occupational therapy, any needs that fell outside of this were referred to other relevant health professionals, such as Audiologists, Speech Therapists, Psychologists at the Department of Education, etc. Referrals made were fed back to the doctors and staff at the GSH HIV clinic, who manage the participant's case. If a child did not attend the appointment they were referred for, a single follow up telephonic call was made to the caregiver enquiring whether they wanted the appointment to be rescheduled or not. If they showed interest in attending a follow up appointment, an appointment was made and details of this were given to the caregiver. If the caregiver failed to attend the second referral appointment, they were not follow up due to time constraints.

3.12.5. Informed consent and assent

Informed consent and assent for children aged 7 and 8 was sought for both the pilot study at Red Cross Children's War Memorial Hospital (Appendix G 1 & H1) and the main study at GSH (Appendix

G2 & H2), before any data was collected. Approval from Western Cape Department of Health (WCDoH), Health Sciences Human Research Ethics Committee, Red Cross Children's War Memorial Hospital (RCCWMH) both and GSH was obtained before caregiver-child dyads at both institutions were approached for participation (See Appendix B, C, D & E).

Interested caregivers who were regular attendees at both Victoria Hospital, Wynberg, and the GSH paediatric out-patient clinics were approached by a co-researcher who was not currently a service provider at the respective clinics, in order to avoid undue pressure, and provided with an information letter about the research (See Appendix F, 1 & 2) – for the pilot study at Red Cross War Memorial Children's Hospital and for the main study at GSH (Appendix F, 3 & 4). Information was given at the clinic while caregivers were waiting to be seen for their regular clinic follow-up. The information letter was available in isiXhosa, English and Afrikaans. A translator was available at the GSH, in order to provide any further clarification needed for those that had IsiXhosa as their first language. Written informed consent was then requested from those caregivers willing to participate (See Appendix G, 1) - for the pilot study at RCCWMH, and Appendix G, 2) - for the main study at GSH). Assent was sought from children aged 7 and 8 (see Appendix H, 1) - for the pilot study at RCCWMH, and Appendix H, 2) - for the main study at GSH. Refusal for participation by either a child or caregiver was respected, with clear assurance that this will in no way influence further access to services.

Permission to conduct this research was requested from the Western Cape Department of Health, as well as clinic managers at GSH (Appendices E). Parents or care-givers of children who attended the clinics were approached individually by research collaborators who work at each of the clinics for possible participation. Parents or caregivers were provided with the Afrikaans or isiXhosa versions of the Information Letter (Appendix F), as well as Consent Form (Appendix G) in order for them to make an informed decision about whether they want to participate in the research or not. For parents or caregivers who gave consent for participation, Afrikaans or isiXhosa versions of Assent Form (See Appendix H) were then be given to their children 7 years and older. Care was taken to reflect neither HIV nor AIDS in the Assent Form. These terms will not be mentioned during interventions or data collection.

3.12.6. Non-Maleficence

No direct or indirect harm was imposed on the participants in this study, and none of the methods involved in the intervention, or gathering of data was invasive in nature. All participants were compensated for travel costs incurred for baseline, mid and post-test appointments, and for intervention sessions. Every effort was made together with the multi-disciplinary team, teachers and

caregivers to use the most appropriate and suitable times for baseline, mid and post-test appointment dates, and intervention sessions to take place. All participants in this study received intervention which had not been usual practice in the GSH setting.

3.12.7. Beneficence

The child and the caregiver 'benefitted' from the additional stimulation and education they received from this intervention, which they would not have previously been exposed to. When additional concerns, such as abuse at home, came to light during the information gathering process, the researchers were able to refer the case to the Social Workers at GSH, and/or to the local authorities and / or to offer family services and / or counselling, where indicated. Children in the experimental group and the control group both benefitted from the research, as both groups received intervention and a GO Box. The experimental group received the GO BOX as part of their intervention and the control group received the GO BOX separate to their intervention at the end of the research period.

3.12.8. Justice

The principle of Justice was upheld by ensuring that participants were not unduly burdened with research imperatives, and that they were able to share in the possible research gains. GSH was chosen as the research site due to it having the largest participant population required for this study. It also had the facilities, resources and structures in place to ensure effective and efficient intervention to take place. The inclusion of children from this site was justifiable, as the study aims to determine the effectiveness of a more cost efficient intervention, which should increase possibility for similar children with related challenges to access these services too.

3.12.9. Risk

The researcher ensured that at all times the participants were safe; by making sure that a member of the research team was present during assessments and intervention sessions. All those administering the assessments and the intervention sessions were trained occupational therapists, and were registered with the Health Professions Council of South Africa (HPCSA), and were therefore considered as competent health care professionals. As GSH was the setting where the intervention took place, there was medical personnel on hand should any participants had required medical assistance during assessment and intervention sessions.

3.12.10. Emergency Care and Insurance for Research-related Injury

There is no known potential risk for injury associated with participation in this research.

CHAPTER 4: RESULTS

4.1. Introduction

This section will present the results of the study. The chapter is organised as follows:

In the first section the baseline measurements are presented. Baseline measurements include the baseline demographics of the sample, as well as the baseline performance of the total sample and the two groups (experimental and control) in the following performance components linked to academic learning, namely: visual motor integration, visual perception, motor coordination; and language, eye hand coordination, performance and practical reasoning. The baseline measurements of the total sample are compared to the classification categories for the Beery VMI and the GMDS-ER to reflect the level of functioning of the group compared to UK and US norms at baseline. Significant differences in baseline demographics between the two groups are highlighted and explored further.

In the next section between-group differences at mid and post test are presented by using a 2-sample t-test. Between-group differences present differences in the dependent variables after five and ten months of interventions. The mid and post test measurements are also compared to the classification categories for the Beery VMI and GMDS-ER mean scores to reflect the level of functioning of the group compared to UK and US norms at these two time points.

Within-group changes are then presented to gauge the effects of each intervention. This looked at the variances within each group over time. Baseline to mid, mid to post and baseline to post test data are compared using a paired t-tests to reflect within-group changes, of Beery VMI mean standard scores and GMDS-ER mean quotient scores and mean z-scores.

Lastly, correlations between measures exploring similar constructs will be presented. Individual attendance of sessions will be presented, as well as the viral loads effect on baseline and post test scores, and the progression of grades of children from the two groups. A summary will conclude this chapter, highlighting important findings to be noted.

4.2. Baseline measurements

4.2.1 Demographic characteristics

Baseline demographics of the participants are shown below in Table 3. The baseline sample consisted of 26 participants, 13 participants in each group. The final sample analysed however consisted of 23 participants (n=23), with the control group (n=12) receiving conventional one-on-one occupational therapy, and the experimental group (n=11) receiving PICHIBI.

The mean age of the participants in the experimental group was 76.5 months (*SD*=4.35). The control group mean age was higher than the experimental group, at 78.6 months (*SD*=4.39). The age range for both groups was the same at baseline, with children as young as 70 months and as old as 84.5 months being assessed. There were three participants in each group that were born prematurely (≤ 36 weeks), a total of 6 premature births for the total sample (6/26). There were more females (n=14) than males (n=12) in the total sample, with 53.8% males and 46.2% females in the experimental group, and 38% males and 61.5% females in the control group. The majority of the participants (88.5%) had their mothers as their caregiver (23/26), with the caregiver's level of education ranging from grade 1 to tertiary level. 46.2% of the experimental group consisted of participants being in grade R and 53.8% in grade 1. 38.5% of the participants in the control group were in grade R and 58.3% were in grade 1. The majority of participants in both groups spoke Xhosa as their first language at both home and school. More participants (n=5) in the control group received additional therapies such as speech and language therapy, or physiotherapy prior or during baseline test, compared to the experimental group (n=3). 76% of the baseline sample had viral loads lower than detectable level (LDL - <40), with 61.5% of them never having had TB (tuberculosis). Although there were differences in demographic variables, these were not significant.

The only significant difference between the groups was time on HAART. The 2-sample t-test (independent t-test or between-subject test) showed statistical significance for time which participants had been on ART (*p*=.021) with the control group being on HAART longer.

Table 4: Demographics for participants at baseline test (n=26)

Variable	**Experimental group (n = 13)**	**Control group (n = 13)**	**Total (n=26)**	*Levene's Test for equality of variances p-value*	*2-Sample t-test*
	Mean (SD)	***Mean (SD)***			*p-value*
Age (months)	76.5 (4.35)	78.6 (4.39)		0.206	0.149
Time on ART (months)	52.5* (13.4)	67* (9.8)		0.318	***0.021****
	No. (%)	***No. (%)***	***No. (%)***		
Gestation (weeks)				0.706	0.969
24-29	0 (0.0)	1 (7.7)	1 (3.8)		
30-36	3 (23.1)	2 (15.4)	5 (19.3)		
37-40	7 (53.8)	8 (61.5)	15 (57.6)		
40-41	3 (23.1)	2 (15.4)	5 (19.3)		
Total	13 (100.0)	13 (100.0)	26 (100.0)		
Gender				0.572	0.267
Male	7 (53.8)	5 (38.5)	12 (46.2)		
Female	6 (46.2)	8 (61.5)	14 (53.8)		
Total	13 (100.0)	13 (100.0)	26 (100.0)		
Caregivers				0.142	0.484
Mother	11 (84.6)	12 (92.3)	23 (88.5)		
Granny	1 (7.7)	1 (7.7)	2 (7.7)		
Aunty	1 (7.7)	0 (0.0)	1 (3.8)		
Total	13 (100.0)	13 (100.0)	26 (100.0)		
Level of primary education				0.909	0.351
Grade R	6 (46.2)	5 (38.5)	11 (42.3)		

Grade 1	7 (53.8)	7 (53.8)	14 (53.9)		
Grade 2	0 (0.0)	1 (7.7)	1 (3.8)		
Total	13 (100.0)	13 (100.0)	26 (100.0)		
Caregivers level of education				0.454	0.687
Primary School	4 (30.8)	3 (23.1)	7 (28.0)		
High School	7 (53.8)	9 (75)	16 (64.0)		
Tertiary	2 (15.4)	0 (0.0)	2 (8.0)		
Total	13 (100.0)	12 (100.0)*	25 (100.0)		
School language				0.012	0.189
Xhosa	10 (83.4)	10 (76.9)	20 (80.0)		
Xhosa & English	0 (0.0)	1 (7.7)	1 (4.0)		
Afrikaans	1 (8.3)	1 (7.7)	2 (8.0)		
English	1 (8.3)	1 (7.7)	2 (8.0)		
Total	12 (100.0)*	13 (100.0)	25 (100.0)		
Home language				0.002	0.149
Xhosa	11 (84.6)	11 (84.6)	22 (84.8)		
Xhosa & English	1 (7.7)	0 (0.0)	1 (3.8)		
Afrikaans	0 (0.0)	1 (7.7)	1 (3.8)		
Afrikaans & Xhosa	0 (0.0)	1 (7.7)	1 (3.8)		
English & Afrikaans	1 (7.7)	0 (0.0)	1 (3.8)		
Total	13 (100.0)	13 (100.0)	26 (100.0)		
Receiving therapy				0.180	0.492
Yes	3 (23.1)	5 (41.7)	8 (32.0)		
No	10 (76.9)	7 (58.3)	17 (68.0)		
Total	13 (100.0)	12 (100.0)*	25 (100.0)		
Viral loads				0.003	0.269
LDL[4] (<40)	9 (75)	10 (76.9)	19 (73.1)		
40<VL<1000	3 (25)	0 (0.0)	3 (11.5)		
1000 <VL<10 000	1 (7.7)	3 (23.1)	4 (15.4)		
Total	13 (100.0)	13 (100.0)	26 (100.0)		

**Missing data:* *Time on HAART- 2 in experimental group; 4 in control group*
Caregivers level of education- 1 in control group
Receiving therapy- 1 in control group
School language- 1 in experimental group

4.2.1.1. Time on ART

Table 4 (above) shows statistical significance (*p*=.021) from the 2-sample t-test comparing the difference between the experimental and control groups time on HAART. Table 4 (below) indicates that children in the control group had been on HAART longer (mean months = 67) than those in the experimental group (mean months = 52.5). The lower sample numbers in the experimental (N=10) and control (N=8) group for this dependent variable are due to viral loads not being reported in the specific medical folders. Negative skewness (-0.13; -0.57) was seen in both groups, indicating that more children had been on ART less months than the mean months. Notably, the minimum time (in months) for children on ART in the experimental group was much less (33 months) than that of the children in the control group (49 months). The maximum duration for time on ART for children in the experimental group (71 months) was also less than those in the control group (81 months).

[4] The acronym LDL stands for Lower than Detectable Level. LDL is a term used to describe the amount of HIV in your blood, i.e. one's viral load of the HI virus. The more HI virus there is in your blood, the higher ones viral load will be. http://www.aidsmap.com/Viral-load

Table 5: Descriptive statistics for duration on HAART for the experimental (n=11) and control (n=9) group.

Group	Mean	SD	Min	Max	Skew
Experimental group	52.50	1 3.43	33	71	-0.13
Control group	67.00	9.80	49	81	-0.57

Pearson chi2(13) = 13.9500; Pr = 0.377

4.2.2 Baseline measurements for performance components linked to academic learning

This section will present the baseline measurements for the two groups for the following performance components linked to academic learning, namely visual motor integration, visual perception, motor coordination, eye hand coordination, performance, practical reasoning and language.

Before the baseline measurements are presented, Table 5 and 6 are provided to describe the classification categories for both the Beery VMI (standard scores) and the GMDS-ER (quotients) so the performance of the sample can be compared to normative standards reflected in these two tests. For both the Beery VMI and GMDS-ER the cut off point for standard and quotient scores is <70. This means that a child scoring <70 is functioning below borderline ability (Luiz et al., 2006). A <70 score in the Beery VMI is classified as "very low" and in the GMDS-ER a <70 score is classified as a "severe delay". These two classifications mean that a child scoring in this category would not be able to function at a standard required in order for them to master and attain age appropriate academic learning outcomes.

In Table 9 and 10, the GMDS-ER looks at those children scoring a <-2 z-score in each subscale. This allows one to see those children scoring in the "severe delay" category, as a <-2 z-score is equivalent to a <70 quotient score (Luiz et al., 2006).

Table 6: Standard Score Classification Category (US) for the Beery VMI

VMI, VP, MC Scoring (Standard Score Interpretation)	
<70	Very low
70-79	Low
80-89	Below average
90-109	Average
110-119	Above average
120-129	High
>129	Very high

Table 7: Quotient Classification Category (UK) for the GMDS-ER

QUOTIENT CATEGORIES	
VERY SUPERIOR	+130
SUPERIOR	120 - 129
HIGH AVERAGE	110 - 119
AVERAGE	90 - 109
LOW AVERAGE	80 - 89
BORDERLINE DELAY	70 - 79
SEVERE DELAY	50 - 69
MODERATE MENTAL RETARDATION	35 - 49
SEVERE MENTAL RETARDATION	20 - 34
PROFOUND MENTAL RETARDATION	20

4.2.2.1. Baseline Measurements for Visual motor integration, Visual perception and Motor co-ordination for the Total sample (N=23)

The mean standard score of the total sample (N=23) was "low" for both visual motor integration and visual perception. 40.9 % of the total sample scored <70 in the visual perception subtest (Table 8).

Table 8: Classification of the Total sample (n=23) for Baseline scores for the Beery VMI

Beery VMI	**Standard Score Mean**	**Standard Score classification category (US)**	**Number of children scoring below 70 (%)**
Visual motor integration *	77.9*	**Low**	3 (13.6%)
Visual perception *	74.0*	**Low**	9 (40.9%)
Motor co-ordination	86.3	Below average	3 (13.0%)

*Missing data *One child's baseline data for VMI and VP subtests (n=22)*

In Table 9 the lowest score was for visual perception in the control group. Both groups scored below average for visual motor integration with 2 children in the experimental group and 3 children in the control group scoring <70 in visual motor integration. The experimental group scored 91.1 (average) for motor co-ordination, with no children scoring <70 at baseline. The control group scored 81.1 (below average) with 25% of the children scoring <70 at baseline.

Table 9: Independent group comparisons to US classification categories for Baseline (B) for VMI, VP and MC for the Experimental (n=11) and Control group (n=12)

Group	**Exp.**	**Control**	**Exp.**	**Cont.**	**Exp.**	**Cont.**
Beery VMI	**Standard Score Mean**		**Standard Score classification category (US)**		**Number of children scoring below 70 (%)**	
Visual motor integration *	81	81.5	Below average	Below average	2(18.2%)	3(27.3%)
Visual perception *	85.1	69.6	Below average	Very low	4(36.4%)	5(45.5%)
Motor co-ordination	91.1	81.8	Average	Below average	0(0%)	3(25.0%)

*Missing data: * One child from the control group for VMI and VP at baseline (n=11)*

4.2.2.2. Baseline Measurements for Language, Eye hand co-ordination, Performance, Practical reasoning and General quotients for the Total sample (n=23)

The mean quotient score, the classification category, and the number of children scoring <-2 for their z-score in the GMDS-ER, for language, eye hand co-ordination, performance, practical reasoning and the general quotient for the total sample is presented in Table 10. All GMDS-ER subscale quotient scores were below the comparable standard average mean (90-109) for the total sample (n=23), the experimental group (n=11) and the control group (n=12). The greatest observed level of delay in total sample was borderline delays in language (subscale C) and practical reasoning (subscale F) at baseline. These two sub scales had the lowest mean quotient scores and the highest

number of children scoring <-2 for their z-scores. Just over half the total sample (56.5%) had a <-2 z-score for eye hand co-ordination, functioning at a low average. More than half, that is 68.2% of the total sample scored low average for the general quotient scores.

Table 10: Classification for the Total sample (n=23) Baseline scores for the GMDS-ER

GMDS-ER	**Quotient Mean**	**Quotient classification category (UK)**	**Number of children with z-score below -2 (%)**
Language: Subscale C	**71.6**	**Borderline delay**	16 (69.6%)
Eye hand co-ordination: Subscale D	80.2	Low average	13 (56.5%)
Performance: Subscale E	81.6	Low average	7 (30.4%)
Practical reasoning: Subscale F	**75.4**	**Borderline delay**	18 (78.3%)
General Quotient: Total	80.3	Low average	15 (68.2%)

In Table 11 the baseline performance of the experimental and control group in language, eye hand co-ordination, performance, practical reasoning and the general quotient is presented. The experimental group showed a "borderline delay" in the language subscale at baseline, with 72.7% of the sample with a z-score of <-2 for this subscale. The control group also classified in the "borderline delay" category, with 66.7% of the group scoring <-2 z-score for language. Practical reasoning saw both groups showing a "borderline delay", with 72.2% in the experimental group and 83.3% in the control group scoring <-2 z-score in this subscale. Both groups scored similar in eye hand co-ordination and practical reasoning, but the experimental group scored higher than the control group in performance. The mean quotient scores for the general quotient (total score) for each groups was the same (80.3) with similar percentages of those scoring <-2 in their z-scores.

Table 11: Comparisons of UK classification categories for Baseline test for language, eye hand co-ordination, performance, practical reasoning and general quotients for the Experimental (n=11) and Control (n=12) group

	GMDS-ER subscale	**Quotient Mean**		**Quotient classification category (UK)**		**Number of children with z-score below -2 (%)**	
	Group	**Exp.**	**Cont.**	**Exp.**	**Cont.**	**Exp.**	**Cont.**
Baseline	Language	**70**	**73.2**	Borderline delay	Borderline delay	8 (72.7%)	8 (66.7%)
	Eye hand co-ordination	82.3	78.4	Low average	Borderline delay	6 (54.5%)	6 (50.0%)
	Performance	86.5	77.1	Low average	Borderline delay	2 (18.2%)	5 (41.7%)

	Practical reasoning	**75.1**	**75.7**	Borderline delay	Borderline delay	8 (72.2%)	10(83.3%)
	General Quotient	80.3	80.3	Low average	Low average	7 (63.6%)	8 (66.7%)

4.2.3. The comparison of Viral Load to Baseline scores for the Beery VMI and GMDS-ER

The aim of the Antiretroviral Therapy (ART) is to lower ones VL to LDL or <40. If the VL is above 40 this indicates that VL has not yet been suppressed. Table 12 (below) shows the viral load (VL) of the child recorded at baseline, for both the experimental and control group. This VL level is compared to their Beery VMI standard scores and their GMDS-ER quotient scores at baseline. The experimental group had four children (child 5, 8, 12 & 13) that had a VL that was >40, whereas the control group had three children with a VL that was >40 (child 3, 8 & 9). Child 9 from the control group had the highest VL level out of both groups at 980 477. The three rows in italics (child 12 and 13 in the experimental group and child 13 in the control group) illustrate the three children whose data was not included in mid and post intervention data analysis, due to the children not attending all three test periods. Their baseline results are presented for comparison.

The majority of the total baseline sample (73.1%) had a VL that was either <40 or LDL and 26.9% had a VL that was above 40. Some of the children with unsuppressed viral loads, that is child 5, 12 and 13, from the experimental group, and child 8 from the control group, presented with generally lower scores in all subtests and subscales, compared to those with a viral load of <40 or LDL. Child 8 from the experimental group, with a VL of 883, had a higher Beery VMI and GMDS-ER scores compared to the rest of the sample with a viral load of <40 or LDL. Child 10 and 11 from the experimental group and child 6 and 7 from the control group, all had a VL of LDL, but their scores for both the Beery VMI and GMDS-ER were generally lower than the rest of the sample.

Table 12: Comparisons of baseline Viral Loads (VL) of children in experimental (n=13) and control Group (n=13) to their baseline scores for the Beery VMI and the GMDS-ER

Participant	**Beery VMI**				**GMDS-ER**				
	Viral Load	Visual Motor Integration	Visual Perception	Motor Co-ordination	Language	Eye Hand Co-ordination	Performance	Practical Reasoning	General Quotient
Experimental Group									
Child 1	LDL	75	100	93	78.2	78.2	80.1	72.4	80.8
Child 2	LDL	87	83	97	65	86.7	74.1	74.1	80.4
Child 3	LDL	76	117	75	82.8	79.5	119.9	82.1	86.8
Child 4	<40	76	75	90	72.5	75.2	85.6	89.5	83

Child 5	**664**	63	62	83	81.3	88.7	66.7	75.3	84.7
Child 6	LDL	79	73	93	71.6	77.7	78.4	75	79.1
Child 7	<40	72	65	86	64.7	71.2	70.6	75.2	74.5
Child 8	**883**	108	123	107	75	105.9	>126.3	81.6	94.7
Child 9	LDL	106	123	110	73.1	113.5	116	85.3	91
Child 10	LDL	58	55	82	52.1	63.6	60	55.7	62.1
Child 11	LDL	91	60	86	53.3	64.5	74	59.8	66.3
Child 12	*382125*	*53*	*56*	*70*	*55.4*	*59.5*	*61.9*	*55.4*	*63.1*
Child 13	*301*	*65*	*73*	*65*	*65.8*	*47.5*	*57.5*	*59.6*	*70.5*
Control Group									
Child 1	LDL	82	70	70	72.5	76.5	62.1	75.2	78.4
Child 2	LDL	84	55	82	77.3	72.3	70.9	73.8	80.9
Child 3	**1401**	93	45	90	72.5	99.3	107.2	81	86.9
Child 4	LDL	96	73	93	99.3	86.1	>127.2	86.1	105.3
Child 5	LDL	87	56	93	72.1	84.4	64.9	67.5	82.5
Child 6	LDL	88	87	78	55.2	68.1	58.3	63.8	69.3
Child 7	LDL	58	63	67	64.6	57.1	62.1	67.1	59
Child 8	**1540**	64	63	67	64.2	74.1	51.9	72.2	75.3
Child 9	**980477**	65	73	60	77.6	68.5	69.9	75.5	79.5
Child 10	LDL			98	68.3	92.7	82.9	75.6	75
Child 11	<40	101	84	86	74.4	80.5	81	76.9	84.5
Child 12	LDL	82	97	98	80	80.6	87.3	93.9	86.7
Child 13	*LDL*	*88*	*119*	*65*	*105.5*	*97*	*>116.4*	*85.5*	*98.8*

** Missing data: Child 10 from the control group, VMI and VP forms*

4.3. Summary of Baseline measurements

At baseline, the total sample was n=26. All participants were younger than 79 months at baseline, and receiving ART. The majority of the sample had their mothers as their main caregivers (88.5%) and for 84.8% of the total population Xhosa was their home language. There were more females than males in the sample and 73.1% of the sample had a viral load that was LDL.

The total sample scored between 70-79 (low) for VMI and VP, and between 80-89 (below average) for the MC subscale, with the highest number of children scoring <70 (very low) seen in the VP subtest. The total sample scored between 70-79 (borderline delay) in language, eye hand co-ordination and practical reasoning, and a between 80-89 (low average) in performance and their overall level of functioning (general quotient).

4.4. Post test measurements for Visual motor integration, visual perception and motor co-ordination

This section will present the mid and post test measurements for the dependent performance component variables of visual motor integration, visual perception, motor coordination, eye hand coordination, performance, practical reasoning and language for the total sample and the control and experimental groups.

4.4.1. Post test measurements for Visual Motor Integration, Visual Perception and Motor Co-ordination for the Total sample (n=23)

In Table 13, Table 6 has been extended on to show the comparison between baseline and post test Beery VMI and GMDS-ER scores for the total sample. Table 12 shows how the total sample progressed or digressed in their scores from baseline to post test, regardless of the intervention they received. The total sample (N=23) improved in all three of the Beery subtests, with the greatest improvement seen in visual perceptual subtest, moving from scores of 70-79 (low) at baseline to scores of 90-109 (average)at post test, a 18.2 mean score improvement. Visual perception also showed to be the strongest academic learning skill at post test level in the total sample in all the three subtests, with the mean post test score (92.2) being the closet to the comparable standard mean score of 100.

Table 13: Total sample (n=23) at Baseline and Post test scores for the Beery VMI

Beery VMI	**Baseline**	**Post**	**Baseline**	**Post**	**Baseline**	**Post**
	Standard Score Mean		**Standard Score classification category (US)**		**Number of children scoring below 70 (%)**	
Visual motor integration	77.9*	85.6**	Low	Below average	3 (13.6%)	1 (4.8%)
Visual perception	74.0*	92.2	Low	Average	9 (40.9%)	2 (8.7%)
Motor co-ordination	86.3	87.2	Below average	Below average	3 (13.0%)	1 (4.8%)

*Missing data *One child's baseline Visual motor integration and Visual perceptual form (n=22)*
***Two children's post test Visual motor integration forms (n=21)*

4.4.2. Post test measurements for the Experimental group (n=11) and the Control group (n=12) for Visual Motor Integration, Visual Perception and Motor Co-ordination

In the below table, Table 14, the changes from baseline to post test are presented and these scores are compared to US classification categories. The number of children performing <70 are also presented. The mean scores for each of the above performance components of the two groups were comparable (average to below average) throughout the intervention period, except for the control group's baseline visual perceptual mean score (69.9), which showed that before intervention the

control group was performing very low. The only decrease in mean scores was seen in the experimental group for motor co-ordination, where a -0.2 drop was seen between baseline and post test. All of the other subtests, in both groups, throughout the intervention period saw an improvement of scores. None of the children in the experimental group scored <70 at post test level, meaning that the entire group was performing above 70 in the area of visual perceptual skills at the end of group intervention.

Table 14: Changes in standard scores from baseline to post test and comparisons to US classification categories for Baseline (B) and Post test (P) for VMI, VP and MC for the Experimental (n=11) and Control group (n=12)

Group	**Exp.**		**Control**		**Exp.**		**Cont.**		**Exp.**		**Cont.**	
Test period	**B** **n=11**	**P** **n=9**	**B** **n=11**	**P** **n=12**	**B** **n=11**	**P** **n=12**	**B** **n=11**	**P** **n=12**	**B** **n=11**	**P** **n=12**	**B** **n=11**	**P** **n=12**
Beery VMI	**Standard Score Mean**				**Standard Score classification category (US)**				**Number of children scoring below 70 (%)**			
Visual motor integration	81	87.3	81.5	84.3	Below average	Below average	Below average	Below average	2(18.2%)	0(0%)	3(27.3%)	1(8.3%)
Visual perception	85.1	96.4	69.6	88.7	Below average	Average	Very low	Below average	4(36.4%)	0(0%)	5(45.5%)	2(16.7%)
Motor co-ordination	91.1	90.9	81.8	83.3	Average	Average	Below average	Below average	0(0%)	0(0%)	3(25.0%)	1(8.3%)

*Missing data: *Two children from the experimental group for VMI at post test (n=9)**One child from the control group for VMI and VP at baseline (n=11)*

4.5. Between-group differences for Visual motor integration, Visual perception and Motor co-ordination following intervention

The two groups mean standard scores were compared at 5 months (mid test) and at 10 months (post test) to compare the changes in the dependent variables of both groups after the interventions.

4.5.1. Between-group differences for Visual Motor Integration

In Figure 5 the progression of the groups' mean standard scores at each of the three time points is presented.

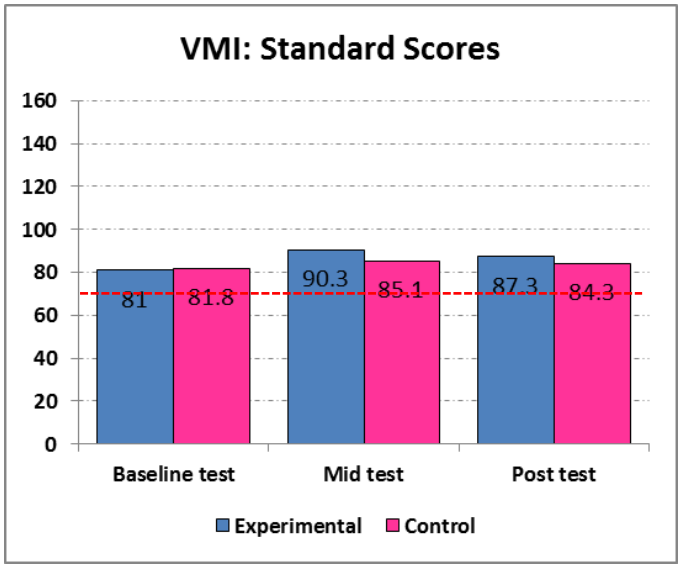

Figure 5: Experimental and Control groups Mean Standard Scores for the Visual motor integration Test at baseline, mid and post test periods.
**Missing data: VMI baseline test for child 10 in the Control group & VMI Post test for child 5 and 8 in the Experimental group*

The 2-sample t-test for the VMI in (Table 15, below) showed no statistically significance between the two groups' mean standard scores during all three test periods.

Table 15: Between group differences for the Experimental and Control groups for baseline, mid and post test periods for Visual Motor Integration (VMI)

					2-sample t-test			
Test	**Group**	**Test**	***Mean***	***SD***	***t***	***Diff***	***p-value***	***(95% CI)***
Visual Motor Integration	Experimental (n=11)	Baseline	81.0	15.86	*0.13*	*20*	*0.899*	*-14.1 – 12.4*
	Control (n=11)		81.8	13.90				
	Experimental (n=11)	Mid	90.3	8.39	*1.09*	*21*	*0.287*	*-4.7 – 15.1*
	Control (n=12)		85.1	13.55				
	Experimental (n=9)	Post	87.5	10.10	*0.68*	*19*	*0.503*	*-6.4 – 12.5*
	Control (n=12)		84.3	10.36				

**Missing data: VMI baseline test for child10 in the Control group*
**Missing data: VMI Post test for child 5 and 8 in the Experimental group*

4.5.2. Between group differences for Visual Perception

In Figure 6 the progression of the groups' mean standard scores at each of the three time points is presented.

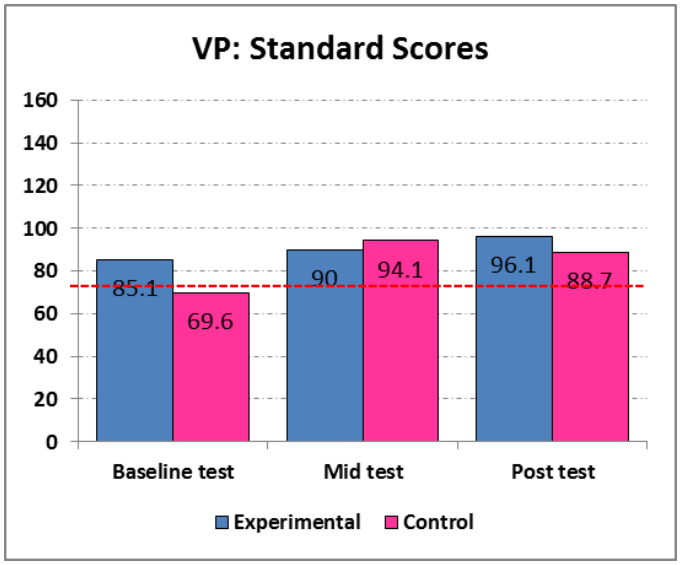

Figure 6: Experimental and Control groups Mean Standard Scores for the Visual perceptual subtest at baseline, mid and post test periods.
**Missing data: Child10, VP subtest at baseline test, for in the Control group*

The 2-sample t-test (table 16) for the VP subtest showed no statistically significance between-groups mean standard scores during all three test periods.

Table 16: Between-group differences for the Experimental and Control groups for baseline, mid and post test periods for the visual perceptual subtest (STVP).

					2-sample t-test			
Test	**Group**	**Test**	***Mean***	***SD***	***t***	***Diff***	***p-value***	***(95% CI)***
Visual Perception	Experimental (n=11)	Baseline	85.1	26.15	*1.69*	*20*	*0.107*	*-3.6 – 34.5*
	Control (n=11)		69.9	15.41				
	Experimental (n=11)	Mid	90.0	18.50	*0.55*	*21*	*0.591*	*-19.7 – 11.5*
	Control (n=12)		94.1	17.42				
	Experimental (n=11)	Post	96.1	12.06	*1.12*	*21*	*0.277*	*-6.4 – 21.3*
	Control (n=12)		88.7	18.80				

**Missing data: VP subtest at baseline test for child10 in the Control group*

4.5.5. Between group differences for Motor co-ordination

In Figure 7 the progression of the groups' mean standard scores at each of the three time points is presented.

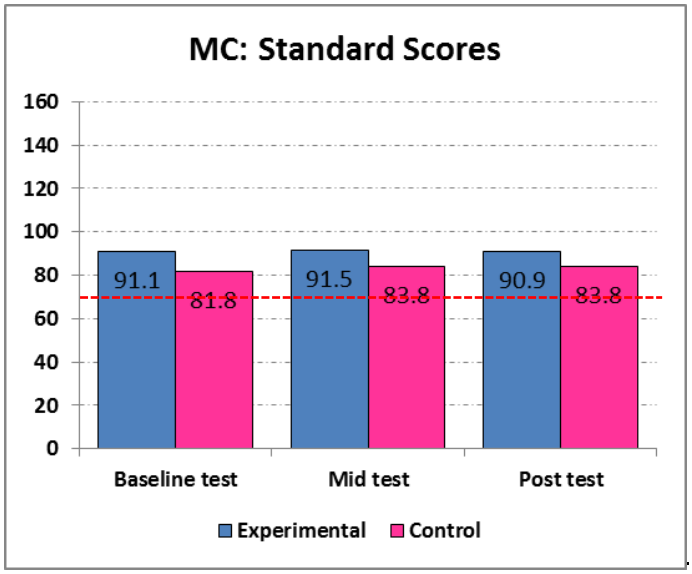

Figure 7: Experimental and Control groups Mean Standard Scores for the Motor co-ordination subtest at baseline, mid and post test periods.

The 2-sample t-test (Table 17) showed that there was no statistically significance between the two groups mean standard scores during all three test periods.

Table 17: Between-group differences for the Experimental and Control groups for baseline, mid and post test periods for the motor co-ordination subtest.

					2-sample t-test			
Test	**Group**	**Test**	***Mean***	***SD***	***t***	***Diff***	***p-value***	***(95% CI)***
Motor Co-ordination	Experimental (n=11)	Baseline	91.1	10.55	*1.84*	*21*	*0.079*	*-1.2 – 19.87*
	Control (n=12)		81.8	13.24				
	Experimental (n=11)	Mid	91.5	8.41	*1.67*	*21*	*0.110*	*-1.9 – 17.1*
	Control (n=12)		83.8	12.83				
	Experimental (n=11)	Post	90.9	9.57	*1.91*	*21*	*0.070*	*-0.6 – 14.8*
	Control (n=12)		83.8	8.23				

4.6. Within-group changes for visual motor integration, visual perception and motor co-ordination for the experimental and control group at baseline, mid and post test

4.6.1. Distribution of scores for each group for Visual Motor Integration, Visual Perception and Motor co-ordination

Figure 8, 9 and 10 (below) show the standard scores for each group in a box and whisker plot, allowing one to see the minimum and maximum individual scores, as well as score distribution in each group.

4.6.1.1. Distribution of scores for each group for Visual Motor Integration

The control group generally had a wider distribution of scores for the VMI at all three test periods, compared to the experimental group. The box length gives an indication of the sample variability; in

this case the control group has a larger variability compared to the experimental group. Standard scores <70 were only seen at baseline testing, but not at mid or post test for the experimental group. The control group consistently had children scoring <70 at each test period.

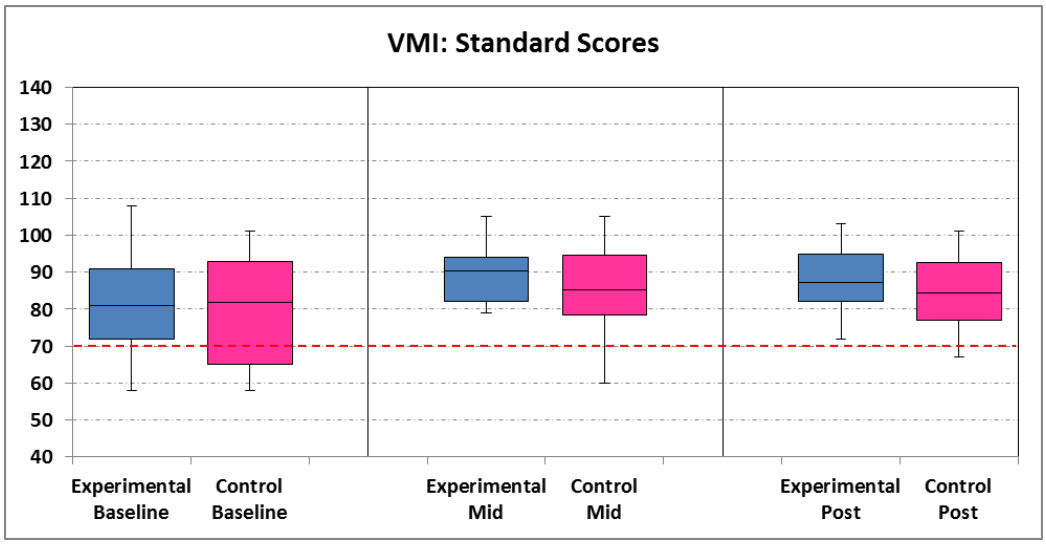

Figure 8: Box and Whisker Plot: 25th (Q1) and 75th (Q3) quartile, mean, maximum and minimum scores for Visual Motor Integration standard scores in Experimental and Control groups at baseline, mid and post test periods. **Missing data: Child 10, VMI baseline test in the Control group; Child 5 and 8, VMI Post test in the Experimental group*

4.6.1.2. Distribution of scores for each group for Visual Perception

Figure 8 (below) shows that the control group's mean standard score for visual perception was <70 at baseline, and that a smaller percentage of the experimental group scored <70 at baseline test. The experimental group's variability was much larger in comparison to the control groups at baseline, similar distribution was seen at mid test and the control group's variability was larger than the experimental group's at post test, showing a greater distribution of scores.

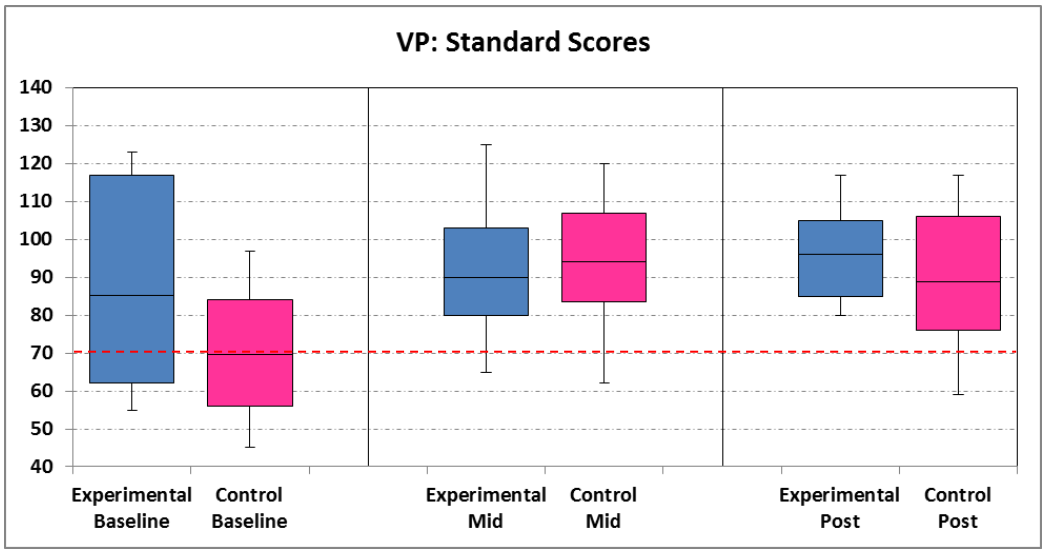

Figure 9: Box and Whisker Plot: 25th (Q1) and 75th (Q3) quartile, mean, maximum and minimum scores for Visual Perceptual standard scores in Experimental and Control groups at baseline, mid and post test periods. **Missing data: Child 10, VP subtest at baseline test, in the Control group*

4.6.1.3. Distribution of scores for each group for Motor Co-ordination

Figure 10 (below) shows the motor co-ordination subtest standard scores in both groups to have a smaller variability, in comparison to the larger variability in the visual motor integration and visual perceptual subtest. The control group's minimum and maximum score is always lower than the experimental group's minimum and maximum score, throughout the three test periods. The experimental group for mid and post test are skewed to the right, with the control group appearing reasonably symmetric over the three test periods. Standard scores <70 were only seen at baseline in the control group.

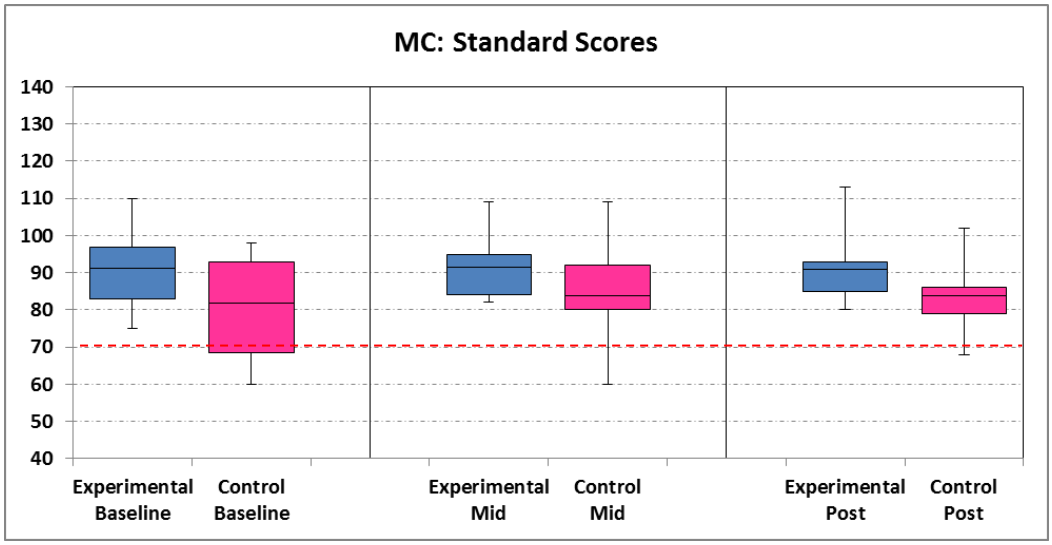

Figure 10: Box and Whisker Plot: 25th (Q1) and 75th (Q3) quartile, mean, maximum and minimum scores for Motor co-ordination standard scores in Experimental and Control groups at baseline, mid and post test periods.

4.6.2. Changes in the experimental and control group scores over baseline, mid and post test

As there were few performance component variables in which significant differences were detected at mid and post test, further analysis was conducted to examine the within-group changes to gauge the effects of each intervention. Baseline and mid, mid and post, and baseline to post test data were compared using a paired t-test (or dependant t-test).

4.6.2.1. Within-group changes for the experimental (N=11) and control (N=12) group between baseline and mid test for Visual Motor Integration, Visual Perception and Motor Co-ordination

Table 18 shows the results of the within-group analysis changes in visual motor integration, visual perception and motor co-ordination from baseline to mid test. All scores improved from baseline to mid test in both groups. A statistically significant improvement in visual motor integration (*p*=.019) in the experimental group and in visual perception (*p*=.001) in the control group in visual perception (*p*=.001) was observed.

Table 18: Within-group comparisons of Visual motor Integration, Visual Perception and Motor Co-ordination between baseline and mid test

Beery VMI	**Experimental group (n=11)**					**Control group (n=12)**				
Time period	Baseline	Mid	*Paired t-test*			Baseline	Mid	*Paired t-test*		
	Mean (SD)	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*	*Mean (SD)*	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*
Visual Motor Integration	81.0 (15.9)	90.3 98.4)	9	10 (-2.8)	**0.019***	81.8 (13.9)	84.8 (14.2)	11	10 (-0.7)	0.521
Visual Perception	85.1 (26.2)	90.0 (18.5)	11	10(-0.6)	0.507	69.6 (15.4)	92.3 (17.0)	11	10 (-4.5)	**0.001***
Motor Co-ordination	91.1 (10.5)	91.5 (8.4)	11	10 (-0.1)	0.901	81.8 (13.2)	83.8 (12.8)	12	11 (-0.5)	0.609

*Missing data: Two children, experimental group, VMI baseline test (n=9); One child, control group, VMI and VP baseline (n=11) *p<0.05*

4.6.2.2. Within-group changes for the experimental (n=11) and control (n=12) group between mid and post test for Visual Motor Integration, Visual Perception and Motor Co-ordination

Table 19 shows the results of the within- group analysis changes in visual motor integration, visual perception and motor co-ordination from mid to post test. Statistically significant changes were observed in the control group in visual perception (*p*=.035), where the scores decreased (-10.3).

Table 19: Within-group comparisons of Visual motor Integration, Visual Perception and Motor Co-ordination between mid and post test

Beery VMI	**Experimental group (n=11)**					**Control group (n=12)**				
Time period	Mid	Post	*Paired t-test*			Mid	Post	*Paired t-test*		
	Mean (SD)	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*	*Mean (SD)*	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*
Visual Motor Integration	98.9 (7.7)	87.3 (10.1)	9	8(0.7)	0.501	85.1 (13.5)	84.3 (10.4)	12	11 (0.2)	0.840
Visual Perception	90.0 (18.5)	96.1 (12.1)	11	10(-0.6)	0.507	94.1 (17.4)	83.8 (8.2)	12	11 (2.4)	**0.035***
Motor Co-ordination	91.5 (8.4)	90.9 (9.6)	11	10 (0.2)	0.799	83.8 (12.8)	83.8 (8.2)	12	11 (0.0)	1.000

*Missing data: Two children, experimental group, VMI mid test (n=9)*p<0.05*

4.6.2.3. Within-group changes for the experimental (n=11) and control (n=12) group between baseline and post test for Visual Motor Integration, Visual Perception and Motor Co-ordination

Table 20 shows the results of the within- group analysis changes in visual motor integration, visual perception and motor co-ordination from baseline to post test. A decrease in scores although not significant was only seen in the experimental group (-0.2) in motor co-ordination, all other scores improved over the baseline to post time period. A statistically significant improvement (p=.009) was observed in the control group, with an increase in standard scores (+19.9) from baseline to post test.

Table 20: With-in group comparisons of Visual motor Integration, Visual Perception and Motor Co-ordination between baseline and post test

Beery VMI	**Experimental group (n=11)**					**Control group (n=12)**				
Time period	Baseline	Post	*Paired t-test*			Baseline	Post	*Paired t-test*		
	Mean (SD)	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*	*Mean (SD)*	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*
Visual Motor Integration	80.0 (13.5)	87.3 (10.1)	9	8(-1.9)	0.086	81.8 (13.9)	85.5 (9.9)	11	10 (-1.2)	0.244
Visual Perception	85.1 (26.2)	96.1 (12.1)	11	10 (-1.7)	0.102	69.6 (15.4)	89.5 (19.5)	11	10 (-3.2)	**0.009***
Motor Co-ordination	91.1 (10.5)	90.9 (9.6)	11	10 (0.1)	0.940	81.8 (13.2)	83.8 (8.2)	12	11 (-0.5)	0.599

*Missing data: Two children, experimental group, VMI baseline test (n=9); One child, control group, VMI and VP baseline (n=11) *p<0.05*

4.6.3. Changes from baseline to post test scores for Visual motor integration (VMI), Visual perceptual (VP) and Motor co-ordination (MC) subtest

In order to show the improvement of both groups in the academic learning outcomes of visual motor integration, visual perception and motor co-ordination from baseline to post test, each groups mean post test score was deducted from their baseline mean score. The differences are seen in the below graph (Figure 11). The control group showed improvement in all three subtests, with the greatest improvement seen in the visual perceptual subtest (18.8). The experimental group improved in the visual motor integration and visual perceptual subtest, but showed a regression in scores in the motor co-ordination subtest (-0.2). This provides evidence that group intervention may be more effective in improving visual motor integration skills, and that individual intervention may be more effective in improving visual perceptual and motor co-ordination skills.

In summary, over the three test periods, the control group improved mean standard scores in all three subtests, and the experimental group improved mean standard scores in visual motor integration and visual perception.

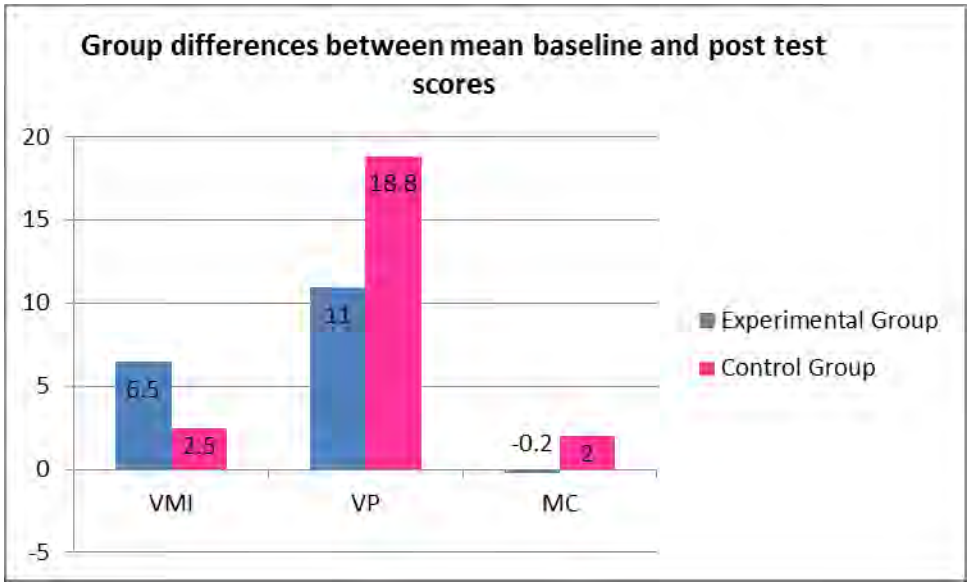

Figure 11: The differences between baseline and post test mean scores for the experimental and control group for all three subtests (VMI, VP and MC).

4.7. Child against child progression for Baseline and Post Test for Visual motor integration, Visual perception and Motor co-ordination subscales

Each individual child's progression in the visual motor integration, visual perceptual and the motor co-ordination subtest, before and after intervention for both groups are shown below. These are followed by figures illustrating the number of children in each group that increased or decreased their scores from baseline to post test, in all three subtests. This was done by deducting post test score from baseline score, for all three subtests of the Beery VMI.

4.7.1 Individual differences in children in Visual Motor Integration from baseline to post test

Figure 12 (below) illustrates that at baseline two children from the experimental group and three children from the control group, a total of five children from the total sample scored <70. At post test, only one child in the control group continued to score <70 at post test, child 7 (67). Child 7 from the control group and child 10 from the experimental group both scored below 60 ("very low") in their baseline test, with only child 10 improving sufficiently enough to a functional level. Six children (child 1, 2, 3, 7, 10 and 11) from the experimental group improved their scores, ranging from a 4 to 27 points improvement. Seven children (child 1, 2, 5, 7, 8, 9 and 12) from the control group improved their scores, ranging from a 1 to 19 point improvement from baseline to post test. A greater improvement in range of scores was seen in the experimental group, showing that group intervention may have a greater impact on visual motor integration than individual intervention.

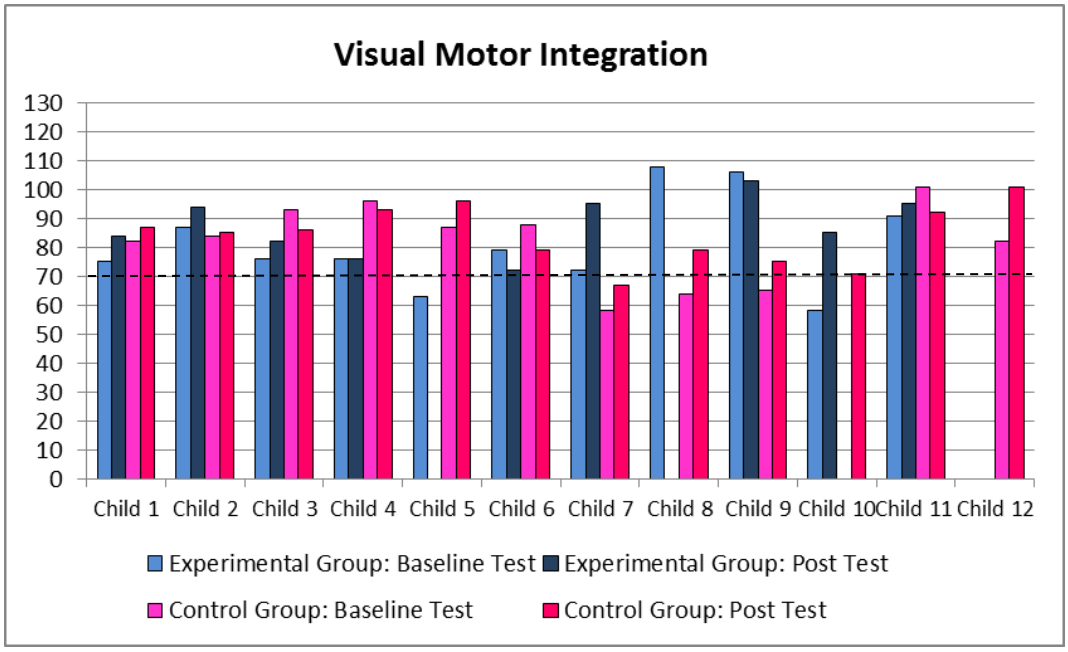

Figure 12: Individual experimental (n=11) and control (n=12) group participant's differences in VMI from baseline to post test.
**Missing data: Child 5 and child 8, VMI at post test from the experimental group; Child10, VMI baseline test, for the Control group*

4.7.2. Individual changes in Visual Motor Integration (VMI) standard scores from baseline to post test

Figure 13 (below) shows the six children from the experimental group and seven children from the control group improved their scores from baseline to post test, with child 4 from the experimental group making no change in score between test periods. Two children from the experimental group and four children from the control group showed a drop in their scores from baseline to post test.

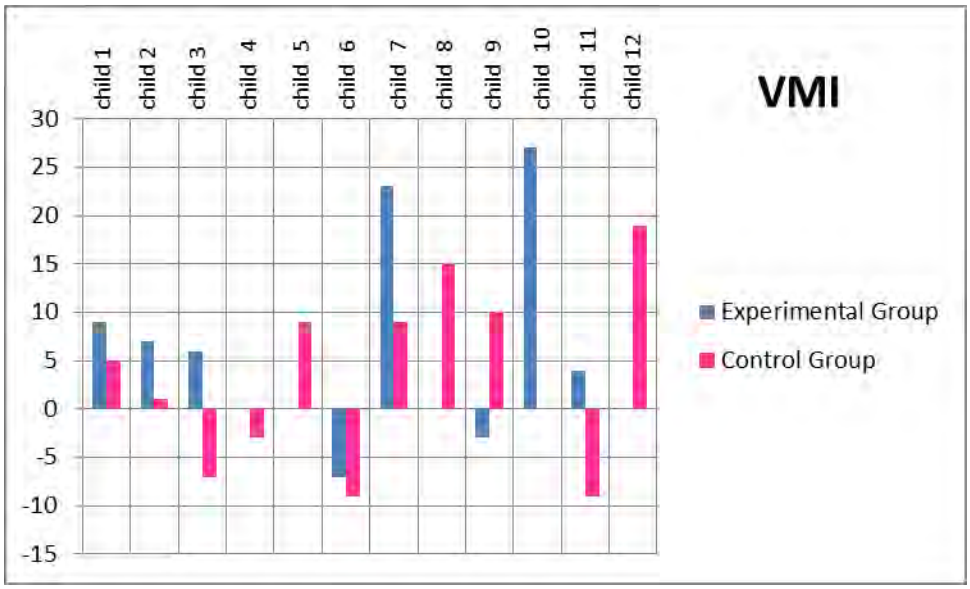

Figure 13: Changes in participants post and baseline test standard scores in the Visual motor integration (VMI) test **Missing data: Child 5 and 8 in the experimental group and child 10 of the control group post test VMI forms*

4.7.3. Individual differences in children in Visual Perception from baseline to post test

Figure 14 (below) shows that the majority of scores fell below 90 (below average) for the visual perception subtest (VP). Child 8 and 9 from the experimental group scored >120 ("high") at baseline test, with child 3 from the control group scoring just below 120 at post test, the highest post test score out of both groups and for all children. Four children from the experimental group scored <70 at baseline test and five from the control groups scored <70 at baseline test. None of the experimental group scored <70 at post test, showing that all children in the experimental group found themselves within the normal level of functioning for visual perception by post test. The control group saw only child 7 with a post test score <70. Seven children (child 2, 4, 5, 6, 7, 10 and 11) from the experimental group, ranging from a 16 to 36 point improvement. And nine children (child 2, 3, 4, 5, 6, 8, 9, 11 and 12) from the control group improved their scores from baseline to post test, ranging from an 11 to 72 point improvement in scores. A greater improvement in range of scores was seen in the control group, reiterating that individual intervention could have a greater effect in improving visual perceptual skills than group intervention.

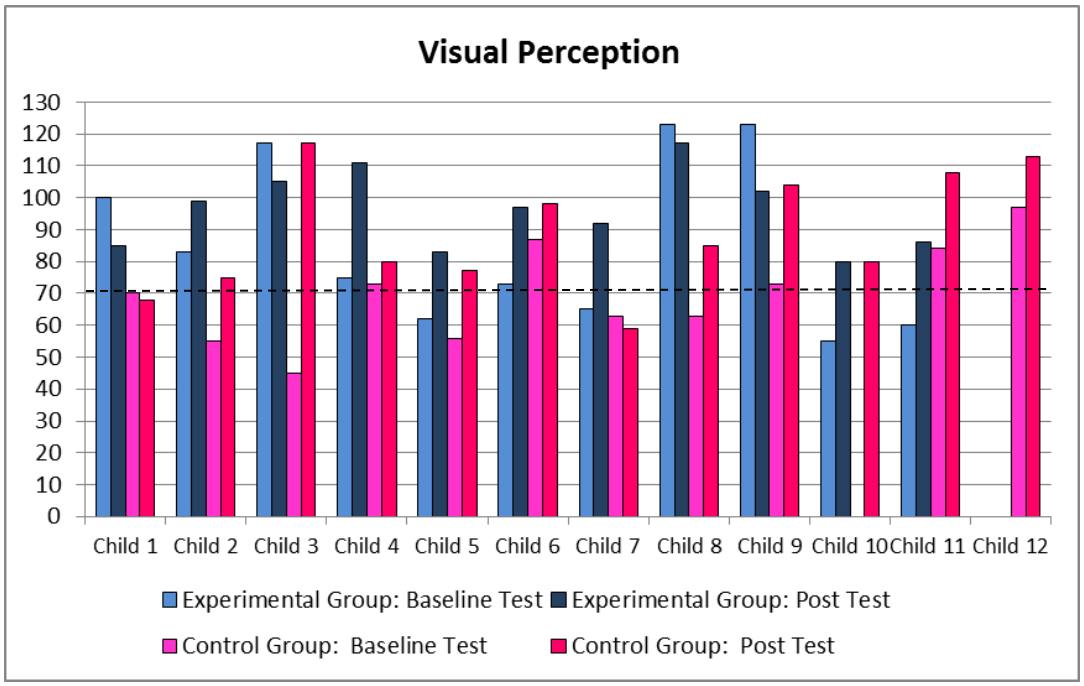

Figure 14: Individual experimental (n=11) and control (n=12) group participant's differences in visual perception from baseline to post test. **Missing data: Child 10, control group, baseline VP test*

4.7.4. Individual changes in Visual Perceptual (VP) standard scores from baseline to post test

Figure 15 (below) illustrates that seven children from the experimental group and nine children from the control group improved their scores from baseline to post test in visual perception. The experimental group saw four children with a lower score in their post test compared to their baseline test score, and the control group saw only two.

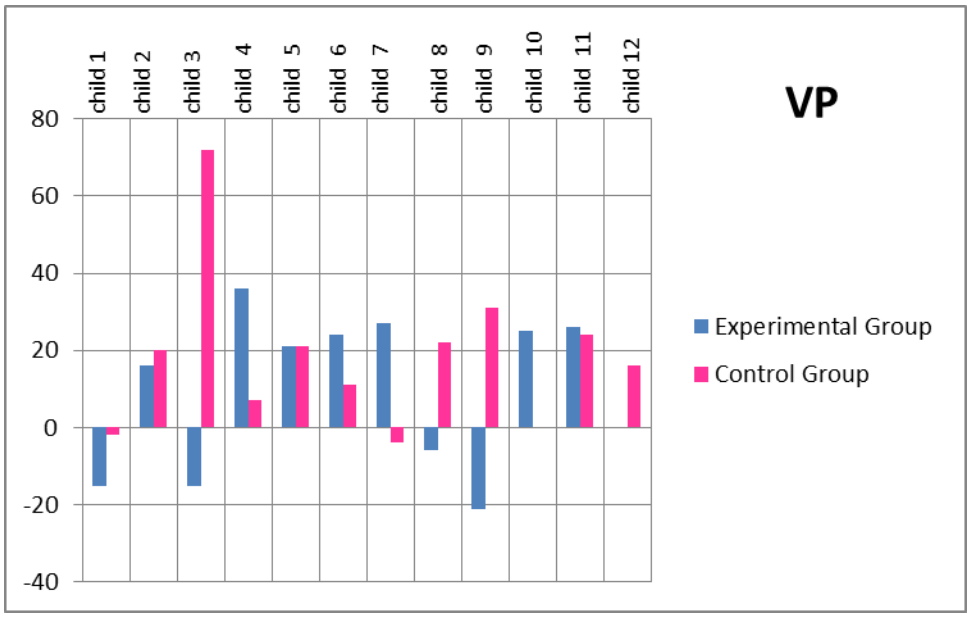

Figure 15: Changes in participants post test and baseline test Visual perceptual (VP) standard scores. **Missing data: Child 10 in the control group for post test*

4.7.5. Individual differences in children in Motor Co-ordination from baseline to post test

Figure 16 (below) shows the general scores for the MC subtest being much higher compared to the VMI and VP subtest. Out of the total sample five children in the VMI test, and ten children in the VP subtest scored <70 either at baseline or post test. In the MC subtest only 3 children scored <70 for baseline test and one scored <79 for post test. Seven of the experimental group participants and six of the control group participants scored in the "average" category either at baseline or post test, and child 8 and 9 from the experimental group scored "above average" in their baseline test. Seven children (child 2, 3, 5, 7, 9 10 and 11) from the experimental group improved their scores from baseline to post test, ranging from a 3 to 8 point improvement. And seven children (child 1, 2, 6, 7, 8, 9 and 12) from the control group improved their scores from baseline to post test, ranging from a 1 to 20 point improvement. Score improvement for the MC subtest was minimal in the experimental group, compared to the improvement made by this group in the VMI and VP subtest. A greater improvement in range of scores was seen in the control group, making it appear that individual intervention may have had a greater impact in improving motor co-ordination skills than group intervention.

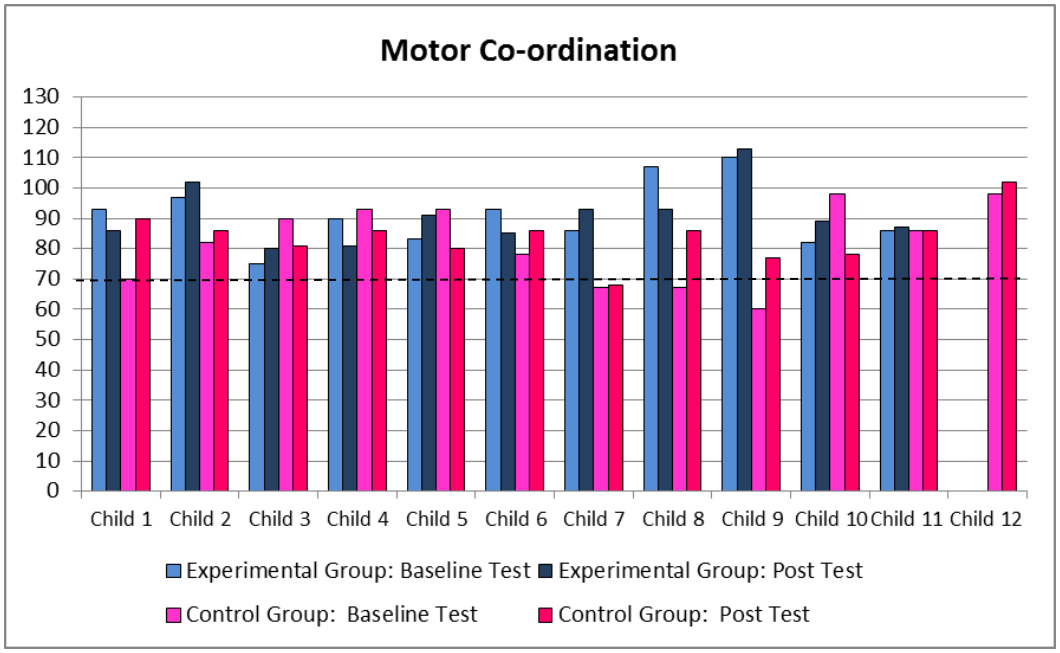

Figure 16: Individual experimental (n=11) and control (n=12) group participant's differences in Motor co-ordination from baseline to post test.

4.7.6. Individual changes in Motor Co-ordination (MC) standard score from baseline to post test

Figure 17 (below) shows that seven children from the experimental group and seven children from the control group improved their scores from baseline to post test. Four children in both groups scored lower in their post test than in their baseline test, and child 11 in the control group had the same score at baseline and post test (receiving a score of 0). The control group saw the greatest improvements in motor co-ordination scores but also the greatest decreases in scores too.

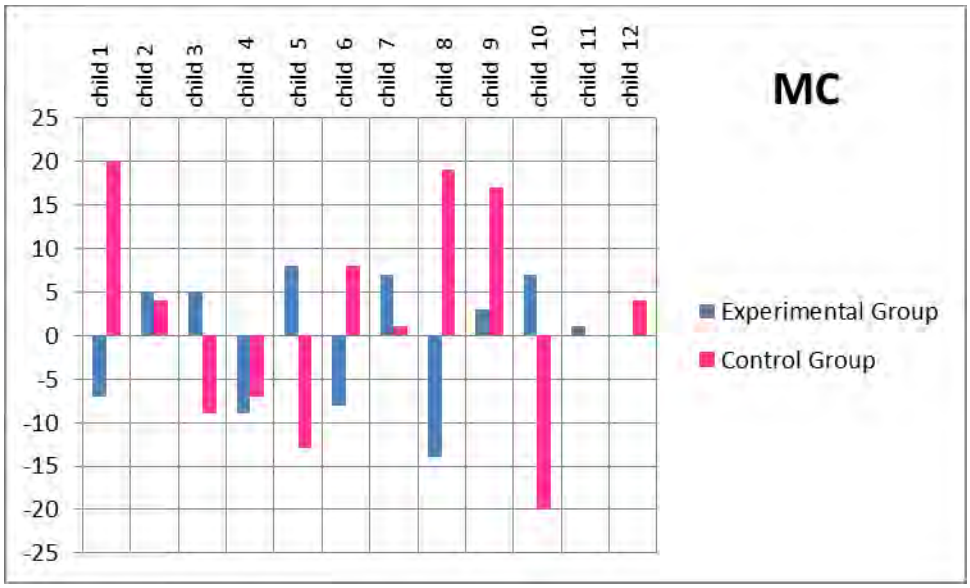

Figure 17: Changes in participants post test and baseline test for the Motor co-ordination (MC) standard scores.

4.8. Summary of the between-group and within-group differences seen between the experimental and control group for Visual Motor Integration, Visual Perception and Motor Co-ordination following interventions

The 2-sample t-tests showed no statistical significance between-groups mean standard scores, for all three tests throughout all three test periods. The results from the within-group comparisons show that statistical significance was found in the experimental group in visual motor integration between baseline and mid test (p=.019); and in the control group in visual perception between all three time periods, baseline and mid (p=0.001), mid and post (p=.035) and baseline and post (p=.009) test.

4.9. Post test measurements for Language, Eye hand co-ordination, Performance and Practical reasoning

4.9.1. Post test measurements for the Total sample (N=23) language, eye hand co-ordination, performance, practical reasoning and the general quotient

All of the GMDS-ER subscales quotient scores for the total sample (n=23) showed an improvement from baseline to post test, however they all remained in the same category classification throughout intervention. Practical reasoning showed to be the weakest academic learning performance component at baseline and post test, with a mean score improvement of 0.3 after interventions.

Table 21: Total sample (N=23) at Baseline and Post test scores for the GMDS-ER

	Baseline	**Post**	**Baseline**	**Post**	**Baseline**	**Post**
GMDS-ER	**Quotient Mean**		**Quotient classification category (UK)**		**Number of children with z-score below -2 (%)**	
Language	71.6	72.0	Borderline delay	Borderline delay	16 (69.6%)	12 (52.2%)
Eye hand co-ordination	80.2	82.4	Low average	Low average	13 (56.5%)	4 (17.4%)
Performance	81.6	86.5	Low average	Low average	7 (30.4%)	3 (13.0%)
Practical reasoning	75.4	75.7	Borderline delay	Borderline delay	18 (78.3%)	15 (65.2%)
General Quotient*	80.3	87.9	Low average	Low average	15 (68.2%)	8 (36.4%)

**Missing data: One child post test GQ had missing data in subscale B therefore the GQ could not be calculated (n=22)*

4.9.2. Post test measurements for the Experimental group (n=11) and the Control group (n=12) for Language, eye hand co-ordination, performance, practical reasoning and the general quotient

An improvement of scores was seen in all subscales from baseline to post test in the experimental group, although no changes in the classification categories was seen. Those receiving individual intervention (control group) displayed a decrease in the mean standard score in language and practical reasoning from baseline to post test. Language shifted from "borderline delay" classification to a "severe delay" classification, and practical reasoning remained in the "borderline delay" category decreasing by 3.0 from baseline to post test. More than 50% of the children in both groups, for language and practical reasoning, showed a <-2 z-score at post test level. The greatest improvement was seen in eye hand co-ordination for the experimental group, with those scoring <-2 z-score dropping from 6 to 1; and a 25% improvement seen in the control groups performance and general quotient z-scores. Both groups general quotient scores were equal at baseline (80.3), making the two samples change in general quotient scores comparable, with the control group improving more (+8.4) than the experimental group (+5.8).

Table 22: Between-group comparison of UK classification categories for Baseline and Post test for language, eye hand co-ordination, performance, practical reasoning and general quotients for the Experimental (n=11) and Control group (n=12)

GMDS-ER subscale	**Quotient Mean**		**Quotient classification category (UK)**		**Number of children with z-score below -2 (%)**	
Group	**Baseline**	**Post**	**Baseline**	**Post**	**Baseline**	**Post**
Experimental Group						
Language	70	74.4	Borderline delay	Borderline delay	8 (72.7%)	6 (54.5%)
Eye hand co-ordination	82.3	84.8	Low average	Low average	6 (54.5%)	1 (9.1%)
Performance	86.5	87.1	Low average	Low average	2 (18.2%)	1 (9.1%)
Practical reasoning	75.1	78.6	Borderline delay	Borderline delay	8 (72.2%)	6 (54.5%)
General Quotient*	80.3	86.1	Low average	Low average	7 (63.6%)	3 (30.0%)*
Control Group						
Language	**73.2**	**69.9**	Borderline delay	**Severe delay**	8 (66.7%)	6 (50.0%)
Eye hand co-ordination	78.4	79.9	Borderline delay	Borderline delay	6 (50.0%)	3 (25.5%)
Performance	77.1	85.8	Borderline delay	Low average	5 (41.7%)	2 (16.7%)

Practical reasoning	**75.7**	**72.7**	Borderline delay	Borderline delay	10(83.3%)	9 (75.0%)
General Quotient	80.3	89.7	Low average	Low average	8 (66.7%)	5(41.7%)

**Missing data: One child from the experimental group GQ, at post test (n=10)*

4.10. Between-group differences in Mean Quotient Scores for Language, Eye hand co-ordination, Performance, Practical reasoning and General quotients

According to the GMDS-ER manual (Luiz et al., 2006) observed and published performance below the normal functioning limits is defined as < -2 SD below the mean (100) a quotient of <70, which shows a significant impairment or severe delay. Using quotients is meaningful as data is corrected for age and it is likened to IQ scores, with a mean=100 and a standard deviation of 15 or 16. Participants who scored more than the highest quotient score attainable in a certain age band in the GMDS-ER manual, had their scores converted to a score without the "more than sign" for data analysis purposes (i.e. a score of >104.9 was converted to 104.9). This was done instead of the score being removed from the data analysis completely, which would skew the data results.

The two groups mean quotient scores were compared at baseline, 5 months (mid test) and at 10 months (post test) to detect changes in the dependent variables after the intervention.

4.10.1. Between group differences for Language (subscale C)

In Figure 18 the progression of the groups' mean standard scores at each of the three time points is presented.

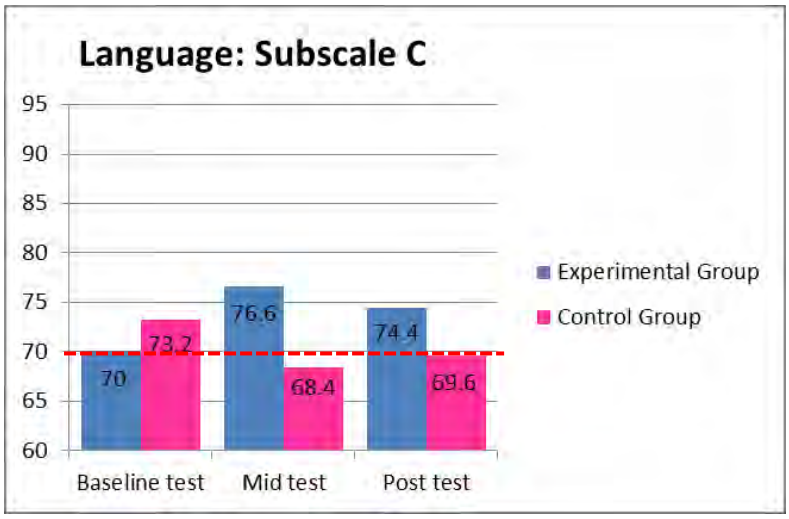

Figure 18: Experimental (n=11) and Control (n=12) groups Language (subscale C) Mean Quotient scores at baseline, mid and post test periods.

Table 23 shows no statistical significance between the two groups at baseline, mid and post test for language, with the p>.05.

Table 23: Between-group for the Experimental and Control groups for baseline, mid and post test periods for Language (subscale C).

					2-sample t-test			
Assessment	**Group**	**Test**	***Mean***	***SD***	***t***	***Diff***	***p-value***	***(95% CI)***
Language: Subscale C	Experimental (n=11)	Baseline	70.0	10.27	0.73	21	0.474	-12.3 – 5.9
	Control (n=12)		73.2	10.75				
	Experimental (n=11)	Mid	76.6	10.18	1.69	21	0.106	-1.9 – 18.4
	Control (n=12)		68.4	12.90				
	Experimental (n=11)	Post	74.4	7.71	1.26	21	0.222	-3.1 – 12.7
	Control (n=12)		69.6	10.17				

4.10.3. Between group differences for Eye hand co-ordination (subscale D)

In Figure 19 the progression of the groups' mean standard scores at each of the three time points is presented.

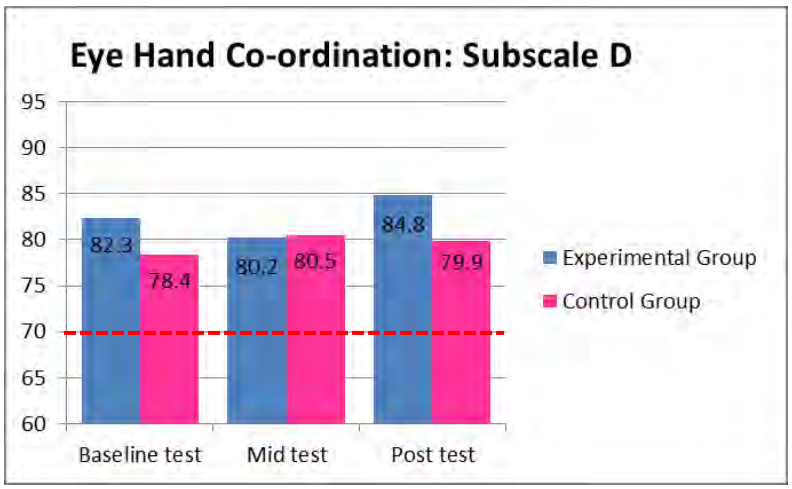

Figure 19: Experimental (n=11) and Control (n=12) groups Mean Eye hand co-ordination (subscale D) Quotient scores at baseline, mid and post test periods.

Table 24 shows that there is no statistical significance between the two groups at baseline, mid and post test periods for eye hand co-ordination, with p>.05.

Table 24: Between-group differences for the Experimental and Control groups for baseline, mid and post test periods for Eye hand co-ordination (subscale D).

					2-sample t-test			
Assessment	**Group**	**Test**	***Mean***	***SD***	***t***	***Diff***	***p-value***	***(95% CI)***
Eye hand co-ordination: Subscale D	Experimental (n=11)	Baseline	82.3	15.74	0.68	21	0 .503	-8.0 – 15.8
	Control (n=12)		78.4	11.53				
	Experimental (n=11)	Mid	80.2	8.22	0.03	21	0.978	-11.7 – 11.4
	Control (n=12)		80.5	16.63				
	Experimental (=11)	Post	84.8	7.71	0.03	21	0.417	-7.1 – 16.5
	Control (n=12)		79.9	10.17				

4.10.5. Between group differences for Performance (subscale E)

In Figure 20 the progression of the groups' mean standard scores at each of the three time points is presented.

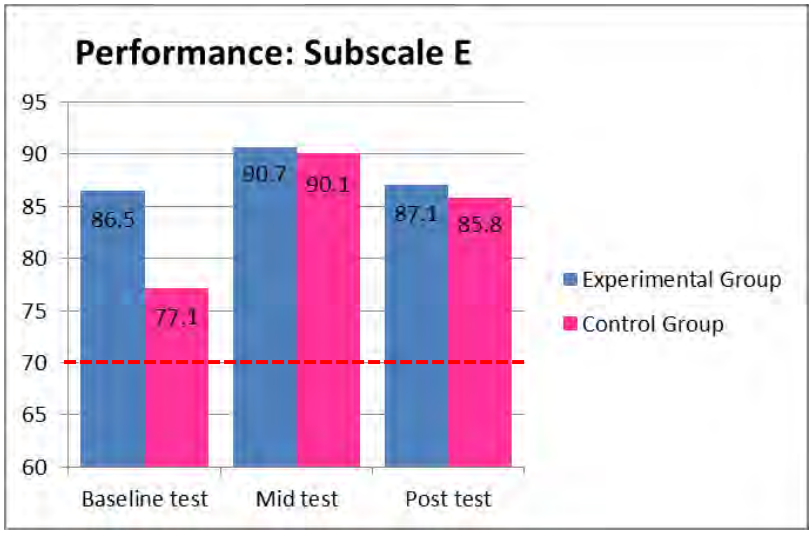

Figure 20: Experimental (n=11) and Control (n=12) groups mean Performance subscale E) Quotient scores at baseline, mid and post test periods.

Table 25 shows no statistical significance between the two groups for performance at baseline, mid and post test, with the p>.05.

Table 25: Between-group differences for the Experimental and Control groups for baseline, mid and post test periods for Performance (subscale E).

					2-sample t-test			
Assessment	**Group**	**Test**	***Mean***	***SD***	***t***	***Diff***	***p-value***	***(95% CI)***
Performance: Subscale E	Experimental (n=11) Control(n=12)	Baseline	86.5 77.1	23.10 21.84	1.00	21	0.328	-10.1 – 28.9
	Experimental (n=11) Control (n=12)	Mid	90.7 90.1	21.23 19.95	0.08	21	0.939	-17.9 – 18.5
	Experimental (n=11) Control (n=12)	Post	87.1 85.8	18.97 17.86	0.15	21	0.881	-14.8 – 17.1

4.10.7. Between-group differences for Practical reasoning: Subscale F

In Figure 21 the progression of the groups' mean standard scores at each of the three time points is presented.

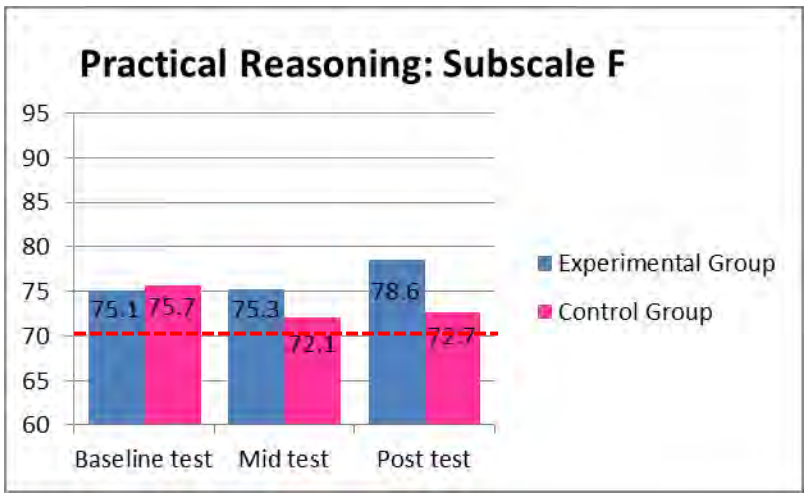

Figure 21: Experimental (n=11) and Control (n=12) groups Mean Practical reasoning (subscale F) Quotient scores at baseline, mid and post test periods.

Table 26 shows no statistical significance between the two groups at baseline, mid and post test in practical reasoning, with the p>.05.

Table 26: Between-group differences for the Experimental and Control groups for baseline, mid and post test periods for Practical reasoning (subscale F).

					2-sample t-test			
Assessment	**Group**	**Test**	***Mean***	***SD***	***t***	***Diff***	***p-value***	***(95% CI)***
Practical reasoning: Subscale F	Experimental (n=11) Control (n=12)	Baseline	75.1 75.7	10.11 8.36	0.16	21	0.873	-8.6 – 7.4
	Experimental (n=11) Control (n=12)	Mid	75.3 72.1	7.05 10.64	0.83	21	0.414	-4.7 – 11.1
	Experimental (n=11) Control (n=12)	Post	78.6 72.7	11.77 11.49	0.24	21	0.237	-4.2 – 16.0

4.10.8. Between-group differences for Mean General Quotient scores (GQ)

In Figure 22 the progression of the groups' mean standard scores at each of the three time points is presented.

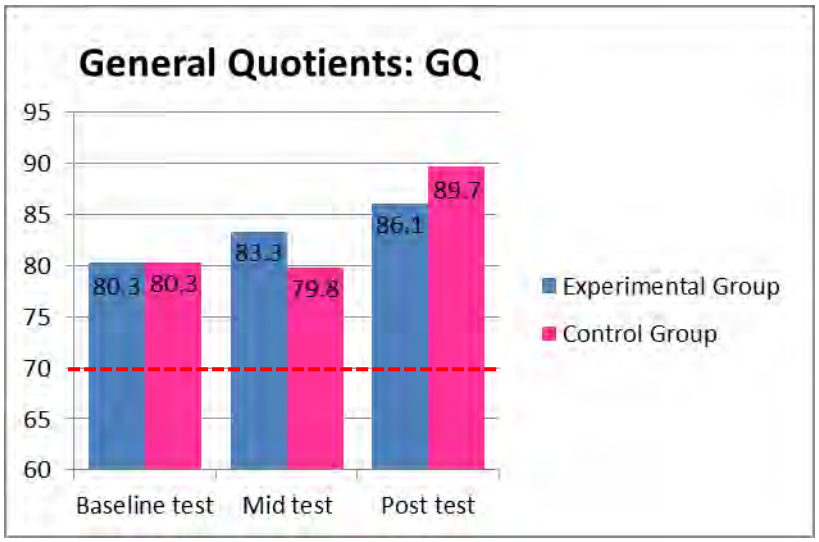

Figure 22: Experimental (n=10) and Control (n=12) groups mean General quotients (GQ) scores at baseline, mid and post test periods. **Incomplete scoring in subscale B for one child in the experimental group.*

Table 27 shows no statistical significance between the two groups at baseline, mid and post test for the general quotient, with the p>.05.

Table 27: Between-group differences for the Experimental and Control groups for baseline, mid and post test periods for general quotients (GQ).

					2-sample t-test			
Assessment	**Group**	**Test**	***Mean***	***SD***	***t***	***Diff***	***p-value***	***(95% CI)***
General quotient: GQ	Experimental (n=11)	Baseline	80.3	9.76	0.68	21	0.994	-9.1 – 9.2
	Control (n=12)		80.3	11.14				
	Experimental (n=11)	Mid	83.3	7.51	0.72	21	0.480	-6.5 – 13.4
	Control (n=12)		79.8	14.19				
	Experimental (n=10)*	Post	86.1	11.86	0.99	20	0.333	-5.9 – 16.7
	Control (n=12)		89.7	13.31				

**Missing data: One child from the experimental group*

4.11. Within-group changes language, eye hand co-ordination, performance, practical reasoning and the general quotient for the experimental and control group at certain time periods during intervention

As there were few performance component variables in which significant differences were detected at mid and post test, further analysis was conducted to examine the within group changes to gauge the effects of each intervention. Baseline and mid, mid and post, and baseline and post test data were compared using a paired t-test (or dependant t-test).

4.11.1. With-in group changes for the experimental (n=11) and control group (n=12) between baseline and mid test, for Language, Eye hand co-ordination, Performance, Practical reasoning and the General quotient

A statistically significant improvement in performance was observed for the control group (p=.027) from baseline to mid test. A decrease in other subscale scores from baseline to mid test was seen in the experimental group in eye hand co-ordination (-2), and in the control group in language (-5.8), practical reasoning (-3.6) and the general quotient (-0.5). All other subscales showed an increase in scores for both groups. These changes were not statistically significant.

Table 28: With-in group comparisons of Language, Eye hand co-ordination, Performance, Practical reasoning and the General quotient between baseline and mid test

Instrument	**Experimental group (n=11)**					**Control group (n=12)**				
Time period	Baseline	Mid	*Paired t-test*			Baseline	Mid	*Paired t-test*		
GMDS-ER	*Mean (SD)*	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*	*Mean (SD)*	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*
Language	70.0 (10.3)	76.6 (10.2)	11	10 (-2.1)	0.058	73.2 (10.7)	68.4 (12.9)	12	11 (1.7)	0.128
Eye hand co-ordination	82.2 (15.7)	80.2 (8.2)	11	10 (0.6)	0.589	78.4 (11.5)	80.3 (16.6)	12	11 (0.1)	0.912
Performance	86.5 (23.1)	90.7 (21.2)	11	10 (-0.6)	0.565	77.1 (21.8)	90.0 (19.9)	12	11 (-2.5)	**0.027 ***
Practical reasoning	75.1 (10.1)	75.3 (7.0)	11	10 (-0.1)	0.951	75.7 (8.4)	72.1 (10.6)	12	11 (1.3)	0.238
General quotient	80.3 (9.8)	83.3 (7.5)	11	10 (-1.3)	0.238	80.3 (11.1)	79.8 (14.2)	12	11 (0.3)	0.763

**p<0.05*

4.11.2. With-in group changes for the experimental (n=11) and control group (n=12) between mid and post test, for Language, Eye hand co-ordination, Performance, Practical reasoning and the General quotient

A decrease in scores from mid to post test was seen in the experimental group in language (-2.2), and performance (-3.7), and in the control group in eye hand co-ordination (-0.5) and performance (-4.2). An increase of scores was seen in all other subscales, in both groups, with no statistical significance.

Table 29: With-in group comparisons of Language, Eye hand co-ordination, Performance, Practical reasoning and the General quotient between mid and post test

Instrument	**Experimental group (n=11)**					**Control group (n=12)**				
Time period	Mid	Post	*Paired t-test*			Mid	Post	*Paired t-test*		
GMDS-ER	*Mean (SD)*	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*	*Mean (SD)*	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*
Language	76.6 (10.2)	74.4 (7.7)	11	10 (0.6)	0.508	68.4 (12.9)	69.6 910.2)	12	11 (-0.4)	0.716
Eye hand co-ordination	80.2 (8.2)	84.5 (12.8)	11	10 (-0.9)	0.380	80.3 (16.6)	79.8 (14.2)	12	11 (0.1)	0.912
Performance	90.7 (21.2)	87 (19.0)	11	10 (0.4)	0.680	90.0 (19.9)	85.8 (17.9)	12	11 (0.8)	0.427
Practical reasoning	75.3 (7.0)	78.6 (11.8)	11	10 (-1.0)	0.354	72.1 (10.6)	72.7 (11.5)	12	11 (-0.2)	0.817
General quotient	82.6 (7.6)	86.1 (11.9)	10	9 (-0.9)	0.238	79.8 (14.2)	80.7 (13.3)	12	11 (-0.7)	0.523

*Missing data: One child in the experimental group for general quotient, post test (n=10); *p<0.05*

4.11.3. With-in group changes for the experimental (n=11) and control group (n=12) between baseline and post test, for Language, Eye hand co-ordination, Performance, Practical reasoning and the General quotient

A decrease in scores was seen between baseline to post test in the control group for language (-3.6), practical reasoning (-3) and the general quotient (-0.5). No decrease in scores was seen for the experimental group, and all other subscales showed an improvement in scores, with no statistical significance noted.

Table 30: With-in group comparisons of Language, Eye hand co-ordination, Performance, Practical reasoning and the General quotient between baseline and post test

Instrument	**Experimental group (n=11)**					**Control group (n=12)**				
Time period	Baseline	Post	*Paired t-test*			Baseline	Post	*Paired t-test*		
GMDS-ER	*Mean (SD)*	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*	*Mean (SD)*	*Mean (SD)*	*Valid n*	*df (t)*	*p-value*
Language	70.0 (10.3)	74.4 (7.7)	11	10 (-1.3)	0.210	73.2 (10.7)	69.6 (10.2)	12	11 (1.1)	0.286
Eye hand co-ordination	82.2 (15.7)	84.5 (12.8)	11	10 (-0.5)	0.629	78.4 (11.5)	79.8 (14.2)	12	11 (-0.5)	0.650
Performance	86.5 (23.1)	87.0 (19.0)	11	10 (-0.1)	0.938	77.1 (21.8)	85.8 (17.9)	12	11 (-1.3)	0.237
Practical reasoning	75.1 (10.1)	78.6 (11.8)	11	10 (-0.8)	0.418	75.7 (8.4)	72.7 (11.5)	12	11 (1.2)	0.263
General	79.2 (9.6)	86.1	10	9 (-2.2)	0.053	80.3	79.8	12	11 (-0.3)	0.776

quotient	(11.9)	(11.1)	(14.2)			

*Missing data: One child in the experimental group for general quotient, post test (n=10); *p<0.05*

4.11.4. Changes from baseline to post test in Language, Eye hand co-ordination, Performance and Practical Reasoning subscales and the General quotient

In order to show the improvement of both groups in the academic learning outcomes of language, eye hand co-ordination, performance and practical reasoning subscale and the general quotient, each group's mean post test score was deducted from their baseline mean score. The differences are seen in the below graph (figure 23). The experimental group showed improvement in all of the subscales and in the general quotient, with the greatest improvement seen in the language subscale (4.4). The control group improved in eye hand co-ordination and performance and in the general quotient, with the greatest improvement seen in performance (8.7). A decrease in mean scores in both language and practical reasoning subscales were observed.

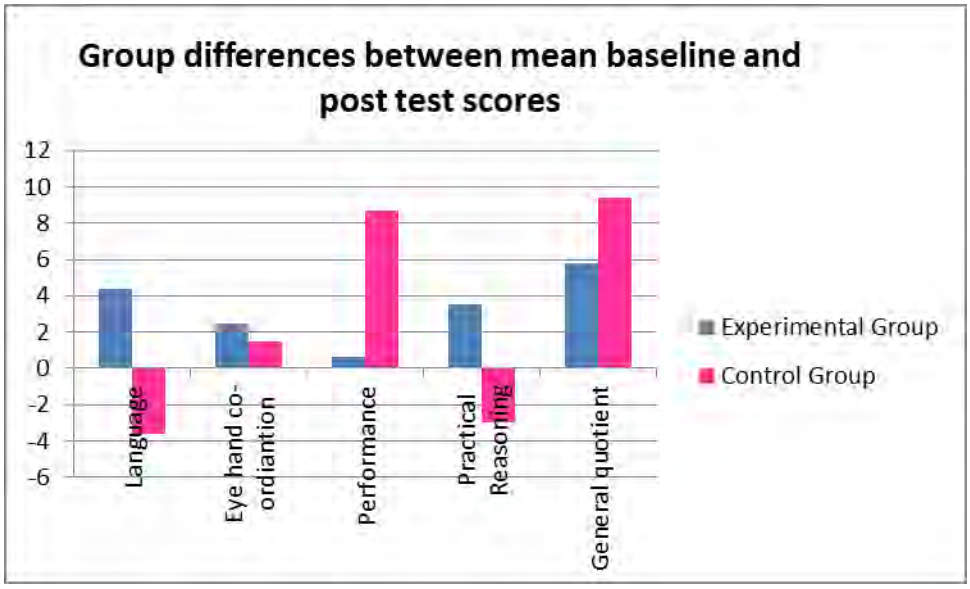

Figure 23: The differences between baseline and post test mean quotient scores for the experimental and control group for subscale C, D, E and F and general quotient.

4.12. Summary of the between-group and within-group differences seen between the experimental and control group for language, eye hand co-ordination, performance, practical reasoning and the general quotient following interventions

Between-group analysis showed statistical significance in visual motor integration between baseline and mid test (p=.019) for the experimental group. And a significant result for visual perception for the control group was seen between baseline and post test (p=.009) and between baseline and mid test (p=.001). The results from the within-group analysis showed that for the GMDS-ER a significant improvement (*p*=0.027) was noted for performance in the control group, from baseline to mid test,

with all other findings proving statistically insignificant. Within-group changes in mean quotient scores did show that group intervention may be more beneficial over a 5 month period for improving language abilities, and may be effective over a 10 month intervention period for improving eye hand co-ordination and practical reasoning. Individual intervention may be more effective in improving performance and the overall general academic learning outcomes (GQ) for HIV-infected children.

4.13. Child against child progression for Baseline and Post test for Language, Eye hand co-ordination, Performance and Practical Reasoning subscales and the General quotient

The figures below show each individual child's progression in the GMDS-ER subscales language, eye hand co-ordination, performance and practical reasoning and GQ, before and after intervention, for both groups. Scores that improved by 7 points from baseline to post test, or scores that remained the same throughout the test period are considered to be significant (correspondence with Dr. Barbara Laughton, 2015). Scores that were more than the ceiling of the manual allowed, were captured as the score without the more than sign (i.e. <104.9 was captured as 104.9).

Each participant's post test score was then deducted from their baseline test score, for language, eye hand co-ordination, performance, practical reasoning and general quotient. This enables one to see if the child improved their score from baseline to post test or if their scored decreased during this time period. This is important in order to establish which intervention was more effective in assisting HIV-infected children in the mastery of each academic learning outcome described above.

4.13.1 Individual differences in children in Language (subscale C) from baseline to post test

Figure 24 (below) shows that four children from the experimental group and three form the control group scored <70 for baseline test, a total of seven children from the total sample scored <70 at baseline, improving to six in post test. Only child 4 from the control group scored in the "average" category at baseline test. Six children from the experimental group and six children from the control group scored lower in the post test compared to the baseline test. Five children (child 3, 6, 8, 10 and 11) from the experimental group showed an improvement in their scores from baseline to post test, ranging from a 5.4 to 23.3 point improvement. And six children (child 3, 5, 6, 8, 10 and 11) from the control group improved their scores from baseline to post test, ranging from a 0.3 to 13.5 point improvement. A greater improvement in range of scores was seen in the experimental group, confirming that group intervention showed a greater improvement in language skills, compared to individual intervention.

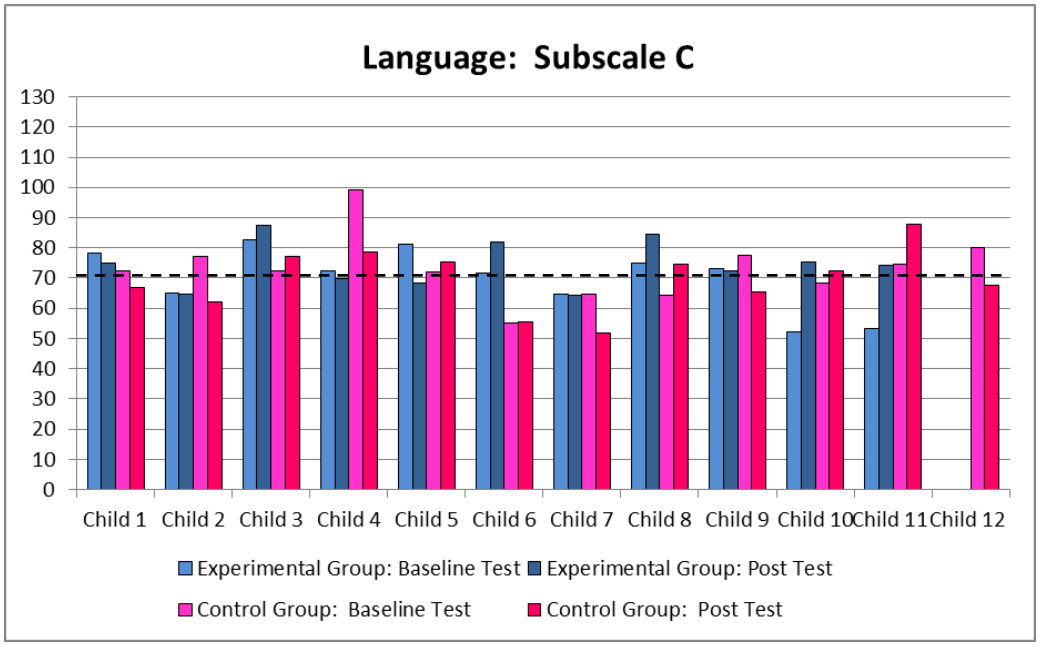

Figure 24: Individual experimental (n=11) and control (n=12) group participant's differences in the GMDS-ER language (subscale C) for baseline and post test.

4.13.2. Individual changes in Language (subscale C) quotient scores from baseline to post test

In figure 25 (below) five children from the experimental group improved their scores from baseline to post test, and 6 children from the control group improved their scores from baseline to post test. Child 10 and 11 in the experimental group showed the greatest improvement between the two groups, improving by 23.3 and 21 points respectively.

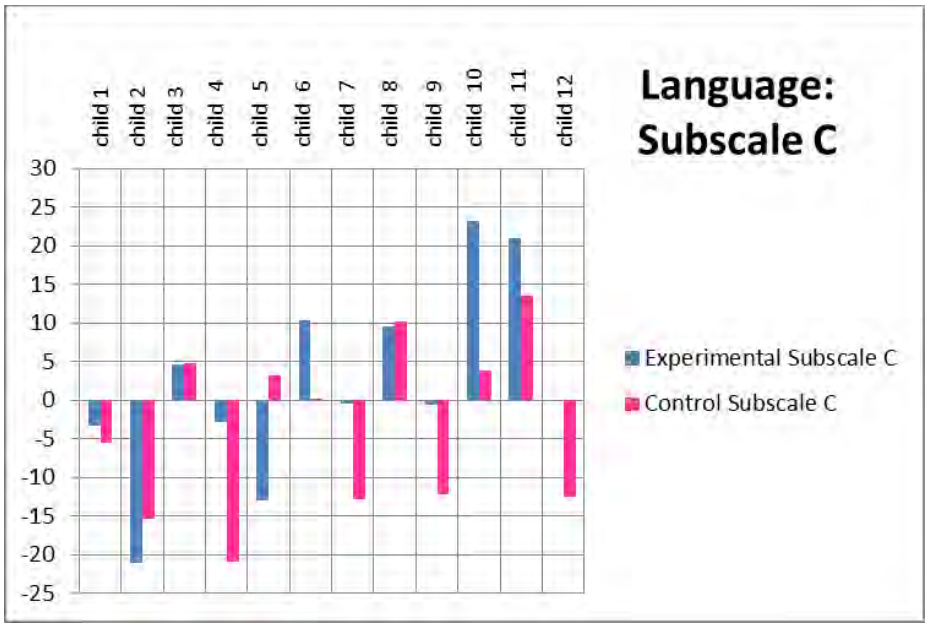

Figure 25: Changes in participants post test and baseline test for language (subscale C) quotient scores.

4.13.3. Individual differences in children in Eye hand co-ordination (subscale D) from baseline to post test

Figure 26 (below) shows that two children from the experimental group and three children from the control group scored <70 for baseline test, a total of five children from the total sample scored <70 at baseline, improving to four in post test. Five children from the experimental group and five children from the control group scored lower in the post test compared to the baseline test. Six children (child 1, 3, 5, 7, 10 and 11) from the experimental group showed an improvement in their scores from baseline to post test, ranging from a 7.2 to 22.3 point improvement. And seven children from the control group improved their scores from baseline to post test, ranging from a 3.2 to 18.8 point improvement. A greater improvement in range of scores was seen in the experimental group, confirming that group intervention showed a greater improvement in eye hand co-ordination skills, compared to individual intervention.

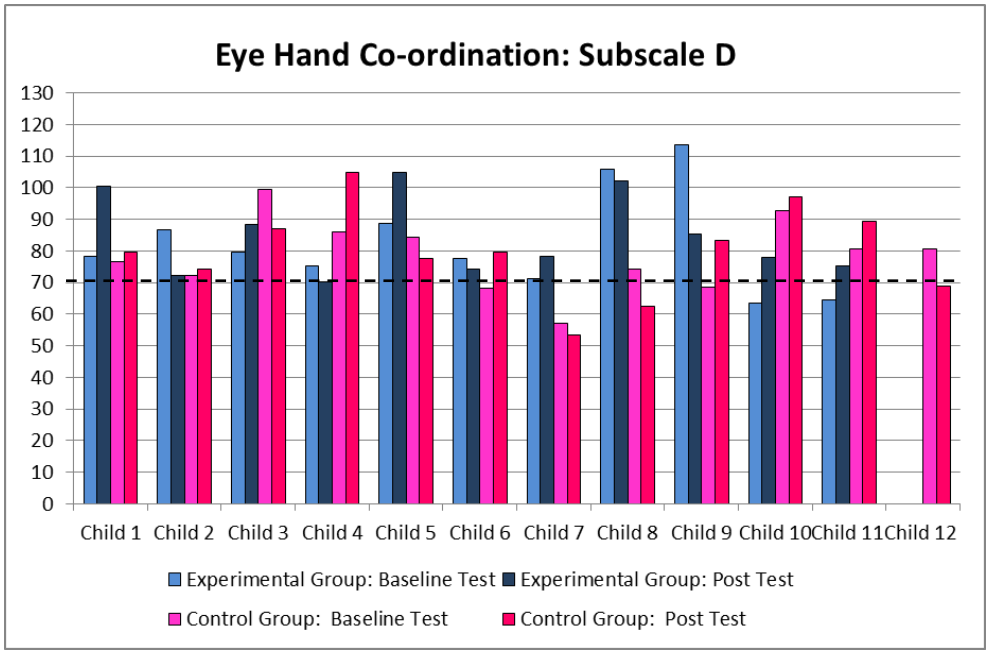

Figure 26: Individual experimental (n=11) and control (n=12) group participant's differences in the GMDS-ER eye hand co-ordination (subscale D) for baseline and post test. **Child 1, 5 & 8 from the experimental group and child 4 & 10 from the control group, scored more than (>) the manuals ceiling for their post test score.*

4.13.4. Individual changes in Eye hand co-ordination (subscale D) quotient scores from baseline to post test

Figure 27 (below) shows that six children from the experimental group and seven children from the control group improved their scores from baseline to post test. The greatest improvement in scores seen in the experimental group was child 1 (22.3) and the greatest decrease in scores in the experimental groups was seen in child 9 (-28.3).

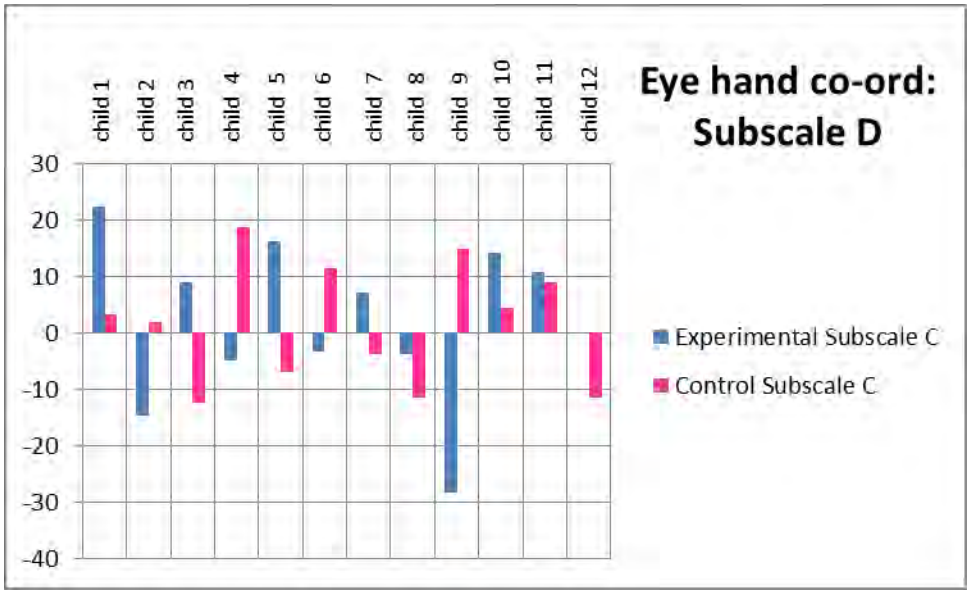

Figure 27: Changes in participants post test and baseline test subscale D Quotient scores

4.13.5. Individual differences in children in Performance (subscale E) from baseline to post test

The below figure (figure 28) illustrates child 1, 3, 4, 5 and 8 from the experimental group and child 2, 3, 4, 5, 6, 8 and 11 from the control group, all scored "average" in their post test scores. Child 4 in the control group and child 8 in the experimental group each scored in the "superior" category for their baseline assessment, but their post test scores dropped to "average". Three children from the experimental group and three children from the control group scored <70 at post test, showing that there were 6 children functioning below borderline ability after intervention had taken place. Five children (child 1, 4, 5, 10 and 11) from the experimental group improved their scores from baseline to post test, ranging from 1.7 to 38.2 point improvement. And six children (child 1, 2, 5, 6, 8 and 11) from the control group improved their scores from baseline to post test, ranging from a 16 to 42.2 point improvement. Child 5 from both groups and child 6 from the control group made significant improvements, from <70 to >90, from baseline to post test. A greater improvement in range of scores was seen in the control group, confirming that individual intervention showed a greater improvement in performance skills, compared to group intervention.

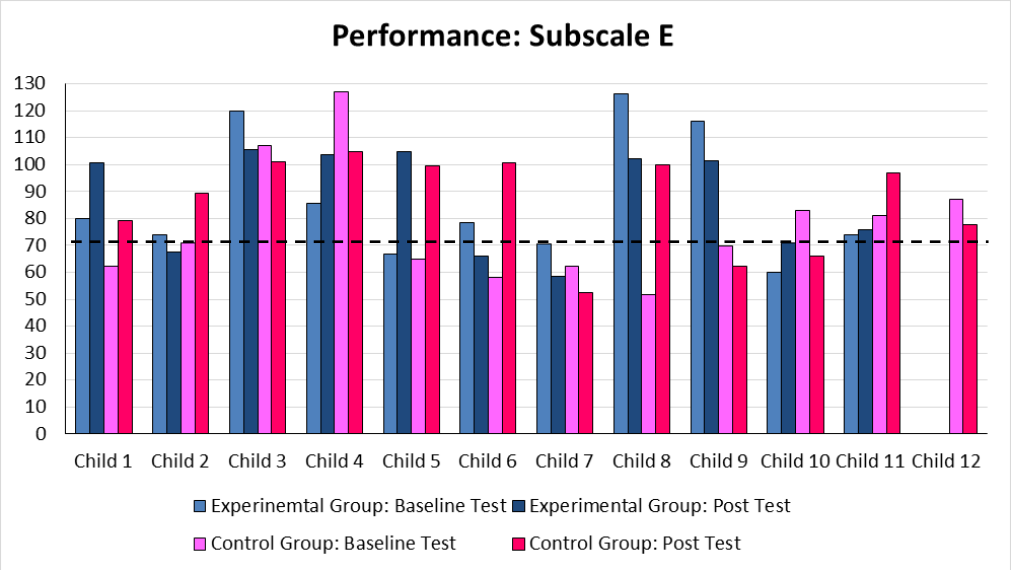

Figure 28: Individual experimental (n=11) and control (n=12) group participant's differences in the GMDS-ER performance (subscale E) for baseline and post test. **Child 1, 5 & 8 from the experimental group and child 4 & 10 from the control group, scored more than (>) the manuals ceiling for their post test scores.*

4.13.6. Individual changes in Performance (subscale E) quotient scores from baseline to post test

Figure 29 (below) shows five children from the experimental group and six children from the control group equal improving their scores from baseline to post test. The control group showed the greatest improvement in scores between baseline and post test in child 6 (42.2) and child 8 (48.1).

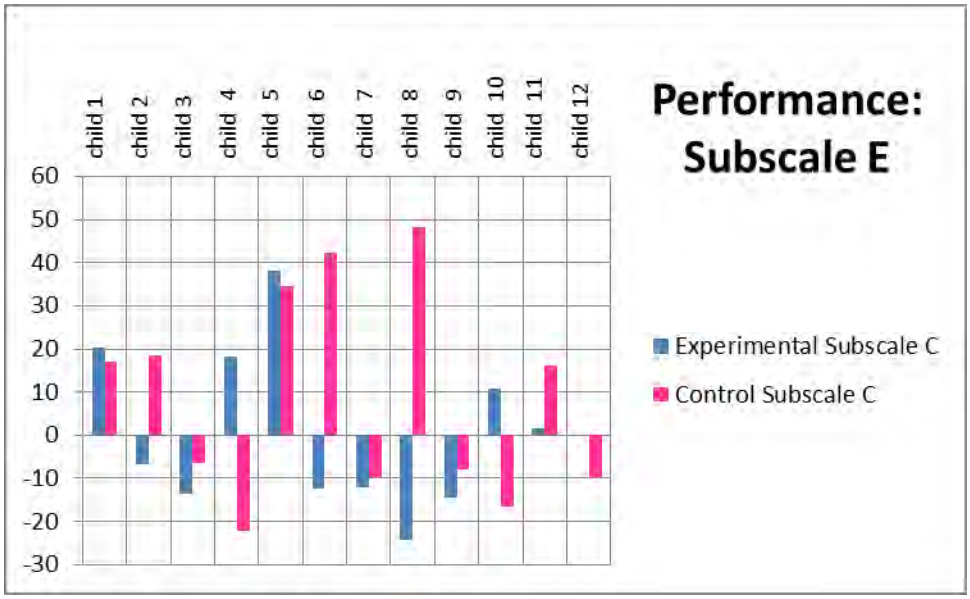

Figure 29: Changes in participants post test and baseline test subscale E Quotient scores.

4.13.7. Individual differences in children in Practical reasoning (subscale F) from baseline to post test

Figure 30 (below) illustrates that child 3 from both groups and child 12 from the control group scored in the "average" category for this subscale. Child 2, 6 and 7 from both groups scored <70 for their post test, as well as child 11 from the experimental group and child 1 and 10 from the control group, a total of 9 children scoring below functional ability after intervention. Six children (child 1, 3, 5, 9, 10 and 11) from the experimental group improved their scores from baseline to post test, ranging from a 0.9 to 33.8 point improvement. And only three children (child 3, 4 and 5) from the control group improved their scores from baseline to post test, ranging from a 3 to 19 point improvement.

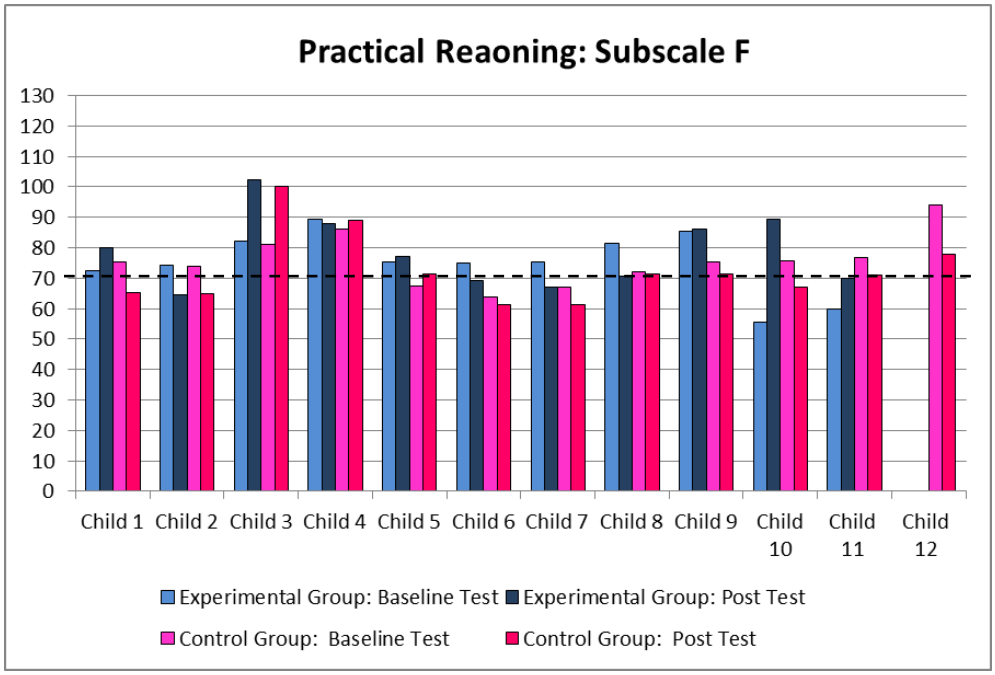

Figure 30: Individual experimental (n=11) and control (n=12) group participant's differences in the GMDS-ER practical reasoning (subscale F) for baseline and post test.

4.13.8. Individual changes in Practical reasoning (subscale F) quotient scores from baseline to post test

Figure 31 (below) that the majority of the children in the control group attained lower scores in their post test compared to their baseline test, with only three children in the control group improving their scores from baseline to post test. The experimental group showed an improvement in six children from baseline to post test. Child 10 in the experimental group showed the greatest improvement, by increasing score results by 33.8 points from baseline to post test.

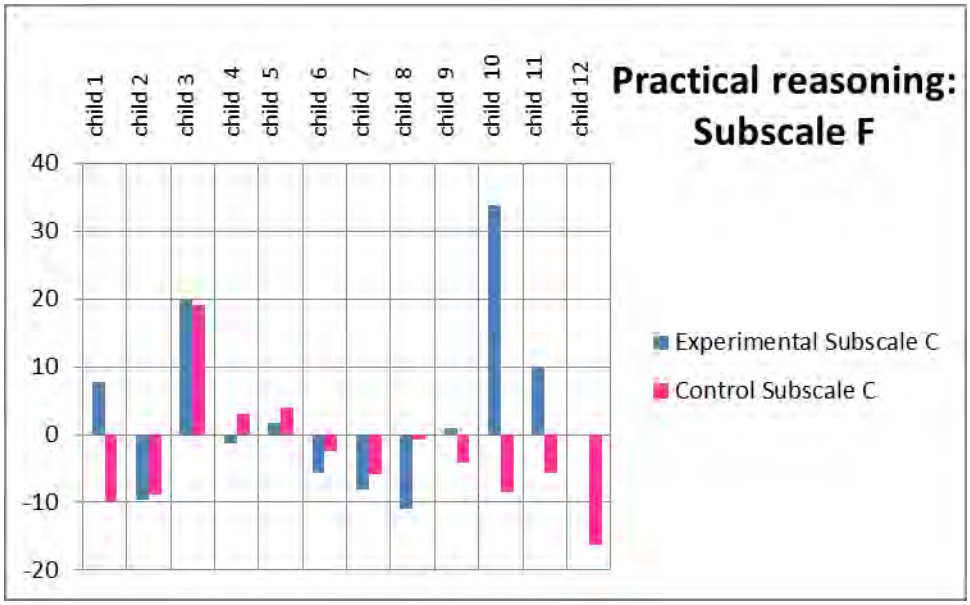

Figure 31: Changes in participant's post test and baseline test for Practical reasoning (subscale F) Quotient scores.

4.13.9. Individual differences in children in General Quotient (GQ) from baseline to post test

Figure 32 (below) shows that child 3 and 8 from the experimental group and child 4 from the control group scored in the "average" category for post test. Three children from the total sample scored <70 at baseline test but only child 7 from the control group scored <70 at post test, showing that this child's overall academic learning ability was below borderline ability after intervention. Seven children from the experimental group (child 1, 3, 4, 5, 8, 10 and 11) improved their scores from baseline to post test, ranging from a 5.6 to 23.5 point improvement. Six children from the control group (child 3, 5, 6, 8, 10 and 11) improved their scores from baseline to post test, ranging from a 1.6 to 6 point improvement.

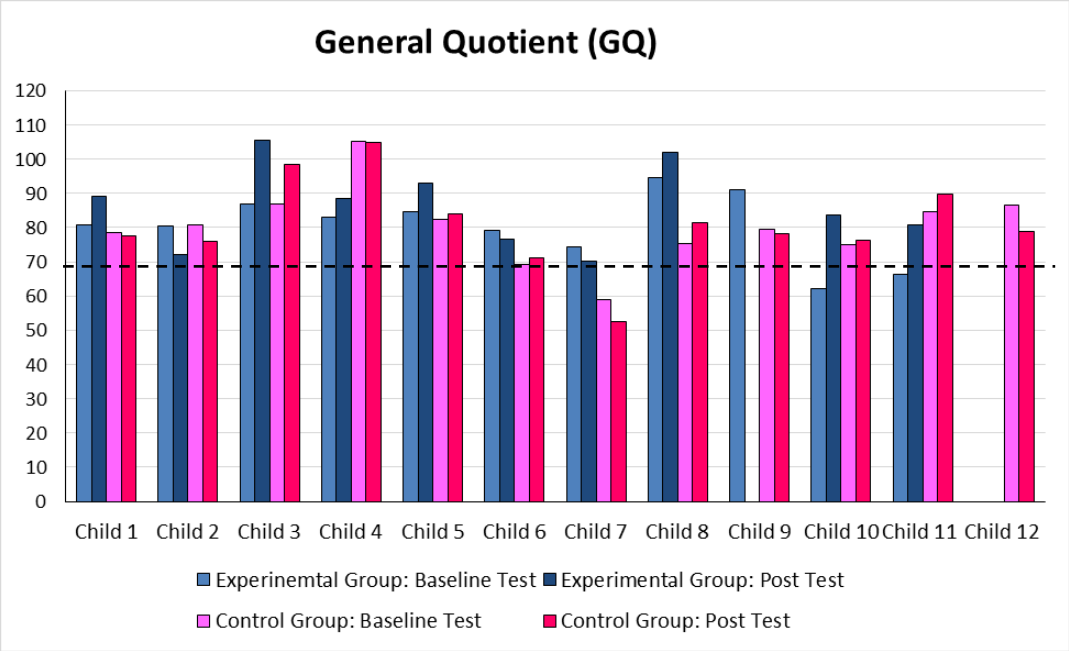

Figure 32: Individual experimental (n=11) and control (n=12) group participant's differences in the GMDS-ER general quotient (GQ) for baseline and post test. **Missing data: Child 9, experimental group.*

4.13.11. Individual changes in General quotient (GQ) scores from baseline to post test

Figure 33 (below) shows a 50% improvement in scores in the control group (6), and a 63.6% increase in scores seen in the experimental group (7) from baseline to post test in general quotients. The greatest improvements from baseline to post test in the total sample were seen in the experimental group in child 3, 10 and 11.

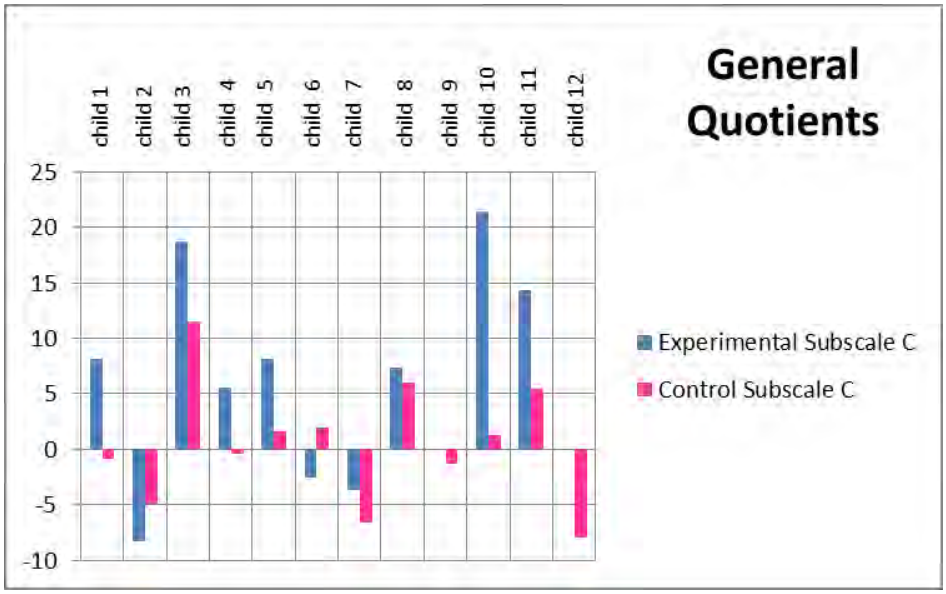

Figure 33: Changes in participants post test and baseline test genera quotient (GQ) scores.
**Missing data: Child 9 in the experimental group*

4.14. Z-scores for Language, Eye hand co-ordination, Performance, Practical reasoning and the General quotient

According to the GMDS-ER manual (Luiz, et al, 2006) a z score <-2 SD is classified as severely delayed, showing a level of performance below the normal functioning limit. Table 31 (below) shows the extent of delay in each group and how it changed throughout the three test periods. The control group had either an equal number to the experimental group or a higher number of children scoring a z score <-2, in all subscales at all three test periods. Changes in the number of chidren experiencing severe delay (a z score <-2) from baseline to post test are reflected in Table 31 below.

Table 31: Number and percentage of children in the Experimental Group (n=11) and Control Group (n=12) with z-scores <-2 for baseline, mid and post test.

Subscales	**Baseline test**		**Mid test**		**Post test**	
	Exp. Group (n=11)	Cont. Group (n=12)	Exp .Group (n=11)	Cont. Group (n=12)	Exp. Group (n=11)	Cont. Group (n=12)
	Number of children with z-scores <−2 (%)		Number of children with z-scores <−2 (%)		Number of children with z-scores <−2 (%)	
Language: Subscale C	8 (72.7%)	8 (66.7%)	4 (36.4%)	8 (66.7%)	6 (54.5%)	6 (50.0%)
Eye hand co-ordination: Subscale D	6 (54.5%)	6 (50.0%)	4 (36.4%)	5 (41.7%)	1 (9.1%)	3 (25.5%)
Performance: Subscale E	2 (18.2%)	5 (41.7%)	0 (0.0%)	2 (16.7%)	1 (9.1%)	2 (16.7%)
Practical Reasoning: Subscale F	8 (72.2%)	10 (83.3%)	8 (72.2%)	9 (75.0%)	6 (54.5%)	9 (75.0%)
General Quotient: GQ	7 (63.6%)*	8 (66.7%)	4 (36.3%)	7 (58.3%)	3 (30.0%)	5(41.7%)

*<-2 (delayed) and > and equal –2 (not delayed)*N=10 for GQ for post test for experimental group*

4.15. Correlations between measures

Pearson product-moment correlation (Pearson's correlation) was run on the total sample to determine the relationship between three sets of performance components that assess similar abilities, in order to determine if there was a significant relationship between the two. These were visual motor integration and eye hand co-ordination, language and practical reasoning and visual perception and performance. The data showed no violation of normality, linearity or homoscedasticity in all three correlations seen in Table 32.

Table 32: Pearsons Correlation for the total sample (n=26) for the language, eye hand co-ordination, performance and practical reasoning subscale, and the general quotients

Performance component	**Mean**	**SD**	**n**	**Pearson's Correlation**	**Sig. (2-tailed)**
Visual Motor Integration *	85.5714	10.11223	21	.114	.623

Eye Hand Co-ordination	82.0391	13.45500	23		
Language	71.8652	9.20388	23	**.536****	**.008**
Practical Reasoning	75.5087	11.75097	23		
Visual Perception	92.2174	16.03393	23	.314	.145
Performance	86.3739	17.98288	23		

**Missing data: Two children, VMI post test, the experimental group*

***Correlation is significant at the 0.01 level (2-tailed).*

4.15.1. Visual Motor Integration and Eye Hand Co-ordination (subscale D)

There was a positive correlation between visual motor integration and eye hand co-ordination, but the findings were statistically insignificant (r = .114, n = 21, p > .05). Even though the results are statistically insignificant, the positive correlation seen shows that when one variable increases in number the other variable will as well. This implies that when visual motor integration scores increase or decrease, eye hand co-ordination scores will increase or decrease respectively, showing a positive relationship between these two constructs.

4.15.2. Language (subscale C) and Practical Reasoning (subscale F)

There was a positive correlation between language and practical reasoning, which was statistically significant (r = **.536**, n = 23, p < .05). This means that there is a positive correlation between the two variables, and that they are significantly related to each other. When language increases or decreases, practical reasoning will increase or decrease respectively.

4.15.3. Visual Perception and Performance (subscale E)

Similar to the other two correlations, there was a positive correlation between visual perception and performance (subscale E), but the findings were statistically insignificant (r = .145, n = 23, p > .05). Even though the results are statistically insignificant, the positive correlation seen shows that when one variable increases in number the other variable will as well. This implies that when visual perceptual scores increase or decrease, performance scores will increase or decrease respectively, showing a positive relationship between these two constructs.

4.15.4. Summary of the Correlations

The Pearson co-efficient was used to determine if there was a correlation between the above performance components linked to academic learning. The correlation co-efficient was positive between all correlations, with a significant correlation (p=.008) seen between language and practical reasoning. This implies that there is a significant relationship between practical reasoning and language. And that when language increases or decreases, practical reasoning will follow the same pattern.

4.16. The relationship between Language and Practical Reasoning

Throughout this study language and practical reasoning were found to generally be the lowest scoring subscales in both groups, throughout all three test periods, compared to eye hand co-ordination, and performance. With the Pearsons correlations showing a statistically significant (*p*=.008) relationship between language and practical reasoning, further analysis was run to determine the relationship between quotient scores in language and practical reasoning. The ANCOVA was therefore employed to determine whether either of the two independent variables or their interactions was statistically significant. The results are shown in the Tests of Between-Subjects Effects, Table 33. ANCOVA tests the null hypothesis, and showed that the error variance of the dependent variable practical reasoning was equal across groups.

Table 33: Test of Between-Subjects Effects for Language and Practical reasoning Mean quotients for the Total sample.

Source	Type III SS	df	MS	F	Sig.
Corrected Model (Practical reasoning)	3061.297b	19	161.121	1.354	0.509
Intercept	259491.585	1	259491.585	2180.986	0.000
Language	3061.297	19	161.121	**1.354**	**0.509**
Error	237.958	2	118.979		
Total	284724.797	22			
Corrected Total	3299.255	21			

**Missing data: For one child (N=22); R Squared = .928 (Adjusted R Squared = .243)*

In Table 34 the F-score (1.35) shows that language quotient scores positively effect practical reasoning quotient scores. The significant p-value (*p*=.509) shows that language was not a statistically significant predictor of scores on practical reasoning (*p*=.509). Even though there was no statistically significant relationship between language and practical reasoning, a covariant needed to be identified to account for the association between these two variables. Possible cofounding variables, home language and CG level of education, were therefore added to the analysis. Table 39 (below) showed that by adding these covariables, the error was reduced from 118.979 (Table 38) to 43.549, but that the *p*-value was still not statistically significant (*p*=.388).

Table 34: Tests of Between-Subjects Effects with covariables (first home language and level of CG education)

Source	Type III Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Corrected Model (Practical reasoning)	3255.706b	20	162.785	3.738	0.389
Intercept	3487.553	1	3487.553	80.084	0.071
First Home Language	0.000	0			

Level of CG education	194.409	1	194.409	4.464	0.281
Language	2944.734	18	163.596	3.757	**0.388**
Error	43.549	1	43.549		
Total	284724.797	22			
Corrected Total	3299.255	21			

R Squared = .987 (Adjusted R Squared = .723)

4.17. The relationship between Home language and School language on Language and Practical reasoning mean quotient scores in the Total sample

The following analysis looked at the difference between language and practical reasoning for those that spoke the same language at home and at school and those that spoke a different language at home and school (Table 36). The majority of children (n=19; 82.6 %) spoke same language at home and at school, with the minority (n=4; 17.4 %) speaking a different language at home and school. Among children who speak the same language at home and at school, the mean difference between language and practical reasoning was negative, at less than 0 during the test periods (-4.47; -2.3). The null hypothesis was rejected, meaning that language had a negative effect on practical reasoning. This does not however take into consideration which group they belonged to. The results are only statistically significant at 5% level during the baseline test (*p*=**.007*),** and not during post test. This means that language had a significantly negative effect on childrens practical reasoning scores before intervention and a negative effect after the 10 month intervention period had taken place.

Table 35: Paired t-test **same** language spoken at home (n=19) and at school and language (subscale C) and practical reasoning (subscale F) mean quotients.

	Baseline test (n=19)			**Post test (n=19)**		
Variable	Mean	Std. Err.	Std. Dev.	Mean	Std. Err.	Std. Dev.
Language: Subscale C	70.16	2.47	10.77	71.72	2.10	9.16
Practical reasoning: Subscale F	74.63	2.18	9.53	74.02	2.45	10.68
Mean (diff)	-4.47	1.64	7.15	-2.3	2.45	10.70
	t = -2.7; Pr(T < t) = 0.007*			t = -0.93; Pr(T < t) = 0.1808		

Mean (diff) = mean (Cquot - Fquot)

Among children who spoke a different language at home and at school, Table 36, the mean difference between language and practical reasoning was negative, less than 0 during baseline and post test periods. The null hypothesis was rejected, meaning that language had a negative effect on practical reasoning during baseline (-0.50) and post test (-10.03) periods. Statistical significance was noted at post test (*p*=.**017***)**.** These results have been interpreted with caution, bearing in mind the small number (N=4) of children who spoke a different language at home and at school. This implies

that speaking a different language at home and school has a negative effect on practical reasoning, before intervention and a significant negative effect after intervention.

Table 36: Paired t-test for a **different** language spoken at home and at school (n=4) and language (subscale C) and practical reasoning (subscale F) mean quotient (practical reasoning)

	Baseline test 1 (n=4)			**Post test (n=4)**		
Variable	Mean	Std. Err.	Std. Dev.	Mean	Std. Err.	Std. Dev.
Language: Subscale C	78.63	2.18	4.35	72.55	5.40	10.80
Practical reasoning: Subscale F	79.13	2.74	5.48	82.58	7.86	15.72
Mean (diff)	-0.50	4.05	8.09	-10.03	2.72	5.44
	t = -0.12; Pr(T < t) = 0.454			t = -3.6; Pr(T < t) = 0.0173*		

4.18. Summary of the changes seen between the experimental and control group for the Language, Eye hand co-ordination, Performance and Practical Reasoning subscales following intervention

The findings between the two groups mean quotient scores made it appear that group intervention (PICHIBI) may be more effective in improving visual motor integration and language over a 5 month intervention period, and in improving scores in eye hand co-ordination and practical reasoning over a 10 month period in this sample. Individual one-on-one intervention seemed to be more effective in improving visual perceptual, motor co-ordination and performance scores over a 5 month period, and in improving the overall or general quotient (GQ) scores over a 10 month period. It should be noted that these findings were not statistically significant, and were merely observed findings.

Within-group analysis saw that PICHIBI was significantly beneficial (p=.019) in improving scores in visual motor integration over a 5 month intervention period, from baseline to mid test. Individual intervention proved significantly effective in improving scores of visual perception over a 5 month (p=.001; baseline to mid test) and over a 10 month (p=.009; baseline to post test) intervention period, and in improving performance scores over a 5 month period from baseline to mid test (p=.027).

Looking at the total sample (n=23), an improvement in all the GMDS-ER subscales quotient scores from baseline to post test was seen, with language, performance and practical reasoning subscales remaining in the same classification category between interventions, and only the eye hand co-ordination subscale positively shifting categories. The language subscale was the weakest academic learning skill for the sample, in both baseline and post test, with a mean score improvement of 0.1 during the intervention period.

4.19. Individual attendance of sessions

Table 37 shows how many sessions were attended by each child for the experimental and control group during the intervention period. None of the 23 children attended all 10 sessions, whether in the experimental or control group. A total of 41 sessions were attended by the experimental group and 57 sessions from the control group. The control group therefore had a higher attendance rate compared to the experimental group. One would assume then that the control group would score higher than the experimental group in the Beery VMI and the GMDS-ER, as they received more therapy time than the experimental group.

Table 37: Participant attendance of interventions for experimental (n=11) and control (n=12) group

Session number	Experimental Group (n=11)	Control Group (n=12)
	No. (%)	No. (%)
1	6 (54.5)	10 (83.3)
2	7 (63.6)	9 (75.0)
3	6 (54.5)	6 (50.0)
4	6 (54.5)	2 (16.6)
5	3 (27.3)	4 (33.3)
Baseline to mid test total attendance	**28**	**31**
6	1 (9.1)	5 (41.6)
7	4 (36.4)	5 (41.6)
8	3 (27.3)	6 (50.0)
9	2 (18.2)	5 (41.6)
10	3 (27.3)	5 (41.6)
Mid to post test total attendance	**13**	**26**
Total attendance	**41**	**57**

Twenty eight sessions were attended in the first 5 months of intervention (baseline to mid test) for the experimental group, and 31 sessions were attended for the control group. Only 13 sessions were attended in the last 5 months (mid to post test) of intervention by the experimental group, and 26 sessions were attended by the control group. The average attendance for the experimental group was 3.8 (4 sessions) and 4.8 (5 sessions) for the control group, a higher average compared to the experimental group. More sessions were attended within the first 5 months of intervention compared to the last 5 months of intervention for the experimental and control group.

Table 38 shows the session attendance rate of each child in the experimental group and the control group. Child 7 from the experimental group attended 80% of sessions and child 3 and 12 from the control group attended 70% of the sessions. However this child's session attendance did not seem to have a greater positive impact on scores compared to those children that attended less than 8 sessions.

Table 38: Individual participant attendance rate for experimental (n=11) and control (n=12) group

Child	Total amount of sessions attended	
	Experimental group (n=11) No. (%)	Control group (n=12) No. (%)
Child 1	6 (60.0)	3 (30.0)
Child 2	2 (20.0)	5 (50.0)
Child 3	1 (10.0)	7 (70.0)
Child 4	2 (20.0)	6 (60.0)
Child 5	4 (40.0)	1 (10.0)
Child 6	6 (60.0)	5 (50.0)
Child 7	8 (80.0)	6 (60.0)
Child 8	3 (30.0)	6 (60.0)
Child 9	6 (60.0)	5 (50.0)
Child 10	2 (20.0)	5 (50.0)
Child 11	2 (20.0)	1 (10.0)
Child 12		7 (70.0)

4.20. Viral load effect on baseline to post test General Quotient scores

Table 39 shows the number of subtests (VMI, VP and MC) and subscales (language, eye hand co-ordination, performance and practical reasoning) each child progressed in from baseline to post test, as well as the increase or decrease in their general quotient scores. An improvement in scores was classified as a baseline score remaining the same or improving over the 10 month intervention period. The positive symbol (+) shows an improvement in scores from baseline to post test, and a negative symbol (-) shows a decrease in score. The children highlighted in grey are those that had a VL <40. Child 5 and 8 from the experimental group, and child 3, 8 and 9 from the control group, all of which had a VL >40, all showed a similar improvements compared to others in the total sample (N=23). Three children from the experimental group (27.3%) and five children from the control group (41.7%) showed a digression in their general quotient scores, even though their baseline viral load levels were either <40 or LDL. Only one child from the control group who had a VL >40 showed a decrease in GQ, the rest all showed an improvement.

Table 39: The total number of subtests and subscales each child improved in, including the increase or decrease in score from baseline to post test for General quotient scores.

Child	Experimental Group (=11)		Control Group (=12)	
	Total no. of subtests and subscales improvement was seen in	Increase or decrease of General quotient score	Total no. of subtests and subscales improvement was seen in	Increase or decrease of General quotient score
1	4	+	4	-
2	3	-	5	-
3	6	+	4	+
4	4	+	5	+
5	5*	+	5	+
6	2	-	5	+
7	4	-	3	-
8	4*	+	5	+
9	3*	/	4	-
10	**7**	+	3**	+
11	**7**	+	5	+
12			3	-

*Missing data:*Experimental group: child 5 and 8 had missing VMI scores; child 9 subscale B therefore GQ could not be calculated**Control group: child 10's VMI and VP subtest*

4.20.1. ANCOVA

Analysis of Covariance (ANCOVA) was used to control for factors which cannot be randomized but which can be measured on an interval scale. In this model below (Table 40) it was asked whether viral load affects a child's general quotient score (GQ) or not. Several selected continuous variables such as gestation, main caregiver, gender, level of education, language spoken at school and therapy received were used in this analysis. The explanatory power of the model was 80.8% (R-squared), and this increased as more covariates or confounding factors were added to the model. The "Corrected Model" statistics that reflect the overall between-group variability is not significant at 5% or at 10% level. The probability of observing an F Value as large as, or larger, than 0.46 under the null hypothesis is >0.01 (not significant). The null hypothesis was therefore not rejected and a conclusion was made that the model does not explain a statistically significant proportion of the variance in general quotient scores in relation to a child's VL. This implies that in the presence of other factors, VL may not explain variation in the general quotient scores during the test periods. This is explained by the fact that level of education (a confounding factor) is significant (p=.099*), and explains the variation in total scores.

Table 40: General quotient and Viral Loads (VL) for Total sample (n=21)

Source	Partial	SS	df	Mean Square	Prob>F
Model (Total GQ)	1 836.93	16	114.81	1.31	0.4103
Viral load	262.47	3	87.49	1	0.4652
Gestation	609.99	7	87.14	1	0.521
Main CG	309.01	1	309.01	3.53	0.1191

Gender	293.14	1	293.14	3.35	0.1268
Level of education	357.99	1	357.99	4.09	**0.0991***
School language	256.56	2	128.28	1.46	0.3157
Therapy	36.41	1	36.41	0.42	0.5475
Residual	437.85	5	87.57		
Total	2 274.78	21i	108.32		

R-squared=0.080 **Missing data: Two missing VL from the total sample (N=21)*

4.21. Grade Progression

The third objective of the study was to track successful grade progression, making comparisons of successful grade progression between HIV positive children on HAART aged 5-8 years receiving conventional occupational therapy intervention and HIV positive children on HAART aged 5-8 years taking part in a play informed caregiver-implemented home-based intervention. In some cases children would have progressed or repeated between baseline and mid test, and others between mid test and post test, depending on how their assessment dates aligned with their school year[5]. Thus successful grade progression would be represented as one increment increase on the bar graph.

4.21.1 Progression of Level of education of participants in both groups, during all three test periods

Table 41 explains the coding for figure 33 and figure 34 below.

Table 41: Key explaining the coding of figures 34 and 35.

Level of Education	Code
Crèche	1
Grade R	2
Grade 1	3
Grade 2	4
Grade 3	5

One can see from figure 35 (below) that child 1 from the control group repeated grade 1, but that no children from the experimental group repeated a grade over the intervention period.

[5] A South African academic school year starts in the middle of January and ends that same year in the first half of December.

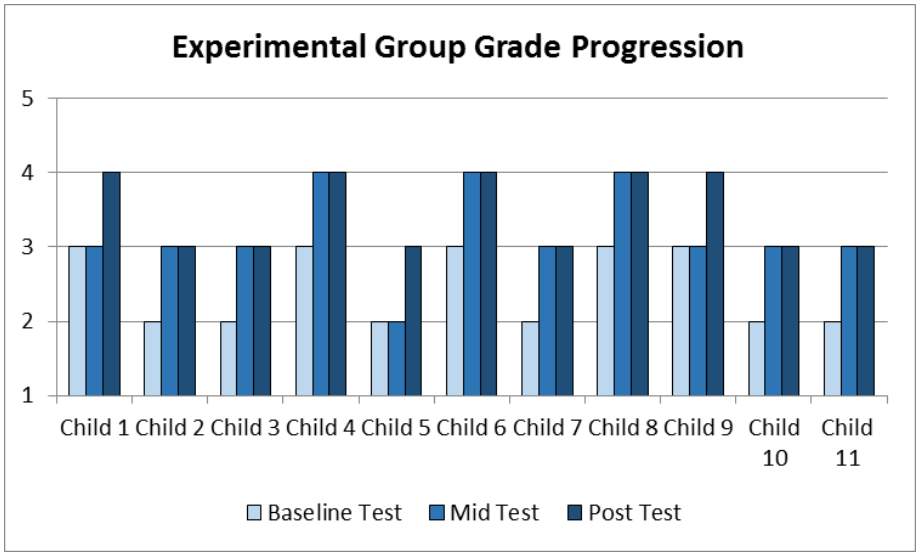

Figure 34: Grade progression of each child in the experimental group (n=11) from baseline to post test.

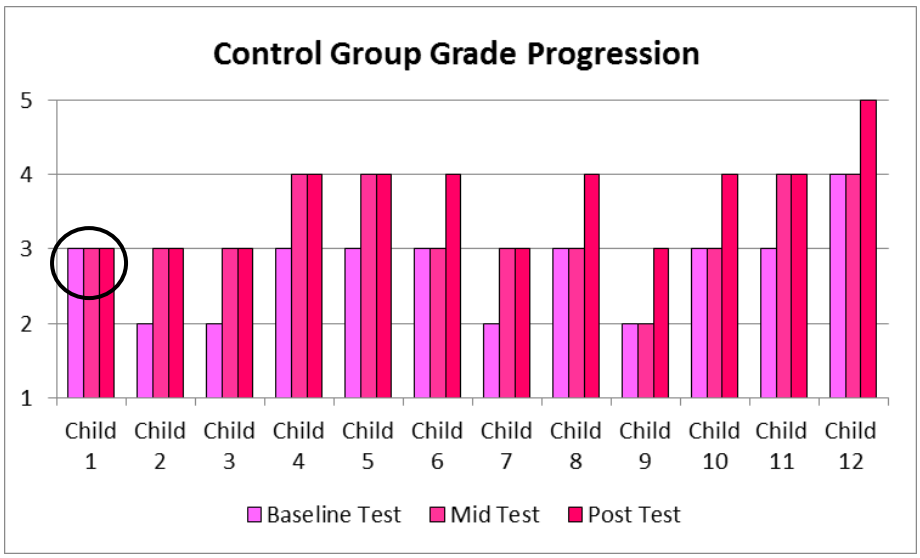

Figure 35: Grade progression of each child in the control group (n=12) from baseline to post test.

4.21.2. Mean differences and Standard Deviation (SD) of level of education between groups

Table 42 (below) indicates that participants progressed from baseline (*M* score=2.6) to mid test (*M* score=3.2) to post test (*M* score=3.6). These results show that there was progression in education between baseline, mid and post test. The standard deviation is <1 throughout all three tests periods, showing minimal deviation, with values on an average of 0.58 from the mean. Out of the 23 children, 22 progressed a grade during the three test periods and one child, from the control group, repeated grade one.

Table 42: Mean differences and Standard Deviation (SD) of level of education between the experimental and control group for all three test periods

Variable	*Mean*	*SD*	*Min*	*Max*
Baseline test	2.6	0.58	Grade R	Grade 2
Mid test	3.2	0.60	Grade R	Grade 2
Post test	3.6	0.59	Grade 1	Grade 3

Even though only one child repeated a grade during the intervention period, this does not necessarily mean that the rest of the participants were ready to progress to the next grade. This is clear from the scores from the Beery VMI, VP and MC subtests and the scores from the GMDS-ER subscales. Thirteen out of the 23 participants (56.5%) scored between a low average to average general quotient score at post test, with nine participants scoring between a borderline and severe delay (39.1%) and still progressed to the next grade.

4.22. Summary

The hypothesis states that PICIHBI (experimental group) will have equivalent or greater effects on the academic learning outcomes than conventional one-on-one occupational therapy intervention (control group) for HIV positive children aged 5 – 8 years, on ART and living in low SES families, measured at 5 months and 10 months intervals. While the null hypothesis states that PICIHBI will have inferior effects on academic learning outcomes when compared to the conventional one-on-one OT. One can see from the results that there are strengths and weaknesses for each group, while the experimental group exceeded in one area of academic learning the control group exceeded in another.

Between-group analysis showed no statistically significance. Within-group analysis showed several significant results. Group intervention (PICHIBI) was significantly more effective (p=.019) in improving visual motor integration skills over a 5 month intervention period, from baseline to mid test. Individual intervention was significantly beneficial in improving visual perception skills over a 5 and 10 month intervention period, from baseline to mid test (p=.001) and baseline to post test (p=.009), and significantly improved performance skills over a 5 month intervention period (p=.027), from baseline to mid test.

A significantly positive correlation between language and practical reasoning was found (p=.008), showing that when language increases or decreases, practical reasoning will increase or decrease respectively. The majority of the total sample (n=23) spoke the same language at home and at school (19/23), and it was found that language had a significant effect on children's practical

reasoning scores (p=00.7) at baseline, for those that spoke the same language and home and at school. For those that spoke a different language at home to the language they spoke at school (4/23), a significant (p=.017) effect of language on practical reasoning was seen at post test level. Implying that speaking a different language at home and school had a significantly negative effect on practical reasoning skills after intervention.

Looking at the total samples' (n=23) changes in scores from baseline to post test, the strongest academic learning outcome was visual perception, with language being the weakest. Visual perception saw the greatest improvement from baseline to post test, regardless of the intervention, whereas language showed the poorest improvement, followed by practical reasoning.

Viral load at baseline did not appear to affect the children's scores as negatively as anticipated, and only one child repeated a grade during the intervention period.

CHAPTER 5: DISCUSSION

5.1. Introduction

The purpose of this study was to determine and compare differences in performance components linked to the academic learning outcomes of HIV positive children on HAART aged 5-8 years receiving conventional occupational therapy intervention (control group) and HIV positive children on ART aged 5-8 years taking part in a play-informed caregiver-implemented home-based intervention (PICHIBI) (experimental group). In order to do this the Griffiths Mental Scale of Development, Extended Revised version (GMDS-ER) and the Beery-Buktenica Developmental Test of Visual motor Integration with Supplemental Developmental tests of Visual Perception and Motor Co-ordination (5th edition, Revised) were used as outcomes measures for the following performance components contributing to academic learning outcomes: in visual motor integration, visual perception, motor co-ordination, language, eye hand co-ordination, performance and practical reasoning.

The results of the study are discussed below, drawing on relevant literature to support the discussion.

5.2. Baseline Demographics

5.2.1. Age of children at baseline

Baseline demographics of the participants in this study showed the mean age of the participants in the experimental group to be 76.5 months (6.4 years), with the control group's mean age slightly higher at 78.6 months (6.5 years). This study drew on a South African sample of older HIV infected children. Other studies conducted in South Africa have investigated the effect HIV has on younger children, ranging from birth to 5 years (Baillieu, 2005; Boivin et al., 2013; Potterton et al., 2016; 2010).

5.3.2. Duration of time on ART

At baseline a significant difference was seen between the duration of time the experimental group had been on ART, a mean of 52.5 months, compared to the control group's mean time on ART, 67 months, a mean difference of 14.5 months. Children born to an HIV-infected mother should be treated with ART within the first few days of life (Cotton et al., 2015), as the use of ART is highly effective in reducing the incidence of abnormal brain function among perinatally infected children and adolescents (Patel et al., 2009). The frequency of neuroimaging abnormalities among HIV infected children which ranged between 35% and 50% (Chiriboga et al., 2004), has diminished since the introduction of ART (Nozyce et al., 2006). Although ART does not reverse neurocognitive deficits, it is found that it may protect against further neuro-developmental degeneration (Smith, 2006). HIV

infected children, even those who receive ART, are still at risk of developing central nervous system diseases (Martin et al., 2006) and showing limited improvement in their cognitive function (Puthanakit et al., 2010). The duration of time on ART is also described to be not the only variable affecting a child's performance, as the degree of fallout in each child is dependent on the extent of the neurological involvement, the CD4 count, the stage of the HIV infection and the presence of opportunistic infections (Shanbhag et al., 2005).

The results from baseline tests showed that this sample on HIV positive children on ART presented with varying delays in the various academic learning performance components assessed. While literature shows that being on ART may reduce cognitive deficits (Patel et al., 2009; Cutugno et al., 2012; Smith, 2004; Noyzce et al., 2006), it is seen from the results in this sample that these children still present with challenges in performance components linked to academic learning. The initiation of ART does not remove the risk of cognitive fallout completely (Martin et al., 2006; Puthanakit et al., 2010). An overview of the results could not establish any clear links between time on ART and a child's academic learning outcomes.

The results of the study highlight the need for a suitable intervention for HIV-infected children in partnership with the effective use of ART, as ART alone does not appear to curb the effects HIV has on a child's academic learning ability.

5.3.3. Prematurity

A total of six premature births for the total baseline sample (23%) was noted. Preterm delivery frequently accompanies HIV-related pregnancy (Chase et al., 2000; Martin et al., 1997). It has been noted that preterm infants are at high risk for progressive impairments at school-going age (Feder et al., 2005). Preterm children can present with perceptual motor and visual motor integration skill deficits (Goyen et al., 1998, Luoma et al., 1998 & Marlow et al., 1993), along with poor visual perception and eye hand co-ordination skills. The performance components show association with a lower legibility in handwriting tasks (Feder et al., 2005), an important performance skill in academic learning.

The relationship between prematurity and HIV on the academic learning outcomes has not been previously explored. It was found in this study that three of the five preterm infants presented with a <70 baseline scores (below functional ability) in visual motor integration and visual perception skills (assessed by the Beery VMI) and all five preterm infants scored <70 at baseline for performance (assessed by GMDS-ER). These results show that preterm infants in this study all experienced challenges in the area of performance, visual motor integration and visual perception.

5.3.4. Gender differences

More females (n=14) than males (n=12) were recorded in the total baseline sample (n=26), and while most studies describe the proportions of male and female study participants, the current study did not analyse or compare for sex differences in outcomes. It is largely acknowledged that the neurodevelopment of young boys and girls are comparable (Laughton et al., 2013), and therefore comparison of gender scores was not indicated.

5.3.5. Main Caregivers

The majority of the participants (88.5%) in the total baseline sample had their mothers as their main caregiver (23/26). This is a much higher percentage than results of prior studies conducted in both South Africa and Malawi by Skeen et al (2014), where only 46.3% of the 979 HIV-infected children (ages 4-13 years) had their biological parent as their main caregiver, and a study in Thailand (Puthanakit et al., 2010) where only 28% of the 39 HIV-infected children were cared for by their biological parent. The high figure of mothers being the childs' main caregiver in this study, could be reflective of the current unemployment levels of 26.7% of the South African population (Mojdeh, 2016). 73.1% of the mothers in this sample were unemployed, which may help explain why they were the ones attending the sessions with their child. Although a mother attending the sessions with the child is encouraged, the high level of unemployment in this sample population is concerning. It is one of the reasons Kidzpositive started their beadwork initiative, where mothers attending the HIV clinics were given the opportunity to make beadwork items and receive a profit for items sold. This initiative created the opportunity for income and in skill acquisition, empowerment and economic sustainability (Fane, Ramugondo, Mamosa & Coker, 2010).

5.3.6. Caregivers level of education, socioeconomic status and the home environment

In this sample caregivers' level of education ranged from grade 1 to tertiary level education, with the majority of caregivers (64%) having had access to high school education (ranging from grade 8 to grade 12).The 2012 General Household Survey (GHS) conducted by Statistics South Africa (Stats SA), found that 28.7% of South Africans had grade 12 (matric) as their highest level of education. This percentage was similar to this sample, 27.2% of the caregivers having passed matric.

In this study, low scores in language and practical reasoning (GMDS-ER) were associated with lower level of caregiver education (grade 1-7). These results aligned with the results of other studies linking poor socioeconomic status, home stress and low level of maternal education with low cognitive function in HIV child samples (Boyede et al., 2013; Hochhauser et al., 2008), showing that variables such as the caregivers level of education, the home environment and the socioeconomic household status all have an influence on the HIV-infected child and their academic learning outcomes. This

finding proves Bronfenbrenner (1992) and Vygotskys (1997) statement to be true, where they report that learning can be influenced by external systems, such as socio-economics, which impacts the interactions within certain environments (i.e. school).

5.3.7. Viral loads in relation to baseline scores

Shanbag et al, (2005) in their study of 146 HIV-infected 2-5 year olds, noted that viral loads were marginally predictive of future changes in neurocognitive standard scores of HIV-infected children. At baseline, only 26.9% of the sample had unsuppressed viral loads. Many, but not all of these children presented with generally lower scores in all subtests and subscales, compared to those children with a suppressed viral loads. No further conclusions between baseline scores and viral loads of the sample could be made in this study.

5.4. Meaning and Importance of Main Study Findings

This study is the first study exploring the impact of an occupational therapy intervention on the academic learning outcomes of the HIV-infected child on ART. Previous studies have described and compared the HIV-infected children's functional and intellectual abilities to their HIV-uninfected peers (Boyede et al., 2013; Cohen et al., 2015; Linn et al., 2015; Lowick et al., 2012; Papola et al., 1994).

The study's specific focus on the academic learning performance components of visual motor integration, visual perception and motor co-ordination (Beery VMI) constructs, together with language, eye hand co-ordination, performance and practical reasoning (GMDS-ER) is also unique. From an occupational therapy perspective, these components are what support academic learning.

5.4.1. Baseline results for Visual motor integration, Visual perception and Motor co-ordination

Out of the total sample (n=23), 21.7 % of the children scored <70 (below functional ability) in the visual motor integration test, 40.9% scored <70 in the visual perception subtest and 13% scored <70 in the motor co-ordination subtest, before intervention. The total sample's poor performance in visual perception is a distressing finding, as a great deal of learning demands a visual learning approach in the school environment (Schneck, 2005). The low visual motor integration scores correlated with numerous studies describing poor visual motor integration skills in HIV-infected children (Cohen et al, 2015; Laughton et al., 2013; Linn, et al., 2015; Melgarejo et al., 2015). Visual motor integration is an important performance component for academic learning, as it has been identified in numerous studies as a more important factor than general intelligence or finger dexterity associated with handwriting performance (Berry, 1997, Tseng & Murray, 1994, Weil & Armundson, 1994; Beery, 1997). Motor co-ordination was the performance component showing the

least deficit, with the highest scores at baseline in both groups, and in the total sample. Similar findings were made in Potterton et al., (2016) study where eye hand co-ordination showed the least number of children scoring <-2 z-score (26.47%).

5.4.2. Post intervention results for Visual motor integration, Visual perception and Motor co-ordination

Post intervention, the control group (n=12) improved their mean standard scores in all subtests, whereas the experimental group (n=11) decreased their mean standard scores in motor co-ordination from baseline to post test (-0.2), but improved their mean standard scores in visual motor integration and visual perception. Visual perception was the performance component most impacted on by intervention, showing an increase from a mean standard score of 74 (low) at baseline to the highest mean standard post test, 92.2 (average). The experimental group was classified as average according to the US classification category, at post test level, for both visual perception and motor coordination. This is an encouraging result, as a study carried out by Dankert et al., (2003) showed that their sample group of twelve 3-6 year olds with developmental delays, showed only a 2 point increase in scores from pre-test to post test, maintaining their sample in the low classification category for visual perception and motor coordination. The post intervention results of the present study are higher than Dankert et al, (2003) post intervention scores, even though Dankert's sample received more regular occupational therapy sessions.

Sortor and Kulp (2003) describe the significant relationship between visual perception and motor co-ordination scores, and associated achievement in both maths and reading. These are the same two performance components that the experimental group scored average in. This could possibly suggest that the experimental group have a firmer foundation in place to provide a supportive platform for them to engage in the academic performance skills of reading and writing, in comparison to the control group.

Visual motor integration mean standard scores at post test level for both groups was more than 70, with the experimental group attaining a mean standard score of 87.3 and the control group 84.3, a "low average" according to the US classification category. No children in the experimental group and only one child from the control group scored less than 70 at post test, and an 80% improvement from baseline to post test was seen in the total sample. These are very encouraging results, as visual motor integration has been reported to be a contributor to effective handwriting in children with handwriting difficulties (Volman et al., 2006) and a positive common denominator in academic performance (Case-Smith et al., 1996; Goldstand et al., 2005; Kulp, 1999; Pienaar et al., 2014; Sortor & Kulp, 2003). It is therefore suggested that children from both groups could be better placed to

master and progress more smoothly in the performance skill of handwriting, after they received intervention, in comparison to their abilities prior to intervention.

Within-group analysis showed statistical significance (p=.019) in using group intervention to improve visual motor integration skills over a 5 month period from baseline to post test. Significant results were found in using individual therapy to improve visual perceptual skills over a 5 month period (p=.001) from baseline to mid test, and over a 10 month period (p=.027) from baseline to post test. This implies that improvement of visual motor integration skills may be better fostered in a group setting over a shorter period of time, whereas visual perceptual improvements may take longer to improve and require more focused and individual attention. These findings were again compared to and were in contrast to Dankert et al, (2003) study which found a greater improvement in visual motor integration scores using individual occupational intervention, compared to the improvement of visual perception and motor co-ordination scores using the same intervention, over the same time period.

Although not all children fell into the "average" functional classification category at post test level, a decrease in the number of children scoring <70 was seen from prior intervention to after intervention. These findings were aligned to Dankert et al., (2003) whose findings concluded that occupational therapy intervention, regardless of the form, is beneficial in improving the academic learning outcomes of visual motor integration, visual perception and motor co-ordination.

5.4.3. Baseline Findings for Language, Eye hand co-ordination, Performance and Practical Reasoning (GMDS-ER)

The second objective was to determine and compare differences in the language, eye hand co-ordination, performance, practical reasoning and total scores (GMDS-ER), between HIV positive children on ART aged 5-8 years receiving conventional one-on-one occupational therapy intervention, and HIV positive children on ART aged 5-8 years taking part in a play-informed caregiver-implemented home-based intervention.

HIV is known to cause neurodevelopmental problems in infants and young children. The impact of HIV on the development of school-age children has been less well described. Potterton et al, (2016) conducted a study at an urban paediatric HIV clinic in Johannesburg, South Africa. A sample of convenience of sixty-eight medically stable children between the ages of 3 and 5 years were assessed with the Griffiths Scales of Mental Development was used. Children were excluded from the study if they had severe HIV encephalopathy, which made it impossible for them to participate in the items on the Griffiths Scales of Mental Development. Children had started combination antiretroviral treatment (cART) at a mean age of 8.1 months. The majority of the children were

virologically suppressed and did not present with wasting or stunting. Severe overall developmental delay (z-scores < -2SD) was detected in 55.88% of children. Developmental facets related to language, cognition and perception were the most severely affected.

A total of 68.2% of the total sample presented with severe overall delay (z-scores < −2SD) prior to intervention. This is a higher percentage compared to the 55.88% of children showing a severe delay in a study done by Potterton et al, (2016). At baseline test the total sample (N=23) showed the greatest deficits in practical reasoning and language, with 78.3% and 69.6% respectively of the children scoring <-2 z-scores, again in line with Potterton et al, (2016) findings. However, this studys' delays in language were more extensive than described in other studies (Papola, Alvarez & Cohen, 1994; Tardieu et al., 1995). Poor practical reasoning scores from this study, aligned with the results of a study by Lowick et al, (2012). In Lowick et al, (2012) study 70% of the HIV-infected group scored <-2 z-score for practical language, comparable to the 78.3% of this studys' total sample scoring <-2 zscore for practical reasoning at baseline.

Performance was the highest scoring academic learning performance component in the total baseline sample. These results were contrary to other studies, which found that performance was significantly lower in HIV-infected children (Lowick et al., 2012). Performance looks at tasks such as completing formboards (puzzles), building with blocks, copying patterns etc. High scores in these tasks could be attributed to possible splinter skill development (Trombly & Radomski, 2004) acquired through the repetition of tasks likes these in clinics, crèches' or at home with caregivers. However the exact variable influencing the promotion of performance in this group is unknown.

Severe delays in over half of the total sample (56.5%) was detected in eye hand co-ordination in the total sample (n=23). Eye hand co-ordination difficulties in Asian HIV samples have been described (Puthanakit et al., 2013; Linn et al., 2015).

5.4.4. Post intervention results for Language, Eye hand co-ordination, Performance and Practical Reasoning (GMDS-ER)

After intervention had taken place, an improvement in overall (GQ) mean scores was noted in the total sample (N=23) and in both the experimental group (n=11) and the control group (n=12). However all GMDS-ER subscale quotient scores were below the comparable standard average mean (90-109). This implies that none of the children were functioning at the average age expected level. In the total sample, the level of severe delay at baseline (68.2%) improved with only 8 out of 23 (36.4%) of the total sample showing a severe overall delay post intervention. Both groups had less than 42% of the children scoring <-2 z-score for the overall quotient at post test.

The control group improved by +9.4 in their mean overall quotient score compared to the experimental group who improved by +5.8 in their mean overall quotient score. Dr. Barbara Laughton[6] states that an increase of +7 points between test period scores is noteworthy, as in low income contexts, scores are likely to decline. The improvements and stability (for language and practical reasoning) in the groups' scores, in this study, are encouraging (Personal correspondence with Dr. B. Laughton, 29 March, 2015).

The interventions had a limited impact on the performance component of language. The experimental group continued to function with a borderline delay at post test, having 54.4% of the group scoring <-2 z-score (below functional level). The control group saw a decrease in language scores over the intervention period, resulting in them being classified as having a borderline delay at baseline test to having a severe delay after intervention. Poor language scores in this study were consistent with other studies with HIV-infected children, where language was the most severely affected academic learning outcome (Cohen et al., 2015; Molteno et al., 1991; Lowick et al., 2012; Wolters, Brouwers, Civitello & Moss, 1997). Lowick et al, (2012) results were the most comparable to the results of this study, as both samples were from low income South African contexts, were on anti-retroviral treatment and were in the foundation phase of their schooling career. Lowicks' study demonstrated that 90% of their HIV-infected sample scored <-2 z-score in language at primary analysis and 83.3% at secondary analysis. Language was the lowest scoring subscale out of all the subscales assessed. Coplan et al, (1998) noted frequent deterioration in language in HIV-positive children, even in the absence of neurological abnormalities, suggesting that language deterioration may even precede cognitive difficulties. From the above findings it appears that HIV has a negative impact on the progression of language in children. Abubakar et al, (2008) however cautioned against accurately estimating the effect HIV has on language, as the development of language had been less vigorously evaluated in Sub-Saharan Africa.

The low post intervention scores observed in language in both groups could have been alternatively attributed to a language or hearing impairment, or a lack of environmental stimulation (Luiz, 1988). It could also be due to the fact that individual intervention was not always conducted in the child's first language, whereas the group sessions had a translator facilitating discussion and the relaying of information from the therapist to the dyad. The exact variable causing such grave delay in the progression of language is unknown and should be investigated further. Language concerns observed in this study should prompt therapists and practitioners working with HIV-infected children to promote hearing screenings, encourage referrals to relevant health care professionals and to

[6] Dr. Barbara Laugton is a doctor at the Tygerberg Childrens' Hospital, specialising in paediatric HIV and is widely recognised for her use of the GMDS-ER in her research.

motivate the use of translators in interventions and hands on engagement between child and caregiver to foster language development.

It has been noted that low language scores are often accompanied by poor practical reasoning scores (Luiz, 1988). Post intervention, the practical reasoning mean quotient score (75.7) was classified as borderline delay. Fifteen (65.2%) of the total sample scored <-2 z-score for practical reasoning after intervention in the total sample. The experimental group had 54.5% of the group performing below functional level (<-2 z-score) for practical reasoning, the exact same percentage as language at post test level. The control group had a higher percentage (75%) of the group scoring a <-2 z-score after intervention for practical reasoning, and 50% scoring <-2 z-score for language after intervention.

It is not surprising that language and practical reasoning received the lowest mean quotient scores. Luiz (2006) describes language and practical reasoning as being the most intellectual constructs in the GMDS-ER. Bothma, Dunn and Kokot (2014) conducted a study in the Free-State, South Africa, consisting of an experimental group of nine 4-8 year old hearing-impaired children who underwent a 14 week movement intervention. Using the GMDS-ER, it was found that language and practical reasoning improved from pre-test to post test, in comparison to the control group that received a placebo intervention. However, even though there was an improvement of scores, the experimental group were still functioning below age appropriate level. These findings were similar to that of this study, as both groups at baseline and post test were not functioning at the anticipated average age appropriate level for these two sub scales according to the UK classifications.

Mean standard scores in both groups showed an improvement in eye hand co-ordination and a decrease in the number of children scoring <-2 z-score from baseline to post test. Three children in the control group and one child in the experimental group showed a severe delay (<70) in the area of eye hand co-ordination post intervention. This was an improvement from the six children seen in each group with a severe delay at baseline test. This is an encouraging result, as school-age children with vertically transmitted HIV, despite normal cognitive development, are at a higher risk of experiencing difficulties in eye hand co-ordination in comparison to their HIV-uninfected peers (Blanchette et al., 2002; Laughton et al., 2013; Linn et al., 2015). This suggests that the majority of children in this study should be able to cope with handwriting tasks given to them in school, as eye hand co-ordination was noted as a predictor of handwriting quality in grade two and three learners (Volman et al., 2006).

Lowick et al., (2012) reported that significantly lower scores in tasks involving performance in HIV-infected children should be expected. It was therefore anticipated that one or both groups would produce performance results similar to those from literature. A optimistic finding was made when both groups were found to be functioning at a low average level in the area of performance post intervention (80-89), with only 13% of the total sample scoring <70. Findings from within-groups changes showed that individual intervention over a 5 month period, from baseline to mid test, was significantly more beneficial than group intervention in targeting the academic learning outcomes of performance in HIV-infected school-going children.

In summary post intervention measurements reflect that both the experimental and control group did not achieve an "average" overall quotient score after intervention. There were still children who at post test were found to be performing below functional ability (<70) in subscales, in both groups. The most concerning results being in the subscales of language and practical reasoning. Generally positive results were demonstrated in both groups, with a decrease in the number of children scoring <70 at baseline, compared to those scoring <70 at post test, in all subscales.

5.5. Grade Progression from Baseline to Post test in both groups

The third objective in the study was to track successful progression to the next grade, making comparisons of successful progression between HIV positive children on ART aged 5-8 years receiving conventional one-on-one occupational therapy intervention, and HIV positive children on ART aged 5-8 years taking part in a play-informed caregiver-implemented home-based intervention.

Grade progression was seen in both groups, with only one child from the control group repeating a grade. This result should be encouraging, as Tardieu et al, (1995) found that 33% of the 33 HIV-positive children in their sample, did not attain normal school achievement. However when one looks at post test results, 52.2% (12/23) of the total sample were performing below functional level (<70) in language and 65.2% scored <70 for practical reasoning. Overall GMDS-ER quotient scores (GQ), saw 8 (36.4%) children from the total sample scoring below 70 after intervention had taken place. The result of one child repeating a grade is therefore overshadowed by the less than adequate achievements seen in these academic learning outcomes.

One could ask why 22 out of the 23 (95.7%) children from the total sample progressed to the next grade, when fallouts were seen in their various performance components, which are requirements for grade progression and mastery of academic learning skills. Although there are several variables that may have effected the decision for these eight children to still progress to the next grade despite their poor scoring, one is left questioning the manner in which these children were possibly

assessed and their ability represented in their termly progress reports. This is of great concern, as children with HIV are more at risk of dealing with academic learning challenges and detrimental cognitive deficits in comparison to their HIV-uninfected peers (Sherr et al., 2014). Thus, being allowed to progress to the following grade when their ability does not correlate to academic expectation, poses greater academic stress on these children.

The reason for one participant in the control group repeating a grade could have been due to numerous factors, physiological or environmentally. Sherr (2005) noted that HIV has the potential to impede access to schooling for a variety of reasons. Either directly related health issues pose a barrier, or indirectly, parental ill health, poverty or withdrawal may hinder access to school. What is known of the participant is that he was not premature at birth, was on ART for longer than most of the other participants, spoke the same language at home and at school, and had a viral load LDL. The child was however born at the end of December, has a caregiver with the lowest level of education (grade 1) compared to the entire sample (n=23) and only attended three therapy sessions. It is difficult to say which variable caused the child to not progress a grade, or to say that the child would have progressed a grade if they were in the experimental group rather than the control group. However, literature does confirm that a child's mother, or caregiver's level of education does affect a child's progression of language (Molteno et al., 1991), which effects progression in all other performance skills.

5.6. The Relationship between Language and Practical reasoning and spoken language

The forth objective was to investigate the relationship between scores in Language (subscale C) and Practical reasoning (subscale F), and comparing this against participants that speak the same language at home and school, and those that speak different languages at home and school, in both the children receiving conventional OT and those receiving PICIHBI, who are HIV positive.

The majority (84.8%) of participants in both groups spoke Xhosa as their first language at home and 80% spoke Xhosa as their first language at school. Nineteen children from the total sample (n=23) spoke the same language at home and at school, with 4 speaking a different language at home from the medium of instruction at school. A negative relationship was seen between participants that speak the same language at home and school, and those that have speak different languages at home and school. This could suggest that those who spoke different languages at home and school have poor practical reasoning. However a study conducted by Cekiso (2014) using 95 grade 3 learners from two schools, where their home language was isiXhosa but their language of instruction

at school was English, concluded that learners performed better in a reading comprehension test in the language that was used as their medium of instruction, irrespective of their home language.

5.7. Viral loads' effect on the General GMDS-ER quotient scores

The last objective was to determine the relationship between General GMDS-ER quotient (GQ) and participant's viral loads, in both the children receiving conventional one-on-one occupational therapy and those receiving PICIHBI, who are HIV positive.

At baseline 76% of the total baseline sample (N=26) had a viral load lower than detectable level (LDL - <40). This is an important figure, as a HIV positive child's viral load and duration on ART correlate to each other, with the effective use of ART aimed at reducing ones viral load (Shisana et al., 2014). Literature states that children with higher viral loads are more likely to demonstrate cognitive delays and poor neuropsychological functioning, which in turn affect academic learning outcomes (Lindsey et al., 2000; Jeremy et al., 2005; Pollack et al., 1996; Shanbhag et al., 2005; Smith et al., 2000; Smith et al., 2006). One would expect then the children in this sample with a higher VL would have lower scores, but the data below shows a mixed set of high and low scores.

The results from this study show that contrary to available literature, the four participants with viral loads that were LDL, had a general quotient score of <70. This indicates that they were functioning below borderline ability, whereas six out of the seven children with a viral load higher than 40, showed a general quotient higher than 70 at baseline test. Only one child's score aligned with documented literature. He had a viral load of 382125, which was the second highest in the total baseline sample. This could indicate that an ominously high viral load is needed in order to see an evident decline in cognitive and poor neurophysiological functioning (Jeremy et al, 2005).

5.8. Comparing the intervention effect to prior studies

Despite the continuous call for children with HIV to receive suitable intervention (Brackis-Cott, 2009; Clark & Schlabach, 2013; Cohen et al., 2015; Guo, Li, & Sherr, 2012; Hejoaka, 2009; Richter et al., 2009; Sherr et al., 2014), only one intervention study for the HIV-infected paediatric population in South Africa has been documented. This study conducted by Potterton et al, (2010) showed that a home stimulation programme taught to the caregiver can significantly improve the developmental progression of children less than 2 years 6 months infected with HIV, compared to their peers who received no intervention.

In the current study it was observed that intervention for children with HIV is both necessary and beneficial, whether they were receiving group or individual intervention. This was highlighted when

reflecting on the total sample's (n=23) general quotient (GQ) scores, where 68.2% (15/23) of the children were functioning at a below functional level at baseline (<-2 z-score). This score improved to 36.4% (8/23) at post test level. Although both groups saw a larger portion of performance components score increase, declines in scores were noted. The experimental group showed a decrease in motor co-ordination standard scores (Beery VMI) over the intervention period. The control group on the other hand showed a decrease in scores in language and practical reasoning scores (GMDS-ER) from baseline to post test.

5.9. The impact of intervention in relation to attendance

A higher attendance rate was seen in the first 5 months of intervention (baseline to mid test), in comparison to the last 5 months of intervention (mid to post test) in both groups. The exact reason for this decrease in session attendance from mid test to post test is unknown. Children that attended 6 sessions or more during the intervention period, regardless of the group, appeared to have progressed slightly more than their peers that attended fewer sessions.

5.10. Intervention considerations

Interventions used in this study presented their own challenges and benefits. Although policies provide a mandate for occupational therapy services to be made available to all South African citizens, rehabilitation services are still a sought after commodity in many health, education and community settings, placing South Africa's health care services in somewhat of a predicament (Dayal, 2010; National Planning Commission, 2011). The main benefit of a group intervention appeared to be that it was able to meet the need of the large patient load the limited human resource of occupational therapists in the South African public health sector (Cullinan, 2006). Group intervention aimed to facilitate a more extensive involvement of caregivers, and aided the interactions of caregivers with one another. Caregiver involvement in the intervention process has shown to provide a type of stress-buffering effect for the effects of depression, which seemed to improve psychosocial and cognitive progression in these school children (Hochhauser et al., 2008; Kotchick et al., 1997). Boivin et al, (2013) found that there was a significant neurocognitive advantage for younger children with HIV, if their caregiver had received training on how to practically enrich the environment in which they grow and learn. However, the logistics of running an effective and efficient group intervention is time consuming and may not always be possible to implement in every health setting. Individual intervention at times was easier to manage and navigate, with only one child's needs focused on during intervention, and the possibility of the caregiver sitting in on the session. However individual intervention does not always foster a bond

and encourage the growth in relationship between the child and their caregiver, which group intervention can.

5.11. Generalisability

The framework of this study is described in the methodology section so that researchers and clinicians can determine the similarity of their populations to that of the current study, and replicate the study if required. Using the baseline demographic characteristics of the study participants (refer to table 3) may assist those wanting to explore similar trials or apply the findings to those in their treatment settings. Findings may be generalised to occupational therapists working in the public health sector, and those attending paediatric HIV clinics in the Western Cape, where staffing and resources are largely similar. The intervention however was not context specific, so it is expected that these findings could be generalised to occupational therapists employed in the public health sector in more rural areas too. The only factors that would need to be kept in mind would be the need for an appropriate space to run the groups and the necessary funding to provide the required resources. Additional staffing such as a translator and or a child minder is beneficial and very helpful, but is not an absolute necessity.

The extent to which the findings are applicable to occupational therapists working in private practice, or in government departments, such as the Department of Education, is not certain. In this study participants and their caregivers not only had to fulfil certain inclusion criteria, but consent and ascent forms were required to be completed before the dyad could participate in the study. Those that did not want to participate in the study, or could not be part of the study, had the choice not to be. Findings may therefore not be generalisable to all children attending HIV clinics, but possibly only to those dyads that showed interest in being part of this research study.

With a sample size of n=23, results are often not very generalizable (Button et al., 2013). In order to make these findings more universal, a larger sample size would need to be recruited.

5.12. Strengths & Limitations

5.12.1 Strengths to build on

- Well known assessment tools were used, the Beery Buktenica Visual motor integration test, including the supplementary subtests (Beery, 2006), and the Griffiths Mental Developmental Scale Extended revised version (Luiz et al., 2006). Both assessment tools are familiar to Occupational Therapists and similar health professionals, not only in the Western Cape but

on a national and globally level too, making the findings comparable to other research carried out.

- This research was pragmatic in nature and therefore did not take place in an unrealistic environment, but rather in an environment very familiar to many South African occupational therapists working in the public health sector. This variable makes it possible for this type of research to be carried out at other health facilities similar to that of Groote Schuur Hospital.
- A randomised control trails (RCT) was chosen for this study, as it is considered to be the best possible source of information guiding best interventions (Black, 1996; Ravaud & Tabach, 2005), and it is largely regarded to hold the highest level of evidence for the efficacy of interventions (Ravaud & Tubach, 2005). RCT's are designed as experiments with a great ability to determine cause and effect relationships (Patsopoulos, 2011), making the data reliable and applicable to similar settings.
- As the design of this study was single-blinded, the participants were unaware of the purpose of the study therefore avoiding any potential biased reactions or responses to the intervention.
- The pre-test post-test control-trail design used in this study allowed for a comparison to be drawn at different time periods throughout the intervention process. Allowing the progression or digression of scores to be determined.
- Translators, who were coached in the use of both assessment tools, were used in assessments were the child was not fluent in English in this study. This strengthened data gathering, as a true representation of the child's potential was attained by them being assessed in their first language.

5.12.2. Limitations to learn from

- A small sample size (n=23) as seen in this study, often resulted in wide confidence intervals and placed constraints on the data analysis, making results less approximate of the population represented. It should be noted that this sample will produce results that are specific to the study, and cannot be generalised to the entire population in the area. A larger sample size would allow for more generalisability across this population.
- Further statistical analysis of the relationship between intervention session attendance rate and academic learning outcomes could have taken place to explore this.
- There was no post intervention follow up and/or assessment to monitor sustained intervention effect. This limited the ability of the researcher to determine the sustained improvements or digression in scores in the various academic learning constructs and if they were purely due to intervention or in addition to the natural maturation of a child over time.
- Although minimal, not all variances measured in the two groups were equal. This may have affected a Type I error rate. Caution in future studies should be taken to reduce any unequal

variances in order to reduce Type I error rate by using a lower value for α. However, using a lower value for alpha means that the detection of a true difference becomes less likely.

- It was not possible to attain all of the participant's recent school reports. This information would have allowed for further comparisons to be made between academic learning outcomes and the academic learning performance skills measured by the CAPS.
- Each childs' viral load was attained at baseline test but not again at post test. Post test viral loads or each child could have possibly helped to explain why some children's scores increased or decreased after intervention was received, as an increase or decrease of ones' viral load during the intervention period may have mimicked or contradicted the child's change in scores from baseline to post test.

CHAPTER 6: RECOMMENDATIONS AND CONCLUSIONS

This chapter provides recommendations for future research and for occupational therapy practice. A conclusion of the study is also provided.

6.1. Recommendations for Future Research

The following recommendations for future research are proposed:

- The study could be replicated with a larger sample size, at similar hospitals or clinics in South Africa, other than the Western Cape, in order to make the results more transferable to the general South Africa population in the various different provinces.
- To compare the impact of the intervention across tertiary, secondary and primary public health care settings in different provinces of South Africa. This would help determine the impact this intervention could have at various levels of the South African public health sector, provincially.
- To conduct a longitudinal study which monitors the impact of the intervention and compares this to curriculum assessments (school reports) of the HIV infected school going population.

6.2. Recommendations for Occupational Therapy practice

The following recommendations for occupational therapy practice are proposed:

- More Occupational Therapists should familiarise themselves with the GMDS-ER, as it is a widely acknowledged and recognised assessment used to provide a holistic representation of a child's functional and academic learning abilities. It is also widely recognised in the psychology field, allowing reports and findings to be used in more than just the field of occupational therapy. This would encourage the gap between health professionals to be bridged, allowing a more holistic approach to be used when treating this population.
- South African therapists, especially those that find themselves working in the government sector of health and education, should familiarise themselves with the effects HIV has on the child's ability to progress in their academic learning outcomes. This can be done by attending relevant courses, workshops or training related to HIV and its effects on child academic learning.
- The results of this research support consideration of group based, caregiver focused interventions to support the vast needs of this population. This is especially important considering the low occupational therapist to client ratios described earlier in this thesis.

- From the results, it is seen that school readiness programmes are needed in schools and/or crèches and educares. It is recommended that OT's investigate developing school readiness programmes that can be implemented into our local schools, equipping our learners for formal education.

6.3. Conclusions

HIV is a chronic illness endemic in the South African context which often dictates the needs of paediatric population, especially those living in low income areas. Literature supports the need for occupational therapy intervention which focuses on the academic learning needs of HIV-infected children. In South African, health and education policies advocate for the provision of occupational therapy services to all, but unfortunately not yet a reality in many health and education settings in South Africa (Dayal, 2010; National Planning Commission, 2011). One of PICHIBI's beneficial characteristics is it's time efficiency, allowing multiple children to be seen daily, accommodating the needs found in the South African public health care system. Additionally PICHIBI encourages the involvement of the childs'caregiver, which assists in providing a basis for an effective occupational therapy intervention and facilitates bonding between child and caregiver.

In light of these factors, the experimental intervention, consisting of a more far reaching group structure and sharing of intervention input to caregivers for application in the home context, could have far reaching effects. The experimental PICHIBI intervention in fact showed that it was significantly beneficial in improving visual motor integration scores over a 5 month intervention periods and maintaining and improving GMDS-ER scores. The control individual intervention showed a significantly greater impact on the improvement of visual perceptual scores over a 5 and 10 month intervention period, and in improving performance over a 5 month period. These results could inform some changes in the content and structure of the experimental PICIHBI intervention to ensure its maximum impact.

The needs of vulnerable HIV-infected children have been highlighted in this study, as deficits in various academic learning outcomes were found. The most concerning finding has been the poor level of functioning in the area of language and practical reasoning, and the progression of grades of children despite their consistent difficulties in some of the academic learning performance components.

Occupational therapists and health care professionals have the ability and potential to assist this population. Those infected with HIV should be enabled to access the services and intervention they

require, in order to reach their academic learning potential. Children are often deprived of a voice at policy level, it is therefore the role of practitioners to represent and advocate for their needs (Sherr, 2005). It is hoped that the findings from this study will assist in advocating for funds and resources to make it possible for the appropriate intervention to reach school-going HIV-infected children, in South African and any other resource-constrained contexts.

6.4. What Happens at the End of a Study?

Results of the study will be shared with the Western Cape Department of Health through the Children and Families Directorate, rehabilitation professionals and paediatricians through scientific conferences, the DG Murray Trust, as well as through peer-reviewed journal publications. Feedback of results will also be provided to the Kidzpositive board and implementation of the most beneficial intervention will be explored.

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WORD COUNT

Including reference list: 48 540

Excluding reference list: 43 238

APPENDICES

Appendix A: Go Box

Appendix B: Ethical approval by the Facility of Health Sciences Human Research Ethics Committee (HREC)

Appendix C: Ethical approval by the Facility of Health Sciences HREC Renewal

Appendix D (1, 2, 3 & 4): Institutional Approval letters

Appendix E: Permission letters

Appendix F (1, 2, 3 & 4): Information letters

Appendix G (1 & 2): Consent forms

Appendix H (1 & 2): Assent forms

Appendix I: Standard Scoring table for VMI Test, VP and MC / IQ Scores

Appendix J: Budget summary

Appendix K: Beery Buktenica Visual Motor Integration Test, Visual Motor Integration subtest

Appendix L: Beery Buktenica Visual Motor Integration Test, Visual Perceptual subtest

Appendix M: Beery Buktenica Visual Motor Integration Test, Motor Co-ordination subtest

Appendix N: Griffiths Mental Developmental Scale – Extended Revised version

Appendix O: Literature Search Map

Appendix P: School Progress report template

Appendix A: Go Boxes

Figure 36: GO Box for children aged 6 to 8 years old

Appendix B: Ethical approval by the Facility of Health Sciences Human Research Ethics Committee

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences
Human Research Ethics Committee
Room E52-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Telephone [021] 406 6338 • **Facsimile** [021] 406 6411
e-mail: shuretta.thomas@uct.ac.za
Website: www.health.uct.ac.za/research/humanethics/forms

17 September 2013

HREC REF: 560/2013

A/Prof E Ramugondo
Occupational Therapy
Health & Rehab
F56.76, OMB

Dear A/Prof Ramugondo

PROJECT TITLE: THE EFFECTS OF PLAY-INFORMED CARE GIVER IMPLEMENTED HOME-BASED INTERVENTION ON PARTICIPATION OUTCOMES FOR HIV POSITIVE CHILDREN ON HAART AND LIVING IN FAMILIES WITH LOW SOCIO-ECONOMIC –STATUS

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30th September 2014

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/research/humanethics/forms)

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the HREC. REF in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN ETHICS
Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.
The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

s.thomas

Appendix C: Ethical approval by the Facility of Health Sciences HREC Renewal

HUMAN RESEARCH ETHICS COMMITTEE
25 SEP 2014
HEALTH SCIENCES FACULTY UNIVERSITY OF CAPE TOWN

UNIVERSITY OF CAPE TOWN
FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938) This serves as notification of annual approval, including any documentation described below.			
☑ Approved	Annual progress report	Approved until/next renewal date	30.9.2015
☐ Not approved	See attached comments		
Signature Chairperson of the HREC		Date Signed	26/9/14

Comments to PI from the HREC

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	25/09/2014		
HREC REF Number	HREC REF: 560/2013	Current Ethics Approval was granted until	30 September 2014
Protocol title	The effects of play-informed care-giver implemented home-based intervention on participation outcomes for HIV positive children on HAART and living in families with low socio-economic status		
Protocol number (if applicable)	N/A		
Are there any sub-studies linked to this study?	☐√ Yes ☐ No		
If yes, could you please provide the HREC Ref's for all sub-studies? **Note:** A separate FHS016 must be submitted for each sub-study.	PhD - HREC/REF 605/2012: This is not strictly a sub-study, but a parallel one, focussed on the design process of the intervention in the main study. It followed action research methodology within a case study approach. Masters Sub-Studies: Other than being true sub-studies, with a separate bigger study, these in fact make-up the bigger study, with the Masters students as co-researchers to the main study. This caused immense confusion for us early on, elaborated on further under Progress of Study. These Masters studies are under-going departmental research review, with 3 of 4 having just submitted rebuttal letters and revised proposals last week.		
Principal Investigator	A/Prof Elelwani Ramugondo		

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

Appendix D: (1, 2, 3 & 4): Institutional Approval letters

Draft WC DoH Letter for Permission to Conduct Pilot Study at Victoria Hospital

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Western Cape Department of Health

To Whom It May Concern:

This is a formal request for permission to conduct a pilot study on a population comprised of HIV positive caregiver-child dyads who attend a paediatric out-patients clinic at Victoria Hospital.

The proposed main study aims to investigate effects of play-informed care-giver implemented home-based intervention (PI-CIHBI) on participation outcomes for HIV positive children (Aged 6 months to 8 years old) on Highly Active Anti-retroviral Treatment (HAART) and living in families with low socio-economic status. There are well-established negative long-term consequences for learning and development for children affected with Acquired Immune Deficiency Syndrome (AIDS). While HAART has proven to be effective in prolonging life expectancy in children living with HIV/AIDS, access to comprehensive health care is critical for these children to continue enjoying quality of life. Caregivers of HIV+ children in South Africa often face contextual challenges that often limit their ability to support their children's optimal participation in learning, development, self-care and play. Consequently, the potential of these children to meet their participation needs as adolescents and adults is compromised.

There are limited studies detailing what may be appropriate and possibly effective responses to developmental, functional and participatory challenges for children infected with HIV, especially those on ART or HAART. Given that home-based intervention has been proven to be effective in improving cognitive and motor development for HIV positive children from families with low SES, and may consequently impact functional and participation outcomes for such children, this kind of intervention may relieve the cost burden on the South African state for rehabilitation services.

Possible positive impact on learning, development, self-care and play for HIV infected children through PI-CIHBI may hold important promise for early childhood development in the country. A description of appropriate PI-CIHBI for families with low SES will inform relevant occupational therapy in South Africa. Efficacy in promoting children's meaningful and productive participation in life will be affirming for both caregivers and therapists.

As part of the research, the Griffiths Mental Development Scales – Revised & Extended Revised (GMDS-R & ER) will be used to collect data at baseline, and twice at six monthly intervals. A pilot study is necessary to establish inter-rater reliability between two co-researchers on the GMDS-R & ER. 16 (10% of the main study sample) children will be recruited from the out-patient clinic at Victoria Hospital. These children are currently seen by one of the co-researchers for individual occupational therapy services. Data obtained from the assessment will inform ongoing intervention.

The study will adhere strictly to ethical principles as outlined in the Declaration of Helsinki (Seoul version, 2008). Ethics approval has been obtained from the Faculty of Health Sciences Human Research Ethics Committee of the University of Cape Town (HREC Reference number…….).

Caregiver informed consent as well as assent from children aged 7 to 8 years old will be sought before participation in the study resumes. There will be no coercion of any form in order gain participation from the study population and each caregiver-child dyad may withdraw from the study at any point in time, free of prejudice should they so wish. All personal information will be kept strictly confidential. The relevant hospital management personnel will be approached to seek consent to conduct this study following a positive response from the Department of Health.

Please forward any question or concern you may have regarding this research to contact details furnished below.

Principal Investigator:

A/Prof Professor Elelwani Ramugondo

Elelwani.Ramugondo@uct.ac.za

021- 406 6048

Chairperson of the UCT faculty of Health Sciences Human Research Ethics Committee:

Professor Marc Blockman

021- 406 6496

Draft Letter to Clinical Manager for Permission to Conduct Pilot Study at Victoria Hospital

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Clinic Manager

Victoria Hospital

To Whom It May Concern:

This is a formal request for permission to conduct a pilot study on a population comprised of HIV positive caregiver-child dyads who attend the paediatric out-patients clinic at your institution.

The proposed main study aims to investigate effects of play-informed care-giver implemented home-based intervention (PI-CIHBI) on participation outcomes for HIV positive children (Aged 6 months to 8 years old) on Highly Active Anti-retroviral Treatment (HAART) and living in families with low socio-economic status. There are well-established negative long-term consequences for learning and development for children affected with Acquired Immune Deficiency Syndrome (AIDS). While HAART has proven to be effective in prolonging life expectancy in children living with HIV/AIDS, access to comprehensive health care is critical for these children to continue enjoying quality of life. Caregivers of HIV+ children in South Africa often face contextual challenges that often limit their ability to support their children's optimal participation in learning, development, self-care and play. Consequently, the potential of these children to meet their participation needs as adolescents and adults is compromised.

There are limited studies detailing what may be appropriate and possibly effective responses to developmental, functional and participatory challenges for children infected with HIV, especially those on ART or HAART. Given that home-based intervention has been proven to be effective in improving cognitive and motor development for HIV positive children from families with low SES, and may consequently impact functional and participation outcomes for such children, this kind of intervention may relieve the cost burden on the South African state for rehabilitation services.

Possible positive impact on learning, development, self-care and play for HIV infected children through PI-CIHBI may hold important promise for early childhood development in the country. A description of appropriate PI-CIHBI for families with low SES will inform relevant occupational therapy in South Africa. Efficacy in promoting children's meaningful and productive participation in life will be affirming for both caregivers and therapists.

As part of the research, the Griffiths Mental Development Scales – Revised & Extended Revised (GMDS-R & ER) will be used to collect data at baseline, and twice at six monthly intervals. A pilot study is necessary to establish inter-rater reliability between two co-researchers on the GMDS-R & ER. 16 (10% of the main study sample) children will be recruited from the out-patient clinic at Victoria Hospital. These children are currently seen by one of the co-researchers for individual occupational therapy services. Data obtained from the assessment will inform ongoing intervention.

The study will adhere strictly to the ethical principles as outlined in the Declaration of Helsinki (Seoul version, 2008). Ethics approval has been obtained from the Faculty of Health Sciences Human Research Ethics Committee of the University of Cape Town (HREC Reference number…….).

Caregiver informed consent as well as assent from children aged 7 to 8 years old will be sought before participation in the study resumes. There will be no coercion of any form in order gain participation from the study population and each caregiver-child dyad may withdraw from the study at any point in time, free of prejudice should they so wish. All personal information will be kept strictly confidential.

Please forward any question or concern you may have regarding this research to contact details furnished below.

Principal Investigator:

A/Prof Professor Elelwani Ramugondo

Elelwani.Ramugondo@uct.ac.za

021- 406 6048

Chairperson of the UCT faculty of Health Sciences Human Research Ethics Committee:

Professor Marc Blockman

021- 406 6496

WC DoH Letter for Permission to Conduct Research at Groote Schuur Hospital

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Western Cape Department of Health

To Whom It May Concern:

This is a formal request for permission to conduct a research study on a population comprised of HIV positive caregiver-child dyads who attend a paediatric out-patients clinic at Groote Schuur Hospital.

The proposed study aims to investigate effects of play-informed care-giver implemented home-based intervention (PI-CIHBI) on participation outcomes for HIV positive children (Aged 6 months to 8 years old) on Highly Active Anti-retroviral Treatment (HAART) and living in families with low socio-economic status. PI-CIHBI will be compared with standard one-on-one occupational therapy intervention to see if it will produce equivalent or even greater improvement in child learning, development and play participation, and greater efficacy in caregivers in promoting these indicators. There are well-established negative long-term consequences for learning and development for children affected with Acquired Immune Deficiency Syndrome (AIDS). While HAART has proven to be effective in prolonging life expectancy in children living with HIV/AIDS, access to comprehensive health care is critical for these children to continue enjoying quality of life. Caregivers of HIV+ children in South Africa often face contextual challenges that often limit their ability to support their children's optimal participation in learning, development, self-care and play. Consequently, the potential of these children to meet their participation needs as adolescents and adults is compromised.

There are limited studies detailing what may be appropriate and possibly effective responses to developmental, functional and participatory challenges for children infected with HIV, especially those on ART or HAART. Given that home-based intervention has been proven to be effective in improving cognitive and motor development for HIV positive children from families with low SES, and may consequently impact functional and participation outcomes for such children, this kind of intervention may relieve the cost burden on the South African state for rehabilitation services.

Possible positive impact on learning, development, self-care and play for HIV infected children through PI-CIHBI may hold important promise for early childhood development in the country. A description of appropriate PI-CIHBI for families with low SES will inform relevant occupational

therapy in South Africa. Efficacy in promoting children's meaningful and productive participation in life will be affirming for both caregivers and therapists.

The study will involve 160 caregiver-child dyads over a year. Data will be collected using the Griffiths Mental Development Scales – Revised & Extended Revised (GMDS – R & ER) and the Test of Playfulness (TOP) on children aged 6 months to 8 years old, and Parenting Sense of Efficacy Instrument (P-SEMI) on the caregivers at base-line and twice at six monthly intervals. Intervention in both the experimental and control group will occur monthly, following the same scheduling currently followed for clinic visits.

The study will adhere strictly to ethical principles as outlined in the Declaration of Helsinki (Seoul version, 2008). Ethics approval has been obtained from the Faculty of Health Sciences Human Research Ethics Committee of the University of Cape Town (HREC Reference number…….).

Caregiver informed consent as well as assent from children aged 7 to 8 years old will be sought before participation in the study resumes. There will be no coercion of any form in order gain participation from the study population and each caregiver-child dyad may withdraw from the study at any point in time, free of prejudice should they so wish. All personal information will be kept strictly confidential. The relevant hospital management personnel will be approached to seek consent to conduct this study following a positive response from the Department of Health.

Please forward any question or concern you may have regarding this research to contact details furnished below.

Principal Investigator:

A/Prof Professor Elelwani Ramugondo

Elelwani.Ramugondo@uct.ac.za

021- 406 6048

Chairperson of the UCT faculty of Health Sciences Human Research Ethics Committee:

Professor Marc Blockman

021- 406 6496

Letter to Clinic Manager for Permission to Conduct Research at Groote Schuur Hospital

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Clinic Manager

Groote Schuur Hospital

To Whom It May Concern:

This is a formal request for permission to conduct a research study on a population comprised of HIV positive caregiver-child dyads who attend the paediatric out-patients clinic at your institution.

The proposed study aims to investigate effects of play-informed care-giver implemented home-based intervention (PI-CIHBI) on participation outcomes for HIV positive children (Aged 6 months to 8 years old) on Highly Active Anti-retroviral Treatment (HAART) and living in families with low socio-economic status. PI-CIHBI will be compared with standard one-on-one occupational therapy intervention to see if it will produce equivalent or even greater improvement in child learning, development and play participation, and greater efficacy in caregivers in promoting these indicators. There are well-established negative long-term consequences for learning and development for children affected with Acquired Immune Deficiency Syndrome (AIDS). While HAART has proven to be effective in prolonging life expectancy in children living with HIV/AIDS, access to comprehensive health care is critical for these children to continue enjoying quality of life. Caregivers of HIV+ children in South Africa often face contextual challenges that often limit their ability to support their children's optimal participation in learning, development, self-care and play. Consequently, the potential of these children to meet their participation needs as adolescents and adults is compromised.

There are limited studies detailing what may be appropriate and possibly effective responses to developmental, functional and participatory challenges for children infected with HIV, especially those on ART or HAART. Given that home-based intervention has been proven to be effective in improving cognitive and motor development for HIV positive children from families with low SES, and may consequently impact functional and participation outcomes for such children, this kind of intervention may relieve the cost burden on the South African state for rehabilitation services.

Possible positive impact on learning, development, self-care and play for HIV infected children through PI-CIHBI may hold important promise for early childhood development in the country. A description of appropriate PI-CIHBI for families with low SES will inform relevant occupational

therapy in South Africa. Efficacy in promoting children's meaningful and productive participation in life will be affirming for both caregivers and therapists.

The study will involve 160 caregiver-child dyads over a year. Data will be collected using the Griffiths Mental Development Scales – Revised & Extended Revised (GMDS – R & ER) and the Test of Playfulness (TOP) on children aged 6 months to 8 years old, and Parenting Sense of Efficacy Instrument (P-SEMI) on the caregivers at base-line and twice at six monthly intervals.

The study will adhere strictly to ethical principles as outlined in the Declaration of Helsinki (Seoul version, 2008). Ethics approval has been obtained from the Faculty of Health Sciences Human Research Ethics Committee of the University of Cape Town (HREC Reference number…….).

Caregiver informed consent as well as assent from children aged 7 to 8 years old will be sought before participation in the study resumes. There will be no coercion of any form in order gain participation from the study population and each caregiver-child dyad may withdraw from the study at any point in time, free of prejudice should they so wish. All personal information will be kept strictly confidential. The relevant hospital management personnel will be approached to seek consent to conduct this study following a positive response from the Department of Health.

Please forward any question or concern you may have regarding this research to contact details furnished below.

Principal Investigator:

A/Prof Professor Elelwani Ramugondo

Elelwani.Ramugondo@uct.ac.za

021- 406 6048

Chairperson of the UCT faculty of Health Sciences Human Research Ethics Committee:

Professor Marc Blockman

021- 406 6496

Appendix E: Permission letter to conduct research at GSH (Dr. Patel)

GROOTE SCHUUR HOSPITAL

Enquiries: Dr Bhavna Patel

E-mail : *Bhavna.Patel@westerncape.gov.za*

G46 Management Suite, Old Main Building, Private Bag X,

Observatory 7925 Observatory, 7935

Tel: +27 21 404 6288 fax: +27 21 404 6125 www.capegateway.go.v.za

Associate Professor E. Ramugondo

Occupational Therapy

Health & Rehabilitation

F56.76 – Old Main Building

E-mail: elelwani.ramugondo@uct.ac.za / paul.roux@uct.ac.za

Dear A/Professor Ramugondo

RESEARCH PROJECT: The Effects of Play-informed Care Giver Implemented Home-Based Intervention on Participation Outcomes for HIV Positive Children on Haart and Living in Families with Low Socio-Economic Status

Your recent letter to the hospital refers.

You are hereby granted permission to proceed with your research. Please note the following:

a) Your research may not interfere with normal patient care

b) Hospital staff may not be asked to assist with the research.

c) No hospital consumables and stationary may be used.

d) **No patient folders may be removed from the premises or be inaccessible.**

e) Please introduce yourself to the person in charge of an area before commencing.

f) Please provide the research assistant/field worker with a copy of this letter as verification of approval.

g) Confidentiality must be maintained at all times.

I would like to wish you every success with the project.

Yours sincerely

DR BHAVNA PATEL

CHIEF EXECUTIVE OFFICER **Date:** 14th January 2014

C.C. Mr Lionel Naidoo *Dr Janine Hendricks* *Mrs Rogini Pillay*

Appendix F: (1, 2, 3 & 4): Information letters

Information letter to caregivers for participation in pilot study

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Dear parent/caregiver

Thank you for taking the time to read this information letter. My name is ..... and I am an occupational therapist (OT) busy doing research with other researchers, to find out how to improve development, play and learning for children living with HIV.

There is very limited information about what may be appropriate and possibly effective ways to improve learning, play and other developmental goals for children infected with HIV, especially those on Anti-Retroviral Treatment. As a response, we are planning to do a study involving 160 caregivers and their children to compare whether group-based play-informed caregiver-implemented home based intervention (PI-CIHBI) will have the same or even better results than one-on-one occupational therapy treatment. Such information is important for OTs, parents and health-care managers to improve the way OT services are made available for children with HIV and their families. Before the main study can begin, one of the tests used to evaluate treatment needs to be checked to see if two different people can get the same results if they are testing the same child. This is important to make sure that the results collected during the main study are accurate.

I would like to invite you and your child to participate in checking the test. The test assesses movement, interaction, language, eye-hand coordination and ability to recognise shapes and numbers, and takes an hour to administer. Two researchers will watch your child perform a number of tasks that are required as part of the test, but write what they see separately. The information they collect will be used to check if they are able to observe the same level of performance in your child.

The assessment will be carried out at Victoria Hospital, in the OT Department where you bring your child for follow-up treatment. The researchers will find out from you about suitable time convenient for you. You will be provided with funds to cover the cost of using public transport. You will receive this on the day of the assessment.

You are under no pressure to participate in this study and you have the right to withdraw at any point without providing an explanation. There will be no penalty involved should you wish to

withdraw. The researchers or the hospital cannot use your decision to refuse participation or withdraw against you in any way.

There are no risks in taking part in the study and there will not be any reward. The information collected in checking the test will however be used as part of the treatment you are already receiving from your OT.

Thank you for considering this request. Please find the consent form attached for you to complete. Ethics approval has been obtained from the Faculty of Health Sciences Human Research Ethics Committee of the University of Cape Town (HREC Reference number…….).

Please forward any question or concern you may have regarding this research to the contact details furnished below.

Principal Investigator:

A/Prof Professor Elelwani Ramugondo

Elelwani.Ramugondo@uct.ac.za

021- 406 6048

Chairperson of the UCT faculty of Health Sciences Human Research Ethics Committee:

Professor Marc Blockman

021- 406 6496

Information letter to child participants for participation in pilot study

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

My name is ..... and I am an OT busy doing research about how to improve play and learning in children. There is very little information out-there about the best way to improve learning and play for children, especially those who have to attend clinics often. My team and I would like to find out whether working with mummies, grannies and aunties is the same or even better than working with children alone in improving learning and play in the children.

This information is important for OTs, mummies and daddies and everyone who is involved in the care of children so that we can all improve the way OTs work with children, especially those who have to visit clinics often. Before the main study can begin, one of the tests used to see if there is an improvement in the child or not after treatment needs to be checked to see if two different people can get the same results if they are testing the same child. This is important to make sure that the results collected during the main study are correct.

I have asked your mummy (grannie or auntie) if you can help us check the test, and she said it is OK. If you would like to take part in the study, you will need to do things like kicking a ball, cutting with scissors, tying shoe-laces and identifying a shape for an hour. Two people will watch you as you do these things and make notes on pieces of paper. If you say yes, but change your mind later, you can tell us you want to stop. You can ask me any question you want about the study.

Information letter to caregivers for participation in main research study

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

Dear parent/caregiver

Thank you for taking the time to read this information letter. My name is ..... and I am an occupational therapist (OT) busy doing research with other researchers, to find out how to improve development, play and learning for children living with HIV.

There is very limited information about what may be appropriate and possibly effective ways to improve learning, play and other developmental goals for children infected with HIV, especially those on Anti-Retroviral Treatment. As a response, we are planning to do a study involving 160 caregivers and their children to compare whether group-based play-informed caregiver-implemented home based intervention (PI-CIHBI) will have the same or even better results than one-on-one OT treatment. Such information is important for OTs, parents and health-care managers to improve the way occupational therapy services are made available for children with HIV and their families.

Assessment information will be collected using a number of tests at the beginning of the study, and twice after six consecutive months. Two tests will be used on the children to assess development, learning and play, and another on the caregivers to assess confidence to work and play with the child to improve learning, development and play.

After the first tests, there will be two kinds of intervention once every month. 80 caregivers and their children will receive PI-CIHBI, while the other group will have the child seen individually by an occupational therapist. Each PI-CIHBI session will run for 1.5 hours and will include two parts of 45 minutes each. The first part of the session will only be attended by the caregivers where a specific skill will be introduced. During the second part of the session, the children will join the group where the caregivers will have an opportunity to practice what they have learnt. The caregivers will be provided with a 'GO box' (a take home toolkit) in which various materials such as balls, crayons, and toys will be provided to allow them to engage in the group activities at home. Therapists will have no direct contact with children in this intervention.

In the group where the child will be seen individually by the OT, the child will be the main focus of treatment. The therapist will focus on the specifically identified needs of the child for development, learning and play using typically available methods; observations and caregiver interviews. The therapist will have 'Go boxes' available and will use the tools appropriate for the child according to the needs identified.

The total time commitment for caregivers and their children throughout the whole study will be 21 hours (3 for assessment and 18 for treatment) for those in the PI-CIHBI group, and 12 hours (3 for assessment and 9 for treatment) for the one where the child is seen individually by the O.T. Children will however receive the same amount of intervention (45 minutes for each visit) while in the clinic, regardless of which group they are in.

Assessments and interventions will be carried out at Groote Schuur Hospital, at the pediatric out-patient clinic where you bring your child for follow-up treatment. The researchers will find out from you about suitable time convenient for you. You will be provided with funds to cover the cost of using public transport. You will receive this on the day of each visit.

You are under no pressure to participate in this study and you have the right to withdraw at any point without providing an explanation. There will be no penalty involved should you wish to withdraw. The researchers or the hospital cannot use your decision to refuse participation or withdraw against you in any way.

There are no risks in taking part in the study and there will not be any reward. Findings from the study will be analysed by the research team and used for presentations, reports and research publications. No identifiable information about you or your child will be collected at any point during the study.

Thank you for considering this request. Please find the consent form attached for you to complete. Ethics approval has been obtained from the Faculty of Health Sciences Human Research Ethics Committee of the University of Cape Town (HREC Reference number……..).

Please forward any question or concern you may have regarding this research to the contact details furnished below.

Principal Investigator:

A/Prof Professor Elelwani Ramugondo

Elelwani.Ramugondo@uct.ac.za

021- 406 6048

Chairperson of the UCT faculty of Health Sciences Human Research Ethics Committee:

Professor Marc Blockman

021- 406 6496

Information letter to child participants for participation in main research study

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

My name is ..... and I am an OT busy doing research about how to improve play and learning in children. There is very little information out-there about the best way to improve learning and play for children, especially those who have to attend clinics often. My team and I would like to find out whether working with mummies, grannies and aunties is the same or even better than working with children alone in improving learning and play in the children.

This information is important for OTs, mummies and daddies and everyone who is involved in the care of children so that we can all improve the way OTs work with children, especially those who have to visit clinics often.

I have asked your mummy (grannie or auntie) if you can help join us in the study, and she said it is OK. If you would like to take part in the study, you will need to do come to the clinic with your mummy (grannie or auntie) once a month and do things like kicking a ball, cutting with scissors, tying shoe-laces and identifying shapes, for almost an hour. You will sometimes be video-taped while playing with your friends in the play-room at the clinic. You may need to do some home-work with your mummy (grannie or auntie) on the things you learnt at the clinic. If you say yes, but change your mind later, you can tell us you want to stop. You can ask me any question you want about the study.

Appendix G (1 & 2): Consent forms

Consent forms for caregivers to participate in the pilot study

Title: A pilot study to determine the inter-rater reliability on the Griffiths Mental Development Scales – Revised & Extended Revised (GMDS – R & ER)

I, ……have read (or had read to me by ……..) the Information Sheet. I understand what is required of me and my child. I do / do not consent to both our participation in the study (Circle appropriate response). All my questions have been answered. I do not fell that my child or I are being forced to partake in this study. I choose to participate of my own free will. I am aware that I can withdraw from the study at any time should I wish to do so. I have been assured that if I refuse to participate in the study or choose to withdraw at a later stage there will be no consequences for me or my child.

Signed:…….. Date: ……..

Caregiver Full Name:……

Place:……

Researcher:……Signed:……..

Consent forms for caregivers to participate in the main research study

Title: The effects of play-informed care-giver implemented home-based intervention on participation outcomes for HIV positive children on HAART and living in families with low socio-economic status.

I, ……have read (or had read to me by …….) the Information Sheet. I understand what is required of me and my child. I do / do not consent to both our participation in the study (Circle appropriate response). All my questions have been answered. I do not fell that my child or I are being forced to partake in this study. I choose to participate of my own free will. I am aware that I can withdraw from the study at any time should I wish to do so. I have been assured that if I refuse to participate in the study or choose to withdraw at a later stage there will be no consequences for me or my child.

Signed:……. Date: …….

Caregiver Full Name:……

Place:…….

Researcher:……Signed:…….

Appendix H (1 & 2): Assent forms

Assent forms for child participants to participate in the pilot study

I am happy  to be part of the study

I am unhappy  to be part of the study

Please circle the first face if you would like to be part of this study, or circle the second face if you would not like to be part of this study.

Signed:

Parent / Guardian Date and place

Researcher Date and place

Witness Date and place

Assent forms for child participants to participate in the main research study

I am happy  to be part of the study

I am unhappy  to be part of the study

Please circle the first face if you would like to be part of this study, or circle the second face if you would not like to be part of this study.

Signed:

Parent / Guardian Date and place

Researcher Date and place

Witness Date and place

Appendix I: Standard Scores VMI Test, STVP and STMC / IQ Scores

Standard Score	Interpretation
<70	Very low
70-79	Low
80-89	Below average
90-109	Average
110-119	Above average
120-129	High
>129	Very high

Appendix J: Budget Summary

Item	Description	Unit cost	No. of Units	Total cost	Amount requested from an external funder
Operational Research Expenditure					
GMDS-ER Assessor (Max R20 000)	Griffths Training	Payment for half fees	1	R3000	R3000
	Inter rater Assessments	16 assessments (2 hrs each) @ R50ph	1	R1600	R1600
	To collect data and score	80 participants pre test (2 hrs each) @ R50ph	1	R8000	R8000
	To collect data and score	80 participants post test (2 hrs each) @ R50ph	1	R8000	R8000
					R20 600
Masters Fees	1 Masters	R19 800 (year1) R17 500 (year2)	1	R 37 300	R37 300
Research travel					
Travel to Sites	Travelling to site	R 12.26/litre 100km per visit	20	R 1500	R1500
Participant /patient transport	Travelling to GSH	R 20/ visit x 12 months	80	R 19 200	R 19 200
Conference Attendance		Conference expenses	1	R6000	R 6000
Other, specify	Laptop / Netbook	R 4000	1	R 4000	R 4000
UCT Scholarship 2013 attained					+R40 000

NRF Grantholder Scholarship attained via Prof. Elelwani Ramagondo		+R40 000
TOTAL		R 88 600
Deficit		R8 600
Applications Made FOR 2014		
UCT Scholarship 2014	(Attained)	R40 000
NRF Innovation Scholarship 2014		R70 000 – Current NRF Scolarship held = R30 000

The Beery-Buktenica
Developmental Test of Visual-Motor Integration

Beery™ VMI Fifth Edition

Ages 2 through 7 (SHORT FORM)

by Keith E. Beery, Norman A. Buktenica, and Natasha A. Beery

Name: _____ Sex: ○ F ❑ M
Last First

School: _____ Grade: _____

Examiner: _____

Test Date: _____ year _____ month _____ day

Birth Date: _____ year _____ month _____ day

Chronological Age: _____ years _____ months

(Count more than 15 days as one month.)

SUMMARY

See the Beery VMI manual (fifth edition) for norms.

	Beery VMI	Visual Perception	Motor Coordination
Raw Scores:			
Standard Scores:			
Scaled Scores:			
Percentiles:			
Other Scaling:			

Comments and Recommendations:

PROFILE

Standard Score	Beery VMI	Visual Perception	Motor Coordination	Percentile
145	-	-	-	99.7
140	-	-	-	99.2
135	-	-	-	99
130	-	-	-	98
125	-	-	-	95
120	-	-	-	91
115	-	-	-	84
110	-	-	-	75
105	-	-	-	63
100	-	-	-	50
95	-	-	-	37
90	-	-	-	25
85	-	-	-	16
80	-	-	-	9
75	-	-	-	5
70	-	-	-	2
65	-	-	-	1
60	-	-	-	.8
55	-	-	-	.3

Begin testing on page 1. Turn booklet over with bound edge toward the student. If subtests are used, always test in this order: VMI → Visual → Motor.

Beery VMI Recording and Scoring

No.	Task or Form	Age Norm (Yrs-Mos)	Score	Observations
1		1-1 Imitated Mark or Scribble		
2		1-4 Spontaneous Scribble		
3		1-9 Contained Scribble		
4		2-0 Imitated		
5		2-6 Imitated		
6		2-9 Imitated		
7		2-10 Copied		
8		3-0 Copied		
9		3-0 Copied		
10		4-1		
11		4-4		
12		4-6		
13		4-7		

No.	Task or Form	Age Norm (Yrs-Mos)	Score	Observations
14		4-11		
15		5-3		
16		5-6		
17		5-9		
18		6-5		
19		6-8		
20		7-5		
21		7-11		

Beery VMI Raw Score = ☐ = total points up to three consecutive No Scores

Record raw score on page 16.
See the Beery VMI manual (fifth edition) for scoring, norms, and teaching recommendations.

Visual-Motor Integration Stepping Stones

You may wish to make notes on the following list of 48 visual motor integration (VMI) developmental Stepping Stones (age norms). These 48 are selected from the 700 Stepping Stones in the *Beery VMI Stepping Stones Record Checklist*, which parents can complete for periodic parent-professional evaluation and planning. The items for parents are listed without specific age norms, just a six-month approximate age range. For professional use, 391 VMI Stepping Stones age norms and *specific* age norms for gross motor, fine motor, and visual perceptual development can be found in the Beery VMI manual (fifth edition). Also see the teaching chapter in the manual for teaching recommendations, including the use of the *Beery VMI Developmental Teaching Activities* for children from birth to age six.

Ages shown below are in years and months. (For example, 0-3 = 0 years and 3 months.)

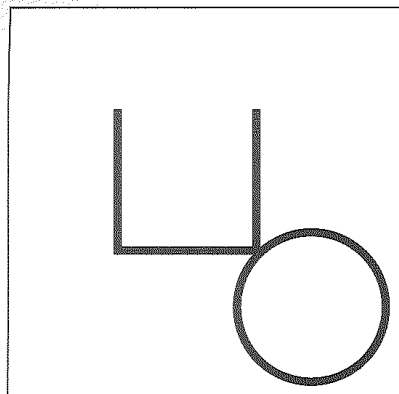
Age	Beery VMI Stepping Stone
0-3	Reaches toward and touches toy
0-6	Picks up small objects or toys
0-9	Hits at dangling objects with hands
0-9	Looks at and manipulates objects in hand
0-9	Bangs small objects on table
0-9	Reaches for small objects with just one hand
0-9	Feeds self finger foods
0-11	Drops small things, such as raisins, into a relatively small opening, such as a cup
1-0	Helps to pull off simple clothing and extends arms and legs to help with dressing
1-0	Imitates adult by scribbling with crayon or pencil
1-0	Makes a stack of 2 blocks
1-0	Copies housework and other activities you do, such as combing hair
1-0	Tries to kick ball by walking into it or by swinging leg (may miss)
1-0	Throws small ball (overhand or underhand) a few feet while standing
1-0	Scoops from one container to another and feeds self some foods without much spilling
1-11	Builds a 6-block tower
2-0	Kicks ball forward with either foot without support
2-0	Throws a large ball
2-0	Imitates building a 2- to 4-block "train" with chimney
2-0	Undresses with help only for fasteners and pullovers with roomy necks
2-0	Catches a large ball thrown gently from very close
2-0	Makes small cuts (snips) on line with child-safe scissors and some help
2-0	Pours accurately from one container to another
2-11	Dresses self with help with fasteners
3-0	Makes continuous cuts with child-safe scissors
3-0	Throws tennis ball 5–7 feet overhand with one hand
3-0	Imitates making a 3-block bridge
3-0	Catches large ball thrown from 3 feet away
3-6	Puts shoes on completely, on correct feet
3-7	Imitates teeth with horizontal and vertical motions
3-9	Kicks large ball while it is rolling, rolled from 4 feet away
3-11	Throws small ball underhand 5 feet, hitting a 2-foot-square target 2 feet above floor
4-0	Draws a person with 3 different body parts
4-1	Pedals a tricycle around obstacles and makes U turns
4-3	Dresses and undresses when requested without much help
4-5	Catches a big ball bounced from 3 feet away
4-6	Bounces ball 2–3 times
4-6	Cuts easy foods with a knife
4-7	Cuts out a big circle with scissors
4-11	Connects a series of dots spaced 1/2 inch apart to make simple drawings, such as lines, circles, squares
5-0	Ties shoes
5-1	Catches tennis ball with hands and chest
5-1	Draws a person with 6 or more different parts
5-5	Connects 2 dots (about 6 inches apart) with a straight line that does not deviate more than 1/4 inch
5-5	Brushes or combs hair well
5-8	Cuts most foods with a knife
5-7	Prints own first name in either uppercase or lowercase without a model
5-11	Cuts out a simple picture following general outline within 1/4 inch

Beery VMI

19

20

21



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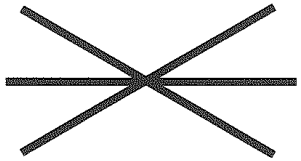
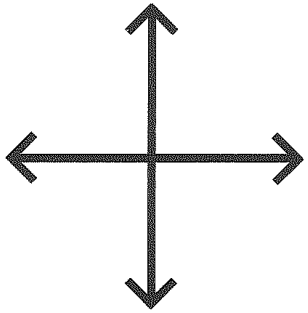


17



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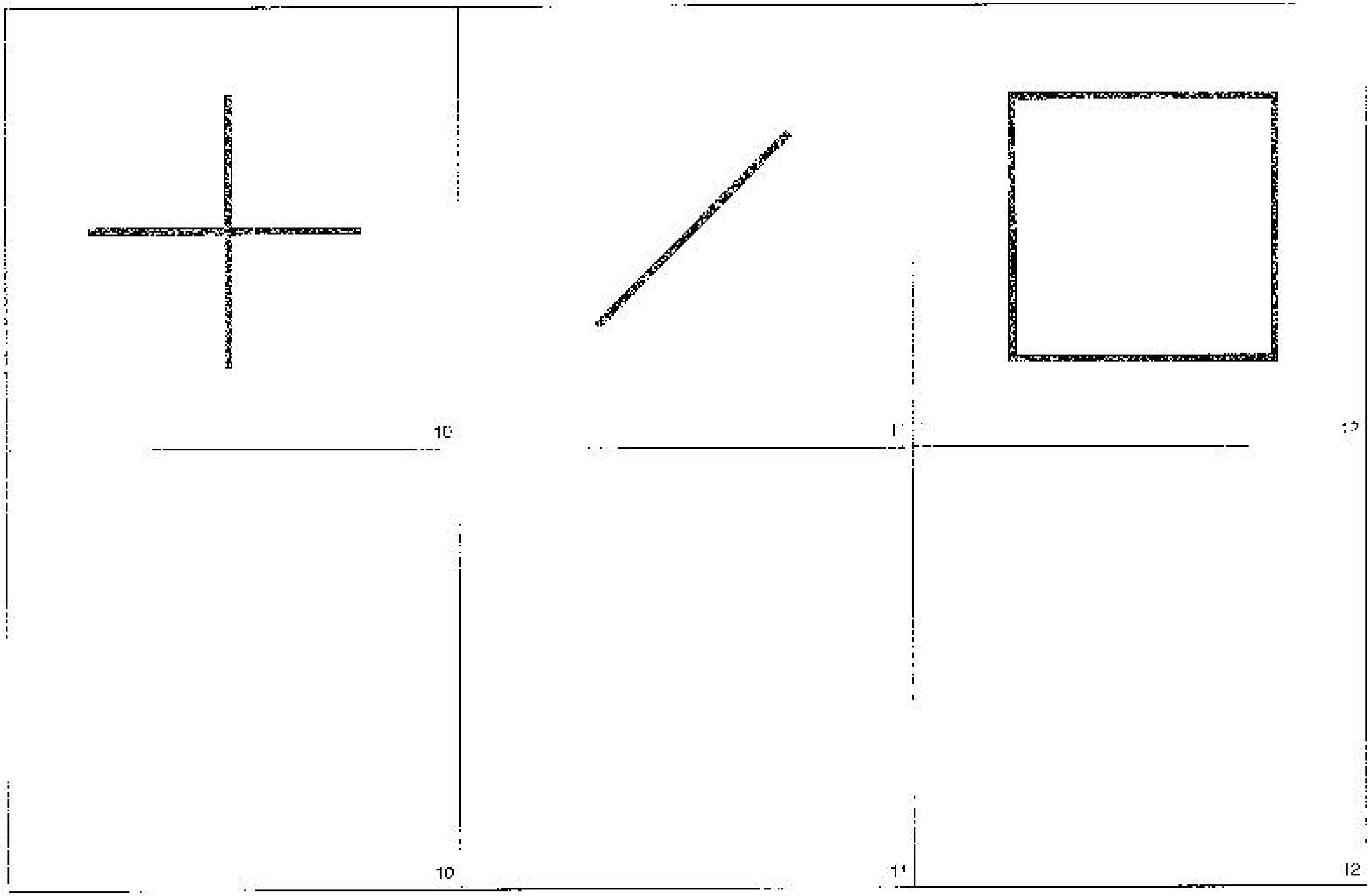
18

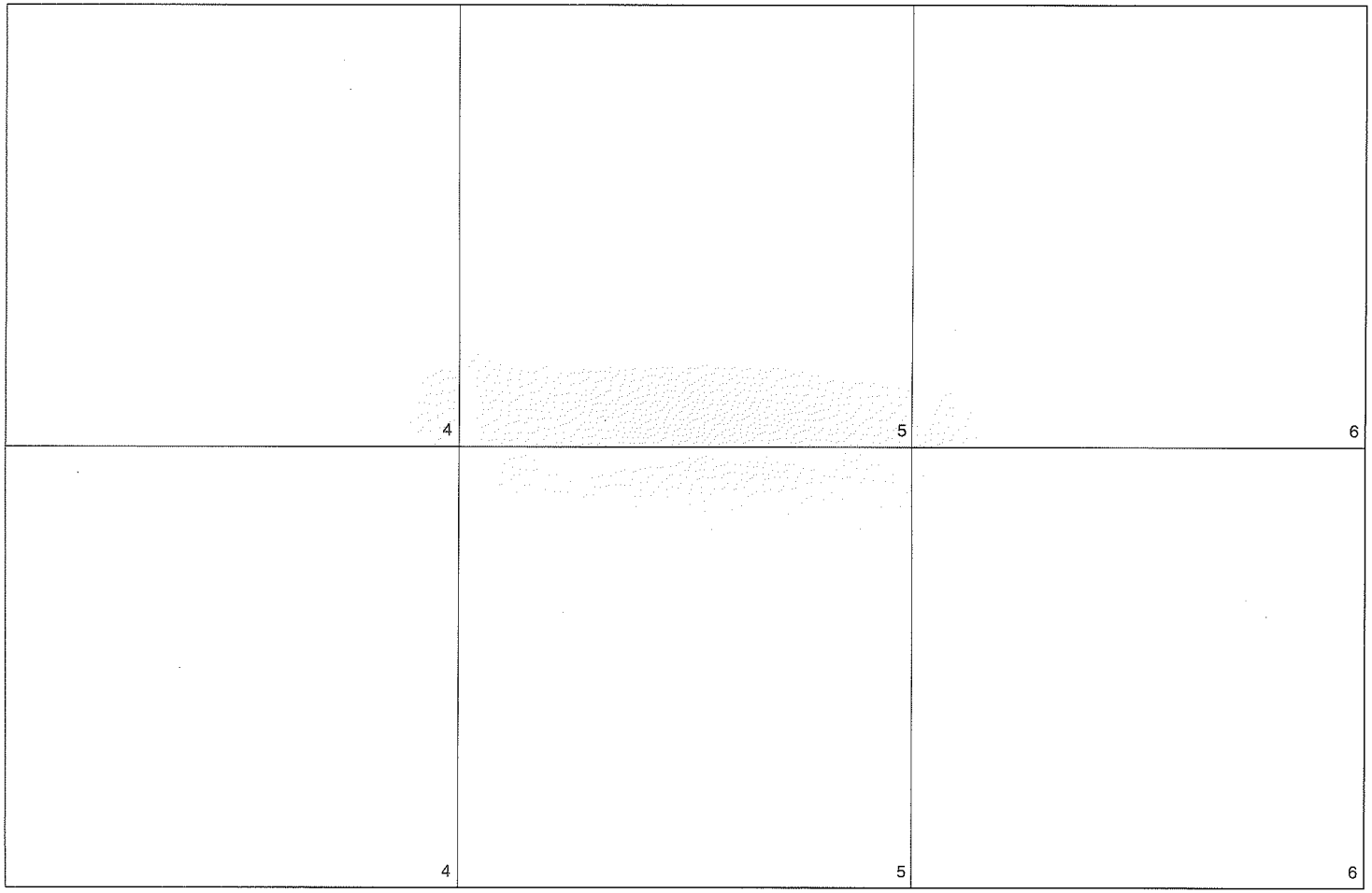


Beery VMI

Page 6

Beery VMI

Imitation of vertical, horizontal, and circular lines



Beery VMI

Appendix L: Beery Buktenica Visual Motor Integration Test, Visual Perceptual subtest

The Beery™ VMI Developmental Test of Visual Perception

Visual Perception

Fifth Edition

by Keith E. and Natasha A. Beery

Ages 2 through 18

Name: _____ Sex: ○ F ☐ M
Last First
School: _____ Grade: _____
Examiner: _____

TURN

Test Date: ____ year ____ month ____ day
Birth Date: ____ year ____ month ____ day
Chronological Age: ____ years ____ months
(Count more than 15 days as one month.)

Task 1. Points to one body part on self when asked: __ eye __ hair __ ear
Task 2. Points to at least 2 of 3 outline pictures: __ cat __ dog __ pig
Task 3. Points to 6 of 8 pictured body parts when asked:
__ hair __ nose __ ear __ foot __ mouth __ hand __ tummy __ eye

Visual Perception Raw Score: _____ (Also enter on the front of the Beery VMI test booklet.)
See the Beery VMI manual (fifth edition) for administration and scoring instructions.

Start timing here.

4 5 6 7 8 9

PEARSON

PsychCorp

The Beery™ VMI Developmental Test of Motor Coordination

Motor Coordination

Fifth Edition

by Keith E. and Natasha A. Beery

Ages 2 through 18

TURN

Name: _____ Sex: ○ F ❑ M
Last First

School: _____ Grade: _____

Examiner: _____

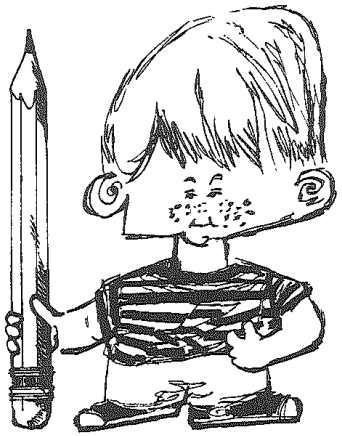
Test Date: ____ year ____ month ____ day

Birth Date: ____ year ____ month ____ day

Chronological Age: ____ years ____ months
(Count more than 15 days as one month.)

Motor Coordination Raw Score: _____ (Also enter on the front of the Beery VMI test booklet.)

See the Beery VMI manual (fifth edition) for administration and scoring instructions.



Let's Draw!

Use a No. 2 pencil (or another pencil with soft black lead) or a ballpoint pen with black ink.
Remember, you get one try with no erasing.
Keep the booklet straight in front of you and don't tilt it.
Just do the best you can on both the easy ones and the hard ones.

Don't skip any!

Please turn the page from the top to begin.

PEARSON

P.O. Box 1416 Minneapolis, MN 55440 800.627.7271 www.PearsonAssessments.com

A 0 9 8 7 6

PsychCorp

Product Number 46220/46221

Start timing here.
7
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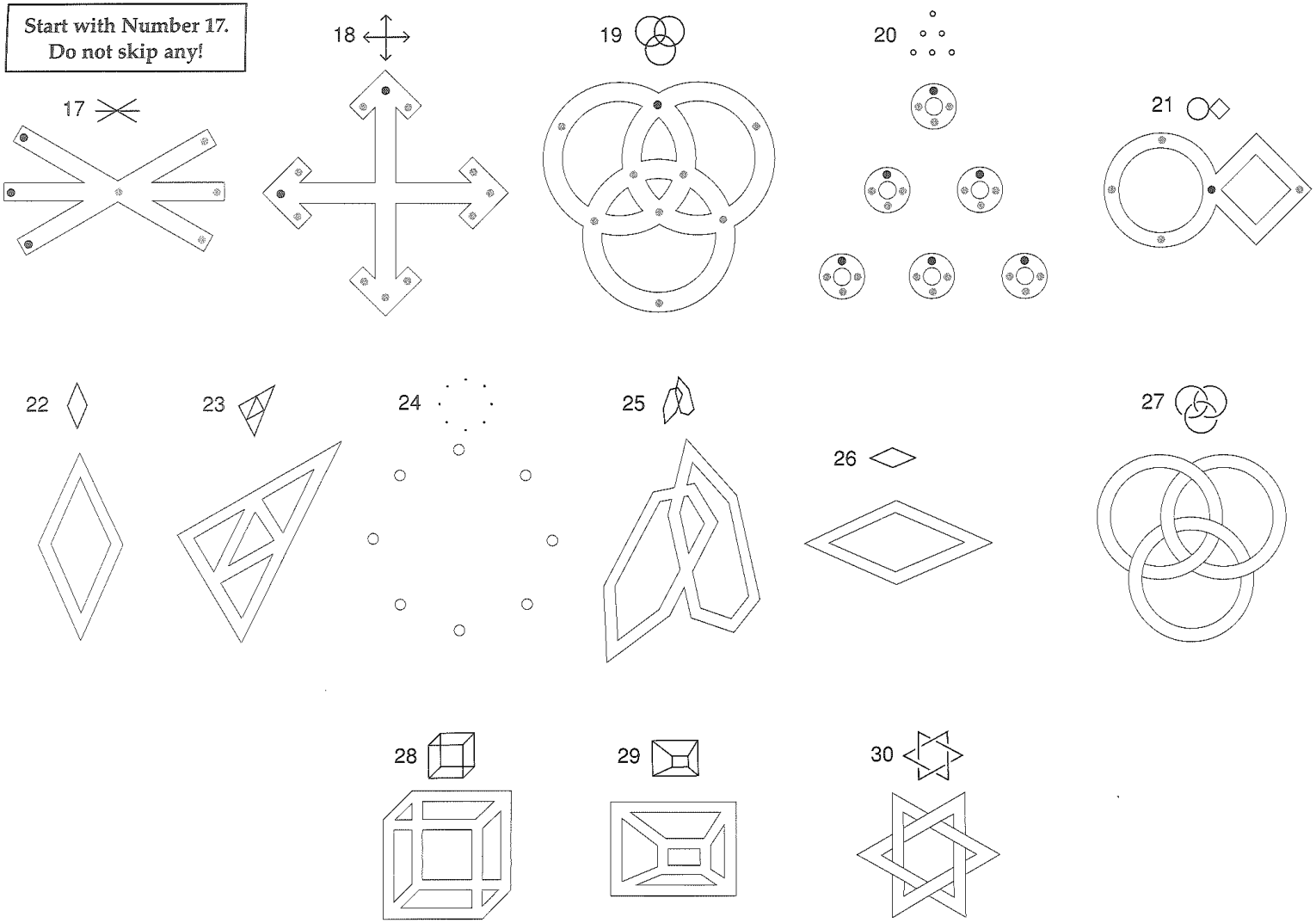
Start with Number 17.
Do not skip any!



Appendix N: Griffiths Mental Development Scale – Extended Revised version

GRIFFITHS MENTAL DEVELOPMENT SCALES – EXTENDED REVISED (GMDS-ER)

for testing babies and young children
from birth to eight years

RECORD BOOK

Child's name: ..... Gender: M/F .....

Address: .....

.....

..... Telephone: .....

Examiner: .....

Referral source: .....

Date of first assessment: ..... year ..... month ..... day

Date of birth: ..... year ..... month ..... day

Chronological age: ..... year ..... month ..... day

Age at first testing: ..... months ..... days

..... months

IMPORTANT NOTICE

REMEMBER TO CONVERT RAW SCORES TO FINAL SCORES USING PERCENTILE TABLES OR THE ANALYSIS MANUAL.

Published by Hogrefe – The Test Agency, 4630 Burgner House, Kingsgate, Oxford Business Park South, Oxford, UK.

HOGREFE
THE TEST PEOPLE

Child's name: ..... Date of birth: .....

Gestation: ..... Birth weight: ..... Delivery: .....

Position in family: ..... Age of siblings: .....

Mother's name: ..... **Father's name:** .....

Age: ..... Nationality: ..... Age: ..... Nationality: .....

Occupation: ..... Occupation: .....

Relevant history: .....

.....

.....

Reason for referral: .....

.....

.....

Vision: ..... Hearing: .....

Summary of test results

Subscales	A			B			C			D			E			F		
Section I (months)*																		
Section II (months)*																		
Section III (items x 2)*																		
Section IV (items x 2)*																		
TOTAL RAW SCORE† for subscales																		
Percentile score																		
Confidence range																		
z-score																		
Age equivalent score (months)																		
Date of test																		
Chronological age																		
Corrected age																		

GQ‡			

*Use MA in months for Sections I and II; items x 2 for Sections III and IV.
†Add 'months' of MA for Sections I and II to 'items x 2' for Sections III and IV.
‡Obtain the GQ raw score by taking the ***average*** of the ***raw scores*** for the six subscales.

Clinical observations/behaviour/diagnosis: .....

.....

.....

.....

.....

.....

SECTION I:

Year 1 Months of age (approx.)		Subscale A Locomotor	Response		Subscale B Personal-Social	Response		Subscale C Hearing and Language	Response
	1	Lifts chin when prone		1	Regards person – fleeting glance		1	Startled by sound R	
	2	Pushes with feet against examiner's hands alternate or both		2	Quieted when picked up R		2	Listens to bell	
	3	Holds head erect for few seconds (sitting)		3	Enjoys bath R		3	Vocalisation other than crying	
	4	Kicks vigorously		4	Visually recognises mother		4	Cooing – one syllable R	
1	5	Lifts head up when prone 25°→40°		5	Follows moving persons with eyes		5	Makes two different sounds	
	6	Active in bath – kicks R		6	Smiles			Listens to music ✓ E	
	7	Rolls from side to back		7	Vocalises when talked to any sound		7	Searches for sound with eyes	
2	8	Back firm when held in sitting position		8	Returns examiner's glance with smiling or cooing		8	Searches for sound with head movements	
	9	Lifts head when in dorsal position pull-to-sit		9	Friendly to strangers R		9	Laughs aloud R	
3	10	Lifts head, shoulders and chest when prone		10	Expresses 2 or more recognisable emotions, e.g. pleasure, fear, sadness, distress or anger		10	Talks (babbles) to persons	
	11	Holds head erect continuously more knees while on lap		11	Stops crying when talked to R		11	Coos or stops crying on hearing music	
	12	Lifts head and shoulders, 'dorsal pull-to-sit'		12	Frolics when played with		12	Turns head deliberately to bell test both sides	
4	13	Crawling reaction 1: draws up knees, etc attempts to go forward		13	Regards mirror image 1: looks at		13	Makes 4 different sounds	
	14	Rolls from side to side via dorsal position		14	Resists adult who tries playfully to take ring		14	Listens to tuning fork 10cm away, both sides	
	15	Sits with slight support		15	Turns head to person talking or singing		15	Responds when called	
	16	Plays with own toes R		16	Holds a spoon		16	Manipulates bell must try ring	
5	17	Stepping reaction 1: dancing movements		17	Anticipatory movements when about to be lifted doesn't have to lift arms		17	Shouts for attention R	
	18	Sits alone for a short time		18	Knows strangers from familiar friends		18	2-syllable babble	
	19	Crawling reaction 2: can turn around when left on floor (pivoting)		19	Prompt reaction to situation, e.g. at table, waiting to be fed reach for objects		19	Listens to conversations	
6	20	Crawling reaction 3: tries vigorously to crawl		20	Manipulates cup or spoon in play		20	Rings bell by handle	
	21	Can roll from stomach to back (or from back to stomach)		21	Displeased if toy is taken		21	Looks at pictures for a few seconds	
	22	Crawling reaction 4: makes some progress forwards or backwards		22	Holds and bites biscuits, rusks, ice-cream wafers, etc		22	Singing tones R	
7	23	Stepping reaction 2: one foot in front of the other		23	Interested in small children other than own siblings R		23	One word (mama, dada, etc) definite and meaningful R	
	24	Can be left sitting on floor R		24	Helps to hold cup or mug for drinking		24	Babbled phrase: 4+ syllables R	
8	25	'Stands' when held up bears weight		25	Pulls off hat		25	Likes rhymes and jingles	
	26	Sits well in a chair		26	Drinks from any open cup or mug if held to lips		26	Knows own name	
9	27	Crawling reaction 5: creeps on hands and knees, etc (or feet)		27	Stretches to be taken up		27	Babbled monologue when alone R	
	28	Pulls self up by furniture		28	Finger feeds (thumb and forefinger), e.g. sultanas, 'Smarties', etc R		28	Shakes head for 'No' R	
	29	Can stand holding on to furniture		29	Picks up and drinks from lidded and closed feeder-cup unaided R		29	Uses 2 definite words R	
10	30	Side-steps round inside of cot or playpen holding rails /furniture		30	Responds socially to mirror image 2: smiles at or plays with		30	Reacts to music vocally R	
	31	Climbs on a low ledge or step		31	Gives affection R		31	Short babbled sentences	
11	32	Can walk when led one/two hands held		32	Plays very simple interactive games with others R		32	Uses 3 words	
	33	Climbs stairs (up) crawls up		33	Plays with cup, spoon and saucer put cup in middle		33	Identifies objects (1)	
	34	Likes pushing pram, toy, horse, etc R		34	Waves bye-bye R		34	Tries definitely to sing R	
12	35	Stands alone		35	Shows an interest in the activities of others R		35	Identifies objects (2)	
		SECTION I: A Total items = ____ Months credit: (/35) × 12 = ____			SECTION I: B Total items = ____ Months credit: (/35) × 12 = ____			SECTION I: C Total items = ____ Months credit: (/35) × 12 = ____	

4

FIRST YEAR

	Subscale D Eye and Hand Co-ordination	Response
	Follows moving light with eyes (shine torch on forehead) 40cm	
	Looks at bell-ring or toy momentarily (hold 35cm away)	
	Looks steadily at bell-ring held still	
	Follows moving bell-ring horizontally (40-45cm away)	
	Follows moving bell-ring vertically (35cm away, ↑ 30cm)	
	Glances from one object to another (use bell ring + ball)	
	Follows moving bell-ring in a circle (40cm away)	
	Watches objects pulled along by string	
	Grasps ring when given	
	Visually explores new environment	
	Reaches for ring and grasps	
	Carries ring to mouth	
	Clutches at dangling ring (25cm away, just above eye)	
	Secures dangling ring	
	Hands explore table surface	
	Plays with ring – shaking, banging, etc	
17	Reaches for and picks up string (demo, place string 6cm away)	
	Looks for fallen object	
	Strikes one object with another	
20	Secures ring by means of string	
21	Watches examiner scribble	
22	Forefinger and thumb partly specialised	
23	Dangles ring by string	
24	Fine prehension	
	Interested in motor car R	
	Likes holding little toys	
	Throws objects (record how child throws)	
28	Thumb opposition complete	
29	Can hold pencil as if to mark on paper	
30	Can point with index finger (score when using doll)	
31	Plays pulling ring or toy by string	
32	Uses pencil on paper a little	
33	Preference for one hand R	
	Plays pushing little cars along	
	Can hold 4 cubes in hands at once D TK2	

SECTION I: D

Total items = ____

Months credit: (/35) × 12 = ____

	Subscale E Performance	Response
	Reflex grasp of examiner's finger (grasp + hang on with mouth)	
2	Reacts to paper 1: generalised physical movements (tissue over face)	
	Energetic arm movements	
	Hand goes to mouth R	
	Holds rod	
	Plays with own fingers R	
7	Reacts to paper 2: vigorous head-turning	
	Resists withdrawal of rod	
9	Looks at yellow box on table (130cm away)	
10	Clasps cube put in hand and holds it	
11	Shows interest in box	
12	Drops first cube for second	
13	Reacts to paper 3: pulls it away	
14	Takes cube or toy from table	
15	Holds 2 cubes (one in each hand)	
16	Manipulates cube or toy	
17	Grasps box	
18	Passes toy or cube from hand to hand	
19	Reacts to paper 4: reaches for and takes	
20	Manipulates 2 objects at once (embroidery rings or other)	
21	Reacts to paper 5: plays with – tears, crumples	
	Lifts cup inverted over toy	
23	Drops one cube for third	
24	Rattles box D TK2	
25	Lifts lid off box	
	Finds toy under cup	
27	Tries to take cubes out of box	
28	Holds third cube	
29	Clicks 2 bricks together (in imitation) TK2	
30	Manipulates box, lid and both cubes	
31	Removes both cubes from box D	
	Unwraps and finds toy or cube (use tissue)	
	One circle board D TK2	
34	Removes lids and both bricks from the other 2 boxes	
35	Puts 2 bricks back into any one box when encouraged to do so	

SECTION I: E

Total items = ____

Months credit: (/35) × 12 = ____

5

SECTION II:

Year 2 Months of age (approx.)	Subscale A Locomotor	Response	Subscale B Personal-Social	Response	Subscale C Hearing and Language	Response
	Climbs into low chair (E)		Claps hands in imitation		1 Uses 4 words	
13	2 Walks alone		Puts small objects in and out of cup in play (D)(E)		2 Uses 5 words	
	Kneels on floor or chair		3 Tries to help dressing – arms into coat, etc. (R)		3 Identifies objects (3)	
14	Stoops		Obeys simple requests – 'give me the cup' (R)		4 Uses 6 or 7 words	
	Trots about well		5 Can hold open cup for drinking (R) but will spill		5 Enjoys picture book	
15	6 Can walk backwards can use toy on string		Tries to turn doorknob or handle (R)		6 Identifies objects (4)	
	Climbs to stand on a chair		7 Shows shoes		7 Uses 9 words	
16	Climbs stairs – up and down (R)		8 Uses spoon himself: spills some (R)		8 Names objects (1)	
	9 Walks backwards pulling toy on string		Likes adult to show book		9 Long babbled sentences – some words clear	
17	10 Can seat self at table		Parts of doll's body (1) – hands, hair, feet, eyes, nose and mouth		10 Names objects (2)	
18	11 Walks upstairs can still hold		Cleanliness – indicates when wet or dirty (word or sign)		11 Uses 12 words	
19	Runs		12 Uses spoon well		12 Uses 20+ words	
	Can kick a ball (tennis ball size) allowed to step		13 Manages cup well – half full		13 Identifies objects (5 or 6)	
20	Goes alone on stairs any method but without adult		Can open a door		14 Uses word combinations	
21	15 Walks up and down stairs can still hold		15 Can take off shoes and socks can loosen straps etc.		15 Identifies objects (7)	
22	Jumps		Parts of doll's body (2) – hands, hair, feet, eyes, nose and mouth		16 Listens to stories	
23	both feet to leave floor		Parts of doll's body (3) – hands, hair, feet, eyes, nose and mouth		17 Names objects (3)	
24	Can jump off a step feet off floor together		18 Helps actively to dress or undress (R)		18 Identifies objects (6)	
	Jumps off one step – both feet together and land together		Parts of doll's body (4) – hands, hair, feet, eyes, nose and mouth		19 Names objects (4)	
	19 Walks upstairs – one foot on each step, adult manner * can use occasional support		Puts away toys or objects when encouraged to do so (R)		20 Names objects (5)	
			21 Asks for things at table by name – at least 2 articles of food or drink (R)		21 Uses sentences of 4+ syllables	
			Begins to co-operate in play with other children (R)			
			23 At table uses spoon and fork together without help can spill *(R)			
	SECTION II: A Total items = ... Months credit: (/19) × 12 = ...		SECTION II: B Total items = ... Months credit: (/23) × 12 = ...		SECTION II: C Total items = ... Months credit: (/21) × 12 = ...	

*Note: Please refer to the revised instructions which provide the administration instructions for items AII.19, BII.23 and EII.18 (see Administration Manual, page 24).

SECOND YEAR

	Subscale D Eye and Hand Co-ordination	Response
	Plays at rolling a ball	
	Places one lid, box or brick upon another can instruct	
3	Pulls cloth to get toy	
4	Scribbles more freely	
	Constructive play with boxes or other materials	
	Can throw a ball towards person demo with mom	
	Tower of 3 bricks	
	Tower of 4 bricks	
9	Enjoys vigorous straight scribble	
	Can transfer cube from one container to another TX2 (D)	
	Can pour water from one container to another TX2 (D)	
	Tower of 5 bricks	
	Makes a brick or toy 'walk'	
14	Circular scribble (in imitation)	
	Tower of 6 bricks	
	Throws ball into basket (D) TX2 stand 60cm away	
	Train of 3 (bricks)	
18	Perpendicular stroke (D)	
19	Horizontal stroke (D)	

	Subscale E Performance	Response
	Two-circle board (1 in) Big on (L)	
2	Puts bricks in and out of boxes in play	
	Square board TX2	
	Two-circle board (2 in)	
5	Can put lid back on box can give him lid	
	Three-hole board (1 in) TX2 □ on (L)	
	Circle and square board together ○ on (L) TX2	
	Three-hole board (2 in)	
9	Puts 2 bricks into one box, and the lid on; all complete	
	Three-hole board (3 in)	
	Circle and square boards rotated	
	Two-circle board rotated	
13	Puts 2 bricks in each box	
	Three-hole board rotated (2 in)	
	Three-hole board rotated (3 in)	
16	Puts lids on all 3 filled boxes	
	Can open screw toy show sweet inside	
	Reassembles screw toy partially	
	Returns 9 bricks to box and replaces lid within 60 secs (Time ____ secs)	

SECTION II: D

Total items = ____

Months credit: (/19) × 12 = ____

SECTION II: E

Total items = ____

Months credit: (/19) × 12 = ____

Objects

	IDENTIFIED	NAMED
Ball		
Spoon		
Brush		
Car		
Doll		
Cup		
Sock		
Brick		
TOTAL		

Toileting questions (unscored Subscale B)

A: Bowel control complete

Is this child usually quite bowel-continent and reliable as regards this function, except for an occasional mishap?

YES/NO

B: Bladder control by day

Is this child usually reliably dry by day in regard to bladder function, but not necessarily at night?

YES/NO

Total months credit: SECTION II

(Total items passed / 101) × 12 = ____ months

SECTION III: THIRD

		Subscale A Locomotor	Response		Subscale B Personal-Social	Response		Subscale C Language	Response
YEAR 3		Jumps off 1 step D; TR2 feet tog. jump + land		1	Puts away toys when encouraged to do so R		1	Names 12 objects in box	
	2	Static balance 1: can stand on one foot for 3+ seconds D; TR2 C			Gives first name		2	Picture vocabulary (12) (NB: Administer after item FIII.10) stop if 6 wrong in a row	
	3	Can rise from kneeling without using hands D C; TR2		3	Assists with small household tasks on request R		3	Defines by use (2+) ask in order	
	4	Can run fast indoors or in a small outside space evenly, steady pace		4	Uses spoon and fork together, without help no spilling R		4	Picture description: names 6+ objects in large picture	
	5	Can stand and walk tip-toe: 6+ steps (5secs) D C; TR2			Knows own gender correct response said b4 in asking		5	Uses 2 or more descriptive words	
		Walks upstairs: one foot on each step, adult manner D; TR2 no holding			Plays well with other children R		6	Talks well in sentences of 6+ syllables	
		Can pedal a tricycle or other pedal toy R		7	Can undo buttons D C; TR2 at least 2			Names 18 objects in box	
	8	Can cross both feet and both knees when seated D C; TR2 on chair			Can undress self R			Names 6+ colours Tick if known: red, white, blue, orange, pink/lilac/purple, brown, green, yellow, grey, black	
YEAR 4		Jumps off 2 steps D; TR2			Washes own hands and face, with some assistance R		9	Repeats one 6-syllable sentence	
	10	Can walk a chalk or painted line at least 1.2m (4ft) long D; TR2 heel - toe			Knows age		10	Comprehension (2+ items)	
		Can run and kick a medium-sized ball D; TR2 3 paces away, no stopping		11	Can do up buttons D C; TR2		11	Defines by use (6+)	
		Can jump over 15cm (6in) foam block hurdle D; TR2 3 blocks, feet tog.			Gives family name		12	Uses 2+ personal pronouns correctly	
		Walks downstairs: one foot on each step, adult manner D; TR2 no holding			Can put on socks and shoes, unaided R		13	Picture description: names 12 objects in large picture	
		Can hop on one foot: 3+ hops D; TR2 check both (L) + (R)			Can dress and undress self R		14	Picture vocabulary (18+) (NB: Administer after item FIII.10)	
YEAR 5	15	Can run fast out of doors R			Managed topcoat, cardigan or raincoat unaided R		15	Opposite (2)	
	16	Touches toes, knees straight D; TR2			Brushes own teeth, without assistance can ask how? R		16	Repeats one 10-syllable sentence	
		Broad jump 37.5cm (15in) over foam blocks D; TR2 9in apart, feet tog.		17	Can fetch item in a shop on request R		17	Picture description: one or more descriptive sentences	
		Kangaroo jumps over 3 foam blocks D C; TR2 4 x 12in apart			Can fasten shoe buckles D			Materials (2+) 1. 'What is a table made of?' 2. 'What is a window made of?' 3. 'What is a house made of?'	
		SECTION III: A Total items = ____ x 2 = ____			SECTION III: B Total items = ____ x 2 = ____			SECTION III: C Total items = ____ x 2 = ____	

18 OBJECTS IN A BOX (Items CIII.1, CIII.7)
Please tick if named correctly

Chair	☐	Cat	☐	Brick	☐	Watch	☐
Doll	☐	Cup	☐	Coin	☐	Key	☐
Ball	☐	Spoon	☐	Knife	☐	Pencil	☐
Horse	☐	Button	☐	Fork	☐		
Dog	☐	Car	☐	Plate	☐		

PICTURE CARDS (Items CIII.2, CIII.14)
Please tick if named correctly

1. Ball	☐	6. Spoon	☐	11. Bird	☐	16. Teapot/Kettle	☐
2. Shoe	☐	7. Flower	☐	12. Key	☐	17. Flag	☐
3. Dog	☐	8. Horse	☐	13. Umbrella	☐	18. Shop	☐
4. Train	☐	9. Cap/Hat	☐	14. Hammer	☐	19. Wheelbarrow	☐
5. Boy	☐	10. Bed	☐	15. Cup	☐	20. Owl	☐

DEFINES BY USE (Items CIII.3, CIII.11)
Please tick if correct

1. Cup	☐	4. Coat	☐	7. Pencil	☐		
2. Knife	☐	5. Car	☐	8. Watch	☐		
3. Chair	☐	6. House	☐	9. Key	☐		

TO EIGHTH YEARS

	Subscale D Eye and Hand Co-ordination	Response		Subscale E Performance	Response		Subscale F Practical Reasoning	Response
1	Builds a tower of 8+ bricks (same colour blocks) D C TX2		1	4-squares board: 50 secs TX2 (small □ on ○, pyramid in centre)		1	Knows 'penny' or 'money'	
2	Copies a horizontal stroke D		2	6-hole board: 50 secs TX2 C (oval on top, 2 piles on top)		2	Repeats one digit (6; 2; 7) ◈	
3	Handles scissors: tries to cut D C		3	Returns 9 bricks to box and puts lid on: 50 secs TX2 C		3	Compares two inserts for size (which one is bigger? swap)	
4	Threads 6 beads (2 rewind pattern twice) D C (demo with 2, but take off)			Reassembles screw toy D C TX2			Repeats 2 digits (1-6; 5-3; 9-4) ◈	
	Copies a circle: Stage 1 TX2 (no demo)		5	4-squares board: 40 secs TX2 C		5	Knows 'big' and 'little'	
	Folds a 10.2cm (4in) square in half (must stand up) D C		6	6-hole board: 40 secs TX2 C			Preliminary counting to 4+	
7	Threads 11+ beads D C		7	Assembles brick boxes by colour: all 12 pieces		7	Compares two towers for height (↑5 ↑3 which one is higher? swap)	
	Copies a cross: Stage 1		8	11-hole board: 60 secs TX2 C (★ @ top, 2 piles with ○ between)		8	Compares two lines for length (which one is longer? swap) D	
	Draws a person: Stage 1		9	Builds bridge with 3 boxes: inferior model (point out ridge, use boxes upside down) D C		9	Can count 4 bricks correctly TX2	
10	Scissors: can cut a square into two fairly equal halves D C		10	4-squares board: 20 secs TX2 C			Visual memory (3) (pics 1→5)	
	Folds a 10.2cm (4in) square twice D C		11	Returns 9 bricks to box and puts lid on: 35 secs TX2 C			Compares two weights (which one is heavier? swap)	
	Copies a ladder: Stage 1		12	6-hole board: 20 secs TX2 C			Knows right from wrong 'Is it right or wrong to hurt someone?' 'Is it right or wrong to lie to someone?'	
	Copies a square: Stage 1			Pattern-making No. 2: 50 secs D ◈ C		13	Can count 10 bricks correctly TX2	
	Draws a house: Stage 1		14	Train under bridge successfully (6 blocks) D C			Knows number of fingers on each hand (hold closed hand)	
	Copies a circle: Stage 2			Pattern-making No. 3: 40 secs D ◈ C		15	Can take out the middle brick (use 5 blocks)	
16	Threads 11 beads to colour pattern D C			Pattern-making No. 5: 50 secs D ◈ C			Repeats 4 digits (3-7-2-9; 5-8-1-6; 4-9-5-2) ◈	
	Copies 6+ letters		17	Builds 'gate' to model, using 3 boxes and lids D C		17	Can count 15 bricks correctly TX2	
18	Scissors: can strip edge of paper (draw line 1.5cm from edge, must cut between) D C		18	11-hole board: 40 secs TX2 C			'Which costs more?' ◈ C 'A bicycle or a ball?' (practice example) 'A watch or an ice-cream?' (no. 1)	
SECTION III: D Total items = ____ x 2 = ____			SECTION III: E Total items = ____ x 2 = ____			SECTION III: F Total items = ____ x 2 = ____		

FORMBOARD	4-squares	6-hole	11-hole
TRIAL 1	secs	secs	secs
TRIAL 2	secs	secs	secs

PATTERN-MAKING	No. 2	No. 3	No. 4	No. 5
TRIAL 1	secs	secs	secs	secs

9 BRICKS TO BOX	
TRIAL 1	secs
TRIAL 2	secs

SECTION IV: THIRD

	Subscale A Locomotor	Response	Subscale B Personal-Social	Response	Subscale C Language	Response
YEAR 6	Can run upstairs		Has a special playmate R name one		1 Comprehension (4+ items)	
	Jump off 3 steps D; Tx2		2 Can get a drink of water from the tap or bottle, without assistance R		2 Talks in sentences of 10+ syllables	
	Can bounce and catch a tennis ball D C; Tx2		Can wash and dry own hands and face, without any assistance R		Names 10+ capital letters can give phonic sound	
	Hopscotch 1 D C; Tx2 4 blocks 12in apart		Can choose own clothes R		4 Similarities (1) P C	
5	Can jog at a steady pace all around playground change direction		Can shampoo hair, with some assistance R		5 Names 10 colours: red, white, blue, orange, pink/lilac/purple, brown, green, yellow, grey, black	
	Can hopskip, recognisable D C; Tx2		Knows address 2 parts		6 Differences (2) P C	
	Can jump over 25cm (10in) foam block hurdle 5 blocks D; Tx2		Can tie a single knot D C; Tx2 around pencil		Names 20+ capital letters can give phonic sound	
8	Marches in time to tambourine Tx2		8 Eats without assistance R cuts up food ind.		8 Similarities (2) P C	
YEAR 7	Can throw a tennis ball up and catch it D C; Tx2 ± ↑ 60cm		9 Can lay a table completely, with some supervision R		9 Differences (3) P C	
	Runs downstairs		Can dress and undress completely, without help R		10 Similarities (3) P C	
	Hopscotch 2 D C; Tx2		Has one special school friend R		11 Picture description: 3 descriptive sentences	
	Can skip with a rope: 3+ single skips D; Tx2 one foot		Knows full address		12 Repeats one 16-syllable sentence	
	Rides a bicycle (two-wheeler) R no supports		Knows birthday 1 day + month		Names 26 capital letters can give phonic sound	
14	Static balance 2: can stand on one foot for 20+ seconds D; Tx2 C		Can tie a bow-knot D C; Tx2 start with single knot		14 Uses 6+ descriptive words	
YEAR 8	Hopskips some distance in an open area D C; Tx2		Can tie own shoelaces R pass if passes @ 17		15 Picture description: 4+ descriptive sentences	
	Hopscotch 3 D C; Tx2		Can shampoo hair, without any assistance R		16 Comprehension (6+ items)	
	Rides a bicycle (two-wheeler) with skill R		Can tie a double bow-knot D C; Tx2		17 Differences (4) P C	
	Jumps off 4 steps D; Tx2		Baths or showers and dries self, without assistance R		18 Uses 6+ personal pronouns correctly	
	Fast skipping with rope: 12+ single skips D; Tx2		19 Can lay a table completely, without help or supervision, on all ordinary occasions R		19 Differences (5) P C	
	Skips well with rope: 12+ double skips feet together D; Tx2		Knows birthday 2 day, month + year		20 Opposites (3)	
SECTION IV: A	Total items = ____ x 2 = ____		SECTION IV: B Total items = ____ x 2 = ____		SECTION IV: C Total items = ____ x 2 = ____	

TO EIGHTH YEARS

Subscale D Eye and Hand Co-ordination		Response	Subscale E Performance		Response	Subscale F Practical Reasoning		Response
	Copies 10+ letters			Pattern-making No. 5: 40 secs D; P C			Knows number of fingers on both hands together hold closed hands	
	Copies 6+ numbers			Pattern-making No. 3: 50 secs D; P C			Can count backwards from 10 10-9-8 D; Tx2	
	Can write own first name		3	Returns 9 bricks to box and puts lid on: 20 secs Tx2 C			Knows morning and afternoon correct answer 1st	
	Copies a cross: Stage 2			Pattern-making No. 4: 50 secs D; P C			'Which goes faster?' (3) 1. 'A big dog running or a puppy (baby dog) running?' 2. 'A bird flying or an aeroplane?' 3. 'A car or a bicycle?'	
	Copies a triangle: Stage 1		5	Builds bridge with 3 boxes: superior model D C			Can say 6 of the 7 days of the week	
	Draws a person: Stage 2		6	4-squares board: 7 secs Tx2 C			'Which costs more?' P C 'A bicycle or a ball?' (practice example) 'A cold drink or shoes?' (no. 2)	
	Draws a house: Stage 2			Pattern-making No. 3: 40 secs D; P C			Can count up to 30	
	Copies 24+ letters			Pattern-making No. 2: 25 secs D; P C			Picture arrangement 1: bird on nest place number order P C	
	Copies a window: Stage 1			Pattern-making No. 3: 30 secs D; P C			Knows right and left (6+) Tx2 1. Right hand 5. Left hand 2. Left ear 6. Right ear 3. Right foot 7. Left foot 4. Right eye 8. Left eye	
	Copies a diamond: Stage 1			10-brick memory stairs 4 blocks at bottom D C			Picture arrangement 2: pouring a drink P C	
	Copies 9 numbers			Pattern-making No. 4: 40 secs D; P C		11	Knows 'long' and 'short'	
	Copies a triangle: Stage 2		12	11-hole board: 30 secs Tx2 C			Days of the week (2+) 'What day comes after Tuesday?' 'What day comes before Saturday?' 'What day comes after Sunday?'	
	Can write full name			Pattern-making No. 2: 20 secs D; P C			Series P C	
	Copies a square: Stage 2		14	6-hole board: 10 secs Tx2 C			Can count backwards from 20 D; Tx2	
	Copies a ladder: Stage 2			Pattern-making No. 4: 30 secs D; P C			Knows 'heavy' and 'light'	
	Copies a window: Stage 2		16	Returns 9 bricks to box and puts lid on: 15 secs Tx2 C		16	Knows 'high' and 'low'	
	Copies a diamond: Stage 2			Pattern-making No. 3: 25 secs D; P C			Repeats 5 digits (6-1-3-8-4; 5-9-2-7-1; 9-2-7-8-6) P	
	Draws a person: Stage 3			Pattern-making No. 5: 20 secs D; P C			Repeats 3 digits backwards (1-8-6; 7-2-5; 4-9-3) P	
	Draws a house: Stage 3			Pattern-making No. 4: 20 secs D; P C			Picture arrangement 3: building a house P C	
	(Credit as two items) (see DIII.14 & DIV.7)			Pattern-making No. 5: 15 secs D; P C		20	Directional arrows (4)	
SECTION IV: D Total items = ____ x 2 = ____			SECTION IV: E Total items = ____ x 2 = ____			SECTION IV: F Total items = ____ x 2 = ____		

Subscale C

LARGE PICTURE

1. **Full verbatim report**: record everything the child says.

2. **Objects named** (nouns) N =
(Items CIII.4, CIII.13)

3. **Descriptive words used** (adjectives, adverbs) N =
(Items CIII.5, CIV.14)

4. **Personal pronouns** and **possessive pronouns** N =
(Items CIII.12, CIV.18)

5. **Descriptive sentences of 6 or more syllables** N =
(Items CIII.17, CIV.11, CIV.15)

SPONTANEOUS SENTENCES

Item CIII.6 6 or more syllables

Item CIV.2 10 or more syllables

REPETITION OF SENTENCES

Item CIII.9 Repeats **6**-syllable sentences: one correct sentence scores as a pass

1. 'I have a little cat.'
2. 'My kitty caught a mouse.'
3. 'The mouse had a long tail.'

Item CIII.16 Repeats **10**-syllable sentences: one correct sentence scores as a pass

1. 'My dog is a very good friend to me.'
2. 'I take my dog when I go for a walk.'

Item CIV.12 Repeats a sentence of **16** syllables: one correct sentence scores as a pass

1. 'It will be my birthday next week; Mummy will give me a party.'
2. 'The children were playing a game in the park and then they went home.'

COMPREHENSION

(Items CIII.10, CIV.1, CIV.16)

1. 'What should you do if you feel tired?'

2. 'What should you do if you are cold?'

3. 'What is the thing to do if it is raining and you have to go out?'

4. 'What should you do if you are going somewhere and you missed the bus?'

5. 'What do you do if you feel lonely?'

6. 'What is the best thing to do if you are on your way to school, and you find it's getting late?'

7. 'What would you do if you were lost?'

OPPOSITES

(Items CIII.15, CIV.20)

1. 'A boy is big, a baby is ..... ?'

2. 'Coal is black, snow is ..... ?'

3. 'A lion is fierce, a lamb is ..... ?'

SIMILARITIES

(Items CIV.4, CIV.8, CIV.10)

Practice example:

'You know the **moon** and the **stars**? Tell me how they are the same as each other. They are both... ?'

1. 'How are a **bird** and an **aeroplane** the same?'

2. 'How are a **car** and a **bus** the same?'

3. 'How are a **door** and a **window** the same?'

4. 'How are a **pen** and a **pencil** (or **crayon**) the same?'

DIFFERENCES

(Items CIV.6, CIV.9, CIV.17, CIV.19)

Practice example:

'You know a **fly** and a **bee**? They are not alike, are they? They are not the same. How are they *different*?'

1. 'How are the **morning** and the **night** different?'

2. 'How are a **fish** and a **dog** different?'

3. 'How are **salt** and **sugar** different?'

4. 'How are a **triangle** and a **square** different?'

5. 'How are **winning** and **losing** different?'

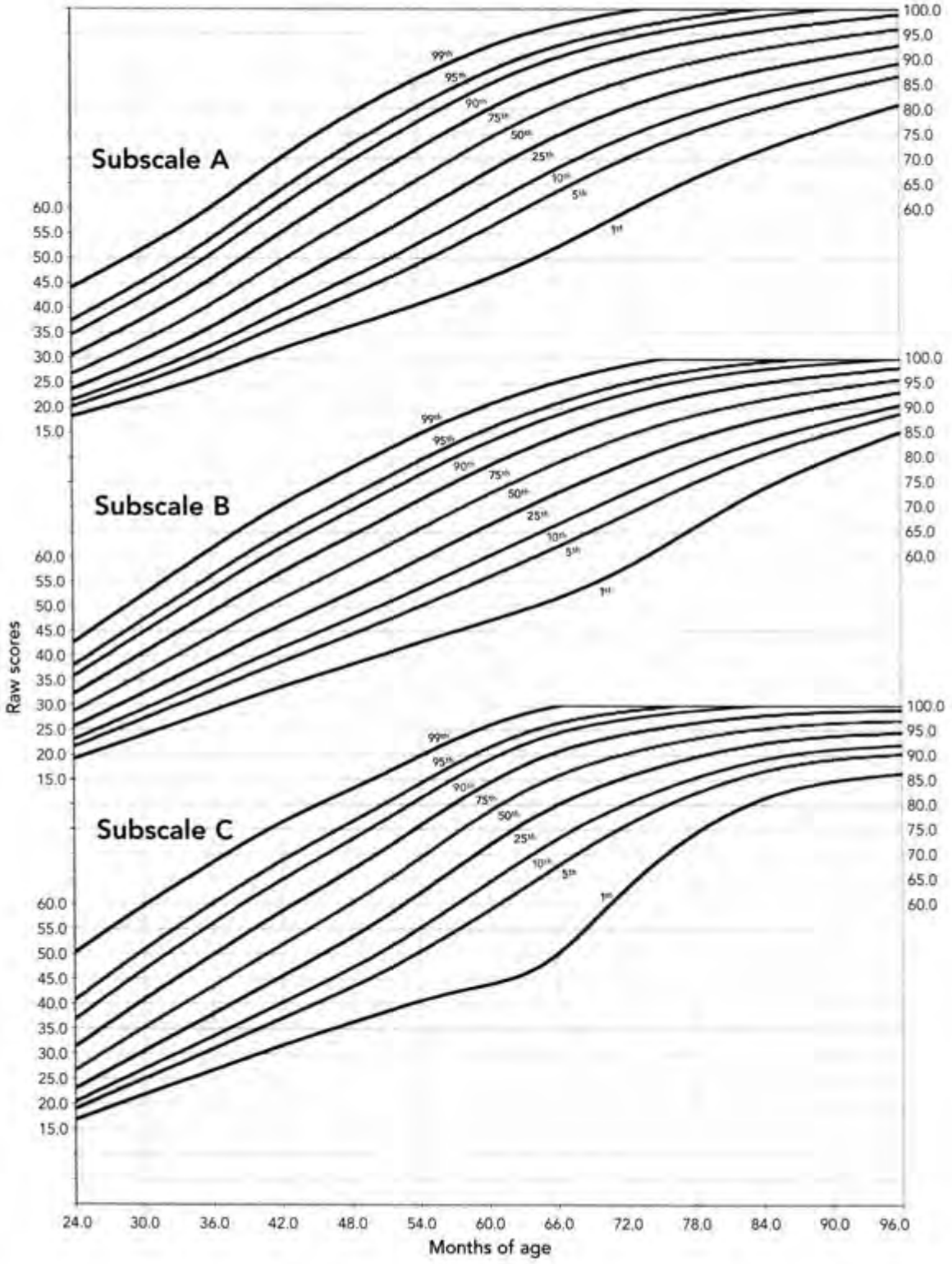
Subscale D

Perpendicular stroke
(Item DII.18)

Young child's attempt at drawing
(Items DII.21, DII.29, DII.32, DII.4, DII.9, DII.14)

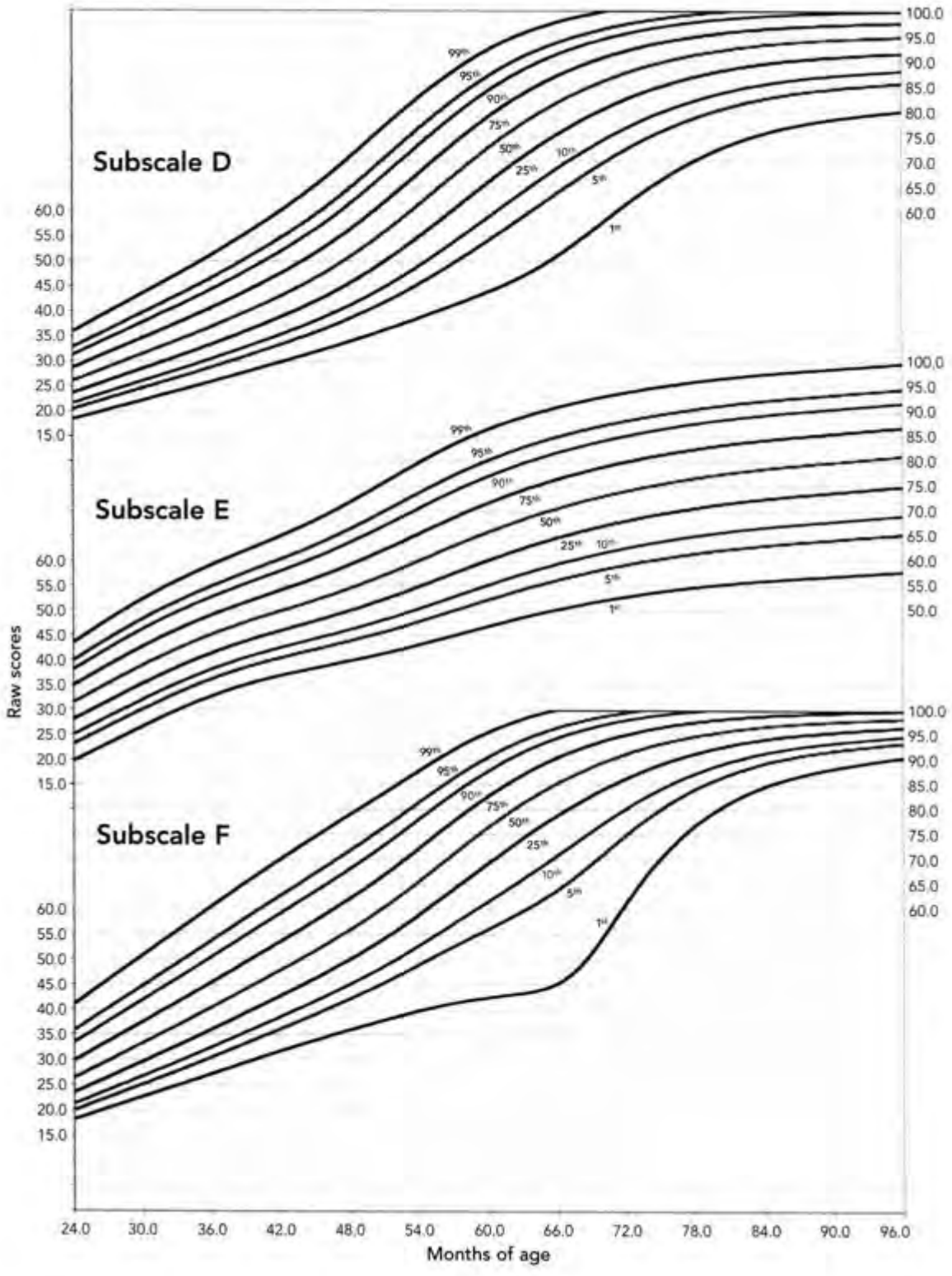
Horizontal stroke
(Items DII.19, DII.2)

Subscales A to C: Percentiles



2

Subscales D to F: Percentiles



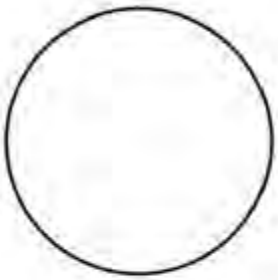
15

GRIFFITHS MENTAL DEVELOPMENT SCALES – EXTENDED REVISED (GMDS-ER)

SUBSCALE D: DRAWING BOOK

Name of child: ..... Date of assessment: .....

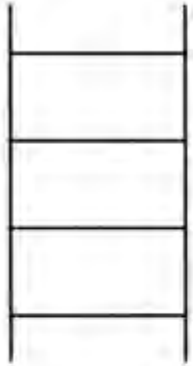
Copy a circle
(Items DIII.5, DIII.15)



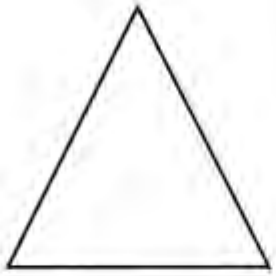
Copy a cross
(Items DIII.8, DIV.9)

Copy a square
(Items DIII.13, DIV.14)

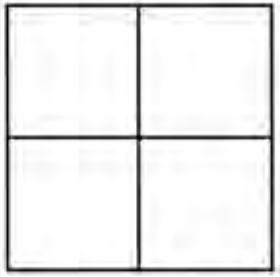
Copy a ladder
(Items DIII.12, DIV.15)



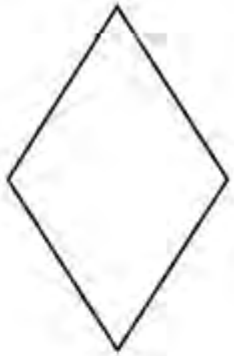
Copy a triangle
(Items DIV.5, DIV.12)



Copy a window
(Items DIV.9, DIV.16)



Copy a diamond
(Items DIV.10, DIV.17)



Draw a person
(Items DIII.9, DIV.6, DIV.18)

Draw a house
(Items DIII.14, DIV.7, DIV.19, DIV.20)

(Items DIV1, DIV8)

A B C D E F G

H I J K L M

N O P Q R S

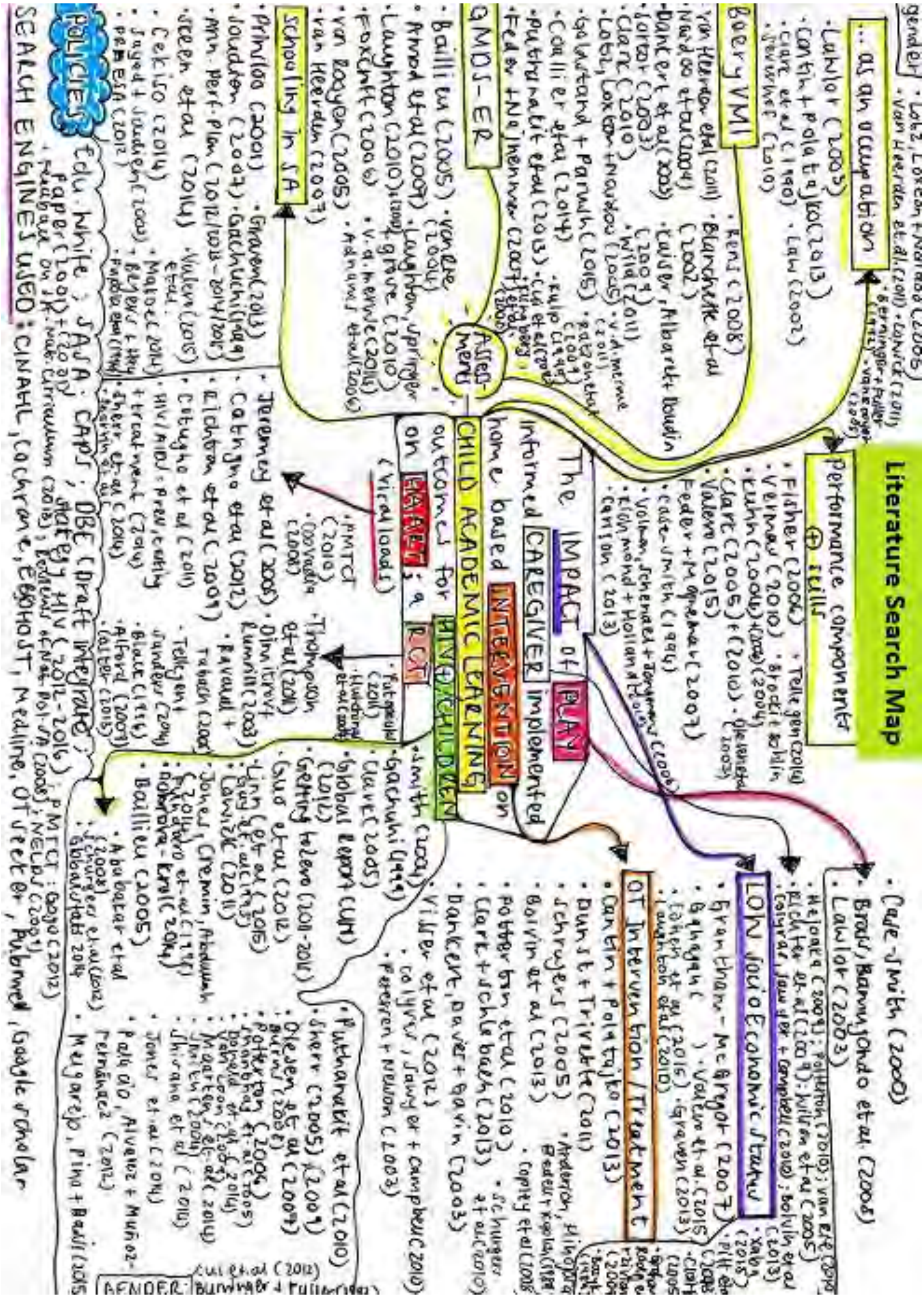
T U V W X Y Z

(Items DIV2, DIV11)

1 2 3 4 5 6 7 8 9

Write full name (Items DIV3, DIV13)

Appendix O: Literature Search Map



Appendix P: School Progress report template

Western Cape Government
Education

TERM 0 REPORT CARD: GRADE 1 D

Start Printing

Print a report for a learner selected in the 'PERSONAL INFO' worksheet

CLICK to Print reports for a group

Date issued: 2016-02-22

Surname & Name of Learner:

Learner Unique No.:

LEARNER PERFORMANCE				
SUBJECTS	TERM 1	TERM 2	TERM 3	TERM 4
	Code	Code	Code	Code
HOME LANGUAGE				
FIRST ADDITIONAL LANGUAGE				
MATHEMATICS				
LIFE SKILLS				
Days Absent	0			

TERM 0 COMMENTS	
HOME LANGUAGE	
FIRST ADDITIONAL LANGUAGE	
MATHEMATICS	
LIFE SKILLS	

School closes on: 2015-04-01 (Learners)

School re-opens on: 2015-04-13 (Learners)

Change Close/Re-open Dates

SIGNATURES

Teacher:.....

Principal:..... Date: 2016-02-22

Parent / Guardian:.....

SCHOOL STAMP

MINIMUM PROGRESSION REQUIREMENTS FOR GRADES 1-3	
Home Language	Level 4 (50-59%)
AND	
First Additional Language	Level 3 (40-49%)
AND	
Mathematics	Level 3 (40-49%)

NATIONAL CODING SYSTEM GRADES 1-3		
RATING CODE	DESCRIPTION OF COMPETENCE	MARKS PERCENTAGE
7	Outstanding Achievement	80 - 100%
6	Meritorious Achievement	70 - 79%
5	Substantial Achievement	60 - 69%
4	Adequate Achievement	50 - 59%
3	Moderate Achievement	40 - 49%
2	Elementary Achievement	30 - 39%
1	Not achieved	0 - 29%