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VISUAL MOTOR INTEGRATION IN TYPICALLY DEVELOPING CHILDREN - ATTENDANCE AT EARLY DEVELOPMENTAL PROGRAMMES AND MOTHERS' RETURN TO WORK

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Occupational Therapy

Johannesburg, 2015

Declaration

I, Nicole Winterstein, declare that this research report is my own work. It is being submitted for the degree of Master of Science in Occupational Therapy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

[Signature of candidate:

day of [month, 20

Dedication

For all the men in my family: To my supportive husband Dale, charismatic son Jayden Tyler (Mr Impossible) and cheeky baby Devon Shay (Mr Small).

Abstract

The purpose of the study was to investigate the effectiveness of early childhood development programmes (EDPs) by comparing the visual motor integration (VMI) of typically developing children in Grade 00 who did and did not attend commercial EDPs in Johannesburg and whose mothers did or did not return to work. Eighty six typically developing participants selected from higher socio economic status (SES) private pre-schools were included in the study. The participants were tested using The Beery-Buktenica Developmental Test of Visual-Motor-Integration. The results indicate that the scores in the BTVMI were higher for participants that did not attend EDPs, and therefore attendance at EDPs appears not to facilitate the development of VMI. However, there was a significant difference in the scores in the VMI test between children for participants in relation to mothers' return to work, with higher scores indicated for children whose mothers did not return to work, indicating that mothers who remained at home to care for the children did facilitate the development of VMI. The scores remain within the normal to above average range for both groups, indicating that there are other factors influencing development of VMI which are not dependent on attending EDPs for most participants as was expected for children from a higher SES

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Definition of Terms

Early developmental programmes: A programme that supports babies and young children And focuses on the holistic development of children including physical, cognitive, language, social and emotional development from conception to age five. These are programmes implemented by the government and designed to provide learning and support appropriate to the child's developmental age and stage (Department of Social Development, 2015).

Commercial Early developmental programmes: These are programmes that target children from higher socio-economic environments to provide stimulation, and enriching experiences to enhance development and learning in children (Lester, 2014).

Visual motor Integration: Visual motor integration (VMI) consists of coordinating visual perceptual skills together with gross-motor movement and fine-motor movement. It is the ability to integrate visual input with motor output. This is how individuals plan, execute and monitor motor tasks, such as threading a needle, tying shoe laces, catching or hitting a ball. It is also essential in academic performance. “VMI is the degree to which visual perception and finger-hand movements are well coordinated.” (Beery & Beery, 2010)(pg. 12).

Visual Perception: It is the ability to interpret the surrounding environment by processing information that is contained in visible light. “This involves the recognition, discrimination and processing of sensory information through the eyes and related central nervous system structures” (Case-Smith & O'Brien, 2010). Visual perceptual skills include the identification of shapes, colours and other quantities; the orientation of objects or shapes in space; and the relationship of objects or shapes to one another and to the environment” (Case-Smith & O'Brien, 2010)(pg. 275).

Motor co-ordination: Is the harmonious functioning of body parts that involve movement, including gross motor movement, fine motor movement, and motor planning (Case-Smith & O'Brien, 2010)(pg254).

Abbreviations

BTVMI:	Beery-Buktenica Developmental Test of Visual-Motor-Integration
EDP:	Early Developmental Programme
USA:	United States of America
UK:	United Kingdom
SES:	Socio-economic status
VMI:	Visual motor integration
VP:	Visual perception
MC:	Motor coordination

CHAPTER 1: INTRODUCTION

1.1 Introduction

Developmental literature indicates that early life experiences and interaction, including stimulation of senses, have the greatest influence on the development of the brain during the first three years of life (O'Brien Caughy, et al., 2004). This is a period for the development of visual and visual perceptual skills (O'Brien Caughy, et al., 2004) as well as the foundation phase for gross and fine motor development (Skill Builders, 2002).

The development of these skills forms the basis for visual motor integration (VMI), which is associated with academic success (Sanghavi & Kelkar, 2005). The process of VMI involves the use of both visual perception and fine motor coordination and requires the ability to translate visual perception into motor functioning. According to Ercan, Ahmetoğlu and Aral (2011), VMI is necessary for performing skills such as drawing, reading and writing (Ercan, et al., 2011).

Various factors influence development in the early years including sleep, nutrition, and attachment and learning opportunities (Swain, 2014). Learning opportunities are provided not only at home by mothers or in non-parental care, but by early childhood developmental programmes run as franchises, offering early developmental stimulation for typically developing children (Swain, 2014). These commercial early developmental programmes typically claim to address the visual motor skills necessary for school readiness, with some programmes even claiming to assist in addressing all areas required for school readiness. These programmes are costly and usually advertised in higher socio-economic areas in big South African cities (Swain, 2014). Although the programmes claim to stimulate and enhance all areas of development, there is no published evidence that the programmes are in fact achieving the aims described in the programmes (Swain, 2014).

While most research has focussed on children at risk, literature does provide evidence that in typically developing children, a mother’s return to work in a child’s first year of life may result in delayed cognitive development but has very little

effect on motor and social development (Karoly, et al., 1998). This is related to the quality of non–parental care available. Controversy exists on this topic in literature as a study by Brooks-Gunn et al. (2002) found no impact of a mother's return to work in school aged children (Brooks-Gunn, et al., 2002). Waldfogel (2006) concluded, however, that children whose mothers do not work full-time do better in cognitive functioning – this conclusion is however dependant on the variables assessed and the context in which they live (Waldfogel, 2006) (Waldfogel, et al., 2002).

Although the effects of mothers' return to work have been researched, the claims made by early developmental programmes in stimulating and enhancing certain areas of development have never had their effectiveness investigated and they have not been researched. The purpose of this study was therefore to determine the potential of these programmes and mothers' return to work after the birth of their child and whether these variables in fact had any effect on visual motor integration in typically developing 'low risk' children.

1.2 Problem Statement

All the commercial early development programmes claim that their approach and activities facilitate and stimulate the appropriate development of visual perceptual and fine motor skills, which are beneficial for normal development. Only one provider of early developmental programmes such as those listed in Appendix A, stated that they cannot guarantee that the child will not experience any future difficulties with the skills addressed in the groups (Victor, 2012).

Research on this topic is inconclusive. No empirical evidence exists to show the stimulation received through attendance of commercial early development programmes contributes to the development of visual motor integration in typically developing children. Additionally, although there is research with competing views about the effects on a child's development of a mother's return to work postpartum, no research exists in South Africa on the effects of a mother's return to work postpartum. Evidence suggests mothers' return to work affects children's cognitive development but it is unknown what effect it has on the visual motor integration skills of typically developing children.

1.3 Research Question

Does the attendance of typically developing children at early developmental programmes and mothers' return to work after the birth of the child have an effect on typically developing children's visual motor integration skills?

1.4 Null Hypotheses (H0)

In a sample of typically developing children in Grade 00, there is no significant difference in the visual motor integration mean z scores of those children who attended an early development programme and those who did not.
In a sample of typically developing children in Grade 00, there is no significant difference in the visual motor integration mean z scores of those children whose mothers returned to work and those whose mothers did not return to work.

1.5 Purpose of the Study

The purpose of this study is to investigate the effectiveness of early childhood development programmes by investigating and comparing the visual motor integration of typically developing children who did and did not attend commercial EDPs and whose mothers did and did not return to work within the first 4 years of life.

1.6 Aim of the Study

The aim of this study is to investigate the effectiveness of early childhood development programmes by comparing the visual motor integration of typically developing children (in Grade 00: 3 years 6 months to 4 years 6 months) who did and did not attend commercial EDPs in Johannesburg and whose mothers did or did not return to work.

1.7 Objectives of the Study

This study seeks to achieve the following objectives:

- To determine the Beery-Buktenica Developmental Test of Visual-Motor-Integration (BTVMI) scores of Grade 00 children who attended early childhood development programmes

- To determine the BTVMI scores of Grade 00 children who did not attend early childhood development programmes
- To compare the BTVMI scores for typically developing children in Grade 00 who did and did not attend early childhood development programmes
- To compare the BTVMI scores for typically developing children in Grade 00 whose mothers did and did not return to work

1.8 Justification of Study

There is an ever-increasing trend to offering early developmental programmes for typically developing children in higher socioeconomic areas. These have not been researched in order to prove/disprove such a statement. These commercial EDPs make claims of stimulating and enhancing certain areas of development; however the effectiveness has never been shown. Evidence is required in order to establish if it is indeed beneficial for mothers of children in higher SES to attend such commercial EDPs and if children whose mothers return to work and who attend such commercial EDPs are benefitting from the programmes. The aim of this study is thus to look at the potential of these programmes and whether they are making any difference in visual motor integration in typically developing 'low risk' children.

The effects of full time parental care from mothers has also been shown to affect a child's cognitive ability but the effects on visual motor integration in typically developing 'low risk' children need to be established.

1.9 Organization of Report

This report has been organized into six chapters. The first chapter is the introduction and describes the research question and objectives put forward by the researcher.

Chapter Two is the literature review and presents information regarding development of visual motor integration. This includes a discussion of the role of foundational skills in influencing a child's ability to develop visual motor integration. This is followed by a discussion of the attendance of early developmental programmes and their influence on development of skills required for visual motor integration. This includes a discussion of the effectiveness of attending EDPs on

VMI, and also the government policy regarding attendance at EDPs. There is little literature that supports the effectiveness of attendance of EDPs for higher socio-economic neurotypical children. This literature review provides information regarding these EDPs that cater for typically developing children in the more affluent low risk environments.

Chapter Three is the methodology and describes the process which the researcher followed in order to accurately answer the research question.

Chapter Four describes the results that were determined from the actual study.

Chapter Five is the discussion and puts forward the comparison of the results of the BTVMI scores of those children who attended EDPs versus those who did not attend EDPs, as well as the results of the BTVMI scores of children who attended EDPs and whose mothers did or did not return to work.

The discussion includes demographics with reference to the children, their attendance, and their length of attendance as well as if the parents returned to work, and if so, after how long. These factors are discussed with correlating p values. Chapter six concludes the major findings and implications of the study.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This literature review will explore literature on the need for normal development in terms of developmental factors related to academic success, including demographic factors, visual perception, motor co-ordination and visual motor integration. Research on the effectiveness of EDPs will be reviewed in relation to the development of typical and atypical children. Additionally, the effect of the mothers' return to work on development is discussed.

2.2 Normal Development

Normal development in childhood consists of sequential changes in function that occurs as an individual matures. This is different to the concept of growth. Growth consists of physical maturation of the individual, while the development of an individual focuses on stages or hierarchical changes which incorporate the skills basis necessary as a prerequisite for higher level skills (Case-Smith, 2005). The most critical part of a child's development occurs between birth and three years of age (Case-Smith, 2005). This stage is most critical due to the developmental sequence of the brain and the impact of neuroplasticity being at its greatest within these primitive years (Gopnic, et al., 1999).

Development can be seen as occurring in sequential stages and is evolutionary, requiring interaction between the child and their environment (Case-Smith, 2005). Development also requires the maturation of the central nervous system, which occurs in children through play experiences and interaction with the environment (Case-Smith, 2005).

Important aspects of a child's development incorporate self-regulation, the establishment of early relationships, knowledge acquisition, and the development of specific skills, which are influenced by individual neurobiology, relationships with caregivers, and physical and psychosocial exposures (Anderson, et al., 2003).

It is now widely accepted that experiences in the first few years of life prepare the child for their on-going development (Anderson, et al., 2003). This view of development is based on critical periods of development that assume the brain is at its most plastic only during the early years and the experiences in these years are essential to future performance, with long-term consequences if the child is deprived (Shonkoff & Phillips, 2000). This approach therefore theorises that by the time a child reaches preschool, the architecture of their brain is in essence constructed and they will never have the ability to assimilate information that they had in the first three years (Shonkoff & Phillips, 2000).

Therefore to develop optimally, children need not only to be cared for but also stimulated (Fisher, et al., 1991). It is suggested that stimulation should provide direct learning experiences for the child, allowing the child to initiate their own exploration and learning in their environment. The parents should provide age-appropriate activities. The stimulation needs to start early in life and parents may need support or to be taught how to stimulate their child appropriately (Fisher, et al., 1991). The stimulation needs to be of a high quality to encompass all areas of development as, according to Ayres 1989, the young brain is extremely malleable and the structure and function of the brain becomes more firm and set with age (Fisher, et al., 1991). It is well documented in neuro-scientific literature that when children are permitted to explore different environments, the result is that of increased branching, greater synaptic connections and efficiency, and increase in the size of brain tissue. This forms a major mechanism of brain development (Case-Smith & O'Brien, 2010). However, for this to be optimal and for positive brain changes to occur, a child is required to be an active participant. Being a passive observer in a stimulus-rich environment does not produce the same positive changes. Through active engagement, participation becomes meaningful and challenging, facilitating development (Case-Smith & O'Brien, 2010).

Meaningful sensory motor activities are mediators for structural, molecular and cellular changes in neural functioning (Kramer & Hinojosa, 2010). Sensory integration is based on this principle of neuroplasticity, whereby exposure to and engagement in optimal sensory experiences will allow for active participation and action, which influences the growth and development of the nervous system (Kramer & Hinojosa, 2010).

Neuroplasticity includes several different processes and morphological changes that take place throughout a lifetime (Gopnic, et al., 1999). Although plasticity occurs over an individual's lifetime, different types of plasticity dominate during certain periods of one's life (Gopnic, et al., 1999). Neuroplasticity is at its greatest within the first years of life and was initially thought to continue until the age of seven (Bundy, et al., 2002). However, research has proven that plasticity occurs long into one's life span into late adulthood but not at the same rate as in the earliest years (Fisher, et al., 1991). Neuroplasticity in the immature brain begins to process sensory information from infancy (Gopnic, et al., 1999).

Over the first few years of life, the neuroplasticity of the brain proceeds at a rapid pace. By the time an infant is two or three years old, the number of synapses is approximately 15 000 synapses per neuron from approximately 2 500 at birth (Gopnic, et al., 1999). Due to numerous connections formed there is an abundance of connections that do not get used and are thus deleted through a process called synaptic pruning (Gopnic, et al., 1999).

Synaptic pruning eliminates weaker synaptic contacts while stronger connections are kept and strengthened (Gopnic, et al., 1999). Those neurons that have not been activated are likely to not survive the pruning. Neurons need to have a purpose in order to survive; this is why stimulation is essential as well as active participation as it ensures that the neurons do not die. Neurons die through a process called apoptosis in which neurons that do not receive or transmit information become damaged and die (Gopnic, et al., 1999). Plasticity enables the process of developing and pruning connections (Gopnic, et al., 1999).

Brain development hinges on the relationship between nature and nurture. This is in keeping with early developmental theories related to development occurring via nature or through nurture (Gopnic, et al., 1999). Early care has a long-lasting impact on development in that it enables development of learning as well as the ability to self-regulate (Nelson & Bloom, 2006). The brain has a remarkable capacity to change; however, negative experiences or absence of appropriate stimulation are more likely to have serious and sustained effects (Gopnic, et al., 1999).

There are, however, neuroscientists including Nelson and Bloom, who view neuroplasticity and the ability of the brain to develop at any time as more important (Nelson & Bloom, 2006). They do not subscribe to the view of critical periods. Lee and Juan (2013) feel that examination of the research does support the focus on the first three years of life and plasticity for learning and stimulation is as great into adulthood (Lee & Juan, 2003).

As early as 1990, Carla Shatz and others have stated that children require a normal environment to develop normally. However, there is no evidence that providing enriched environments and extra stimulation makes any difference to typical children living in a normal environment (Shatz, 1990).

Developmental theories present the theory that combined interactions and environments have a major impact on a child's readiness to learn and their success within the school environment (Anderson, et al., 2003). Research has found that the average age at which formal school education should be started is six to seven years; however, the average age at which informal education should be introduced is three to four years. Informal education consists of structured play time and the initiation of the development of certain gross motor and fine motor skills (Whitebread, 2013). Readiness for formal education is based on the child's development in the preschool years and one of the factors shown to be predictive of academic success is visual-motor integration skills (Ohl, et al., 2013)

2.2.1 Visual Motor Integration

Visual-motor integration is the degree to which visual perception, and finger-hand movements are well coordinated (Beery & Beery, 2010).

Visual-motor integration, which is the skill of coordinating motor skills and visual perception, covers basic skills such as seeing and using objects. Developmental skills of VMI include: crawling, walking, and running. Avoiding dangers, eating; academic skills such as drawing, painting, reading and writing and more advanced intellectual skills of VMI such as using a computer, constructing buildings, using tools and discovering (Daly, et al., 2003).

The development of VMI is based on the development of both visual perception and motor skills and starts with the early association between motor and visual systems when an infant starts to accurately reach towards objects (Eliasson, et al., 2006). The development of VMI is dependent on the normal development of movements in the infant and toddler years. Head control and hand function with different grasps, guided by proximal control of the upper limb, all need to develop first (Eliasson, et al., 2006). Once the child has control over isolated finger movements, they can start to use a mature pencil grasp to achieve drawing movements (Eliasson, et al., 2006).

The normal development of visual skills and visual perception will also contribute to the VMI skills of a child. Sensory stimulation and exposure to environmental factors enhance the development of VMI, visual perception and motor coordination. Infants receive stimulation from lines, light intensities and different patterns of movement, which facilitates their perception of the world. They start to see colour from two to three months and spatial abilities have been shown from three to four months of age. Perception for spatial relationships for objects occurs later with the development of binocular vision and perception of depth from four months of age. Size and shape constancy also develops in infancy (Arterberry, 2008).

The visual abilities that start in infancy form the basis for other visual perception required for visual motor integration and the visual perception of movement has been linked to the development of motor skills and praxis. Visual perceptual skills are required for adequate VMI to develop (Caeyenberghs, et al., 2009).

Visual motor integration is an important component for occupational performance and has a strong relationship to scholastic requirements in school work, as it is the skill that underpins one’s ability to copy letters from the blackboard with accuracy and legibility, and enables one to spatially organise one’s work on a page adequately. It is also important for children’s ability to dress themselves, to feed themselves as well as to function within their occupational performance areas (Daly, et al., 2003).

Deficiencies or delays in visual perception or motor skills, which improve rapidly in early childhood, arouse some problems in acquiring academic skills, participating

in school activities, social relations and self-concept (Dankert, et al., 2003) (Case-Smith, 2005) (Beery & Beery, 2010).

Kulp (1999) examined the VMI scores of 191 typical children with a mean age of 7.78 years from a high socioeconomic environment and academic achievement (Kulp, 1999). They compared the results on the Beery Developmental Test of Visual Motor Integration (BDTVMI) and the Otis-Lennon School Ability Test (OLSAT) as well as the teachers' ratings of the children's reading ability, of children in preschool and school grades up to Grade 3 (Kulp, 1999). They found significant correlations between the BDTVMI scores and scores for reading, maths, writing and spelling - all aspects of the OLSAT except the non-verbal aspect (Kulp, 1999).

The results of this study were confirmed in a study in 2003 by Sortor and Kulp, who looked at the Developmental Test of Visual-Motor Integration and its Subtests Related to Achievement Test Scores (Sortor, et al., 2003). The study reported that the relationship between VMI and academic achievement was due to the effects of cognitive ability and intelligence (Sortor, et al., 2003). Previous research conducted by Pienaar et al, (2013) depict that VMI, visual perception and motor proficiency are fundamentals for school academic success. The results proved that there was a high correlation between academic performance and VMI and the supplemental subtests. There was a significant relationship in the clustered academic performance score, VMI and visual perception (Pienaar, et al., 2013) (Sortor, et al., 2003). Based on the results in this research, it was concluded that VMI, visual perception, hand control and motor proficiency are strongly related to basic academic skills within the first formal school year (Pienaar, et al., 2013). Similar results have been evident in previous studies (Solan & Mozlin, 1986). Studies were also conducted by Solan and Mozlin 1986, Kulp 1999, Daly et al 2003, and Sortar and Kulp 2003; which were of similar nature within developed countries and amongst higher socio-economic groups (Solan & Mozlin, 1986) (Kulp, 1999) (Daly, et al., 2003) (Sortor, et al., 2003). They too displayed outcomes of strong relationships between VMI, visual perception and academic areas of maths, reading and writing (Pienaar, et al., 2013).

Visual motor integration is also one of the greatest predictors for the legibility of handwriting as well as a child's academic performance (Daly, et al., 2003)(Volman, et al., 2006; Kulp, 1999). According to research, fine motor and handwriting concerns are the two most common reasons for referral to a school-based occupational therapist (Anderson, et al., 2003). Visual motor integration is considered a performance skill that should be addressed in poor handwriting, as handwriting is a fine motor skill that requires a combination of perceptual-motor skills (Cornhill & Case-Smith, 1996); (Volman, et al., 2006).

2.3 Developmental factors related to visual motor integration and the development of academic achievement

2.3.1 Demographic factors

The environment in which a child grows up determines the neural connections in their brain. Although genetics plays a role and is a predetermined factor, stimulation and environmental exposure influences the neural pathways, connections and development of the brain (Fisher, et al., 1991). It is through the 'just right' amount of stimulation and active participation from the child within stimulating environments that neurons connect and pathways are formed (Fisher, et al., 1991). If a child is not an active participant and their regulatory levels are not intact, then no connections will be made and it makes little difference how much sensory stimulation is given - little impact will be made on the child's development (Fisher, et al., 1991).

Academic success and school readiness therefore have been related to a number of demographic factors, including socioeconomic status, nutrition, low birth weight and the type of early care and stimulation received. This study considers children from a high to middle socioeconomic background, but the effects of socioeconomic status on the developmental factors that affect academic success and cognitive development will be considered, as will the care received in terms of full time parenting by mothers who stay at home and do not return to work.

2.3.1.1. Socioeconomic status

Socioeconomic status has been found to be significantly related to both cognitive and fine motor ability at a school age. Low Socioeconomic status (SES) places

individuals at risk for poor development (Bradley & Corwyn, 2002). Children who are born in low SES are at risk of low birth weight as well as other disabilities. This is due to the poor prenatal care, poor nutrition of the mother during pregnancy and the increased risk of infection during pregnancy (Bradley & Corwyn, 2002). A child in a low SES environment is more susceptible to being affected by injuries and infections; and the effects of the infection or injury may be more severe (Bradley & Corwyn, 2002).

'High risk' children living within low SES have minimal access to stimulating programmes and materials, which impacts on their development, including cognitive development (Bradley & Corwyn, 2002). These children are less likely to be exposed to various materials within their environments, and thus their susceptibility to various risks increases (Bradley & Corwyn, 2002). People of low SES have limited access to EDPs and thus the development of children is influenced negatively (Bradley & Corwyn, 2002).

Birth complications, medical conditions and genetic predispositions are also known to cause developmental delay and there is abundant research available on the impact of EDPs on development for non-neurotypical children (Dankert, et al., 2003). Thus these factors were part of the exclusion criteria for this study.

Research is available on children from lower socio-economic environments and 'at-risk' children, but very little evidence is provided for children of neuro-typical development from more affluent environments who, by default and circumstances, are generally exposed to more sensory stimuli which aid in development of visual perceptual skills (Dankert, et al., 2003) than children from low economic backgrounds (Shonkoff & Phillips, 2000). Similar findings for motor proficiency indicate that children from more affluent environments also have opportunities to develop fine motor co-ordination (Grissmer, et al., 2010).

2.3.1.2 Mothers' return to work

In most societies within the world, including South Africa, women are considered to be the primary caregivers for children (Meherali, et al., 2010). However, over the past few years an increased number of women have returned to work in order to earn an income, and thus there is a change in parenting styles (Meherali, et al.,

2010). Working women often experience feelings of guilt as they are unable to spend time with and care for their children on a constant basis (Meherali, et al., 2010).

According to research by Hickman (Hickman, 2006) children who attend play school have higher cognitive functions than those who remain at home with parents (Hickman, 2006). It has also been found that those women who work maximise their non-working time with their children, which ensures positive parent-child interaction instead of passive activities between the mother and the child (Meherali, et al., 2010). This is due to the structured quality time that the employed mother spends with their child when returning home from work (Meherali, et al., 2010).

However, on the other hand, the mother's return to work could have a negative influence on the child's development (Meherali, et al., 2010). This is due to the child spending a large proportion of their day in childcare centres; thus the quality of care that the child receives could be average and impact on the stimulation that the child receives (Meherali, et al., 2010).

A study performed by Gregg, Washbrook, Propper and Burgess (Gregg, et al., 2005) identified that those mothers who return to work before the child is 18 months have a negative impact on the child (Gregg, et al., 2005). However, overall, no connection has been noted between the caregiver's return to work and the child's cognitive development (Meherali, et al., 2010).

Research by Landry et al. (2003) indicated that responsive parenting in the early childhood years has a unique place in a child's development and could increase learning. This supports the child's object exploration related to visual perceptual and motor skills (Landry, et al., 2003).

There are conflicting 'mommy wars' when having to return to work (Baker & Milligan, 2008). Mothers are trapped with feelings of guilt yet require financial independence and success. Research provides evidence in some cases that high quality care interventions can improve cognitive development for children at risk (Baker & Milligan, 2008). However, little research is available for 'normal' children from higher SES who are not considered 'at risk' (Baker & Milligan, 2008).

Other recent research by Baker & Milligan, found that maternal employment within the first year of a child's life can result in delayed cognitive development (Baker & Milligan, 2008). In a study conducted in Canada, it was found that with an increase in the amount of maternity leave given (extended from six months to one year), children fared better in cognitive development (Baker & Milligan, 2008). Information received from this study was based on measures of parenting, temperament, motor and social development, achievement of milestones, functional family unit, social and family environmental factors. The results obtained depicted an increase in cognitive development in those children whose mothers did not return to work within the first year; however, the impact of these measures on development was negligent and the scores for motor and social development were close to zero (Baker & Milligan, 2008).

2.3.2 Visual Perception

Visual perception is an important precondition for reception and recognition of visual stimuli (Schneck, 2010). It is a developmental process that is learned and increases with development, experience, exposure, and practice and through stimulation (Schneck, 2010).

Vision is one of the distant senses that allow one to understand what is occurring outside of their body. It feeds information to the individual and allows them to plan and adapt accordingly. Visual perception is important to one's learning ability and contributes to one's planning of different movements (Schneck, 2010). It acts as a guide until a motor plan is formed. Vision is a dynamic system of inter-sensory interactions (Schneck, 2010).

Visual perception refers to the process that is responsible for reception and cognition of visual stimuli to be interpreted (Exner, 2010). Visual perceptual skills include one's ability to visually recognise, discriminate and process sensory information coming from the eyes and received by the central nervous system structures. It requires functioning of the visual skills necessary to track and fixate on objects using the eye movements and extra ocular eye muscles. This includes skills required for smooth and accurate tracking of moving objects (Exner, 2010).

Information processing is in the visual perceptual domain as one of the factors that determine a child's school readiness (Schneck, 2010). Visual and perceptual motor skills are important aspects of academic performance such as reading and writing. If the visual perceptual system is not functioning optimally, one is likely to present with functional problems in areas of performance in daily occupations such as eating, dressing, locating objects on a desk, as well as batting a ball (Schneck, 2010).

It was identified that three areas are required for a child to be able to read and write - these areas are: one's ability to recognise and distinguish specific distinctive features; the ability to observe invariant relationships in events that occur over time; and the ability to find a hierarchy of patterns, which facilitates the processing required for adaptations from one task to another (Case-Smith & O'Brien, 2010). Young children tend to prefer learning through kinaesthetic and tactile senses rather than visual and auditory experiences (Case-Smith & O'Brien, 2010). Thus a greater predictor in development for academic success would be exposure through these senses.

Visual perceptual skills develop along a continuum. Visual cognitive abilities are present at birth, whereas other higher-level visual cognitive tasks only develop in adolescence. This development occurs through perceptual learning (Schneck, 2010). The foundations of visual perception comprise three fundamental visual skills, namely, oculomotor control, visual fields and visual acuity. The following tier in this hierarchy of development includes visual attention, scanning, pattern recognition, visual memory and visual cognition (Schneck, 2010).

Development of visual perceptual skills occurs within a hierarchy in the central nervous system (Case-Smith & O'Brien, 2010). The developmental sequence requires adequate visual-receptive and visual-cognitive functions. Visual-receptive processes develop at 24 weeks in utero with the anatomical structures and visual pathways complete. By the second month of life, the development of accommodation, convergence and oculomotor subsystems should be established. However by the time a child is in kindergarten, they should be able to move their eyes in horizontal, vertical, diagonal and circular motions (Case-Smith & O'Brien, 2010).

Vision enables infants to acquire information, identify objects and organise information received from their environment (Case-Smith & O'Brien, 2010). This in conjunction with auditory input and input from stimuli within their environments allows for greater accumulation and organisation of information in order to process what is going on within their environment. This is the development of visual cognitive skills, which lay the foundation for perceptual learning (Case-Smith & O'Brien, 2010).

Research indicates that visual perception is related to readiness to learn to read, and maths ability (Willows, 1998). Feagans and Merriwether (1990) showed that poor visual discrimination ability was related to poor reading with 132 learning-disabled and typical children in a six year longitudinal study (Feagans & Merriwether, 1990).

2.3.3 Motor skills and motor co-ordination

Motor coordination is one's ability to combine body movements with the kinematic and kinetic properties (space and force) to produce an intentional action (Daly, et al., 2003). According to Daly et al. (2003), "Motor coordination is achieved when subsequent parts of the same movement, or the movements of several limbs or body parts are combined in a manner that is well timed, smooth, and efficient with respect to the intended goal." (Daly, et al., 2003).

Fine-motor coordination is the ability for one to control the small intrinsic muscles of the body and to coordinate the action of the eyes and hands together in order to perform particular manipulative movements (Daly, et al., 2003). This is a developmental process and requires integration of the grasp reflex from infancy. Kinaesthetic input from receptors in the muscles, joints, tendons and skin also provide essential information for development and refinement of fine-motor actions (Exner, 2010).

Fine motor skills are essential for kindergarten success. Research has proposed that a large percentage of a child's school day is spent engaging in fine motor activities. (36%-66%). Fine motor activities include eating breakfast, playing with Legos, colouring, and writing (Marr, et al., 2003). It is proposed that children who have difficulty with fine motor demands of kindergarten are at risk of falling behind,

becoming dependent on others, being teased by their peers, and developing low perceived scholastic competence (Shonkoff & Phillips, 2000); (Piek, et al., 2006). The inferences of poor fine motor skills extend beyond kindergarten: A systematic review by Grissmer et al (2010) found that fine motor performance in kindergarten to be a strong predictor of later math and reading achievement (Grissmer, et al., 2010).

However, other research shows that while the development of motor skills has been associated with other developmental functions such as perceptual ability, gross motor skills have an association with cognitive ability in school aged children rather than fine motor skills. Burns, O'Callaghan, McDonell, and Rogers (2004) found when they assessed 132 children at one year on the Griffith Mental Development Scale and four years on the McCarthy Scales of Children's Abilities, that their motor development was associated with their cognitive and perceptual development (Burns, et al., 2004).

Piek et al. (2008) reported in a study on the gross and fine motor function of 33 children, with a mean age of eight years and six months, whose motor function was assessed at four, six, eight, 12, 16, 18, 20, 24, 30, 36, and 48 months (Piek, et al., 2008). They found no relationship between fine motor function and perceptual cognitive performance at school (Piek, et al., 2008). Gross motor function, including posture control and the age at which crawling and walking started, showed a significant relationship to cognitive ability at school age (Piek, et al., 2008). This was supported by a study by Murray et al. (2006) who found that children who stood earlier scored better on tests of cognitive and perceptual functioning as adults (Murray, et al., 2006). They also found that fine and gross motor ability function in infancy and early childhood did not predict motor function at a school going age (Piek, et al., 2008). Even so, popular early developmental programmes do advertise the necessity of stimulation of gross and fine motor milestones (Piek, et al., 2008).

2.4 Early Development Programmes

Early childhood development programmes are designed to improve the perceptual, motor and cognitive functioning of preschool children, and ultimately influence school readiness to learn in the school environment (Anderson, et al.,

2003). They provide opportunities to establish a critical foundation for children's development, academic success, health, and general well-being (Anderson, et al., 2003). The programmes focus on motor development, areas of sensory development, progression of play, emotional and social development, and parental education within workshops (Lester, 2014).

Very few childhood development programmes like the American based Head Start®, are formulated to assist children from disadvantaged backgrounds to prepare them to enter formal schooling (Anderson, et al., 2003). Rather, most are expensive and are aimed at parents in middle to higher socioeconomic areas where children may have access to stimulation (Anderson, et al., 2003).

Eleven commercial EDPs, available in Johannesburg, that are advertised online and target the population who can afford to attend them were reviewed (Appendix A). Six of the commercial EDPs advertised, aim for the enhancement of fine and gross motor skills, while one specifically addresses coordination and two offer programmes for enhancement of gross motor skills and perceptual abilities (Anderson, et al., 2003). Other aims of the commercial EDPs include encouraging a healthy lifestyle, fostering success and enhancing self-esteem, stimulating problem solving abilities, increasing memory, developing mathematical and reasoning abilities, musical, physical, social, emotional, cognitive and language development as well as attentive listening and creative thinking (Anderson, et al., 2003).

Enhanced ability for early symbolic thinking, literacy and writing readiness are mentioned in three programmes and the importance of mother-child relationships and the role of parents in the development of their child is the emphasis of one programme (Anderson, et al., 2003). Therefore it is implied that attendance of such commercial EDPs will address aspects underlying the development of skills including perceptual and motor skills if mothers attend such programmes with their infants and toddlers (Anderson, et al., 2003).

2.4.1 Effectiveness of Early Development Programmes

There is a lack of evidence regarding the impact of attendance at early childhood development programmes for typically developing children, but research in 'high

risk' children is abundant due to the important effects of early experiences and environment on child development (Anderson, et al., 2003). Intervention for infants and toddlers and their families can effectively increase the odds of favourable developmental outcomes (Anderson, et al., 2003).

Various development programmes have been implemented with the intention of improving the outcomes for ‘high risk’ infants and research has investigated the effects of these programmes on both the cognitive and motor development of preterm infants at various stages of development (Anderson et al., 2003). In a systematic review conducted by Anderson et al (2003), nine studies from thirteen different papers were analysed regarding 'high risk' population of children in preschool (Anderson, et al., 2003). Six of the nine studies recorded improvements in academic skills for children who were enrolled in childhood development programmes. These EDPs targeted ‘high risk’ children and were implemented on a daily basis. The results of one of the nine studies indicated a negative effect and the final two studies did not provide any data suitable for comparison (Anderson et al., 2003). Of the remaining three studies, standardised cognitive skills assessments outcomes relevant to kindergarten curricula indicated an increase in school readiness for children enrolled in early childhood development programmes (Anderson, et al., 2003). A study based in the United States researching the effectiveness of early childhood programmes demonstrated that data collected from the Perry Pre-school Program following forty years revealed increased rates of high school graduation (Shonkoff, 2009).

This programme targeted children particularly in adverse circumstances of poverty and focused on enriched learning opportunities, parent education and support services especially for mothers. The outcome depicted inconsistent quality of the programme and how the programme was implemented (Shonkoff, 2009). Through decades of programme evaluation, it is evident that programme outcomes are determined through distinguishing good services from bad, which in turn will distinguish positive outcomes from negative outcomes (Shonkoff, 2009). In effect, the success of a programme is dependent to a degree on how the programmes are being run (Anderson, et al., 2003).

Seven studies were identified which measured cognitive outcomes in terms of intellectual ability. Of the seven studies, six of them resulted in increased scores upon IQ testing for students who had attended development programmes (Anderson, et al., 2003). Treatment effects have been found at the infant and preschool age but no significant effects have been observed once the children entered school. This, in part, is a result of early intervention and attendance of EDPs and a child's ability to gain experience and exposure and mastery of skills (Anderson, et al., 2003).

Furthermore, it was indicated that early developmental interventions were of no benefit regarding motor outcomes in infancy or at school going age (Orton, et al., 2009). Relatively few studies have examined the long-term effects of intervention programmes on low risk children, such as children who have been carried to term and are typically developing (Caughya, et al., 2004). This research has not been conducted on a large scale nor have long-term effects been examined, i.e. effect on skills once entering school. Therefore it is interesting to determine the effects commercial EDPs have on low risk children (Caughya, et al., 2004).

Research in South Africa indicates that the early years are critical for a child's development. Focus therefore needs to look at both the advantages and disadvantages in these early years (Unicef, 2006). Based on this previous research resulted in governments worldwide to promulgate legislation to provide early childhood development programmes for disadvantaged children. These EDPs, which are continual and occur on a daily basis, are thus expected to have positive correlating results to the above-mentioned studies (Unicef, 2006)

2.4.2 Government Legislation with regards to Early Development Programmes

In South Africa, Early Childhood Development (ECD) is a priority and is supported by legislation, national policies and strategies (Afrika Tikkun, 2013). Legislation aims to ensure that the children from lower socio-economic environments get exposure to the requirements necessary for child development. These programmes differ to the commercial EDPs being offered in a higher socio-economic environment due to the demand for general development in children

regarding their physical, cognitive, and social and language development (Afrika Tikkun, 2013).

Special focus is on the development of materials and tools for primary caregivers of 0-3 year-old children in order to promote skills development at community level for these groups, particularly child-headed households (Unicef, 2006). The goals of such EDPs in government are to use play activities to develop areas of numeracy and literacy, empower pre-existing programmes and implement a government standard within crèches in the community to offer such programs on a grant basis. This grant is included in the Children's Bill of Rights section 28(1) (c) (Unicef, 2006). The Child Care Act 1983, as amended, provides for the regulation of early childhood facilities and the payment of subsidies/grants to these facilities (Unicef, 2006).

The Education White Paper 5 on early childhood intervention places great emphasis on child development in the first three years of life (Department of Education, 2001), and deems it as a critical period in which a child's future may be moulded (Asmal, 2001). This is largely due to research on the plasticity that the brain holds to make multiple connections and, through stimulation, to develop pathways for future use. Due to this reasoning, the government is focusing on the implementation of EDPs especially for those of low SES who are considered 'at risk', to break the poverty cycle and give children the necessary tools to develop age-appropriate skills and reach their optimal functioning for lifelong learning and development (Asmal, 2001). Early developmental programmes are being implemented to lay down the foundational skills to prepare children for school so that they will be able to cope with the demands required of them. During this period, foundational skills are laid down with emphasis on critical concepts, skills, perceptual motor skills, basic numeracy concepts and skills, problem solving and learning (Asmal, 2001).

2.4.3 Early development programmes and the neuro-typical child.

According to Piaget, children aged two years to seven years fall in the pre-operational stage and children aged between seven to eleven years fall between the concrete operational stages (Santrock, 2008). The children in this research fall

within the pre-operational stage of development. During this period, the child begins to understand the environment through the integration of movement and perceptual ability and interactions with others (Santrock, 2008). It is also within this stage that language and cognitive development occurs. Thus EDPs should address motor skills, including both fine and gross motor skills as well as visual abilities and visual perceptual skills, at an age appropriate level, to have a positive influence on both the physical and cognitive development of children (Santrock, 2008).

Early developmental programmes also need to be run in a way that captures the group, using efficient group facilitation principles. In order for brain development to be optimal, activities within the groups need to be levelled appropriately for the age band, provide opportunity for the 'just right challenge', and provide adequate stimulation with active participation (Bundy, et al., 2002). If a child is not actively engaged, little impact occurs on normal brain development, and if a child is over-stimulated and over-regulated it could result in a negative impact on development (Bundy, et al., 2002). This includes the development of VMI, which can be assessed from the age of three years (Beery & Beery, 2010) (Meherali, et al., 2010). To develop VMI specifically, the programmes should include reaching for items in the environment by looking at them. Items should differ in size and shape and require different positions of the upper limb (Ollendick & Schroeder, 2003). This should be a focus within EDPs; however, it may be difficult for those running the EDPs to facilitate within a large group setting and it is essential to have the skills to facilitate. For the toddler, reaching skills should include bilateral and controlled movements and encourage block building and completion of simple shape boards (Ollendick & Schroeder, 2003).

Commercial EDPs targeting higher SES families are run differently from those offered within the national legislation as they are run once weekly for two hours per session, as opposed to a programme that is designed and implemented on a daily basis similar to that of a pre-school programme (Lester, 2014). As advertised, there is exposure to multiple sensory stimulation, gross and fine motor activities, opportunity for social interaction, nutritional snacks, songs, action movements to songs and essentially play activity programmes (Lester, 2014). The groups are intended for up to twelve mothers and their children per group session,

but this may not always be regulated. Commercial EDPs offer mothers the opportunity to be actively involved in a non-intrusive yet supportive manner, to ultimately enable self-motivation and enable special bonding between mother and child (Lester, 2014).

For the younger age groups, babies from 2-12 months, the programme offers an opportunity to learn how to stimulate their baby in a hands-on, fun, professional and social environment (Lester, 2014). The commercial EDPs provide activities which help to stimulate gross and fine motor and visual milestones; sensory development, play, emotional and social development as well as parental education (Lester, 2014).

Advertised benefits of the commercial EDPs are to enhance sensory-motor learning, through stimulating the senses and challenging physical abilities, which is essential for development (Lester, 2014). According to the website of one programme, “Babies are encouraged to perceive, understand and act on the world around them. Through this programme, babies establish a sense of self and learn how to relate to others, which affects their physical, mental and social competence throughout life” (Lester, 2014).

Through engagement in the programme it is emphasised that a baby will gain the physical skills necessary for normal development as well as the ability to interpret and organise incoming sensory information from all sensory modalities of taste, touch, sound, sight and hearing, as well as the proprioceptive and vestibular functioning (Lester, 2014). The programme says it enhances motor development and learning via sensory stimulation (Lester, 2014).

2.5 Conclusion

According to The Education White Paper 5, great emphasis is placed on early childhood intervention especially within the first three years of life (Department of Education, 2001). A child’s future is moulded through early intervention, exposure and environmental factors. It is beneficial for children to gain maximal exposure and stimulation to numerous environmental factors, social interaction and sensory stimulation in order to maximise development of the brain pathways (Asmal, 2001). The implementation of EDPs, especially for those of low SES who are

considered ‘at risk’, focuses on breaking the poverty cycle and giving children the necessary tools to develop their skills age appropriately and helping them reach their optimal functioning for lifelong learning and development (Asmal, 2001). Thus the main implementation of EDPs is to assist with development of the necessary skills to prepare children for formal education (Asmal, 2001).

According to the Education White Paper 5, age of entry to Grade one is six years. The policy is intended for children living in rural areas to implement a reception year (Grade R) in order to develop foundational skills incorporated in the EDPs (Asmal, 2001). There are also EDPs in place to focus on stimulation for children four years and younger. This includes education for mothers and caregivers emphasising the importance of stimulating the child, providing adequate nutrition, health care and opportunities, in order to help develop foundation skills and narrow the cultural gap between the previously advantaged and disadvantaged (Asmal, 2001). Previous research has concentrated on individuals with developmental delays due to a number of other factors that include low SES, low birth weight, prematurity, smoking, alcohol abuse during pregnancy and other environmental and gestational factors (Asmal, 2001). Studies of long-term evidence of subtle developmental differences within neuro-typical children have received comparatively very little attention (Asmal, 2001).

Early developmental programmes focus on sensory stimulation to develop motor and visual skills that are essential for the development of VMI at a pre-school level (Santrock, 2008). Foundational skills, if stimulated and laid down, have proven to be a major indicator for academic success. Demographic factors that affect development of skills previously mentioned include SES, parenting skills and caregiver input (Beery & Beery, 2010). Within this study further emphasis on child development and VMI includes mothers’ return to work, which has been shown to have an effect on a child’s cognitive ability. In studies conducted in the US and UK, there was sufficient evidence proving that mothers’ return to work within the first year of life will have a negative impact on child cognitive development.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter will report on and justify the methodology chosen to execute the study, the population that was accessed and procedures that were followed, including how the data was collected and analysed. Lastly, it will describe the steps taken to ensure that this project adhered to the ethical considerations.

3.2 Research Design

A non-experimental research design, using a case-control study was selected for this research. A case-control study is retrospective in nature and the design requires identification of cases (a group that has been exposed and a control group) then the exploration of how this has influenced outcomes. It is a non-experimental design with no manipulation of the independent variables (attendance at EDP's and mothers return to work) and no intervention (Brink, et al., 2012). In this design, participants are not randomised to the exposed or unexposed groups. In the context of this study, the aim is to explore and explain the relationship between the BTVMI scores of children who did and did not attend EDPs as well as their scores if their mothers did or did not return to work (dependent variables).

Within this current study, four hundred children were all assessed regardless of their attendance at EDPs and their mothers' return to work, taking into account all necessary inclusion/exclusion criteria. These variables were used to determine their outcome status with relation to scores within the BTVMI (Porta, 2008).

Thus, as it is the intention of this study to compare the scores of the BTVMI of children in relation to various variables, the case-control design was the best option for this particular research as it allowed for the researcher to look back retrospectively and compare the results of the groups to determine the relationship between the variables being researched (Bailey, 1997).. There was no manipulation of the independent variable as it had occurred in the past in that the child had or had not attended an EDP, or their mother had or had not returned to work (Brink, et al., 2012).

A case control study was better suited to this research as the variables in a case control study cannot be influenced. The study retrospectively investigated to see if attendance at EDP's and mothers return to work had an influence on a child's BTVMI. Information obtained provided descriptive quantitative data, which is analysed accordingly within the results chapter. Within this design it is essential to collect data from both groups in the same way (Hissong, et al., 2014). In the case of this current study, data was gathered using quantitative methods. Quantitative data provided the fundamental comparison between observations of quantitative relationships, whether the children attended or did not attend the early development programmes, and mathematical expression - the scores on the BTVMI. The researcher asked a specific, narrow question, being: "did the child attend or did the child not attend any early development programme, did the child's mother return to work or not?" and collected a sample of numerical data from the BTVMI from children participating to answer the questions (Brink, et al., 2012).

3.3 Population

The population accessed were typically developing children in Grade 00 (3 years 6 months to 4 years 6 months) who attended private schools in the northern suburbs of Johannesburg. This age band was chosen as children at this age are typically entering into nursery schools, and it eliminates exposure to formal schooling as a variable influencing the scores of the BTVMI. This age band would have allowed for little formal education and mainly exposure to stimuli within their immediate environments.

3.4 Sample

3.4.1 Sample Selection

The private schools in the northern suburbs of Johannesburg were selected as a convenience sample in order to gain special segments of the population (people of a higher socio-economic status) who would be more likely to attend the commercial early developmental programmes of this nature.

The subjects were selected by means of convenience, as they were the easiest to recruit for the study. Four hundred consent forms were issued out. The

convenience sample was also used in conjunction with consent. The units that were selected for inclusion in the sample were the easiest to access - The researcher handed out consent forms to all children within the age bands being assessed from schools participating and took in the first children who had returned their consent forms until the necessary quota was reached (AERD Dissertation, 2012). There were one hundred and eighty forms returned of which only eighty six met the inclusion criteria.

3.4.2 Sample Size

A power calculation initially indicated that there would be 63 children per group, having a 90% power to detect an 8.69 point difference in the standard scores between the groups (Lotz, et al., 2005) on the BTVMI, based on a SD of 15 (Beery, 2005). This testing was based on a 0.05 level of significance. The sample size was significantly less due to the decreased amount of consent forms returned and meeting the inclusion criteria.

3.4.3 Criteria applicable

3.4.3.1 Inclusion Criteria

Certain criteria were used to obtain the sample. The following inclusion criteria were used:

- Children who were born at or above 37 weeks gestation
- Children who attended early developmental programmes for a minimum of 3 months –either Moms and Tots Workshops, Moms and Babes Workshops or other early developmental programmes
- Children who did not attend early developmental programmes

3.4.3.2 Exclusion Criteria

The following exclusion criteria were used to control for confounding variables:

- Children with visual problems that required glasses
- Children with a neurological, genetic and/or learning disability diagnosed by a neurologist or psychiatrist

- Children who were at the time of assessment receiving or had previously received occupational therapy, speech therapy or physiotherapy
- Children considered low birth weight i.e. less than 2500g at birth

3.5 Measurement Tools

3.5.1 Parent Questionnaire (Appendix A)

A basic questionnaire was designed by the researcher to record the child's demographics. This information was needed to determine whether the children met the inclusion criteria. The personal information gathered was not included in the main study. The attendance at an early developmental programme was determined along with the length of time one did attend the EDP. It was also determined how many children did not attend the EDPs. This questionnaire consisted of closed ended questions focusing on the demographic information. Closed ended questions required a 'yes' or 'no' answer such as, "Did your child attend an early developmental programme?" These were followed with options for one to check with correlating boxes: "if yes? For how long did the child attend? 3 months, 6 months 12 month or other?"

An open-ended question was included following the closed ended questions regarding attendance of EDPs and time of attendance at EDPs for the purpose of gaining more diverse data and information on the benefits of the early developmental programmes and required the parents to provide information on what aspects were emphasised in the early developmental programme (Brink, et al., 2012).

This questionnaire was piloted to enhance the content validity of the questionnaire. The piloting process involved two stages. In Stage One the researcher asked three occupational therapists to evaluate the questions. These therapists were experienced occupational therapists who each had at least ten years work experience in the field of paediatrics. The questions were assessed for content, clarity and relevance. These therapists were emailed a copy of the questionnaire along with the information about the research being conducted. They were all from a similar culture and English was their first language. They were asked to assess if there were any ambiguous questions. Additionally, they

also assessed if any of the questions being asked appeared difficult in nature to interpret and answer, if there were any questions that were irrelevant and if there were any other questions that they felt should be asked and included within the questionnaire. The therapists felt it was an adequate questionnaire and that it covered the necessary aspects that were being identified for this particular study. The content it included was considered adequate for the topic without including too many extraneous factors. It was suggested that the questionnaire include an additional aspect of return to work for the mother/primary caregiver. This question was included after the questionnaire had been piloted. It was also suggested that the study not be limited to Moms and Babes and Moms and Tots only, but rather include other early developmental programmes, as they appeared all to be of a similar nature.

The second stage of the piloting process involved mothers who would assess and answer the questionnaire but would not be included in the study. The questionnaire was piloted amongst mothers of the same population but who were not participating in the sample. The questionnaire was distributed to 10 mothers to check that the wording excluded ambiguity or questions that were difficult to answer. These mothers found it easy to understand and complete the questionnaire within approximately five minutes. There was no report of any misunderstanding or ambiguity and they filled it in with ease. They found it simple and straightforward.

3.5.2 The Beery-Buktenica Developmental Test of Visual Motor Integration (BTVMI) 6th edition (Appendix B)

Keith Beery first developed the BTVMI in 1967. It was used to identify, through early screening, children who may need extra assistance and to determine the services needed, as well as to test the effectiveness of educational and other interventions. It is a valuable tool for assessing one's visual-motor integration. It has been revised over the years and focuses mainly on early childhood education. It consists of three sections that focus on visual motor integration, visual perception and motor co-ordination. (Beery & Beery, 2010)

The Visual Motor Integration component of the test included drawing 27 geometric forms, which were presented in order of increasing difficulty. The test was

individually administered to each child, which took approximately 15 minutes per child. It was originally supposed to be administered in groups of ten; however the researcher found that it was difficult to give verbal instruction to a group of children of these young ages and therefore the test was administered on a one-on-one basis. Separate supplemental tests for Visual Perception and Motor Coordination were included and assessed individually. The supplemental Visual Perceptual test of the BTVMI was administered in 5 minutes and presented the same 27 geometric forms. For each form presented, an identical form was chosen amongst others that look nearly but not exactly the same; the child simply had to point to the identical figure. The task is considered a visual discrimination task and motor requirements were minimal. The supplemental Motor Coordination sub-test was administered whereby the child had to trace the same 27 geometric forms with a pencil within 5 minutes. The purpose was to stay within the double lined paths. The BTVMI and supplemental tests were scored using a profile form provided and were converted to a standard score and a z score.

The BTVMI was used as the means of assessment in this research study due to its ability to assess all aspects of visual motor integration. Furthermore “the overall reliability of the BTVMI and its supplemental Visual Perception and Motor Coordination test had overall average reliabilities of .92, .91 and.90 respectively”, indicating a “relatively high reliability in comparison with other measures of perceptual-motor skills” (Beery & Beery, 2010)(p 104). The results from the test also yield numerical values, which allowed for accurate analyses and determination of the difference between the two groups. The BTVMI (Beery & Beery, 2010) is used internationally and is regarded as a valid test (Brown, 2009).

In a study conducted by Dunn, analysis yielded a correlation of 0.75 between the test scores, which supports the sustainability of the widely used Developmental Test of Visual-Motor Integration in a multi-ethnic sample. The BTVMI is the most commonly used tool in South Africa (Dunn, et al., 2006). The BTVMI is widely used in South Africa. Due to the population selected to participate in this particular study which essentially is targeting neurotypical children, which is a unique minority of the South African population; the BTVMI is normed to this dynamic.

The reliability of the BTVMI is dependent upon whether there is adequate consistency within the content of its items (internal consistency), the individual's performance on the test when it is re-administered (test-retest reliability), and scoring performed by different examiners (inter-rater reliability) (Beery & Beery, 2010).

The overall reliability should be a minimum of .70 for tests used for research purposes. With regards to the content sampling, the Rasch-Wright results indicated high content reliability and person reliability for the BTVMI with a total group item separation of 1.00, and a total group person separation of .96 (Beery & Beery, 2010).

Internal consistency of the BTVMI included an odd-even split half correlation for 1-year age groups of .88 and an odd-even split half correlation across age groups of .95. Beery VMI split half correlations for 1-year age groups were .93 with a median of .84 SEM (Beery & Beery, 2010). Inter-scorer reliability was depicted between .93 to .99 for experienced scorers and .73 for inexperienced scorers (Beery & Beery, 2010).

The test is only as valid as it is reliable. In order for the test to be valid it must be reliable and consistent in the measurement (Beery & Beery, 2010). The test must demonstrate good content validity, which is strongly supported in the BTVMI, concurrent validity, which was moderately high between the Beery VMI and newer, lesser-developed geometric form-copying tests. Construct, predictive validity and controlling for bias must also be considered. The results generally support the validity of the Beery VMI and its supplemental tests (Beery & Beery, 2010).

The therapist administering the assessment was previously trained in the administration of the BTVMI and had reviewed the administration protocol for the under five-year age group. The instructions and guidelines were available in the manual and were reviewed by the assisting therapist and researcher before tests were administered.

3.6 Data Collection

3.6.1 Step 1:

Various private schools within the northern suburbs of Johannesburg were approached for consent to include Grade 00 learners in this project. Eight schools were approached. A letter asking for permission to conduct research, outlining the aims, objectives and methodology of the study were given to the principal and school governing body. Upon agreement to participate, the principal was asked to give signed permission. Only five permission slips were received back.

Following the attainment of permission from the principals (Appendix C), the parents of all learners enrolled in Grade 00 were invited with their children to participate in the study (Appendix D). An information sheet with full explanation of the study was sent out to the parents of the learners, along with a written consent form requesting their child's participation in the study (Appendix E). Approximately four hundred consent forms were sent out along with the school newsletter. One school allowed the researcher to send out emails to the parents informing them about the research study. The email contained an information letter and consent form and requested parents to return the form to the school if they gave consent. Other schools did not allow virtual communication and thus an envelope with all necessary documentation was sent home with the children along with the newsletters. Upon consent, the parents were asked to complete the questionnaire that was attached to the information form (Appendix A), which provided brief demographic information required for the research. This assisted in determining whether the child was within the inclusion or exclusion criteria, of which only eighty six children were within the inclusion criteria. The questionnaire also determined their attendance at an early developmental programme.

3.6.2 Step 2

All children whose parents gave consent were included in the study. Therefore the first 54 children who had attended early childhood developmental programmes and 32 that had not attended early childhood developmental programmes whose parents agreed to participate, and who gave informed consent for their children to participate, that met the inclusion criteria, were selected to make up the two groups for the study. The mothers' status in terms of return to work was established for all 86 participants.

A suitable time was set up with the school and teachers to start with assessments. After obtaining verbal assent from each child (Appendix F) assessments were done individually and each assessment took approximately thirty minutes per child. This time period included the necessary instructions and demonstration that is required for children under five years of age when imitating the ‘direct copying’ part of the VMI.

To assist the child to reach their potential during the assessment, the following ergonomics considerations were taken; correct height table and chairs to accommodate little children and ensuring there was minimal distraction in the room. Their own classrooms were used as they offered optimal conditions in terms of ergonomics. However, these were then only available for use during break times, and it was difficult to prevent distractions like noise and movement coming from the playground and outside environment. The rooms were familiar to the children, which did alleviate anxiety and also accommodate for the right lighting, adequate ventilation and minimal visual distraction due to familiarity.

The BTVMI was administered blindly to all the children participating in the study. This was done through the researcher not knowing if the child being assessed did or did not attend EDPs or whether their mother worked or not. This was to ensure that there is no bias from the researcher and that the scores were not influenced by prior knowledge of participants by the researcher. An assisting colleague issued codes to the children whose parents had signed the consent in order to minimise bias. The children were issued codes, which had no indication of variables to be studied to ensure confidentiality and to keep the assessors blinded to the important study variables. A code was attached to the children’s assessment forms and this code was the same as the one assigned to the child’s consent form and questionnaire. The child was taken to the assessing therapist by the teacher without identifying them by name

Since the children participating were assigned codes, the researcher did not know the child’s status in relation to the variables being assessed. A list with the children’s names and codes was kept in a secure location by the researcher so parents could be informed if their child’s results indicated they needed further assessment and follow-up.

Each child was then assessed individually. The assisting therapist then checked the demographic information from the questionnaire to determine whether the child met the inclusion criteria.

The instructions given to the children followed the standardised procedure for individual administration. The tests were scored by the researcher according to the scoring guidelines set out in the Beery VMI administration, scoring and teaching manual (sixth edition) (Beery & Beery, 2010), to convert raw scores to standard scores and yield a z-score for each of the three subtests of the BTVMI.

3.7 Data Analysis

The information obtained provided descriptive data for the demographics and the attendance at early development programmes and mothers' return to work. Percentages and means and standard deviations were used to analyse these variables.

Frequency distributions of the z scores for the three tests in the BTVMI were used to compare the data against a normal distribution. Chi-squared tests were used to determine if the scores for the BTVMI were significantly different from the expected normal distribution.

Since all the results for the BTVMI were not normally distributed, Mann Whitney U tests were used to determine the statistical difference for z scores for the three tests in the BTVMI between the participants who did and did not attend EDPs and who participants whose mothers did and did return to work.

The scores were entered into an Excel spreadsheet and represented in tables and bar graphs to display differences or similarities.

The Freidman ANOVA was used to determine if there was a significant difference in return to work of mothers for those who did and did not attend EDP's.

3.8 Ethics

Ethical clearance was obtained from the Human Ethics Research Committee of the University of the Witwatersrand before the commencement of the study (Ethical clearance number M121161; Appendix G).

The aims, objectives and research process were explained to the principal and permission granted to conduct the research at the school was requested (Appendix C).

All parents of participants were provided with the information sheet along with the school newsletter (as described above) (Appendix D) and signed informed consent before commencing with the research (Appendix E). The information sheet included details on the study and the reason for the study in that the aim was to identify if the scores for Visual-Motor Integration would be affected having attended or not having attended an early developmental programme. It also highlighted the fact that participation was on a voluntary basis and there would be no negative consequences to engaging or not engaging in the study.

All participants participated in the research on a voluntary basis and none of the participants requested to leave the study. All parents were given the researcher's contact details and asked in the information sheet to provide their details if they wanted to receive feedback. Children were asked to give verbal assent before being assessed (Appendix F).

Ethical obligations were abided by as parents of children whose results were below average were contacted, given feedback and also given the names of three occupational therapists in the surrounding areas.

All identifying information was kept safe by the researcher. The information was stored in a private practice facility within a locked filing cabinet, which is accessible to the researcher only.

3.9 Conclusion

This chapter has described how the study was executed by the therapist/researcher and what procedures were followed. It describes the design, sample, measurements, process, tools and the analysis of the data. The following chapter will describe the results and the data obtained from the procedures described above.

CHAPTER 4: RESULTS

4.1 Introduction

This study examined the development of children who attended early developmental programmes (EDPs) and the scores of children who did not attend EDPs in terms of their motor visual integration. The scores on the Beery VMI test were compared for a sample of 86 children between the ages of 42 months and 54 months in Grade 00. Of the 103 children recruited into the study, 17 did not meet the inclusion criteria due to gestational age or birth weight or attendance at either occupational, physiotherapy or speech therapy.

Fifty-four (62.79%) of the participants had attended EDPs while 32 (37.02%) had not. There was no drop out from the study as a cross-sectional design was used.

4.2 Demographics of Participants

When comparing the demographic information between those participants who had attended and had not attended EDPs, the results indicate that there is no significant difference between the two groups in terms of their mean age (Table 4.1). The two groups can therefore be considered comparable.

The age bands assessed were between 42 months and 54 months (3 years 6 months to 4 years 6 months). The mean age of the participants was 47.02 months with similar mean ages for those that had attended EDPs and those who had not. (Table 4.1). A higher percentage of participants fell into the younger age band.

Participants were grouped according to six-month age groups; 42-48 months (3 years 6 months to 4 years) and 49-54 months (4 years to 4 years 6 months). Although there was a slightly higher percentage of participants in the younger age group, this was not statistically significant. More of the older participants had attended EDPs.

There was a greater percentage of male participants in the study but the difference in gender of the participants was not statistically significant. A higher percentage of girls had attended EDPs.

Table 4.1 Demographics of participants

	Total group (n-86)		**Had attended Early Developmental Programmes (n=54)**	**Had not attended Early Developmental Programmes (n=32)**		
Age						
	Mean (SD)	**p value**	**Mean (SD)**	**Mean (SD)**		**p value**
Age in Months	47.02 (3.88)		47.59(3.87)	46.06(3.79)		0.25
	n (%)		**n (%)**	**n (%)**		
42-48 months (Age band 1)	52 60.46%	0.69	31(59.6%)	20(39.4%)	100%	0.16
49-54 months (Age band 2)	34 (39.54%)		23(66.6%)	12(32.4%)	100%	0.23
Gender						
Boys	52 (60.46%)	0.69	31(59.6%)	20(39.4%)	100%	0.16
Girls	34 (39.54%)		23(66.6%)	12(32.4%)	100%	0.23

Significance p≤ 0.05*
Significance p≤ 0.01**

4.3 Birth History

According to the inclusion criteria, all the participants had a birth weight above 2.5 kg's with a range of 2.5 kg's to 3.9 kg's and a gestational age of between 37-41 weeks.

The mean birth weight and gestational age for the participants who had attended and those who had not attended EDPs was very similar. When comparing the birth histories of the two groups there was no significant difference between the groups of children in terms of their age, gestational age at birth and birth weights (Table 4.2).

Table 4.2 Gestational age at birth and birth weights of participants

	Total group (n-86)	**Had attended Early Developmental Programmes (n=54)**	**Had not attended Early Developmental Programmes (n=32)**	
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	**p value**
Birth Weight (in kg's)	2.98	2.97(0.36)	3.01(0.34)	0.52
Gestational Age at Birth (in weeks)	38.61	38.56(1.08)	38.69(1.15)	0.62

Significance p≤ 0.05*
Significance p≤ 0.01**

4.4 Early Developmental Programmes

4.4.1 Programmes Attended

Table 4.4. Indicates the percentage attendance at the various EDPs offered in the area in which the research was completed. Since some participants indicated attendance to more than one programme the percentage is over 100%. The EDP that was attended by most of the participants was Moms and Babes, followed by 'other programmes'. Moms and Tots was the least attended (Table 4.3).

Table 4.3 Programme Attended

n = 54	N	(%)
Moms & Babes	38	70.37%
Moms & Tots	13	24.07%
Other	27	50.00%

4.4.2 Aspects or skills the programme emphasised

The mothers of the participants were asked to indicate which aspects or skills the programme they attended emphasised in terms of the child's development.

Out of the 86 participants who were included in the study, 41 participants did not complete this part of the questionnaire and thus a large percentage of data on this aspect is missing.

Table 4.4 Aspects or skills the programme emphasised

n = 45	N	(%)
Gross motor	19	42.22%
Fine motor	15	33.33%
Sensory	4	8.88%
Music	5	11.11%
Language	7	15.55%
Normal development	17	37.77%
Social	23	51.11%
Other (Not Applicable due to insufficient response)	41	91.11%

For the mothers that did answer the question, they indicated the greatest emphasis was placed on developing social skills (51.11 %), followed by gross motor skills (42.22 %) and overall normal development (37.77 %) (Table 4.4).

Programmes may have emphasised more than one aspect or skill and this was reflected in the results.

4.4.3 Length of Time Participants Attended Early Developmental Programmes

Mothers were asked to indicate length of time that they and their child had attended the EDP.

Attendance for a minimum of three months was 12.96%. The majority of participants attended EDPs for more than three months but less than 12 months. The remaining 11.11% attended for more than 12 months (Table 4.5).

Table 4.5 Time Attended at Early Developmental Programmes

n = 86	N	(%)
3 months and less	7	12.96%
6 months and less	22	40.74%
12 months and less	19	35.19%
More than 12 months	6	11.11%

4.5 Mothers' Return to Work

Table 4.6 illustrates the return to work by mothers of the participants. A slightly higher percentage of mothers returned to work after the birth of their child but the difference for return to work and not return to work was not statistically significantly different for the total sample (Table 4.6).

When the mothers who returned to work and those who did not were compared in terms of attendance at EDPs, a significantly higher number of mothers who returned to work attended EDPs with their child ($p \leq 0.02$).

Table 4.6 Return to work of Mothers/Caregivers

	Total group (n = 86)		Had attended Early Developmental Programmes (n=54)	Had not attended Early Developmental Programmes (n=32)		
	n (%)	**p value**	**n%**	**n%**		**p value**
Return to Work	47 (54.65%)	0.39	32(68.08%)	15(31.82%)	100%	0.02**
Did Not Return to Work	39 (45.35%)		22(56.41%)	17(43.59%)	100%	0.45

Significance p≤ 0.05*
Significance p≤ 0.01**

4.6 Visual Motor Integration

The frequency of the z scores obtained by the participants on the BTVMI test for the VMI section as well as both the supplemental tests for visual perception and motor coordination were determined and compared to the expected frequency of these scores on a normal distribution. The mean z scores for the VMI and two supplemental tests of the BTVMI for all participants fell within the average range between (-1.0)-(+1.0).

4.6.1.1 Visual Motor Integration

Figure 4.1 compares the z scores of the participants with the normal expected values for the scores on the VMI test of the Beery VMI.

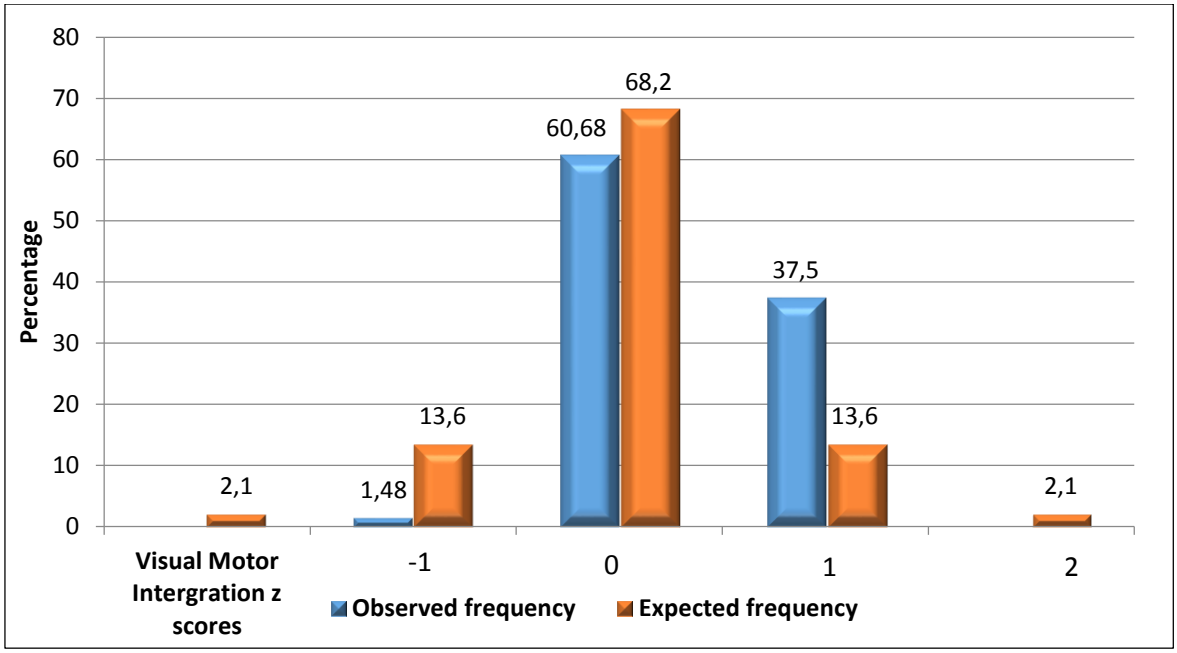

Figure 4.1 Expected and observed scores for visual motor integration on the Beery Developmental Test of Visual Motor Integration.

Participants performed better than expected on the VMI test with most scoring in the typical and above average (+1SD) range. Nearly 40% of the participants achieved above average (+1SD) scores. The distribution of the participants' scores was significantly different from the expected ($p \leq 0.00$).

4.6.1.2 Visual Perception

Figure 4.2 compares the z scores of the participants with the normal expected values for the scores of the supplemental visual perception test of Beery VMI.

The results for visual perception indicated the percentage of participants achieving typical scores was what was expected. Again, more participants scored above average (+1SD) with 23.25% scoring in this range.

Participants performed better on the visual perceptual aspect of the BTVMI than expected and are not at risk for deficits in visual perception. The significance level is set at less or equal to 0.05 thus the distribution of the participants' scores was close to significance ($p \leq 0.06$).

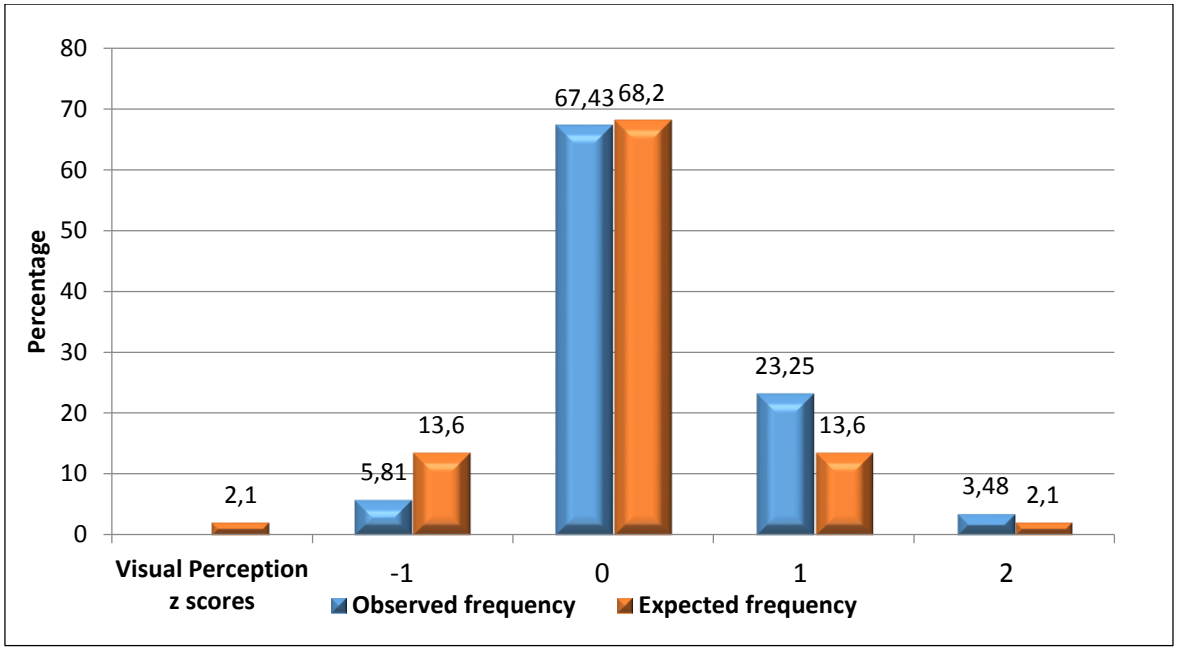

Figure 4.2 Expected and observed scores for visual perceptual Subtest scores for the Berry Developmental Test of Visual Motor Integration

4.6.1.3 Motor Co-ordination

Figure 4.3 compares the z scores of the participants with the normal expected values for the scores of the supplemental motor co-ordination test of Beery VMI.

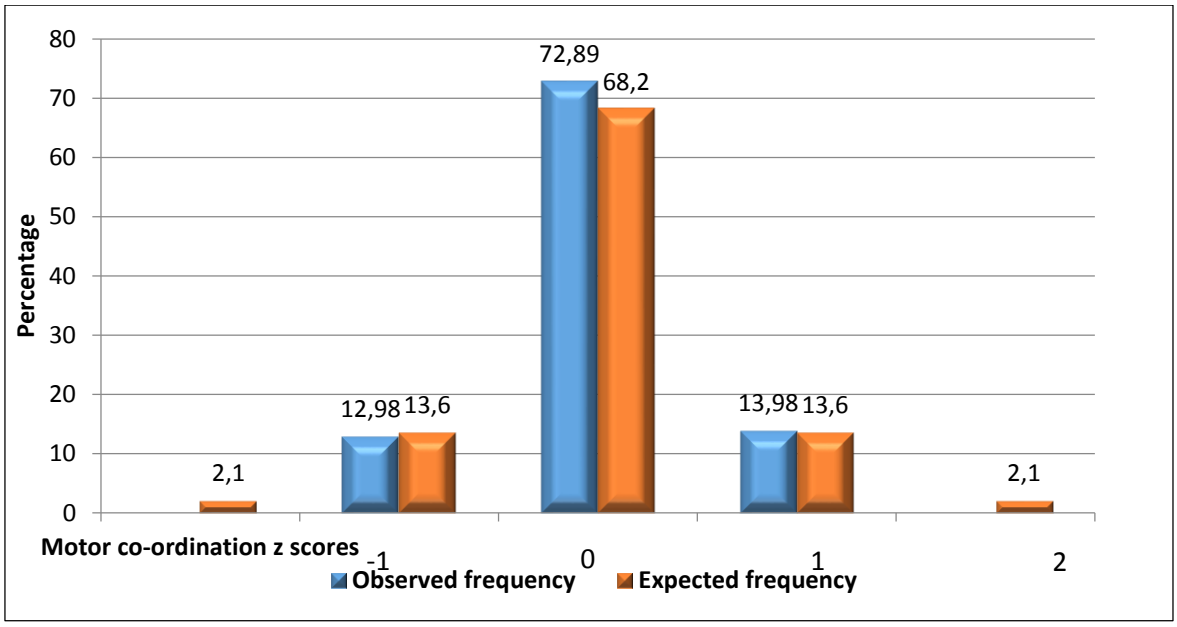

Figure 4.3 Expected and observed scores for motor coordination subtest scores for the Beery Developmental Test of Visual Motor Integration

The distribution of the scores for the participants was similar to the expected range. The participants had a slightly higher percentage for the typical or 0 range. The results for motor coordination can be accepted as falling in to the expected range for this group. The distribution of the participants' scores was not significantly different from the expected ($p \leq 0.83$).

4.6.1.4 Visual Motor Integration and Attendance at Early Developmental Programmes

The frequency of the z scores of the participants who had and had not attended EDPs were compared with the expected values for the scores on the VMI test of Beery VMI. Participants performed better than expected on the VMI test, with most scoring in the typical and above average (+1SD) range.

Table 4.7 Frequency of the z scores for Visual Motor Integration and Supplemental sub test results of the Beery Developmental Test of Visual Motor Integration and attendance at Early Developmental Programmes

		Percentages				
Normal Distribution		**2.1 (-2)**	**13.6 (-1)**	**68.2 (0)**	**13.6 (+1)**	**2.1 (+2)**
Visual Motor Integration test	Had attended			70.35	27.77	1.85
	Had not attended		3.12	43.74	53.12	
Visual perception subtest	Had attended		7.4	72.19	18.51	1.85
	Had not attended		3.12	59.37	31.25	6.24
Motor co-ordination subtest	Had attended		14.18	70.36	14.8	
	Had not attended		9.37	78.11	12.5	

Of the participants who had not attended EDPs, approximately more than half (53, 12%) achieved above average (+1SD) scores. Just below 30% of the children who had attended EDPs scored above average (+1SD) with more than expected scoring in the typical range.

In Table 4.7 it can be seen that a higher percentage of participants who had not attended EDPs performed better on the VMI test than those who had attended EDPs. However, the difference between the groups for the mean z scores was not significant (Table 4.8).

The results for visual perception were similar to those for the VMI test but the participants who had not attended EDPs scored significantly higher (p≤ 0.02) than those who had attended (Table 4.8).

Table 4.8 Mean z scores for the Visual Motor Integration and Supplemental subtest results of the Beery Developmental Test of Visual Motor Integration and attendance at Early Developmental Programmes

	Total group (n-86)	**Had attended Early Developmental Programmes (n=54)**	**Had not attended Early Developmental Programmes (n=32)**	
	Z Score	**Z Score**	**Z Score**	
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	**p value**
Visual Motor Integration Test	0.67 (0.77)	0.58(0.82)	0.83(0.73)	0.13
Visual perception subtest	0.44 (0.98)	0.26 (0.93)	0.74(0.97)	0.02*
Motor co-ordination subtest	0.03 (0.80)	0.00 (0.73)	0.09(0.84)	0.55

Significance p≤ 0.05*
Significance p≤ 0.01**

Of the participants who had attended EDPs, approximately 70% achieved a typical (0) z-score which equates to the group mean for the age group assessed. The difference was seen in the above average (+1SD) scores with 30% of participants who had not attended EDPs and 15% of those who had attended scoring in this range (Table 4.7).

In the supplemental motor subtest, the distribution of the scores for the participants who had attended EDPs was very similar to the expected range. The

participants who had not attended EDPs had a slightly higher percentage for the typical or 0 range. The results for motor coordination can be accepted as falling within the expected range for this group.

4.6.2 Effect of Mothers' return to work on the scores on the Beery Developmental Test of Visual Motor Integration

The mean standard scores for the VMI and two supplemental tests of the BTVMI for the participants whose mothers did not return to work all fell within the below to above average range (-1.00 - +2.00 SD).

More than 50% of the participants (whose mothers did not return to work) scored in the above average range on the VMI test (Table 4.9). This was confirmed by the difference in the mean z scores in Table 4.10, where a significantly higher score was seen for the VMI test scores for the participants whose mothers did not return to work compared to those whose mothers did return to work. ($p \leq 0.04$).

When the return of mothers to work was analysed for the participants who did and did not attend EDP's, there was no significant difference ($p \leq 0.25$).

Table 4.9 Frequency of the z scores for Visual Motor Integration and Supplemental sub test results of the Beery Developmental Test of Visual Motor Integration and mothers' return to work

		Percentages				
Normal Distribution		**2.1 (-2)**	**13.6 (-1)**	**68.2 (0)**	**13.6 (+1)**	**2.1 (+2)**
Visual Motor Integration test	Did return to work		2.12	66.02	29.78	2.12
	Did not return to work		3.12	43.74	53.12	
Visual perception subtest	Did return to work		8.51	65.95	21.27	4.25
	Did not return to work		3.12	59.37	31.25	6.24
Motor co-ordination subtest	Did return to work		14.88	69.78	14.88	
	Did not return to work		9.37	78.11	12.5	

The percentage of participants whose mothers did not return to work was also higher in the above average range for the supplemental visual perception subtest (Table 4.9), but the mean z scores were not significantly different between this group and the group whose mothers did return to work (Table 4.10).

The groups whose mothers did and did not return to work had little difference between the frequency and the mean z scores for the supplemental motor coordination subtest.

A higher percentage of the scores of the participants whose mothers did not return to work fell within the typical range for motor coordination, but the distribution of scores for this test was close to the frequencies of the normal distribution for both groups (Table 4.9)".

Table 4.10 Mean z scores for the Visual Motor Integration and Supplemental sub test results of the Beery Developmental Test of Visual Motor Integration and mothers' return to work

	Mother returned to work (n=47)	**Mother did not return to work (n=39)**	
	Z Score	**Z Score**	
	Mean (SD)	**Mean (SD)**	**p value**
Visual Motor Integration Test	0.53 (0.76)	0.85 (0.76)	0.04*
Visual perception subtest	0.30 (1,05)	0.61 (0.87)	0.18
Motor co-ordination subtest	-0.08 (0.84)	0.18 (0,73)	0.53

Significance p≤ 0.05*
Significance p≤ 0.01**

4.7 Summary

A sample of 86 participants in Grade 00 aged between 42 and 54 months were included in the study. The participants were considered in terms of those that had and those that had not attended EDPs with a greater percentage of the sample having attended. There was no significant difference in the demographics and birth history of the participants in the groups that had and that had not attended EDPs.

Information obtained on the EDPs showed that Moms and Babes was the most frequently attended group and the main aspects and skills emphasised were social skills, gross motor skills and normal development. The majority of participants had attended the EDPs for a period of less than six months to 12 months. These groups were then considered in terms of visual motor integration and mothers' return to work.

The null hypothesis for the supplemental visual perceptual scores and attendance at EDPs was rejected, as significant differences were found between the groups. The results showed that attendance at EDPs had a possible negative impact on Visual perceptual development, as the participants who had not attended EDPs had a better score than those who had attended.

Only the VMI scores were significantly better for participants whose mothers did not return to work so the null hypothesis was rejected for the VMI test for the variable mothers' return to work but accepted for attendance at EDPs.

The null hypothesis is accepted for the supplemental motor coordination subtest as no significant differences were found for either attendance at EDPs or the mothers' return to work.

CHAPTER 5: DISCUSSION

5.1 Introduction

This discussion will review the demographic information of the participants as well as the EDPs attended by the participants. The differences in the BTVMI scores of the groups that did and did not attend EDP and whose mothers did and did not return to work will be discussed. EDPs will be discussed in relations to the findings of this study. The implications of these findings will be considered.

5.2 Demographic characteristics of sample

Participants were recruited from Grade 00 classes in private nursery schools and were between 3 years 6 months and 4 years 6 months (42 and 54 months).

There was no significant difference in the proportions of participants in the age groups 3 years 6 months to 4 years and 4 years to 4 years 6 months for those who had attended EDPs in this study. These different age-groups are in different classes in the nursery schools. Therefore the age groups were considered comparable and combined for analysis purposes (Table 4.1). The findings were also similar for gender which showed no significant differences according between those who had attended EDPs and those who had not.

Due to adherence to the inclusion criteria, all the participants were comparable in terms of gestational age and birth weight and no children with low birth weight or gestation age below 37 weeks were included in the study. It was important to exclude children who did not meet these criteria as research indicates that these variables may affect their VMI (Goyen, et al., 1998).

The participants were below the age where they are expected to attend formal education. In South Africa, formal schooling now starts at the age of 5 years with the introduction of a reception class (Grade R) which was introduced by the National Department of Education (Department of Education, 2001) to prepare all children for formal schooling. These participants were however amongst the 55% of children in South Africa who attend organised private informal education from the age of three years (Hall, 2013).

The National Department of Education in South Africa does not provide public informal nursery school facilities even though it acknowledges the importance of sensory stimulation, parent/mother and caregiver education and exposure to enriched environments. This is because the implementation of EDPs for purposes of building foundational skills for the 4 year olds and younger ages falls into the scope of the Department of Social Development (Department of Social Development, 2015).

5.3 Early Developmental Programmes

The importance of EDPs is linked to the theories of neuroplasticity and the need to stimulate the brain in the first three years of life. The Department of Social Development does provide funding to support EDPs in low socio-economic environments. Such EDPs in low socio-economic communities focus on foundation skills for academic success and the programme is run in a similar environment and pattern to a pre-school. These programmes are being taught to crèche teachers and caregivers to be executed on a daily basis (Afrika Tikkun, 2013). EDPs in the community aim to ensure children participate in order to achieve higher school enrolment, higher completion rates and lower drop-out rates. It has been proven to be an investment as it saves on further assistance and remediation at school-going age (Afrika Tikkun, 2013). Research provided depicts improved parent-child relationships as well as reduced economic disparities and gender inequalities in society (Afrika Tikkun, 2013). It enables parents to be free to look for employment opportunities, thereby potentially increasing household revenue (Afrika Tikkun, 2013).

Comparatively, commercial EDPs being offered in the more affluent areas are of a different nature and are offered on a once-weekly basis and are expensive to attend. The charge associated with the EDPs advertised are for group sessions once weekly for an hour and it appears that these programmes are becoming more popular. These programmes advertise that they promote development in a child's fine motor skills, gross motor skills, visual motor skills and some programmes even claim that they are able to address all areas of school readiness.

It appears that mothers are keen to attend these commercial EDPs even through environmental exposure and stimulation within higher SES environments. It can be assumed that these children are usually exposed to stimulation on a daily basis with the resources one finds within their immediate environment. If the mother returns to work, caregivers are employed to look after children and stimulate them or they attend a crèche where they receive stimulation. For a neuro-typical child this is generally considered adequate but in this study, of the participants recruited, 62.7% (n=54) had attended EDPs which are expensive. The cost is approximately R1500 per term and does not include make up sessions if the session falls on a public holiday. These commercial EDPs are advertised in every maternity ward as well as every clinic, and posters are seen in the offices of paediatricians and doctors. Nurses responsible for inoculations are advertising their effectiveness and encouraging mothers to attend.

The popularity of the commercial EDPs seems to be based on their focus on infant and toddler development and on parents wishing to provide optimal development for their children even if they are developing normally. The premise of such programmes is to “increase the number of connections between the brain and body through stimulating sensory programmes. These programmes cater for fine and gross motor development and are specially designed by leading Child Psychologists, Pre-School Teachers, Occupational therapist and Physiotherapists” (Lester, 2014). It is the objective of these workshops to increase neural connections, which are most pertinent within the first three years of life. This theory is supported by neuroplasticity being rife within the first few years of life before pruning of neurons occurs (Shonkoff & Phillips, 2000). The programmes provide age-appropriate activities and provide guidance for parents on what stimulation to give their child and how to allow their child to interact with the environment (Fisher, et al., 1991). The programmes are divided into various age bands namely; 2-6 months, 6-12 months, 12-18 months and 18-42 months. Activities are specific to the age bands and thus graded accordingly. The facilitators running the programmes have adequate training to determine if children are displaying difficulties; however, due to the number of children in the group and limited training, it is difficult for the facilitator to determine the level of active participation and active learning that occurs.

The mothers in this study who attended the EDPs with their child did so for between six months and one year with only 11% attending for more than a year (Table 4.5). The commercial programmes target groups from birth to 3 years 6 months. There may be a number of reasons why mothers only attend for a shorter period. These may include cost, placing the child in other types of care and time since 32 (59.2%) of the 54 mothers who attended EDPs with their child returned to work. The programmes are consistent in their structure on a weekly basis and follow a routine that is easy for the mothers to engage on, integrate and follow through into their home environments. Thus attending such programmes, even for a short period of time, will provide tools and skills for the mothers.

The fact that the commercial EDPs are done in groups may also affect mother's attendance. A positive aspect may be the group support offered when the child is younger while the mother is still learning to care for her child. Social support and parent education may be of greater importance in attendance of EDPs. Mothers who return to work may feel overwhelmed and that the time they have to spend with their child is limited - the attendance of such programmes, which enables them the time and ability to bond with their child in a dedicated time slot may be what is of greater importance to the mothers than whether their children's development will be optimised. Thus apart from providing environmental stimulation, the programmes also claim to provide an opportunity for a mother and child to spend quality time together as well as directing the toddler's energy without experiencing separation anxiety. This environment also provides a social atmosphere for toddlers to experience group interaction (Lester, 2014). It is also noted that the results may be skewed by the mother's participation in the activities they provide to the child at home - having attended EDPs and having learnt principles within the sessions may have innately been incorporated into the daily routine for the children, thus enhancing stimulation and opportunities for growth through internalisation of information imparted.

A negative aspect may be that some mothers who returned to work but attended the commercial EDPs may also have felt that this was enough stimulation for the

child and may have neglected further stimulation. Another possible problem may result from the presentation of the programmes, as running groups effectively requires skills and ability to take numerous factors into account and remain in control throughout the sessions. Even though some groups were started by occupational therapists, not all the groups are run by professionals. Programmes designed and developed by occupational therapists and other professionals were initially also implemented by occupational therapists and were run in a therapeutic nature based on early childhood development. This exposed children to environmental factors and experiences meant to assist with normal development. Subsequently, such programmes have become more popular and the demand to attend EDPs is ever increasing. The programmes have also been further commercialised and have mostly been sold to franchisees who are typically mothers looking for part time income. These mothers are implementing a scheduled programme according to a manual which is given to buyers as an overview of the programme on how it is to be run and how the classes must be structured. The programmes are thus no longer being run, implemented or executed by trained professionals in the field of normal childhood development.

Due to every child having a different threshold level for stimulation, the ability to run a group which is most effective for all children requires skill and ability of the facilitator to read each child's responses and adjust/adapt the group/task/activity accordingly (Case-Smith & O'Brien, 2010). Therefore the way in which groups in the EDPs are run is important in providing opportunity and exposure but simultaneously considering a child's ability to engage within the group setting in order to gain maximal benefit.

However, being a franchise, and having little supervision and guidance, what is of great concern is whether these groups are being implemented as the programme depicts and whether the level of the group meets the objectives of the sessions. Occupational therapists take the 'just right' challenge into account and are able to grade sessions according to every child's strengths, weaknesses and their abilities or just beyond their abilities. It is not clear how much training franchisees have been given to ensure the optimal benefit to the children and the mothers attending each session. It is unknown what the quality and expertise of the individuals

running the EDPs are and whether programmes are graded and applied to optimise development of the children attending.

When asked which aspects of development the programmes emphasised the greatest percentage of mothers indicated social development, followed by gross and fine motor skills and normal development (Table 4.4). The benefits of attending these programs according to the advertisements include enabling a child to think logically and develop self-control, develop concentration and increase the child's sense of security (Lester, 2014).

Most EDPs are usually run once a week for two hours at a time with 12 moms and their tots in each class. Programmes were designed to provide activities that promote opportunities for the all-round development of the child (Lester, 2014). The scheduled two-hour programme includes messy play, exposure to a variety of educational toys, gross motor activities, and ring time including action songs, musical instruments, learning about the body, colours and numbers. There is a time for stories followed by an activity on the story as well as outside time, whereby children can play on the bikes, swings, sandpits, climb and enjoy outdoor toys. To end off the session, it is advertised that children are given nutritious snacks and the mothers engage in socialising while enjoying their tea (Lester, 2014).

Since 75% indicated other without explaining what this was, it is not clear if the mothers were aware of exactly what skills and developmental aspects were being addressed in the EDPs. While visual skills were not mentioned, it is clear there was an emphasis on motor skills, of which the fine motor skills are an essential component of VMI (Beery & Beery, 2010). The programme the majority of the participants attended – Moms and Tots - advertised that it was developed to prepare children for the demands of the school environment and to maximise intellectual capacity of the children. This should provide a benefit to children and form foundations for visual motor integration. As previously mentioned, these skills are determinants for academic success and assist with reading, writing and mathematical abilities (Case-Smith & O'Brien, 2010).

5.4 Visual Motor Integration

The first two objectives of this study were to determine the Beery-Buktenica Developmental Test of Visual-Motor-Integration (BTVMI) scores of children who did and did not attend early childhood developmental programmes.

The results from this study indicate that the BTVMI for the participants all follow a normal distribution, especially for the motor coordination supplemental test (Figure 4.3). For the VMI test and the visual perceptual supplemental test, the scores were above the expected range particularly in +1 to +2 SD range (Figure 4.1- Figure 4.2).

The development of typical children is theorised to occur in sequential steps identified by researchers in the early 1930's and 40's and reflects the maturation of the nervous system in a sequential manner (Case-Smith & O'Brien, 2010). However, such theories did not take into account the environmental factors and how this would influence development of such motor milestones. Piaget developed this understanding with interplay between a child's innate abilities and the environment fuelling the nature versus nurture debate. This development follows a sequential pattern and although genetics has a predisposed effect on development, assuming we are referring only to neuro-typical children, a child's exposure and interplay with the environment will assist with this developmental sequence. Amongst other developmental theorists, Vygotsky also examined the dynamic interplay between a child's environments, physical, social and cultural and examined development. He determined the difference in development of those living in rural areas versus those in higher socioeconomic groups (Case-Smith & O'Brien, 2010).

Research has identified the impact of low socio-economic stature and poorer environmental factors on development, but little research is evident on high income socio-economic stature on a child's development. One can assume that a context of a well-resourced environment should have a great advantage on child development by mere exposure to more stimulation in the environment and interaction within the environment influence development (Case-Smith & O'Brien, 2010).

Development of VMI occurs from birth. A child is not born with adequate VMI; it develops from reflexes and becomes more controlled and co-ordinated as one develops (Case-Smith & O'Brien, 2010). Exposure to environmental stimuli influences the development of VMI, and there is evidence that in low socio-economic environments a lack of exposure and poor stimulation result in poor VMI. Thus one can assume the opposite in higher income environments due to stimulation and exposure. The findings in this study would suggest that this is so as the BTVMI scores the participants from a high SES do fall within the typical and above average range. These findings are not unexpected as Martin et al. (1977) showed that the effects of SES on visual motor integration development in in children in preschool was better in children of high SES (Martin, et al., 1977). This is supported by research which also demonstrated better visual perception and visual spatial relations, both of which are related to VMI, in preschool children of High SES (Noble, et al., 2005) and in slightly older children (Ercan, et al., 2011).

5.4.1 Impact of attending an early childhood programme on visual motor integration

The third objective of the study was to compare the BTVMI scores for typically developing children in Grade 00 who did and did not attend early childhood development programmes.

In this study, while there was no significant difference in the scores of participants who did and did not attend EDPs for the VMI test and the motor-coordination subtest of the BTVMI, there was a significant difference in scores of the visual perception subtest of the VMI (Table 4.8). More than half of the participants who did not attend EPDs scored above average for the VMI test scores as well (Table 4.7). Therefore, although the scores fell within the typical and above average range, the participants who did attend EDPs scored lower than the participants who did not attend EDPs. The reason for this finding is not clear and it may have been due to the sample size and a type I error. The significance however was set at alpha 0.05 with 90% power so the sample size should not have affected the results.

Another possible reason for the finding is that VMI is developing at an age when the participants were attending the EDP, however later stimulation after the age of

2 years 6 months when the child starts to match shapes and draw may have a greater effect on the development of skills assessed in the BTVMI. Figure-ground perception required to identify the shapes develops between 3 to 5 years and therefore, like other aspects related to VMI, cannot be addressed in the EDPs.

The participants in this study attended EDPs mostly for a year up to the age of 18 months where aspects of vision related to the orientation of the head and eyes as well as the integration of visual cues and identification of objects can be addressed (Menken, et al., 1987). While essential for the development of VMI, other environmental inputs and neural maturation are required before the child can recognise and reproduce shapes accurately.

This indicates that for the development of VMI and the related supplemental visual perception and motor coordination, the attendance at EDP programmes has no effect for typically developing children from high socioeconomic circumstances. Other demographic factors such as genetics, neural maturity, the environment and exposure to other stimuli would appear to play a larger role in the development of VMI than stimulation at EDPs for the participants in this study. This could include the type of care received in the early years and the provision of stimulation by the caregiver, including the mother.

Early Developmental Programmes have no impact on visual motor integration development if not a negative impact according to the findings in this study.

5.4.2 The influence of mothers' return to work on visual motor integration

The fourth objective of the study was to compare the BTVMI scores for typically developing children in Grade 00 whose mothers did and did not return to work.

There is evidence both supporting and refuting that mothers' return to work has an effect on child cognitive development. Within families of the United States, children of mothers who returned to work after the birth of the child did present with significant challenges in their cognitive function. It has also been reported that limited research is available on this topic in the United Kingdom. However, UK research shows that there was little to no significant difference in children's

cognition if their mothers returned to work before or after the child was 18 months old (Gregg, et al., 2005).

In this study there was a significant difference in VMI test scores of participants whose mothers returned to work and those who did not. The participants whose mothers did not return to work had significantly higher scores on this test with more than half of the participants scoring above average for the test if their mothers did not return to work (Table 4.10). However, the scores of participants whose mothers did and did not return to work still all fell into or above the expected values when compared to a normal distribution (Table 4.8). There was no significant difference in scores of the supplemental visual perceptual and motor-coordination subtests of the BTVMI.

This indicates that participants whose mothers did not return to work appear to have benefitted from this in terms of their development of VMI. Although not identical, as the mothers in this study had not returned to work after three to four years, a similar study by Baker & Milligan (Baker & Milligan, 2008) showed that mothers' return to work had an impact on their children's cognitive development up to the age of 2 years. The evidence of improved childcare in their study within the first year of a child's life resulted from the extended period of maternity leave mothers of Canadian children were given. The study only found small changes in cognition and the author suggested that children be followed up when they are older using other assessment tools .

Studies in America by Brooks-Gunn et al. (2002) and the United Kingdom by Gregg et al. (2005) were done on children between 3 and 7 years of age. The first study concluded that mothers' return to work full-time within the first nine months of life showed negative effects on cognitive development (Brooks-Gunn, et al., 2002) while the second indicated there is a small effect on cognitive development if the mother returns to work in the first 18 months of the child's life (Gregg, et al., 2005). They based their results on The Avon Longitudinal Study of Parents and Children (ALSPAC), completed by mothers on a heterogeneous sample of 12000 children's school entry level tests that determined the their abilities in reading, writing, mathematics and language skills. A study by Waldfogel in 2006 further supported the research which concluded that children fare better on average if

their mothers do not return to work within the first year of a child's life, although the effects vary by context (Waldfogel, 2006).

These studies therefore lend support to the findings of this study where the scores for the supplemental visual perceptual test and motor co-ordination test were also higher, although not significantly, for the participants whose mothers did not return to work.

The studies above also concluded that the education level of the mother and care by untrained relative caregivers played a role in the findings. This indicates that the cognitive development is dependent on the type of care given within the first year of life. There is evidence especially in low income bracket socio-economic environments that children who receive greater exposure to environmental factors and greater stimulation will have greater development, and thus attendance at EDPs may be better for the child than their mother's care. However, little evidence is available for higher socio-economic populations whose mothers return to work.

The scores also depict that mothers who returned to work were more likely to attend EDPs. This result would require further investigation but may be because the mother receiving a salary meant she could afford the EDP and that she felt this allowed an hour or two of quality time with her child who was cared for during the day by someone else. This could also be seen as time for a mother and child to bond in a structured environment, enabling a mother to give the child the added benefits of bonding and 'learning' all at one time. In higher socioeconomic environments, it is common practice to have domestic workers and nannies within the household to care for, nurture, provide basic needs and stimulate children. However, it is not always taken into consideration the education level of the domestic worker, caregiver or nanny and thus carry-over cannot be ensured. In a study by Waldfogel (2002) it was found that a child's cognition is affected by the quantity of caregiving. Results depicted that children who received less hours of supervised skilled caregiving fared better than those who received longer hours of supervised unskilled caregiving, thus influencing the child's cognition (Waldfogel, et al., 2002).

Crèches are becoming increasingly popular amongst higher income families as parents feel that this is the best way to stimulate and expose children to necessary

factors to help their children to reach their maximal benefits. Mothers feel that it is more comforting to send their children to crèches where they are exposed to environmental and social factors which are essentially more beneficial than staying at home with the caregiver or nanny.

Some mothers have to return to work to maintain lifestyle, but 45% did not return to work indicating that they were financially secure enough not to need a salary and this advantaged the child. This allowed the mother to stay at home with the child and expose the child on a daily basis to necessary stimulation as well as to build a foundation for school-readiness.

5.5 Limitations of the study

The sample was selected from a higher socio-economic environment, which by default exposes children to greater stimulation and environmental factors on a daily basis compared to children from other SES brackets. The population was selected based on the availability of commercial EDPs in the area where they lived and the possibility of the mothers being able to afford these expensive EDPs and being most likely to have attended them. This resulted in a homogeneous sample in terms of SES.

Mothers were not asked why they chose to attend the EDPs or what type of childcare their child received if they returned to work which would have added depth to the study. It was also not established what other stimulation the children received at home and what care they had received if their mother returned to work. These are confounding variables as the carry-over from the EDPs into the home was not determined. One must also be mindful that EDPs are not standard and vary from business to business and from facilitator to facilitator of the groups, and thus may have a difference on the effectiveness and outcomes of the results obtained.

It was also not established what role occupational therapists played in either developing or presenting the EDPs and whether this would affect the quality of presenting the ‘just right’ challenge and grading of sessions according to every child’s strengths, weaknesses and their abilities. It is not certain how much training

franchisees have been given to ensure the optimal benefit to the children and the mothers attending from each session.

These aspects need further research to determine if they play a role in the development of neuro-typical children.

CHAPTER 6: CONCLUSION

The purpose of this study was to determine whether the attendance at early developmental programmes by typically developing children from a high SES and mothers' return to work after the birth of the child had an effect on their visual motor integration skills. It is evident that the demographics and criteria selection for the population sample played a role and influenced the outcomes of VMI scores, as the scores fell above that expected on a normal distribution. The participants in this study fit into the expected range of VMI scores for children from a high SES according to the literature.

With regard to this study there was little significant difference in the VMI scores of the participants having attended or not having attended commercial EDPs. The participants who did not attend EDPs scored slightly better.

However there was a significant difference in the VMI scores in participants whose mothers did and did not return to work. The difference was not significant for the visual perceptual and motor co-ordination supplemental tests and the scores were within the normal range for both groups of participants. The scores on the BTVMI were higher for the participants whose mothers did not return to work indicating, as literature suggests, that this may give advantage to the child in terms of cognitive development. In this sample from a higher SES, the advantage was still found for this variable.

Thus the null hypothesis was rejected for VMI ability and mothers' return to work and accepted for the supplemental tests and mothers' return to work. Although the null hypothesis was rejected for the visual perceptual supplemental test in terms of attendance at EDPs, this was a negative result and the acceptance of the null hypothesis for the VMI and motor co-ordination supplemental tests indicated attendance at EDPs had no effect on VMI ability in participants from a high SES.

Attendance at EDPs had no effect on the participants' VMI with the participants who did not attend having higher scores. Therefore it can be concluded that the commercial EDPs at an early age do not support the development of VMI.

Therefore, for this aspect of development, EDPs do not affect the development of neuro-typical children.

In agreement with the international literature, however, mothers' return to work had an effect on the participants' VMI, with those participants whose mothers who did not return to work having higher scores.

6.1 Recommendations

Further research needs to address the reasons why mothers of typically developing children, from higher SES environments feel the need to attend commercial EDPs and if in fact these mothers understand the real impact the EDPs have on development.

More research should also be undertaken to determine the effects of commercial EDPs in all spheres of child development. It may be that within the social sphere it enables a child to gain important skills for social interaction and future interaction and it may be the ultimate cause for increased self-esteem and confidence within typically developing children. Attendance at commercial EDPs may be what moulds future performance in other related spheres.

It should also be further investigated to determine if attendance to commercial EDPs is more important as a support to mothers rather than for stimulation of the child.

At present there is little research available on the care and stimulation children in both low and high SES are receiving if the mother returns to work. It would therefore be beneficial to carry out studies that would further investigate this topic with reference to mothers' return to work and the child care available for neuro-typical children at home with the care-giver.

Research should also be directed toward offering the same opportunities to mothers in low SES in the South African context through implementation of support groups for mothers. Moms and tots are already associated to a non-government organization focusing on children in underprivileged environments. Some EDPs have developed a non-profit organization that is run similarly to a crèche whereby the programme is implemented on a school day basis and

implemented by caregivers. Activities are designed to encourage children to make decisions, problem solve, explore and develop skills to become ready for the formal school environment. The effectiveness of this programme should be investigated as the need for these children is greater.

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Appendix A

PARENT QUESTIONNAIRE

To be kept Separate

Parent's Name:	
Contact number:	
Child's Name:	
CODE	

CODE _____

EARLY CHILDHOOD PROGRAMME QUESTIONNAIRE

Child's Age:	Years_____ months _____
Child was born at	_____ weeks
Birth weight:	
Does your child have any diagnosed neurological, genetic and/or learning disability?	Yes _____ No _____
If so, what?	
Who diagnosed the problem?	
Does your child wear glasses?	Yes _____ No _____
Did you return to work after the birth of your child? If so, how old was your child when you returned to work?	Yes _____ No _____
Has your child previously attended or is he/she currently attending speech therapy or physiotherapy?	Yes _____ No _____
Has your child previously attended or is he/she currently attending occupational therapy?	Yes _____ No _____
Did your child attend an early developmental program as an infant or toddler?	Yes _____ No _____
If so, for how long (approx. in months)?	
Which early developmental program did he/she attend? (Moms & babes/moms & tots/mothers and miracles/clamber club/baby gym…)	
What aspects of development did the programme emphasize?	

The Beery–Buktenica
Developmental Test of Visual–Motor Integration

Code (for administrator use only):_____

Beery™ VMI Sixth Edition

Ages 2 through 7 (SHORT FORM)

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

Examiner: _____

Test Date: ____ year ____ month ____ day

Birth Date: ____ year ____ month ____ day

Chronological Age: ____ year ____ month

(Count more than 15 days as one month.)

SUMMARY

See the Beery VMI manual (sixth 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 examinee. If subtests are used, always test in this order: VMI → Visual → Motor.

PEARSON

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3 4 5 6 7 8 9 10 11 12 A B C D E

PsychCorp

Product Number 46243/46244

The Beery™ VMI Developmental Test of Visual Perceptio

Code (for administrator use only): _____

Sex: ○ F ❑ M

Visual Perception

Sixth Edition

TURN

School: _____ Grade: _____

Examiner: _____

Test Date: _____ year _____ month _____ day

Birth Date: _____ year _____ month _____ day

Chronological Age: _____ year _____ month

(Count more than 15 days as one month.)

by Keith E. and Natasha A. Beery

Ages 2 to 100

Items 1–3 are for children; credit for adult if Item 4 is answered correctly.

Item 1. Points to one body part on self when asked: __ eye __ hair __ ear

Item 2. Points to at least 2 of 3 outline pictures: __ cat __ dog __ pig

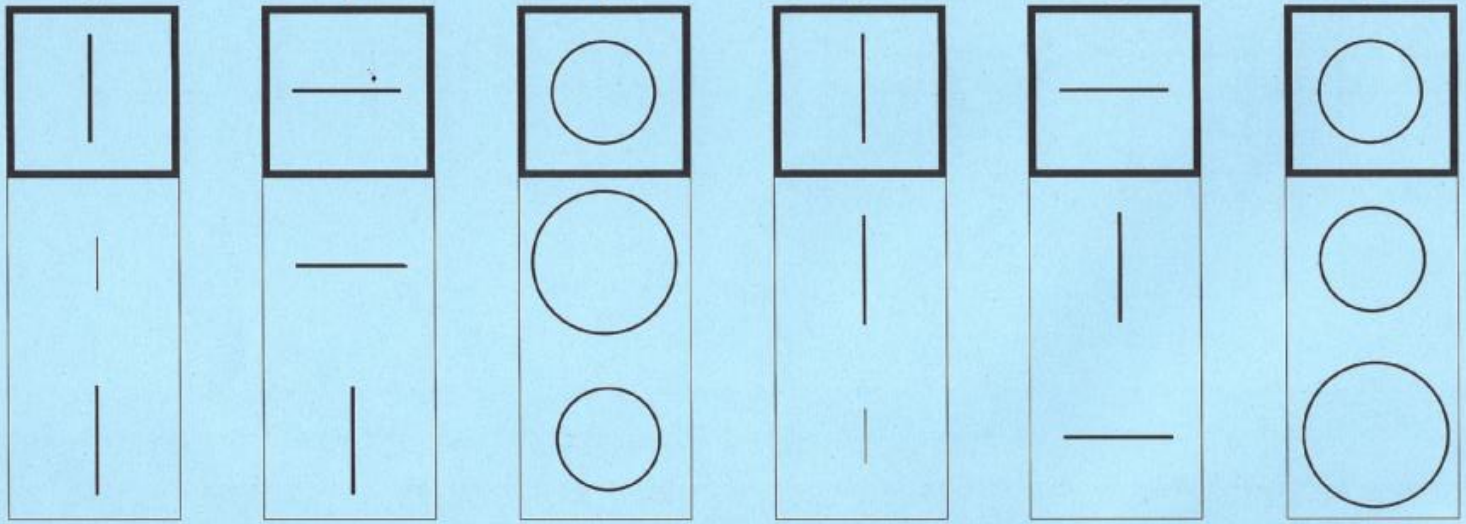
Item 3. Points to 6 of 8 pictured body parts when asked:
__ hair __ nose __ ear __ foot __ mouth __ hand __ tummy __ eye

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

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

Start timing here.

4 5 6 7 8 9



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The Beery™ VMI Developmental Test of Motor Coordin

Code (for administrator use only): ____ Sex: ○ F ❑ M

Motor Coordination

TURN

Fifth Edition

Examiner: _____

Grade: _____

by Keith E. and Natasha A. Beery

Ages 2 through 18

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.

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Product Number 46220/46221

Appendix C

Occupational Therapy

School of Therapeutic Sciences • Faculty of Health Sciences • 7 York Road, Parktown 2192, South Africa
Tel: +27 11 717-3701 • Fax: +27 11 717-3709 • E-mail: denise.franzsen@wits.ac.za

Mr/Mrs _____

School_____

Str., _____

Dear Sir/Madam

RE: REQUEST FROM SCHOOL PRINCIPLE AND/ORGOVERNING BODY FOR PERMISSION TO CONDUCT RESEARCH

I am a postgraduate student currently registered for my master's degree in Occupational Therapy at the University of the Witwatersrand. I am conducting research to investigate the **Attendance at Early Developmental Programmes and Visual Motor Integration, In Typically Developing Children**

Early developmental programmes are offered country-wide and consist of groups/classes run for infants and toddlers as well as their mothers, with the goal of enhancing development, specifically of gross and fine motor skills, visual and auditory perception as well as sensory processing. The advertising of such programmes list such benefits as the enhancement of the development of hand-eye and fine motor co-ordination as well as visual/perceptual skills. Such fine motor and perceptual skills are involved in the process of Visual Motor Integration which requires the ability to translate visual perception into motor functioning (in other words the ability to copy and action or drawing). However, no research exists regarding the effect such early developmental programmes have on the development of Visual Motor Integration in typically developing children. It is therefore the intention of this study to investigate the relationship between attendance of early developmental programmes and the development of Visual Motor Integration in typically developing children in Grade R.

The study has received ethical clearance from the University of the Witwatersrand Ethics Committee.

The data collection procedure will involve obtaining consent from the parents of all your Grade R learners and then evaluating the learners whose parents provide consent for their participation. The learners will be evaluated using The Beery-

Buktenica Developmental Test of Visual Motor Integration. The evaluation will be conducted by myself and another Occupational Therapist, with groups of 10 learners and each group evaluation will take a maximum of 30 minutes to administer. Dates and times which are convenient and suitable for the teachers will be negotiated should you provide permission to conduct the study in your school.

The school and learner's identity and details will remain confidential during the data collection procedure as well as in the final research report. The results of The Beery-Buktenica Developmental test of Visual Motor Integration will be provided upon request to those parents whose children participated in the study. Where a child scores below the average for his/her age, the parents will be provided with the contact details of two occupational therapists (not the researcher's details).

It would be highly appreciated if you would grant me permission to conduct this research within your school.

Should you decide to participate in the study please complete the tear off slip below which I will collect.

I eagerly anticipate your reply and thank you for your time in this matter.

Should you have any queries please contact me via my details listed below or those of my research supervisor.

Yours sincerely

Nicole Winterstein
BSc Occupational Therapy (WITS)
Occupational Therapy Masters student (WITS)
082 343 1155
nixginsburg@gmail.com

Supervisor
Fasloen Adams
MSc OT (UCT)
Fasloen.adams@wits.ac.za

If you have any ethical concerns please contact the chairman of the Wits Research Ethics Committee, Professor P Cleaton-Jones at 011 717 1234 or anisa.keshaw@wits.ac.za

Please complete and return the tear off slip:

_ _ _ _

Appendix D

Information Sheet to Parents

Dear Parent/Guardian

I am a postgraduate student currently registered for my master's degree in Occupational Therapy at the University of the Witwatersrand. I am conducting research to investigate the **Attendance at Early Developmental Programmes and Visual Motor Integration, In Typically Developing Children.**

As a parent I am sure you have heard of and have possibly attended early developmental programs with your child. These programmes commonly consist of groups/classes run for parents together with their infants and toddlers with the aim of enhancing childhood development. These programs typically address gross and fine motor skill development, visual and auditory perception as well as sensory processing. The advertising of early developmental programs lists such benefits as the enhancement of the development of fine motor skills and visual/perceptual skills. Such fine motor and perceptual skills are involved in the process of Visual Motor Integration which requires the ability to translate visual perception into motor functioning (in other words the ability to copy an action or drawing). Visual Motor Integration is necessary in many daily living skills such as learning how to dress and eat, play games and learning how to write by copying the alphabet off the board. However, no research exists regarding the effect which early developmental programs have on the development of Visual Motor Integration in typically developing children. It is therefore the intention of this study to investigate the relationship between the attendance of early developmental programs and the development of Visual Motor Integration in typically developing children in Grade 00.

It would be greatly appreciated if you would provide written consent for your child to participate in this research study.

The study has received ethical clearance from the University of the Witwatersrand Ethics Committee and has received permission to be conducted by the Principal and School Governing Body.

Should you provide consent for your child's participation in the study the following will occur:

- Your child (in a group of 9 other children) will be assessed on the school premises at a date and time most convenient to the teacher.
- The assessment to be administered is the Beery-Buktenica Developmental Test of Visual Motor Integration which is a non-invasive standardised measure used country-wide by Occupational Therapist to assess Visual Motor Integration skills.
- The testing procedure will require your child to be seated at a desk and follow simple instructions in order to copy various simple drawings and figures with a pencil. He/she will also be requested to look at various shapes and drawings and

identify from a number of options, which drawing looks identical to the original item.
- The testing procedure will last a maximum of 30 minutes.

Ethical considerations

- The school's, your own and your child's details shall remain confidential during the data collection procedure as well as in the final research report.
- Your child will not be at any disadvantage should you decide not to give your consent for his/her participation.
- You have the right to withdraw your child from the study at any time.
- The results of your child's test will be provided to you upon request and no other person.
- Should your child's score fall below the average for his/her age, you shall be provided with contact details of other Occupational Therapists should you wish to have your child assessed further.

Should you decide to provide your consent for your child to participate in the study, please complete the attached questionnaire and return it together with your consent slip by (latest date...).

Thank you for your time and consideration in this matter.

Should you have any queries please feel free to contact me or my supervisor at the contact details listed below.

Yours sincerely

Nicole Winterstein
BSc Occupational Therapy (WITS)
082 343 1155
nixginsburg@gmail.com

Supervisor
Fasloen Adams
MSc Occupational Therapy (UCT)
(011) 717 3701
Fasloen.adams@wits.ac.za

If you have any ethical concerns please contact the chairman of the Wits Research Ethics Committee, Professor P Cleaton-Jones at 011 717 1234 or anisa.keshaw@wits.ac.za

Appendix E

INFORMED CONSENT

RESEARCH STUDY TO INVESTIGATE THE ATTENDANCE AT EARLY DEVELOPMENTAL PROGRAMMES AND VISUAL MOTOR INTEGRATION, IN TYPICALLY DEVELOPING CHILDREN

I, (name) _____, hereby provide consent for my child, (name) _____, currently enrolled in Grade R at (school's name) _____ to participate in the above mentioned study.

Ethical considerations

- The school's, your own and your child's details shall remain confidential during the data collection procedure as well as in the final research report.
- Your child will not be at any disadvantage should you decide not to give your consent for his/her participation.
- You have the right to withdraw your child from the study at any time.
- The results of your child's test will be provided to you upon request and no other person.
- Should your child's score fall below the average for his/her age, you shall be provided with 2 contact details for Occupational Therapists should you wish to have your child assessed further.

In providing my consent I agree that I have read the attached information document as well as understand and acknowledge the above mentioned ethical considerations.

Signature: _____

Date: _____

Appendix F

Verbal Assent

Hello,

My name is Nicole and I would like to ask you to come and do some drawing with me. Would that be alright – we will be doing it here in this classroom.

Witness
Signature _____

Appendix G

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Mrs Nicole Winterstein

CLEARANCE CERTIFICATE	**M121161**
PROJECT	Attendance at Early Development Programmes and Visual Motor Integration, in Typically Developing Children
INVESTIGATORS	Mrs Nicole Winterstein .
DEPARTMENT	Department of Occupational Therapy
DATE CONSIDERED	30/11/2012
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 05/02/2013 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor :

DECLARATION OF INVESTIGATOR(S)
To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

Appendix H

Turnitin Originality Report
Research25febturnitin.docx by Nicole Ginsburg

From Research Reports (r81ry1d3Co4mm74R7Q96NN68Z4cz65ClvrOD7vOcI5TNqjTdh1kQ17XfD75p9iEr3ms1r4EKHi3b3t74nwx5C00cIY1gfAWom2S)

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Zülfiye Gül Ercan. "Investigating the Visual-Motor Integration Skills of 60-72 Month Children from High and Low Socio- Economic Status As Regard Age Factor", International Education Studies, 07/31/2011

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Pienaar, A. E., R. Barhorst, and J. W. R. Twisk. "Relationships between academic performance, SES school type and perceptual-motor skills in first grade South African learners: NW-CHILD study : Academic performance and perceptual-motor development", Child Care Health and Development, 2013.

8

< 1% match (publications)

Ted Brown. "Internal Consistency and Concurrent Validity of Four Instruments Used to Evaluate the Visual-Motor Integration Skills of School-Aged Children", Journal of Occupational Therapy Schools & Early Intervention, 01/2009

9

< 1% match (Internet from 16-Dec-2009)

http://www.population.gov.za/pop_dev/index.php/Download-document/2-Families-households-and-children.html