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Master's in Psychology (MAPsyc) Research Report

A Child in Context: The Relationship Between Early Childhood Development and Stimulation in the Home Environment

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Declaration

I, Candice Ramsammy, declare that this research report is my own, unaided work. It is submitted for the degree of Master of Arts in Psychology by Coursework and Research Report at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination at this or any other university.

Abstract

The development of the preschool child is largely shaped by their context. The influence of the home context, and the stimulation provided therein, on the development of executive function, social-emotional cognition and motor development has not been extensively researched in South Africa. Hence, this study aimed to explore the South African home context by examining the relationship between stimulation in the home environment and early childhood development of preschool children, particularly in the domains of executive function, social-emotional cognition and motor ability. The preschool child's development in theses domains was measured in a sample of 34 caregiver-child dyads from Soweto using a combination of iPad-based assessments: Early Years Toolbox and the novel Paediatric Evaluation of Emotions, Relationships and Socialisation, along with a locally validated paper-based motor development screening tool (Ages and Stages Questionnaire-Version 3). Additionally, the stimulation available in the home environment was measured with the Home Observation for Measurement of the Environment. Findings suggest that some types of stimulation available within the home environment were related to the child's social-emotional cognition and motor ability. Notably, more accepting responses to the child's negative behaviours instead of the use of harsh punishments were associated with higher social-emotional cognition scores, and more language stimulation provided in the home environment was associated with higher fine motor ability scores. These findings have implications on the types of tools used for assessment of preschool children, possible future design of developmental interventions, and it highlights the value of the home environment in the development of preschool children.

Keywords: Early childhood development, pre-schoolers, home stimulation, executive function, motor development, social-emotional cognition.

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Chapter One: Introduction

The human brain undergoes development throughout one's lifespan. This developmental trajectory, however, does not occur at a constant pace. Instead, there are periods of rapid neuroplasticity in which the brain undergoes reorganisation and restructuring (Mundkur, 2005). The first five years marks such a period in which the neural structure undergoes a shift as the brain becomes more refined (Britto et al., 2017). These changes underlie development in the preschool-aged (ages three to five) child's cognitive function, social-emotional cognition, motor development, as well as the coordination between these domains.

The brain does not develop in isolation, but rather as a response to the environment and experience (Black, 1998). It is shaped by the context of the preschool child. It is that context that is of particular interest and can generate much information about how brain development occurs, and in turn how child development progresses. The child however exists in multiple contexts and spaces. They exist in the context of their community, their religious affiliations, their school, as well as the political setting. There is much research that has focused on the school context, as the largest impact can be made at this level (Bailey, 2006; Eccles & Roeser, 2011; Greenberg et al., 2003; Zeidner, Roberts, & Matthews, 2002; Zins & Elias, 2007). Failure at a school level is costly not only to the child, but also to the family, and thus to the larger society as success at school informs later adult productivity and earning potential, which has the ability to disrupt the intergenerational transmission of poverty (Bradley, Caldwell, Rock, Hamrick, & Harris, 1988; Grantham-McGregor et al., 2007; Walker et al., 2011). School success is an important

means of potential empowerment and growth (Lóapez & Valdés, 2000). However, larger structural and political changes need to be made for changes in development to be seen.

Another important context of the child is that of the home. This is often combined with the socio-political or economic context. The home cannot be separated from these contexts, however, more consideration should be given to factors within the home. This is an area of study that is currently lacking in South Africa. Thus, this study aims to explore factors within the home that may promote early childhood development. Moreover, the unique South African (SA) home environment is of interest. The SA home environment is unique in its composition, as it is often strongly influenced by cultural and parental beliefs, communal practices, and high-density living (Madhavan, Schatz, Clark, & Collinson, 2012; Minde, Minde, & Vogel, 2006; Tomlinson, Cooper, & Murray, 2005). The family structure is often multi-generational, with a variation in father presence and parents' marital status (Hall & Mokomane, 2018; Richter & Grieve, 1991). This research is vital in uncovering the ways in which the SA home environment, and stimulation therein, plays a role in the developmental outcomes of children. It aims to acknowledge the importance of this context, and the advantageous role it may play in child development.

By understanding the interaction between the preschool child and their environment, we can identify experiences that may help guide children back onto a 'normal' developmental trajectory (Nelson, 1999). We can also identify experiences that are protective, preventing deviation from this trajectory. This has implications for preschool educational and developmental interventions that can then provide stimulating activities to promote development (Mundkur, 2005). This also has implications for parent education programs, which are more impactful, both

statistically and practically, when delivered during early childhood (Camilli, Vargas, Ryan, & Barnett, 2010).

Early Childhood Development

Early childhood is arguably the most significant period for cognitive, social and physical development (Anderson & Reidy, 2012; Blakemore, 2010; Howard & Melhuish, 2017). The first 1000 days, from conception to roughly two-years of age, has been shown to be a sensitive period for brain development (Cusick & Georgieff, 2016). Research has shown the importance of nutrition (Elmadfa & Meyer, 2012; Wrottesley, Lamper & Pisa, 2016) and the environment (Fox, Levitt & Nelson, 2010) during this period. Fox and colleagues (2010) then suggested the extension of this period to three years of age, supporting this with studies on neurodevelopmental outcomes. Although development of these systems continues beyond childhood, the foundations are further laid at the preschool age, defined as the ages three to five, which influence domains of psychological functioning and behaviour in later life (Howard & Melhuish, 2017). Thus, early childhood development may be predictive of long term outcomes, such as executive dysfunction, psychosocial dysfunction, and poor school success, which then affect later earnings (Grantham-McGregor et al., 2007; Howard & Melhuish, 2017).

At the preschool age, the brain undergoes structural changes that manifest as the development of various skills (Best & Miller, 2010; Howard & Melhuish, 2017). These include the emergence of cognitive skills, social-emotional cognition and motor abilities. This allows children

to focus, learn, respond to their environment, interact with others, and to regulate their behaviour. These skills form the foundation on which more complex skills are later built. It is essential for us to promote, protect and support this early development during the preschool ages to enable children to reach their full potential (Richter et al., 2017).

Cognitive Development.

Cognition is made up of various high mental processes that enable us to think, imagine, perceive, plan and act (Ward, 2015). One important element is executive function. This can be described as cognitive processes that organise, coordinate, direct and supervise goal-directed behaviours, emotional responses and cognitive activity (Beauchamp & Anderson, 2010; Best & Miller, 2010; Ward, 2015). Executive function can be described in various ways. It can be defined as "hot" executive function, and "cool" executive function. "Cool" executive function refers to purely cognitive aspects, while "hot" executive function refers to affective processes, such as those involved in the Iowa Gambling Tasks, where participants have to learn to avoid risky choices with high rewards and higher losses in favour of less risky choices with lower rewards and lower losses (Hongwanishkul, Happaney, Lee, & Zelazo, 2005; Ward, 2015). These distinctions are not mutually exclusive, instead a degree of each is utilised in cognitive processing.

Another description was suggested by Miyake and colleagues (2000), in which executive function consists of three elementary components, namely inhibitory control, cognitive shifting and the updating of working memory. Inhibitory control is the intentional constraint of automatic or dominant responses (Best & Miller, 2010). This allows us to resist temptations, resist acting impulsively and allows us to select where to focus our attention (Diamond, 2013). Working

memory is the ability to manipulate, monitor and code incoming information, and update it to memory (Best & Miller, 2010). This component allows us to hold information about what happened earlier and relate it to what possibly comes later (Diamond, 2013). The last component is cognitive shifting, which entails moving or shifting between multiple tasks or mental sets, allowing one to engage with relevant tasks while disengaging with irrelevant tasks (Best & Miller, 2010). Therefore, enabling the ability to engage in multiple tasks simultaneously.

Miyake et al. (2000) found that these three components show both unity and diversity. This means that all three components share an underlying common ability yet can be shown to be distinguishable constructs. The diversity is evident in the variation of the developmental trajectories of the three components (Best & Miller, 2010), which also build on each other (Diamond, 2013). For example, inhibition and working memory develop prior to cognitive switching, and the ability to cognitively switch between tasks requires inhibitory control of the current task, while keeping the new task in one's memory.

These developmental changes in the elements of executive function reflect cerebral development, particularly in the prefrontal cortex, which follow a distinct maturation trajectory during the preschool ages of three to five-years-old (Röthlisberger, Neuenschwander, Cimeli, Michel, & Roebers, 2012). Tasks that require either inhibitory control, working memory or cognitive shifting activate different areas within the prefrontal cortex, yet also activate common or overlapping areas. This is as a result of the use of a combination of processes in order to complete tasks, and also reflect a common underlying process as described by Miyake and colleagues (2000). We can also see the development of the brain in the rapid improvement in the

three components of executive function (Röthlisberger et al., 2012). At the age of one, children are able to pass simple inhibition tasks (Garon, Bryson, & Smith, 2008), as compared to the preschool age, where a rapid improvement of this ability is seen, as well as the accuracy of completing complex inhibition tasks, such as the go/no-go trials (Diamond, 2013; Garon et al., 2008).

There is also an improvement in working memory during the preschool years (Carlson, 2005). More complex abilities, such as manipulating the information held in one's working memory, develop early during the preschool period (Garon et al., 2008). As cognitive shifting builds upon inhibition and working memory skills, it is seen to emerge later in pre-schoolers. The ability to shift to a new rule or mental set emerges after the age of four, with children succeeding at switching tasks between four-and-a-half, and five-years-old (Diamond, 2013; Garon et al., 2008).

The development of executive function is fundamental for the avoidance of poor inhibitory control, later manifestations of Attention Deficit Hyperactivity Disorder (ADHD), and other developmental disorders (Isquith, Crawford, Espy, & Gioia, 2005). Disrupting the developmental process may result in poor attention, impulsive behaviours, rigid thinking, poor planning and the inability to generate or implement strategies (Beauchamp & Anderson, 2010). Disruption has also been associated with physical aggression, developmental psychopathology, and a lack of school readiness and later school success (Sarsour et al., 2011).

The rapid development of the executive function networks during the preschool age is important for the regulation of other brain areas (Anderson & Reidy, 2012; Howard & Melhuish,

2017). “Hot” executive function, for example, has shared neural connections with brain regions that are associated with the processing of emotions. Executive function is associated with the development of theory of mind, an element of social-emotional cognition which will be discussed later in this literature review (Röthlisberger et al., 2012). Executive function is thus linked to emotional, behavioural and social functioning, making it a critical element for the development of social skills (Anderson & Reidy, 2012).

Social-Emotional Development.

Humans are social beings, and therefore social skills are an important element of development (Blakemore, 2008, 2010). Our survival is dependent on the social interactions we have with others, such as our caregivers, families and larger communities. We employ a set of neurocognitive processes that are collectively referred to as social-emotional cognition to make sense of our social world (Beauchamp & Anderson, 2010; Blakemore & Mills, 2014).

A variation of processes are drawn upon during social interactions, such as encoding social information, inferring mental and emotional states of others and then making decisions based on the context that is in line with societal norms (Arioli, Crespi, & Canessa, 2018; Blakemore & Mills, 2014). As per Arioli and colleague’s suggestion (2018), social-emotional cognition is defined in terms of three domains, namely social perception, social understanding, and social decision-making. The first domain is social perception, which requires one to be able to distinguish between objects and people, to process faces, and to be able to interpret emotional expressions (Arioli et al., 2018). It also includes the ability to detect motion, and to engage in joint attention (Blakemore & Mills, 2014). This is the ability to understand triadic relationships, which are

relationships that include yourself, another person and a third object, and is seen to emerges in early infancy and develops rapidly thereafter (Saxe, 2006).

The second domain is social understanding which involves decoding and interpreting other people's mental states and intentions (Arioli et al., 2018). This mentalisation of other's intentions, beliefs and emotions entails the development of Theory of Mind (ToM; Premack & Woodruff, 1978), which is the awareness that people have motivations and mental states that may be different from our own (Blakemore, 2008). This ability allows one to theorise about the intensions, purposes, beliefs, and thoughts behind the behaviour of other people (Premack & Woodruff, 1978). At the preschool age, there is the emergence of ToM, and a shift from mentalising another person's mental state, to mentalising what someone may be thinking about a third party or object (Arioli et al., 2018). This becomes a contributing factor to the later development of moral cognition as the child begins to integrate ToM information with information regarding consequences (Young, Cushman, Hauser, & Saxe, 2007).

Being able to reason about other people's minds is important so that one can react accordingly. Social decision-making is this third domain of social-emotional cognition. It is essential that we understand the behaviours of others to make decisions that are appropriate within a social context (Arioli et al., 2018). This domain depends on choices that have already been made, predictions of choices that will be made, and the awareness of the consequences of one's actions. Social-emotional cognition is dependent on the ability to reason about other people, and thus using these elements we can interpret people's behaviours as well as predict

said behaviours based on an understanding of 'other' minds, and we can then respond accordingly (Koster-Hale & Saxe, 2013; Saxe & Kanwisher, 2003).

These social processes and responses are often quick and instinctive, indicating a complex recruitment of neural networks. These underlying neural regions recruited for social processes are collectively referred to as the "social brain" (Adolphs, 2009). These brain areas are functional during early development in association with basic social processing, which then mature and refine through childhood and adolescence (Blakemore, 2008). These networks undergo neuroplasticity during the preschool age, as seen by the emergence of social understanding, particularly the development of ToM (Saxe & Kanwisher, 2003). During the preschool ages, many aspects of social competence begin to emerge as peer relations become more involved (Denham, Wyatt, Bassett, Echeverria, & Knox, 2009). The emergence of ToM in early childhood continues into adolescence, and reflects the maturation in the child's social environment as they increase their independence, peer interactions, and place greater importance on relationships and friendships (Beauchamp & Anderson, 2010). The rapid development of social-emotional cognition during the preschool years presents an important period of promotion and protection, as it underlies later social competence.

In an attempt to draw together the above theories of development and structure, Beauchamp & Anderson (2010) propose the Socio-Cognitive Integration of Abilities Model (or SOCIAL), which considers the above levels of social development with consideration of both internal and external influential factors as well as brain integrity. This theory expanded upon a previously established theory called the Social Information Processing framework, which

proposed that individuals adapt their attitudes, beliefs and behaviours according to the information in their social environment (Salancik & Pfeffer, 1978). This model by Salancik and Pfeffer (1978) states that we can learn about an individual's behaviour based on the external factors of the individual. SOCIAL proposes internal factors such as temperament, personality and physical attributes, in addition to external factors such as the family environment, culture and socio-economic status in the social-emotional development (SES; Beauchamp & Anderson, 2010).

The development of social-emotional cognition is important as it allows us to develop and sustain relationships, which allows us to participate and function within a community (Beauchamp & Anderson, 2010). Difficulties forming friendships is an indication of an impairment in social interactions, and is often seen in children with autism (Chamberlain, Kasari, & Rotheram-Fuller, 2007). To form friendships social understanding is required to understand what the other person is thinking and feeling. Furthermore, social interactions are necessary for this skill to develop.

Illustrating the importance of social interactions is the classic example of Harlow's experiments on social deprivation in primates (Ward, 2015). In Harlow's experiments, new-born monkeys were either partially isolated from their mothers and peers, or completely isolated (Harlow, Dodsworth, & Harlow, 1965). Partial isolation resulted in aggressive behaviours, the inability to form social attachments, compulsive and repetitive behaviour, while complete isolation resulted in severely impaired social behaviours, a lack of aggression, and high levels of fear (Harlow et al., 1965; Ward, 2015). Similarly, in humans, inadequate social contact and early nurturing may increase the risk of children developing socially dysfunctional behaviours. These

contexts of social deprivation include loss of parents, maternal separation, as well as social isolation (Beauchamp & Anderson, 2010; Cacioppo & Hawkley, 2009). These children tend to grow poorly, fail to thrive, show delayed development, and display inappropriate emotional and interpersonal behaviour (Richter et al., 2009).

Such disruptions to social development may contribute to psychological distress (Mallinckrodt & Wei, 2005), reduced self-esteem (Williams & Galliher, 2006), social exclusion (Masten et al., 2009), social isolation and lack of satisfying friendships (Chamberlain et al., 2007), and bullying (Arsenio & Lemerise, 2001), which may later impact on the individual's quality of life and physical health (Cacioppo, Hawkley, Norman, & Berntson, 2011). Social interaction is also a critical factor in some types of early learning and neurocognitive development (Blakemore, 2010). Establishing good social cognitive functioning during early development has implications on health from infancy into adulthood, and is predictive of academic performance, delinquency, mental health, substance abuse, and work-place performance (Denham et al., 2009). Social-emotional cognition not only associated with cognitive development but is also linked to motor ability as we can mentalise the intention of others actions (see Arioli et al., 2018, on mirror neurons). These domains of development can therefore not be studied in isolation.

Physical Development.

Early childhood is an optimal period to develop motor skills and establish motor competence, with the preschool period being the ideal space to promote physical activity (Bardid, Rudd, Lenoir, Polman, & Barnett, 2015). Motor skills can be defined as the ability to perform a learned sequence of movements in a smooth and efficient manner to complete a

particular task (van der Fels et al., 2015). Motor competence refers to the ability to perform various motor tasks proficiently (Bardid et al., 2015). This ability relies on both motor coordination and physical fitness.

Motor ability can be categorised as gross motor and fine motor skills. Gross motor skills refer to tasks such as walking, jumping and sprinting (van der Fels et al., 2015). This category includes all underlying physical abilities, such as strength and balance, which are needed to perform a task (Piek, Dawson, Smith, & Gasson, 2008). Fine motor skills on the other hand refer to skills where fine motor precision and integration are needed to perform the task, such as building puzzles and manipulating scissors (van der Fels et al., 2015).

Piaget theorised that children learn through observations of motor interactions with objects (van der Fels et al., 2015). This explorative behaviour is associated with cognitive development (Piek et al., 2008), with motor skills relating significantly to cognitive skills in children (van der Fels et al., 2015). Gross motor skills were found to be a significant predictor of cognitive performance, working memory and processing speed specifically (Piek et al., 2008), while fine motor ability was predictive of reading and mathematics achievement, and thus better school success (Cameron et al., 2012). This may be explained by common underlying processes of executive function and motor competence such as sequencing, monitoring, and planning. It may also be explained by activation of the common underlying neural regions. Thus, children who coordinate their motor ability with ease may display greater processing capacity for learning more complex cognitive tasks (Cameron et al., 2012). Motor ability is also associated with the

social processing of the executed movements of others (Arioli et al., 2018). This allows us to mentalise or interpret other people's intentions.

As mentioned earlier, the preschool ages present an opportunity to refine gross motor and fine motor ability and improve motor competence. Given the interconnected nature of the domains of development, this will in turn impact on the development of executive function and contribute to the social understanding element of social-emotional cognition. The understanding and promotion of motor ability is therefore important as supports the child's overall development.

Interdependency of Developmental Domains.

As seen earlier, cognitive, social-emotional and physical development does not occur in isolation. The development of these domains (ie. cognitive, social-emotional and physical development) are as a result of rapid changes in underlying neural structures during the preschool ages, making it a period sensitive to influence. The brain's structure and composition is not static, but dynamically changing throughout one's lifespan (Mundkur, 2005). By supporting our emotions, behaviours and cognitions, these changes allow us to adapt so that we can live and function in the social world (Guyer, Pérez-Edgar, & Crone, 2018).

This neuroplasticity occurs through various mechanisms including the reduction of gray matter in the brain and the increase in white matter through myelination (Casey, Galvan, & Hare, 2005). It may also be a result of the formation of new neurons (neurogenesis) and the growth of neural support cells (gliogenesis) (Grantham-McGregor et al., 2007; Shonkoff, Phillips, & National

Research Council (NRC), 2000). There are also various modifications at a synaptic level (P. J. Anderson & Reidy, 2012; Mundkur, 2005) . These changes have been shown to underlie several interdependent domains of child development, including but not limited to cognitive, social, and motor ability (Grantham-McGregor et al., 2007). This underlies the co-occurring emergence of skills seen during the preschool ages.

Some of the mechanisms underlying neuroplasticity are highly dependent on and shaped by experiences (Mundkur, 2005). Thus negative experiences, instead of stimulating experiences, may also have harmful effects on the brain, and hence on development (Nelson, 1999). These processes are therefore dependent on the developing child's environment. Families are the most proximal and fundamental social system influencing human development, and thus provide a critical point for effective and lasting behaviour change, as well as protection (Richter et al., 2009).

Home environment

A child's developmental trajectory in the above-mentioned domains is not the sole result of biological changes**.** The child's brain adapts in accordance to the child's context, and the child's development reflects the interaction between the child and their environment (Black, 1998). At the preschool age, the child's brain is highly susceptible to environmental factors. This includes factors such as access to healthcare, nutrition and diet, exposure to infectious disease and environmental toxins, school, and their SES (Walker et al., 2011). The economic situation of a

family could affect how a child's stress system develops for example, which may put the child at risk for physical and mental health disorders (Fernald & Gunnar, 2009).

The impact of the environment on children can be mediated by family and the home (Richter et al., 2009). It was found that the home environment partially mediated the relationship between family SES and elements of executive function, particularly updating of working memory and inhibition (Sarsour et al., 2011). This may be evident as families are the most proximal and fundamental social system influencing child development, and thus provides a critical point for effective and lasting behavioural change (Richter et al., 2009).

Structural features of the family as well as the child's physical environment are significant predictors of cognitive development (Richter & Grieve, 1991). A significant positive relationship was found between the quality of stimulation provided during a child's first two years, and later IQ scores (Bradley & Caldwell, 1976). The associations were stronger with regards to: (1) the parent's responsivity to the child, which may develop a sense of trust and enjoyment in the environment; (2) academic stimulation, which facilitates continuous striving to learn; (3) learning material, which may form the basis of concept formation (Bradley & Caldwell, 1976). Caregiver activities and age-appropriate materials that promote problem-solving (e.g. puzzles) and language (e.g. books) were also found to facilitate cognitive development (Walker et al., 2011). It was also found that children from single parent families performed lower on cognitive tests as compared to children from two-parent families, regardless of SES (Sarsour et al., 2011).

With regards to social development, daily interaction with parents, family members, school staff and other children have also been found as influential (Beauchamp & Anderson,

2016). The frequency and quality of social interactions, access to stimulating social environments, and maternal attachment have a positive impact on the development of social cognition (Bigelow et al., 2010; Brooks–Gunn, Hans, & Waldfogel, 2002). Parent-child interactions are an important element in this domain (Denham et al., 2009). Social development is encouraged through positive emotionality, sensitivity, and responsiveness towards the child (Walker et al., 2011).

Structural features of the home are also associated with social-emotional development, such as the size of the household. Research on Macaques social groups, for example, have found that the size of the primate's social group has a significant impact on the brain areas associated with social cognition (Sallet et al., 2011). Increased group size meant that more facial expressions and gestures needed to be decoded. Larger social groups meant that more predictions are needed to be made about other primates' behaviours. This may indicate that in cases of overcrowding and high density living, children are exposed to more faces, and like the Macaque, have to decode more intentions and predict more behaviours (Blakemore, 2008). Thus, this household structure may promote or influence social-emotional development.

The stimulation within the home environment also plays a critical role in the development of childhood obesity (Strauss & Knight, 1999). Strauss and Knight (1999) suggested that this may occur as a result of parental modelling where children see a preference for high fat foods, as well as sedentary lifestyles. Child-rearing practices, such as deciding whether the child sleeps on their back or their stomach, letting children play on the floor, and allowing them access to stairs, may also promote motor development (Venetsanou & Kambas, 2010). Having older siblings in the

house also promotes motor development as young children tend to imitate their siblings (Venetsanou & Kambas, 2010).

Another important factor within the home is the knowledge parents have about child care. Based on a study conducted in Baltimore, parenting knowledge about child-rearing has been associated with the quality of stimulation in the home environment (Parks & Smeriglio, 1986). For example, parents with knowledge about developmental milestones would encourage their children to achieve those milestones. Another example is a parent under stress due to low SES, who then may use less positive parenting, have lower levels of warmth and responsivity, and may not monitor their children as closely (Bradley & Corwyn, 2002).

Many factors within the home environment are associated with development, such as parenting attitudes, expectations, and styles (Bradley & Corwyn, 2002). This has an effect on parenting knowledge, social interactions between the child and the caregiver, as well as the behaviours modelled by the caregiver which, as indicated earlier, impacts on the child's development. Stimulation in the home environment has been strongly correlated with academic achievement for children up to the age of 10 years old (Bradley et al., 1988). Thus, the home environment and the stimulation provided therein, is seen to play an important role during early childhood, particularly with regards to cognitive, social, and physical development.

The South African Home Environment.

The home environment, as indicated above, is an influential context in which a child develops. In South Africa, children under the age of five are exposed to various risk factors such

as malnutrition, poor health, poverty, and unstimulating home environments, which then negatively impact on their cognitive function, social-emotional cognition, and motor development (Collinson, 2010; van Heerden, Hsiao, Matafwali, Louw, & Richter, 2017; Zere & McIntyre, 2003). These are contexts of low SES and informal settlements commonly known as townships. With this context comes the narrative of the "Township child" who is portrayed as helpless, vulnerable, ignorant and passive to the influence of the environment. Although often the case, these narratives tend to overlook the resilience of the child and the coping strategies adopted (McGarry & Shackleton, 2009; Seery, Holman, & Silver, 2010). There are alternative forms of support and stimulation for children in these contexts which is not fully understood and often overlooked.

The child's context is also influenced by culture, which plays a fundamental role in child-rearing practices, schooling systems, customs, and shapes societal norms (Beauchamp & Anderson, 2010)**.** South Africa has a diversity of cultures, which have a diverse impact on early childhood development. Culture affects the ways in which emotions are processed and displayed. It was shown that participants from different cultures displayed differences in how they constructed social meaning and processed information (Chiu, Morris, Hong, & Menon, 2000). This means that culture affects the way in which people not only perceive their social environment, but also the ways in which they evaluate and regulate their behaviour (Hong & Chiu, 2001). The same can be said for South African cultures. For example, a study comparing emotion norms across five African countries, found that South Africans characterised the experience and expression of guilt as undesirable and inappropriate whereas Ghanaians characterised guilt as a

desirable and appropriate (Kim-prieto & Eid, 2004). This is just one example from Kim-prieto and Eid's study (2004) illustrating differences in what is deemed "appropriate" in terms of emotional expression. This would impact on how the emotions are processed and interpreted, based on cultural differences.

Nevertheless, culture does not always contribute to adaptive development. Social dysfunction, for example, could occur as a result of the lack of social opportunities within a context, stigma or restrictions placed on social participation (Beauchamp & Anderson, 2010). Similarly, the characteristics of the South African home are not static. In cases where homes are characterised by high levels of crowding, there are often limitations on housing options, leaving these families in areas where there is a lack of safety and high levels of violence (Blair & Raver, 2012; Bradley & Corwyn, 2002). High levels of crowding may mean more children in the house and may result in less time and attention given to each child, reducing the quality of parent-child interactions (Bradley & Corwyn, 2002). However, the other adults or children in that environment may act as alternative stimulating agents, which may make up for the primary caregiver's 'absence' (Bradley & Caldwell, 1976). In cases of overcrowding, children are exposed to more faces, and would have to decode more intentions and predict more behaviours (Blakemore, 2008). This potentially provides a stimulating environment for social-emotional development. This family and home structure may provide insight into alternative ways in which SA children may be stimulated.

Cultural practices and parental beliefs also determine how involved parents are with their children and how responsive they can be to their needs (Blair & Raver, 2012; Minde et al., 2006).

In Xhosa and Northern Sotho culture, the community collectively takes responsibility for a child's safety and well-being, and instil norms such as feeding the baby on demand, carrying the infant on the back, responding to a crying child, and make adjustments to the child's feedback regardless of the temperament of the child (Minde et al., 2006; Tomlinson et al., 2005). It has been suggested that these day-to-day practices of African mothers' help promote and support early development, which may account for the faster development during their first year of life (Blair & Raver, 2012). These practices include mothers and babies sleeping together, carrying the baby on the mother's back, and exposure of the baby to a social network of family (Tomlinson et al., 2005; van Heerden et al., 2017). Breastfeeding is also an identified protective factor (Walker et al., 2011), however rates of exclusive breastfeeding practices in South Africa may not be high (Peer, English, Honikman, & Du Plessis, 2016; Sibeko, Dhansay, Charlton, Johns, & Gray-Donald, 2005). It is essential to uncover other practices in a South African home that may account for and support child development.

Informing the type of support available to the child in their home, is the interaction between the caregiver and child, as well as the variety and quality of objects available to the child, such as puzzles and books (Bradley et al., 1988). These elements in a typical home in a South Africa township may give us an idea of the types of stimulation available to preschool children. In urban South African areas, it has been shown that the home environment is significantly related to mental development and psychomotor development, independent of SES (Richter & Grieve, 1991). Hence, it is not only important to look at the absence of particular forms of stimulation, but also the presence of alternative forms of stimulation that shape child

development (Blair & Raver, 2012; Shonkoff et al., 2000). Given the important role of the home context in the development of preschool children, more research is required on the South African home environment and how it impacts on the child's development.

Conclusion

The literature reviewed above has indicated that important developmental changes occur during the preschool ages of three to five-years-old. During this preschool period, there is the emergence of complex executive function skills, the progression of more sophisticated elements of social-emotional cognition, and the refinement of gross-motor and fine-motor abilities. The development of these domains during this age is important in establishing the foundation on which future abilities are later built. This makes the understanding of, and the development of interventions for this period vital.

The literature has also shown the influential role the child's environment plays in promoting their development. The home environment is one such context in which social-emotional cognition is strongly shaped, and executive function as well as motor abilities can be encouraged. Interventions in the home environment have been shown to be effective in promoting children's development (Britto et al., 2017). In the context of South Africa, this is a powerful tool in promoting development in areas of low SES, low resource availability, and where there is a lack of access to facilities. Therefore, it is essential to uncover the types of stimulation available in the South African home environment and understand their relationship to a child's

development. This will allow for the development of suitable home interventions that improve stimulation provided in the home environment that then promote the development of preschool children.

Thus, this study aimed to explore the relationship between stimulation in the South African home environment and the early childhood development of preschool children, particularly in the domains of executive function, social-emotional cognition, and motor ability. Furthermore, it explored which key stimulants were predictive of better developmental outcomes. The research question that guided this study was as follows: Is there a relationship between stimulation provided in the home environment and the development of executive function, social-emotional cognition, and motor abilities in preschool children? Based on the literature, more stimulation in the home environment was hypothesised to have a strong, positive relationship to the developmental domains of preschool children. In other words, the more stimulation present in the home, the better the child's cognitive, social-emotional and physical development. Academic stimulation, learning materials available to the child, and caregiver responsivity were hypothesised to be key elements in the home, promoting development the strongest. A secondary aim of this study was to assess the development of preschool children from Soweto, South Africa.

Chapter Two: Methods

The methods chapter provides important information on how the research was conducted. This chapter outlines and details the context of the study and the research design used. It describes the sample and the sampling strategy implemented. The instruments used in this study are explained, followed by the research procedure. It then outlines the data analysis used. It concludes with the ethical considerations that were taken into account throughout the study.

Context of the Study

This research paper was part of a larger project, SUNRISE: International Surveillance Study of Movement Behaviours in the Early Years. SUNRISE is an international cross-sectional project that acknowledges the importance of the early years in the development of physical, social and cognitive skills, and recognises that there is a lack of this developmental information, particularly in low-and middle-income countries (LMICs). The primary aim of SUNRISE is to determine the proportion of four-year-old children who meet the Global 24-hour Movement Guidelines set by the World Health Organisation.

The project intends to collect international surveillance data regarding development in the early years from multiple countries, including Brazil, South Africa, Canada, China, and Papua New Guinea. The SUNRISE website provides more information on the study as well as the participating countries (see www.sunrise-study.com). This is to help the global community

prevent childhood obesity and move towards ensuring children's developmental potentials are reached. The current research project was part of the pilot study for the SUNRISE project in South Africa, which tested and contributed to the refinement of the recruitment plan and data collection procedures for the larger project. This project was conducted by a research team that included a research partner from the University of Witwatersrand, Department of Psychology, South Africa, who conducted a parallel study that included SES, demographic variables and early childhood development. This research partner, alongside the primary author, were responsible for data collection. The team also included a field worker based in Soweto who assisted in accessing the community, as well as bridging cultural and language barriers. The SUNRISE Principal Investigator for South Africa was responsible for training the data collection team. Selected methods from the SUNRISE project are presented in this thesis.

Research Design

This quantitative study was descriptive and cross-sectional, and utilised a correlational design to describe the nature of the relationships between the observed variables, namely home environment stimulation and early childhood development (Babbie, 2013). It was therefore a non-experimental design. The theoretical predictor or independent variable (IV) in this study were the components of stimulation within the home environment. The outcome or dependent variables (DV) include all three domains of development (cognitive, social-emotional and physical), measured by executive functioning, social-emotional cognition and fine- and gross-motor skills respectively.

Sample and Sampling

A non-probability, volunteer sampling strategy was used to recruit a sample of 34 caregiver-child dyads, with the children being between 3.7 and 5.4 years old (mean ± sd: 4.5 ± 0.39). There were 15 female child participants (44%) and 19 male child participants (56%). Twenty-four of the caregivers recruited were mothers (70%), one father (3%), six grandmothers (18%), one grandfather (3%), and two aunts (6%), as illustrated in Figure 1.

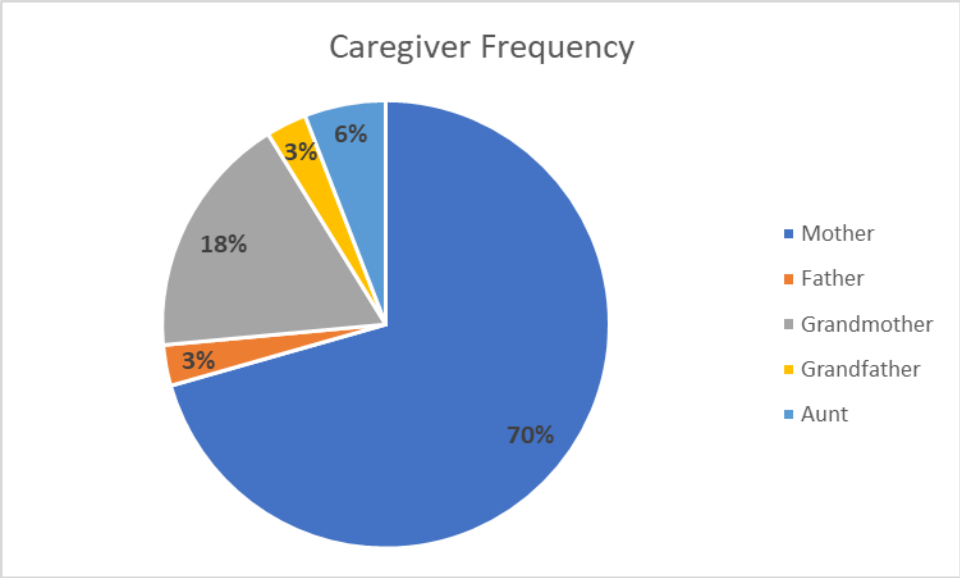

Figure 1: Frequencies of relationship of caregiver to child. A graphic representation of the frequencies, represented as percentages, of the relationship of the participating caregivers to the children.

The sampled dyads lived in the Diepkloof, Meadowlands and Orlando areas of Soweto, and the children attended preschools within these areas (Figure 2 below maps these areas). Diepkloof lies in the eastern settlement of Soweto which constitutes four settlement types, namely a formal township, a hostel area, an informal settlement, and a relatively affluent area, all in close proximity in a small geographical region (Mafukidze & Hoosen, 2008). The research

sample was recruited from the formal township of Diepkloof, which is the oldest and largest of the settlements (Mafukidze & Hoosen, 2008). Meadowlands on the other hand, is one of the oldest suburbs in Soweto, and is the only suburb that doesn't include any informal or squatter areas (Burton, 2003). The last area, Orlando, is a township forming part of the greater Soweto area, and is divided into two main areas, Orlando East and Orlando West (Mbokazi, 2016).

Figure 2: Map of Diepkloof, Meadowlands and Orlando areas of Soweto. The outlined areas on the map illustrate the areas in Soweto in which the sample resided and attended preschool.

The researchers, along with the field worker, approached four preschools and explained the research project to the principals of the preschools. Permission was given by the preschools'

principals to conduct part of the research at the school. With the support of the teachers, information sheets and consent forms were sent home with children turning four-years-old in 2018, and those who had turned five-years-old after 30 June 2018. This allowed the researchers to control for the ages of the potential child participants. The only exclusion criteria for this study was children with physical or intellectual disabilities, as screened by the teachers at the school, as they would not be able to complete the assessments to capture their developmental outcomes. A total of 41 consent forms were signed and returned to the researchers. Of those 41 participants, one child was excluded from the sample due to difficulties communicating in a language that the child understood. An additional three caregiver-child dyads were excluded as the researchers could not contact the parents to arrange interview sessions. A further three caregiver-child dyads were excluded from the sample, one due to the distant location of their home, and the remaining two due to the unsafe nature of their home location. A final sample of 34 caregiver-child dyads participated in this study.

Measures

Four measures were used to capture the developmental outcomes of the children, as well as the stimulation provided in the home environment. The developmental measures captured executive function as a representation of cognitive ability, social-emotional cognition as a representation of social-emotional ability, and fine- and gross-motor abilities as a representation of physical development. These measures are described below.

Early Years Toolbox.

The Early Years Toolbox (EYT) was used to assess executive function. This iPad-based assessment is designed in a way that ensures that levels of exposure to technology do not affect performance. Three measures of EF were used: (a) the *Go/No-Go* test that assesses inhibition; (b) the *Mr Ant* subtest that assesses working memory; and (c) the *Dimensional Change Card Sorting* task that assesses cognitive shifting (Howard & Melhuish, 2017). Howard and Melhuish (2017) describe the subtests as follows: The *Go/No-Go* task requires children to tap the screen to "catch the fish", and to "avoid catching the sharks" by not touching the screen. For the *Mr Ant* task, the children were required to remember where stickers were placed on a cartoon ant and identify these locations after a brief interval. The *Dimensional Change Card Sorting* task asks children to sort rabbit and boat cards by colour or shape. The rule is then changed, and the child has to sort accordingly. It took 20 to 35 minutes to complete all three tasks.

The *Go/No-Go* task was scored as a proportion of "go" and "no-go" accuracy (Howard & Melhuish, 2017). The *Mr Ant* task was given a point score, where one point was given for each consecutive level in which two of the three trails were completed accurately, and 1/3 for correct trials that followed. The *Dimensional Change Card Sorting* task was scored as the number of correct sorting after the rule was changed. In all the above tasks, higher scores indicate better performance. Table 1 describes which element of executive function each subtest captures, their instructions, the procedure of the test and how the tests are scored (Howard & Melhuish, 2017).

Table 1

Summary of the Early Years Toolbox subtests used to capture executive function

Element of Executive Function	Name of Subtest	Instruction	Procedure	Scoring (Max)
Inhibition	Go/No-go	Children see a fish or a shark swim across the iPad screen. They are instructed to tap the screen when they see a fish (catch the fish), and don't touch the screen when they see a shark (avoid catching the sharks)	1) 'Go' trial instructions 2) Five practice 'go' trials 3) 'No-go' instructions 4) Five 'no-go' trials 5) Combined go/no-go instructions 6) 10 mixed practice trial 7) Three test rounds, with 25 trials each	The proportion of "go" and "no-go" accuracy (max= 1)
Working memory	Mr Ant	An image of a cartoon ant is presented on the screen with a number of coloured dots on different parts of his body. After a brief presentation of a blank screen, the children must identify where the coloured dots were by tapping the dot location	1) Instruction round 2) Three practice trails 3) Eight levels, three trials per level 4) Discontinuation: failure on all three trails in a level	Point score, where one point was given for each consecutive level in which two of the three trails were completed accurately, and 1/3 for correct trails that followed (max= 8)
Cognitive switching	Dimensional Change Card Sort	The child is presented with cards that must be sorted by the instructed dimension (e.g. colour). After a period, the sorting instruction is changed to the other dimension (e.g. shape)	1) Demonstration trial 2) Two practice trials 3) Six trials by one dimension 4) Six trails by another dimension 5) If successfully completed five of each trial, a third sorting instruction is presented for six trials	The number of correct sorting after the rule was changed (max= 12)

This sample of preschool going children avoided the prejudice that children who do not attend preschool experience due to their lack of exposure to concepts introduced in the school environment (van Heerden et al., 2017). The EYT does not rely on numeracy or literacy skills and had been translated into indigenous South African languages including isiZulu and Sesotho, making it appropriate for the sample (Cook et al., 2019; Howard et al., In review). The EYT was conducted in the various translated languages in accordance with the child's language

preference. The psychometric properties, although established on an Australian sample, are high, with the Go/No-Go having a Cronbach's α of between 0.84 and 0.95, and strong convergent validity with established measures (Howard & Melhuish, 2017).

To ensure accurate data collection, the research team underwent training on the EYT provided by members of the SUNRISE project team in South Africa. The research team then familiarised themselves with the tool through a piloting process. This also ensured competence on the measure. The pilot was conducted on four-year old children at two preschools in the Roodepoort area, Johannesburg, South Africa. The measure was conducted in a relatively quiet space by the research team in the afternoons after the children had their naps.

Paediatric Evaluation of Emotions, Relationships and Socialisation.

The Paediatric Evaluation of Emotions, Relationships and Socialisation (PEERS) is an iPad-based application that uses interactive games to test social competency, including the domain of social-emotional cognition (Anderson, 2017). The social-emotional cognition domain has six subtests, namely emotion perception, emotion recognition, social information processing, theory of mind, moral reasoning, and social risk. Two of these subtests were appropriate for this study's age group. This included the emotion perception task, *Matching Emo*, and the emotion recognition task, *Finding Emo* (Beauchamp & Anderson, 2016).

For the *Matching Emo* task, the children were presented with eight illustrated faces, each displaying a different emotion, and a target emotion written on the screen. They were required

to select the animated face that matched the targeted emotion (Beauchamp & Anderson, 2016). In the *Finding Emo* task, the children were presented with four photos, where three of the photos displayed the same emotion, and one photo displayed a different emotion. The children were instructed to select the photo of the person that displayed an emotion different to the others (to find the odd one out). It took the children roughly 10 to 35 minutes to complete both tasks. Both tasks were scored on the number of errors the children made, where lower scores indicated better performance. Table 2 provides a description of the PEERS subtests, the element of social-emotional cognition each subtest captures, their instructions, the procedure of the test and how the tests are scored (Beauchamp & Anderson, 2016).

Table 2

The Paediatric Evaluation of Emotions, Relationships and Socialisation subtests used to capture social-emotional cognition

Element of Social-emotional cognition	**Name of Subtest**	**Instruction**	**Procedure**	**Scoring (Max)**
Emotion perception	Matching Emo	Children are presented with illustrated faces and a target emotion is written on the screen. The child is instructed to select the illustrated face that matched the emotion.	1) One practice trial 2) First test round with three trails 3) Second test round with 24 trials Each trial has three attempts, and will move on to the next item after three incorrect responses	The number of incorrect responses (max= 72)
Emotion recognition	Finding Emo	Four photos are presented to the child, three displaying the same emotion, and one displaying a different emotion. The child is instructed to select the photo displaying the different emotion by tapping on the photo.	1) Three practice trials 2) Test round, with 24 trails	The number of incorrect selections (max= 24)

The PEERS is grounded in theoretical and empirical neuropsychological work and the social neurosciences. Anderson and colleagues acknowledge the importance of social skills for a child's well-being and have created the first clinically-validated, theory driven, and child-friendly assessment to describe the social profiles of children (Anderson, 2017). It is currently still in its developmental stage and is being validated in various countries. This tool will provide great insight into the development of social-emotional cognition and was highly valuable in this study. However, as the tool is still in the piloting stage, this is the first time is had been used in a South African context. Accordingly, the measure's administration was translated into isiZulu, Sesotho and isiXhosa.

For each of the languages, the administration manual was translated by a research partner who speaks two indigenous African languages. The translations were then sent to colleagues who were fluent in the languages. The colleagues made additional contributions to the translations, and then compared it to the original manual, while also ensuring that the language was comprehensive for four-year-old children. The research partner checked and approved the final translated manuals. The research team was trained by a team at the Murdock Children's Institute in Australia, who are developing the PEERS. This ensured accurate data collection, familiarity with the procedure, and competence with the measure.

These translations, along with the other measures, were piloted on children attending two preschools in Roodepoort, South Africa. The children were within the same age range as that of the sample. The performance trends were consistent amongst the piloted children, regardless of language of administration. For the duration of the study, the research partner and field worker

used the translated administration manuals, as per the language that the child was most fluent in. For the Matching Emo subtest, the targeted emotions were read out to the child in isiZulu, Sesotho or isiXhosa by the research partner and field worker. For the Finding Emo subtest, the instructions were also given and reiterated, as per the manual, in the most appropriate language.

Ages and Stages Questionnaire-Third edition.

The Ages and Stages Questionnaire-Third edition (ASQ-3) was used to gather data on fine and gross motor ability (see Appendix 1). This paper-based questionnaire can be completed by the parent or an observer. The assessment measures five developmental domains, each containing six questions on developmental milestones (Kerstjens et al., 2009). This study only utilised the gross motor and fine motor domains and was completed by the researcher. It is a simple and cost-effective measure, which provides a report of current skills which has been shown to be predictive of developmental delay (Juneja, Mohanty, Jain, & Ramji, 2012).

Various questionnaires are available for the different age groups. The 48-month questionnaire was used in this study. This version of the questionnaire was part of the larger study's battery of assessments (SUNRISE) and was used accordingly in this study. The measurement units in the assessment were converted according to the metric system so that it was applicable to the sample. For example, '5 feet' in question one became 1.5 m, and '20 inches' became 50 cm. Each item were marked as "Yes", "Sometimes", or "No", and were scored as 10, 5, and 0 respectively (Juneja et al., 2012). Scores for each domain was calculated as the sum of the items. Higher scores indicated better developed gross- and fine-motor ability. Table 3 provides the subtests of the ASQ-3 that were used in this study to capture motor ability. The table

provides sample items for each subtest used, as well as how the items were scored (van Heerden et al., 2017).

Table 3
Summary of the Ages and Stages Questionnaire- Third edition subtests used to capture motor ability

Developmental domain	Number of items	Sample items	Scoring (Max)
Gross motor	Six	• Does your child catch a large ball with both hands? (*You should stand 1.5 m away and give your child two or three tries before you mark the answer)* • Does your child climb the rungs of a ladder of a playground slide and slide down without help? • Does your child hop up and down on either the left or right foot at least one time without losing her balance or falling?	Yes= 10 Sometimes= 5 No= 0 Sum up the total of the six items (max= 60)
Fine Motor	Six	• Does your child unbutton one or more buttons? (*Your child may use their own clothing or a doll's clothing)* • Does your child draw pictures of people that have at least three of the following features: head, eyes, nose, mouth, neck, hair, truck, arms, hands, legs, or feet? • Does your child colour mostly within the lines in a colouring book or within the lines of a 5 cm circle that you draw? (*Your child should not go more than 0.5 cm outside the lines on most of the picture)*	Yes= 10 Sometimes= 5 No= 0 Sum up the total of the six items (max= 60)

Van Heerden and colleagues validated the ASQ-3 as a developmental screening tool for the South African population, with a reliability of between 0.60 and 0.88 for the total scores of each domain (Hsiao et al., 2017; van Heerden et al., 2017). Another study conducted in South Africa showed that the ASQ-3 had a 95.6% specificity, indicating a high ability to identify typically developing children (Visser et al., 2016). South African children were found to perform significantly better in gross motor ability at the age of four, and significantly lower in fine motor ability, as compared to children from Zambia, United States, Norway, Korea and Spain (van

Heerden et al., 2017). The ASQ-3 was also shown to have a high concurrent validity of 90.7% with the combined Parents Evaluation of Developmental Status (PEDS) and PEDS Developmental Milestones (PEDS:DM; Silva, 2011). This was particularly for the identification of developmental delays in infants aged six months in South Africa. The scale has also been validated amongst children in India (Juneja et al., 2012), showing an 83.3% sensitivity in detecting developmental delays, and validated with children from the Netherlands (Kerstjens et al., 2009).

The research team received training on this measure by the SUNRISE team. This allowed for an understanding of the measure and ensured accurate data collection. This measure was also piloted along with the other measures with children between the ages of three and five from two preschools in Roodepoort, Johannesburg, South Africa, as previously described.

Early Childhood-Home Observation for Measurement of the Environment.

The Early Childhood - Home Observation for Measurement of the Environment (EC-HOME) is a systematic assessment of the environment in which a child is raised (Appendix 2). It is a paper-based measurement that takes place within a naturalistic context, which assesses the quality and quantity of stimulation in the home environment, as well as the support available to the child (Totsika & Sylva, 2004). This measure was developed in the United States and is a widely used measure of elements of the home environment (Glad, Kottorp, Jergeby, Gustafsson, & Sonnander, 2014). The assessment consists of both observations and an interview, with an interview schedule provided to help structure the conversation around a typical day experienced by the child between the ages of three and six (Glad et al., 2014; Appendix 3). This assessment

took place in the home of each child and took roughly 30 minutes to complete. It was conducted with the assistance of a field worker to overcome language barriers.

Specific items were slightly modified by the researcher to make them more appropriate to the current sample. For example, item three '*Child has a record, tape, or CD player and at least 5 children's records, tapes or CD's'* was modified to include a playlist or music on a digital device (such as a phone or tablet). Item 9 '*Family buys and reads a daily newspaper'* was modified to include weekly newspapers. Item 48 *'Child eats at least one meal on most days with mother and father'* was changed to '*Child eats at least one meal on most days with the family'* due to the living arrangements that included multigenerational and extended families.

The measure consists of 55 items, with eight subscales, namely: Learning Materials, Language Stimulation, Physical environment, Responsivity, Academic Stimulation, Modelling, Variety, and Acceptance (Parks & Smeriglio, 1986; Totsika & Sylva, 2004). Table 4 below provides a description of each subscale, as well as sample items from each subscale (Caldwell & Bradley, 2003). Each item was scored yes (1) or no (0), and a total score was obtained for the eight subscales by summing up the items (Parks & Smeriglio, 1986). Higher scores indicated a more enriched home environment.

Table 4

Summary of the Early Childhood- Home Observation for Measurement of the Environment subscales

EC-HOME[a] subscales	Description	Number of items[b]	Sample items	Scoring (Max)
Learning Materials	The availability of toys, books and games to the child that facilitate learning. It also considers how the adult uses the toy to facilitate learning.	11 items: 3 Interview 8 Either	• Child has 3 or more puzzles (E) • Child has toys or games that help teach numbers (E) • Child is encouraged to learn shapes (I)	Yes = 1 No = 0 (Max= 11)

EC-HOME[a] subscales	Description	Number of items[b]	Sample items	Scoring (Max)
Language Stimulation	Overt attempts by the caregivers to encourage language development through conversation, modelling, and direct teaching.	7 items: 4 Interview 2 Observe 1 Either	• Child is encouraged to learn the alphabet (I) • Caregiver uses correct grammar and pronunciation (O) • Child has toys that help teach names of animals (E)	Yes = 1 No = 0 (Max= 7)
Physical Environment	Describes the safety, perceptual appeal, and roominess of the physical environment.	7 items: 7 Observe	• Building appears safe and free of hazards (O) • Outside play environment appears safe (O) • Rooms are not overcrowded with furniture (O)	Yes = 1 No = 0 (Max= 7)
Responsivity	The caregiver's emotional and verbal responsivity to the child, and the warmth in the relationship.	7 items: 1 Interview 6 Observe	• Caregiver holds child close 10-15 minutes per day (I) • Caregiver praises child's qualities twice during visit (O) • Caregiver caresses, kisses, or cuddles child during visit (O)	Yes = 1 No = 0 (Max= 7)
Academic Stimulation	Direct caregiver involvement in the child's learning, and the encouragement to acquire skills and knowledge that is considered important during the early childhood years.	5 items: 5 Interview	• Child is encouraged to learn colours (I) • Child is encouraged to learn numbers (I) • Child is encouraged to learn to read a few words (I)	Yes = 1 No = 0 (Max= 5)
Modelling	The modelling of desired and acceptable behaviours by the caregiver, and the communication of those expectations.	5 items: 4 Interview 1 Observe	• Some delay of food gratification is expected (I) • TV is used judiciously (I) • Parent introduces Visitor to child (O)	Yes = 1 No = 0 (Max= 5)
Variety	Describes the family lifestyle that provides the child with a variety of enriching experiences.	9 items: 6 Interview 2 Observe 1 Either	• Child is taken on outing by a family member at least every other week (I) • Child's artwork is displayed some place in the house (O) • Child has real or toy musical instrument (E)	Yes = 1 No = 0 (Max= 9)
Acceptance	The caregiver's ability to accept negative behaviour from the child as something to be expected from young children rather than an act demanding immediate harsh reprisal.	4 items: 1 Interview 3 Observe	• No more than 1 instance of physical punishment occurred during the past week (I) • Caregiver does not use physical restraint during visit (O)	Yes = 1 No = 0 (Max= 4)

Note. [a] Early Childhood- Home Observation for Measurement of the Environment

[b] Items are either obtained through the interview process (I), observed during the visit (O), or through either method (E)

Internal consistency for the subscales was between 0.53 and 0.83, and 0.93 for the total scale (Totsika & Sylva, 2004). Split half reliability (KR-20), a reliability method that randomly splits the data and compares the halves for similarities (Field, 2009), ranged from 0.53 and 0.83 for the subscales and 0.93 for the total (Totsika & Sylva, 2004). A Swedish study calculated a Person Separation Index (PSI) which corresponds with Cronbach's α, and reflects the ability to differentiate persons along a latent variable (Glad et al., 2014). The PSI was 0.86 for the total scale, displaying satisfactory reliability. Moderate concurrent validity was also established by Totsika and Sylva (2004). Agreement between raters was at 90% (Totsika & Sylva, 2004) and between 84% and 100% for a Swedish sample (Glad et al., 2014).

Supplementary Interview Schedule.

During the data collection process, the research team discussed the EC-HOME subscales and decided to develop an exploratory supplementary interview schedule. This was intended to explore possible elements specific to the South African home environment that could make a possible contribution to the EC-HOME. This supplementary interview schedule consisted of seven items, which contributed to five of the eight subscales (Appendix 4). The seven items were based on literature on early childhood development and the home environment. The nine supplementary items, and the relevant literature consulted are listed below in Table 5.

Table 5

Supplementary interview questions for the Early Childhood-Home Observation for Measurement of the Environment

EC-HOME[a] Subscale	Supplementary items	References	Scoring
Learning Materials	1. Is the child allowed to play games on an electronic device (cellphone, tablet, etc.)? If yes, what games do they play? (Assess whether games may be deemed educational)	See Bedford, Saez de Urabain, Cheung, Karmiloff-Smith, & Smith, 2016; Dye, Green, & Bavelier, 2009; Li & Atkins, 2004	Yes= 1 No= 0
Language Stimulation	2. What languages can the child speak? (More than one language contributes positively)	Lorette & Dewaele, 2015; Quinteros Baumgart & Billick, 2018; Sarsour et al., 2011	1 Language = no (0) More than 1 language= yes (1)
Responsivity	3. Level of affectivity of the caregiver towards child (observation) On a scale of one to ten, with one being cold and 10 being warm.	Observational item	6-10= 1 1-5= 0
	4. How do you respond to the child when they get hurt? (award point for comforting behaviours, such as holding the child and soothing them)	Lucas, Richter, & Daelmans, 2018	Soothing behaviours such as hugging = 1 Using only words= 0
	5. How can you tell if something is wrong without the child saying it explicitly? (Sensitivity of caregiver to the child)	Richter et al., 2017; Walker et al., 2011	Vague description of nonverbal cues= 0 Detailed description given of cues =1
Academic Stimulation	6. What is the best way to reward or encourage the child? (Acknowledgement and encouragement of achievements)	Richter et al., 2017; Walker et al., 2011	Use of vague verbal gestures (e.g. Good boy)= 0 Actively rewarding child= 1
Modelling	7. What is your bedtime routine? How often do you follow the routine? (modelling of routines and structure)	Mindell & Williamson, 2018	Is there a routine? Yes= 1 No= 0

Items were scored in the same binary system as the EC-HOME. For items that could not be answered as yes or no, a binary scoring system was applied. For example, the item asking what

languages the child can speak was scored as yes if the child spoke more than one language, and as no if the child was monolingual. The scores obtained from the additional items were then added to the subscale total. This supplementary interview schedule was only developed once the study had begun as a result of the differences and unique aspects observed in South African homes and families. Therefore, it was conducted on a subset of the sample comprising of nine caregiver-child dyads.

Procedure

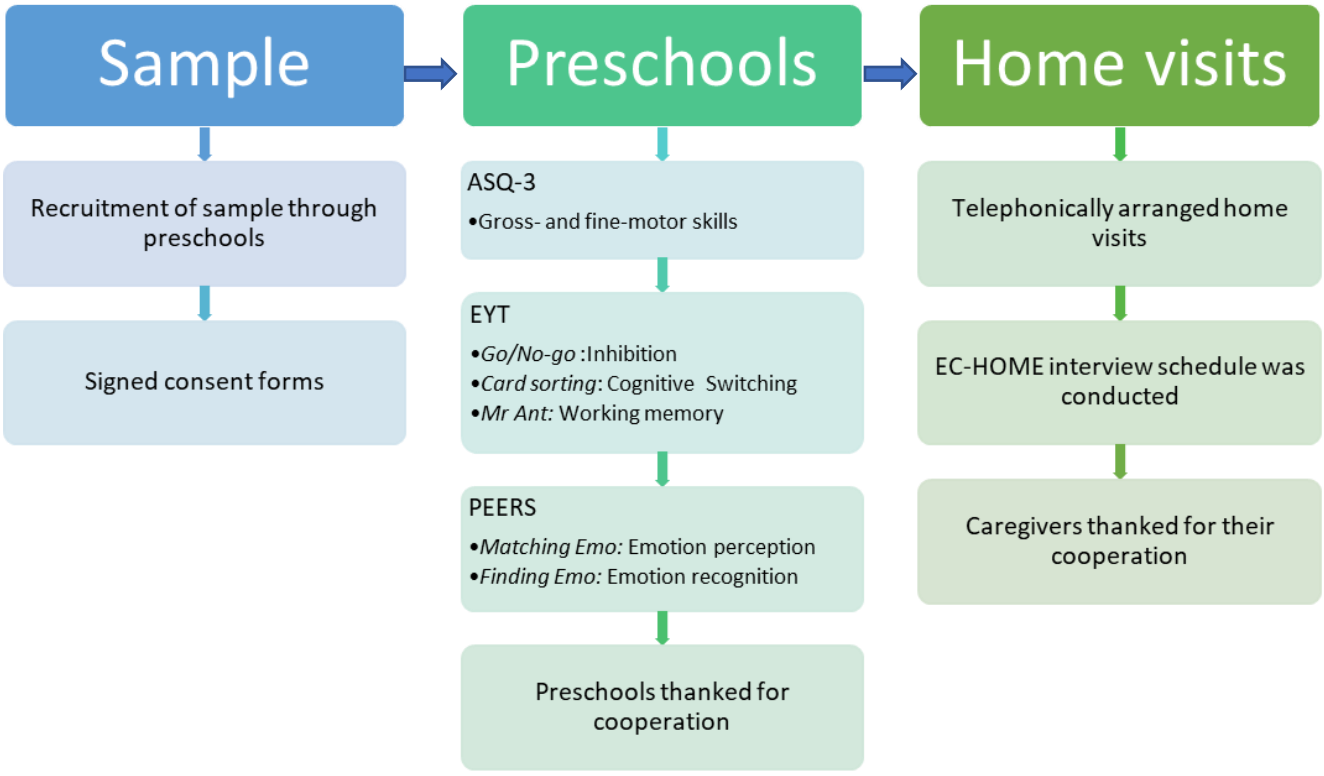

Figure 3: Research procedure. This diagram indicates the research process as well as the order in which the assessments were conducted. This was completed by the research team, consisting of the researcher, a research partner, and a field worker.

The order of the research process is illustrated in Figure 3 above. As mentioned earlier, a sample was recruited through four preschools, with the assistance of a fieldworker. Once signed consent forms were returned, days were arranged with the participating preschools for data collection to take place. On these days, the participating children had their developmental domains assessed. The ASQ-3 was conducted by the researcher and took approximately five minutes to complete. The iPad-based assessments were also completed at the preschools on the arranged days.

The EYT was administered after the ASQ-3, where the children completed the go/no-go to familiarise themselves with the touch interface of the iPad. This was followed by the Dimensional Change Card Sorting task, and then the Mr Ant task. The PEERS followed the EYT, with the children completing the Matching Emo and Finding Emo respectively. These were conducted on an iPad provided by the larger SUNRISE project and took each child between 30 minutes and an hour to complete all the assessments. The iPad-based assessments were primarily conducted by a research partner, with the assistance of a field worker, as they could navigate the language preferences of the children.

The assessments were done with the children on weekdays at the preschools and were completed before 12h00, which was when the children started preparing for lunch and their nap. This was to ensure the children were not fatigued during the assessment. If participating preschools had more children, the researchers would continue data collection after the children had their nap. This decision was based on the time constraints of the study. The assessments were conducted outside of the classrooms where there was relatively less noise and distractions.

During this time, caregivers were contacted telephonically to arrange a convenient date and time for the home visit. The child had to be present and awake during these home visits, and so these were often arranged for weekdays after 15h00. If a weekday could not be arranged, a morning during the weekend was set. The caregivers were contacted telephonically prior to the home visits to remind the participants that the researcher will be visiting and to ensure that they will be home.

With the help of a fieldworker, the EC-HOME interview took 30 minutes to an hour as caregivers were open to talking about their children, after which the caregiver was thanked for their time. Observations were noted during the interviews on the interaction between the caregiver and the child. Once the supplementary interview schedule was developed, it was also conducted during the home visits. This was done on a subset of the sample and took an additional 10 minutes. Once the data collection was complete, the preschools were gifted with some resources to thank them for their co-operation.

Data Analysis

Variables.

The independent variable (IV) in this study was the 'Stimulation in the Home Environment'. It was measured using the EC-HOME and produced eight subscales as well as a total score. This study had three dependent variables (DV), namely executive function, social-

emotional cognition, and motor ability. These variables and their subscales are illustrated in Figure 4 in relation to each other.

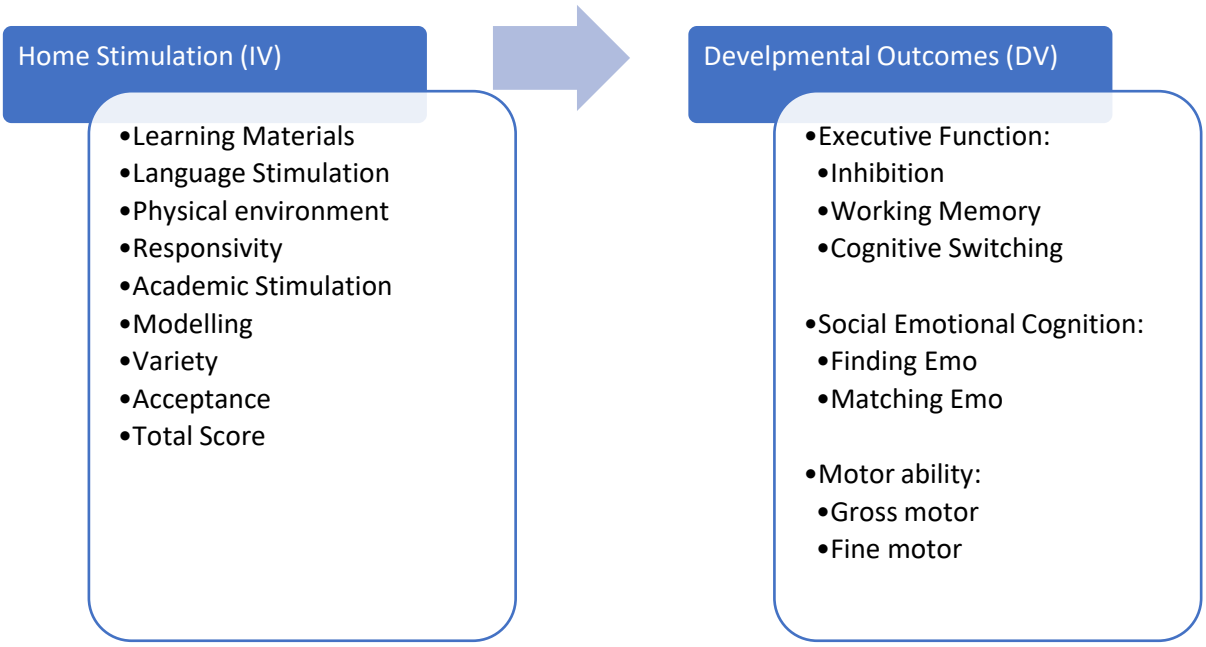

Figure 4: The independent variables and the dependent variables collected in this study.

Data Preparation.

Once the data was collected and recorded electronically, it was encoded and cleaned. Part of the data cleaning process was identifying outliers, as they affect the mean and consequently the standard deviation of the data (Field, 2009). Outliers were identified using boxplots, and further confirmed by using the mean ± 2SD. There was one outlier for the gross-motor ability, fine-motor ability, and *Matching Emo* respectively. To continue with descriptive statistics, the outlier scores were removed.

All statistical analysis was run on IBM SPSS Statistics Software 25 (IBM Corp, 2017). All variables were screened for normal distribution using skewness, kurtosis, and normality test. Skewness and kurtosis fell between -1 and 1 for the data to be considered normally distributed. The Shapiro-Wilk test of normality was used, as it was more appropriate for the sample size, and determined whether the distribution differed significantly from a normal distribution (Field, 2009). The use of all three statistical analyses were used collectively to confirm distribution of the data. Table 6 displays the results for the analysis on the independent variables, and Table 7 displays the results on the dependent variables.

Table 6 indicated that six of the eight subscales from the EC-HOME were negatively skewed, indicating a trend in higher scores on those subscales. These skewed subscales include language stimulation, physical environment, responsivity, academic stimulation, modelling, and acceptance.

Table 6
Distribution measures of the independent variables

Independent Variable from the EC-HOME[a]	**Skewness**	**Kurtosis**	**Shapiro-Wilk**	
			Statistic	**Significance**
Learning Material	0.32	-0.88	0.94	0.053
Language Stimulation	**-1.15**	**1.03**	0.81	**0.000***
Physical Environment	-**1.04**	0.34	0.84	**0.000***
Responsivity	-0.11	**-1.32**	0.91	**0.011***
Academic Stimulation	**-1.09**	**2.53**	0.73	**0.000***
Modelling	-0.38	0.29	0.89	**0.002***
Variety	-0.19	-0.27	0.95	0.141
Acceptance	**-1.82**	**2.70**	0.56	**0.000***
HOME Total	-0.34	0.76	0.98	0.698

Note. [-a]Early Childhood- Home Observation for the Measurement of the Environment

*Significance level of p<0.05

Table 7 indicates that both gross- and fine-motor variables were negatively skewed. This distribution indicated that the trend for the scores obtained for these measures were clustered on the higher end of the scores. Thus, the children in the sample tended to perform well on the gross- and fine-motor tasks. These scores were transformed to obtain a normal distribution for descriptive statistics to be run, by applying the logarithm to the reversed score. Cognitive switching also indicated a skewed distribution. However, upon inspection of the histogram seen in Figure 5 below, cognitive switching had a bimodal distribution, hence the kurtosis and Shapiro-Wilk values. It was treated as normally distributed.

Table 7
Distribution measures of the dependent variables

Developmental Domain	Dependent Variable	Skewness	Kurtosis	Shapiro-Wilk	
				Statistic	Significance
Executive Function	Inhibition	-0.32	-0.63	0.95	0.16
	Working Memory	-0.38	-0.48	0.94	0.06
	Cognitive Switching	-0.24	**-1.65**	0.85	**0.00***
Social-Emotional Cognition	Matching Emo	0.05	-0.41	0.98	0.90
	Finding Emo	0.07	-0.40	0.98	0.87
Motor Ability	Gross Motor	**-1.39**	**1.56**	0.73	**0.00***
	Fine Motor	**-1.48**	**1.98**	0.77	**0.00***

Note. *Significance level of p<0.05

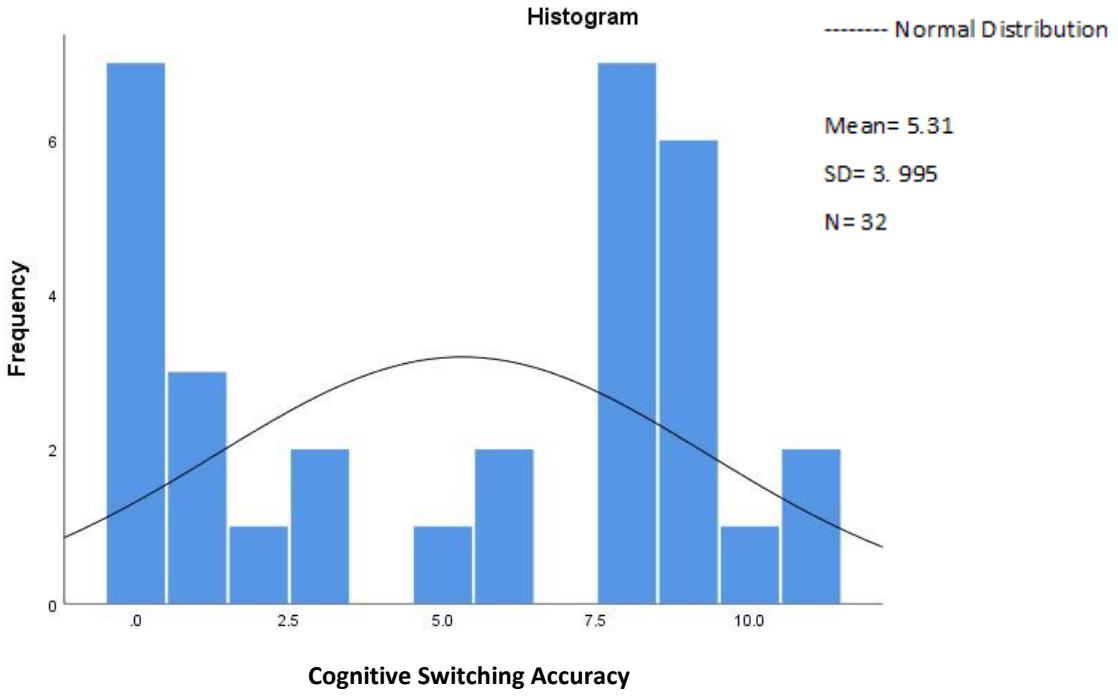

Figure 5: Histogram of the frequency of cognitive switching scores. This displays a bimodal distribution of the cognitive switching data.

Data Analysis.

Although the domains of development undergo changes in an interconnected manner, the statistical analysis treated each of the domains in isolation. For executive function (measured by the EYT), descriptive statistics were first run on each of the subtests to obtain the means and standard deviations (SD), so that the overall trend in the sampled children's performance could be determined. These means were then statistically compared to the norms. This will answer the secondary aim of this study of assessing the development of preschool children in Soweto, South Africa. These norms were based on an Australian sample of children between the ages of three and five, across four Australian states with a distribution of SES (Howard & Melhuish, 2017). At

this stage, these are the only available norms for this assessment. The comparison was done using a single sample t-test and was done according to the four age categories. This statistical test was appropriate as all assumptions were met (normal distribution; variables were at least an interval scale of measure; variables were independent; and there were no significant outliers) (Field, 2009).

This procedure was also done for social-emotional cognition (measured by the PEERS), where a single sample t-test was also used to compare the sample scores to the preliminary norms. This was conducted on the sample as a whole. These preliminary norms (since tool is still under development) are derived from an Australian sample of children between the ages of four and five. For motor ability (measured by the ASQ-3), a Wilcoxon Signed-Rank Test was used to compare the gross- and fine-motor variables to the norms as the variables did not follow a normal distribution. This is the non-parametric equivalent of a single sample t-test. The norms were based on a sample of children up to the age of five from KwaZulu-Natal, South Africa. Effect sizes were calculated for the above using Cohen's d.

To answer the research question, of whether there were relationships between stimulation in the home environment and a child's developmental outcomes, correlations were run between the independent and dependent variables. As there were violations to the assumptions of normal distribution of the data and the assumption of no outliers, a non-parametric Spearman's rho was run (Field, 2009). The social-emotional cognition subtest scores, *Matching Emo* and *Finding Emo* were reversed, changing the interpretation of the scores so that higher scores indicated better

performance. This was to ensure consistency in the interpretations of the outcome variables, so that higher scores indicated better performance on all measures.

With the executive function, it has been argued that at the age of three children display more uniform executive function, rather than the three distinct elements (Wiebe, Espy, & Charak, 2008). For this reason, the researcher collapsed the elements into their latent construct. The elements of executive function (inhibition, working memory and cognitive switching) were measured and calculated in different ways. To combine the three components, the variables were standardised to t-scores, which are used for small sample sizes. Once these components were standardised, they had a mean of 50 and a SD of 10. The t-scores of the three executive function components were then averaged, and that average became the combined executive function (CEF) variable. Higher scores indicated better performance on executive function measures. Spearman's correlation was run on the CEF variable and the EC-HOME variables.

The researcher also collapsed the elements of social-emotional cognition. This was to include the possible effect of the underlying latent variable. *Finding Emo* and *Matching Emo* were both scored as the number of errors made. The errors of both tasks were added and converted to a percentage of the theoretical maximum error (the sum of the *Finding Emo* maximum and the *Matching Emo* maximum). This percentage was reversed and that became the Social-Emotional Cognition (SEC) variable. The reversal was to change the interpretation so that higher scores indicated better performances. This was not done for motor ability as different skill sets are used in gross motor tasks as compared to fine motor tasks. Spearman's correlation was run on the SEC variable and the EC-HOME variables.

The additional information provided by the supplementary interview was quantified and added to the relevant subscales of the EC-HOME. This was done for a subsample of nine participants. Spearman's rho correlations were run on these adjusted variables, as there were still violations to the assumptions of normal distribution and outliers. As existing correlation is one of the assumptions that need to be met to run a regression analysis, regression models were built with variables where significant correlations were found.

Ethical Considerations

This study was part of a larger project, and ethical clearance was obtained from the University of the Witwatersrand Human Research Ethics Committee (Medical) (M160534; Appendix 5). Participants received an information sheet (Appendix 6) informing them of the purpose of the study. It served as an invitation to participate, explaining the voluntary nature of participation, and informing them that they may withdraw from the study at any time without negative consequences (Department of Health, 2015). The information sheet explained all procedures that the participants were asked to consent to, which included the home stimulation assessment, the EYT, the PEERs, and the ASQ-3.

Participants were made aware of any anticipated risks and benefits (Department of Health, 2015). There were no associated risks in this study, and benefits included parents receiving information about their child's development. Participants were also informed that data collected was to be treated confidentially, available only to the research team with no identifying

information being reported. The data was stored digitally on a password encrypted device until the larger project is complete.

Due to the face-to-face nature of the home visits, anonymity with the research team could not be guaranteed. Each participating dyad was assigned a code which was used instead, removing any identifying information. Should the data be published or used at a conference, the participants anonymity will be ensured in those publications. Participants were informed that any further questions could be directed to the supervisor or the researchers using the contact details provided in the information sheet. A one-page summary of the research findings was offered to the participants upon request.

After receiving the information sheet, caregivers who wished to participate in the study were required to sign a consent form for both their caregiver, and for the child. During the assessments with the children, the researchers were sensitive to the child's willingness to participate and were to discontinue assessment should the child have wished to.

Chapter 3: Results

The primary aim of this study was to explore the relationship between stimulation in the home environment, and various domains of development in preschool children specifically between the ages of three and five. This results chapter reports on the statistical analysis conducted between the independent variables (stimulation in the home environment) and the dependent variables (executive function, social-emotional cognition, and motor ability).

Cognitive Development

Descriptive Statistics.

The means and standard deviations were run on each of the elements of executive function. The descriptive statistics are displayed in Table 8. No significant differences were found between the means of the boys and the girls for inhibition ($t(32)=1.10$, $p=0.28$, $d=0.37$), working memory ($t(32)=1.35$, $p=0.19$, $d=0.47$), or cognitive switching ($t(32)=-0.43$, $p=0.67$, $d=0.15$).

Table 8
Means and standard deviations of executive function subtests (EYT)

Executive Function Dependent Variables	EYT Subtest	Total sample (N=34) Mean (SD)	Range [a] Min - Max	Boys (N=19) Mean (SD)	Girls (N=15) Mean (SD)
Inhibition	Go/No go	0.63 (0.22)	0.13 - 0.95	0.66 (0.19)	0.58 (0.26)
Working Memory	Mr Ant	1.99 (0.71)	0.33 - 3.00	2.11 (0.76)	1.78 (0.61)
Cognitive switching	Dimensional Change Card Sorting	5.31 (4.00)	0.00 - 11.00	5.00 (4.20)	5.60 (3.92)

Note. [a] Observed range

The Australian norms for the executive function data are displayed according to age categories (Howard & Melhuish, 2017). The sampled data was thus categorised into four age groups as illustrated in Figure 6 (years: months): 3:6 to 3:11; between 4:0 – 4:5; between 4:6 – 4:11; between 5:0- 5:5.

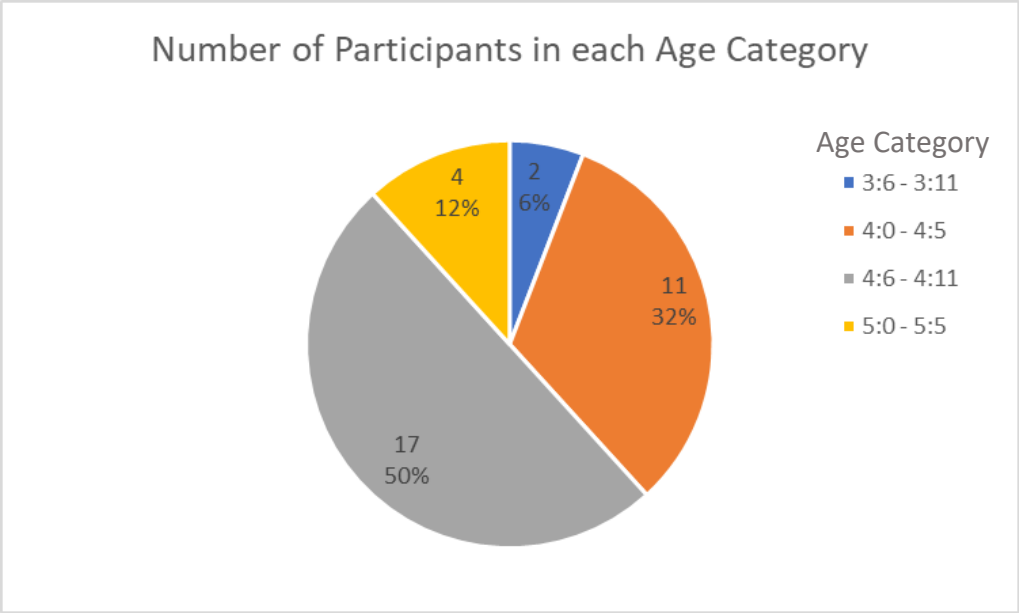

Figure 6: The distribution of participants in each age category (years: months).

Overall, the single sample t-tests showed no significant differences between the norms and the sample scores for the inhibition task, the working memory task, nor the cognitive control task (all p's> 0.078). This was consistent across all age categories, apart from the oldest age category in this sample, ages 5:0 to 5:5. In this age category (5:0 – 5:5), a significant difference was found between the norm and the sample for inhibition [$t(3)= 3.57$, $p=$ **0.038,** $d=$ 1,78], where the sample performed significantly better (mean= 0.76, SD= 0.06) than the norm (mean= 0.65, SD= 0.21). A significant difference was also found between the norm and the sample in this age category (5:0 to 5:5) for cognitive switching [$t(3)= 8.48$, $p=$ **0.003**, d=0.42], where the samples

scores were significantly higher (mean= 9.0, SD= 0.82) as compared to the norm (mean= 5.54, SD= 4.35). Figure 7 shows the comparison per age category for each of the executive function tasks.

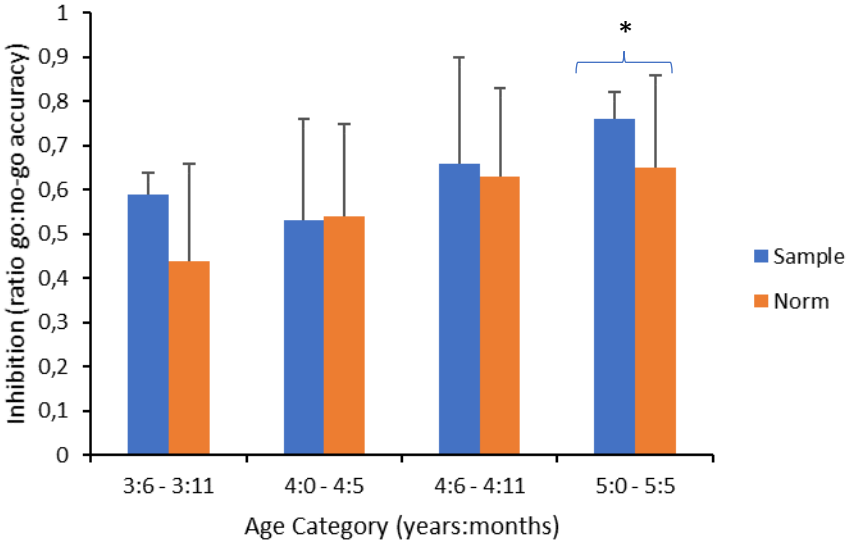

Figure 7.1: The difference between the sample means and the norms for inhibition according to age category. *Significance level at 0.05

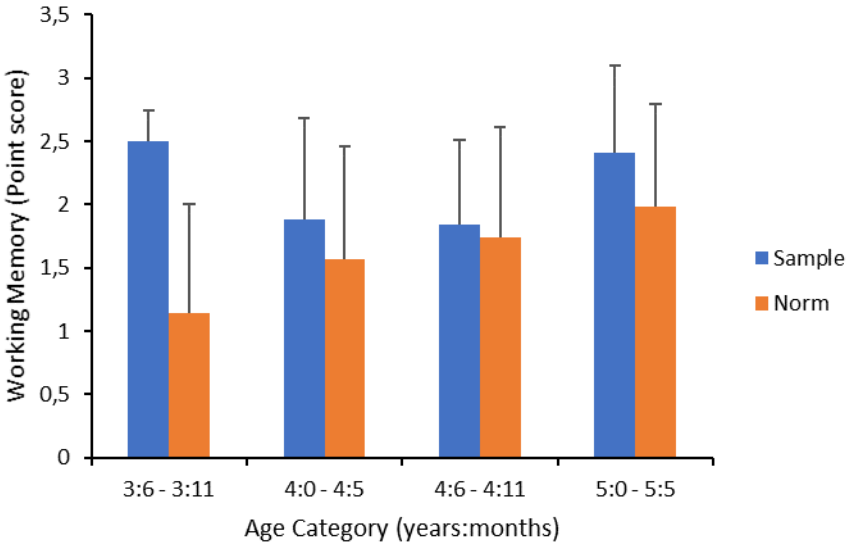

Figure 7.2: The difference between the sample means and the norms for working memory according to age category.

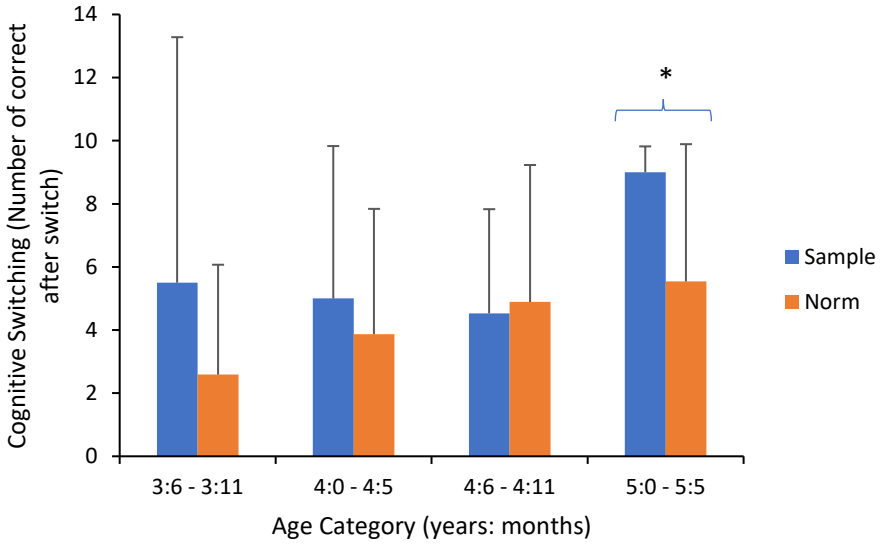

Figure 7.3: The difference between the sample means and the norms for cognitive switching according to age category.
*Significance level at 0.05

Correlations.

No significant correlations were found between the elements of executive function and the components of the EC-HOME (all *p's*> 0.139). The correlations run between the collapsed variable, *Combined Executive Function* (CEF), and the components of the EC-HOME also found no significant correlations (all *p*'s> 0.189). Table 9 below displays the Spearman's rho values for the above-mentioned correlations.

Table 9

Spearman's rho correlations between components of stimulation in the home environment and the combined executive function variable, and its three elements

Independent Variables from the EC-HOME[a] assessment	Executive Function Dependent Variables			
	Inhibition	Working Memory	Cognitive Switching	Combined Executive Function
Learning materials	-0.146	-0.052	0.138	0.019
Language stimulation	0.044	0.026	-0.091	-0.032
Physical environment	-0.008	-0.008	-0.083	-0.035
Responsivity	-0.009	0.014	0.241	0.114
Academic stimulation	0.259	-0.254	0.209	0.053
Modelling	-0.241	-0.200	0.018	-0.144
Variety	-0.068	0.073	0.148	0.074
Acceptance	-0.100	-0.242	-0.077	-0.187
Total Home Stimulation	-0.083	-0.065	0.189	0.051

Note. [a]Early Childhood- Home Observation for the Measurement of the Environment
N= 34

The correlations run on the supplemented EC-HOME and executive function also revealed no significant relationships (all *p*'s> 0.065). Table 10 below provides the Spearman's rho statistics for the correlations.

Table 10

Spearman's rho correlations between revised components of stimulation in the home environment and the combined executive function variable, and its three elements

Revised Independent Variables from the EC-HOME[a]	Executive Function Dependent Variables			
	Inhibition	Working memory	Cognitive Switching	Combine Executive Function
R-Learning materials	-0.596	-0.389	-0.287	-0.451
R-Language stimulation	0.065	-0.382	-0.212	-0.203
Physical environment	-0.087	0.191	-0.292	-0.208
R-Responsivity	-0.118	-0.142	0.043	-0.051
R-Academic stimulation	-0.557	-0.307	0.028	-0.292
R-Modelling	-0.550	-0.477	-0.351	-0.495
Variety	-0.362	-0.525	-0.220	-0.397
Acceptance	-0.548	-0.216	-0.350	-0.548
R-Total Home Stimulation	-0.318	-0.123	-0.009	-0.167

Note. [a]Early Childhood- Home Observation for the Measurement of the Environment
R= Revised subscale with the addition of the supplementary questionnaire
N= 9

Social-Emotional Development

Descriptive statistics.

The means and standard deviations were run on each of the elements of social-emotional cognition. The descriptive statistics are displayed in Table 11. No significant differences were found between the means of the boys and the girls for the *Finding Emo* ($t(32)=0.27$, $p=0.79$, $d=0.09$), or *Matching Emo* ($t(32)=0.54$, $p=0.59$, $d=0.19$) subtests of the PEERS.

Table 11

Means and standard deviations of social-emotional cognition

PEERS[a] Dependent Variables	Total sample M (SD)	Range [b] Min - Max	Boys (N=19) M(SD)	Girls (N=15) M(SD)
Finding Emo	15.38 (3.37)	9.00 - 23.00	15.16 (3.68)	15.47 (2.85)
Matching Emo	35 (8.67)	17.00 - 53.00	33.26 (11.30)	35.07 (6.79)

Note. [a] Paediatric Evaluation of Emotions, Relationships and Socialisation
[b] Observed range

The t-test that were run comparing the whole sample to the norm found a significant difference for the *Finding Emo* subtest of the PEERS ($t(33)= 5.11$, $p<$ **0.001**,$d= 0.88$), where the number of errors for the sample (M= 15.29, SD= 3.29) was significantly higher than the norms (M= 12.41, SD= 3.48). There was also a significant difference found for the *Matching Emo* subtest ($t(33)= 9.05$; $p<$ **0.000**, $d= 1.55$), where the sample had a higher number of errors (M=34.06, SD= 9.49) than the norm (M=19.33, SD= 12.19). These comparisons are illustrated in Figure 8 below.

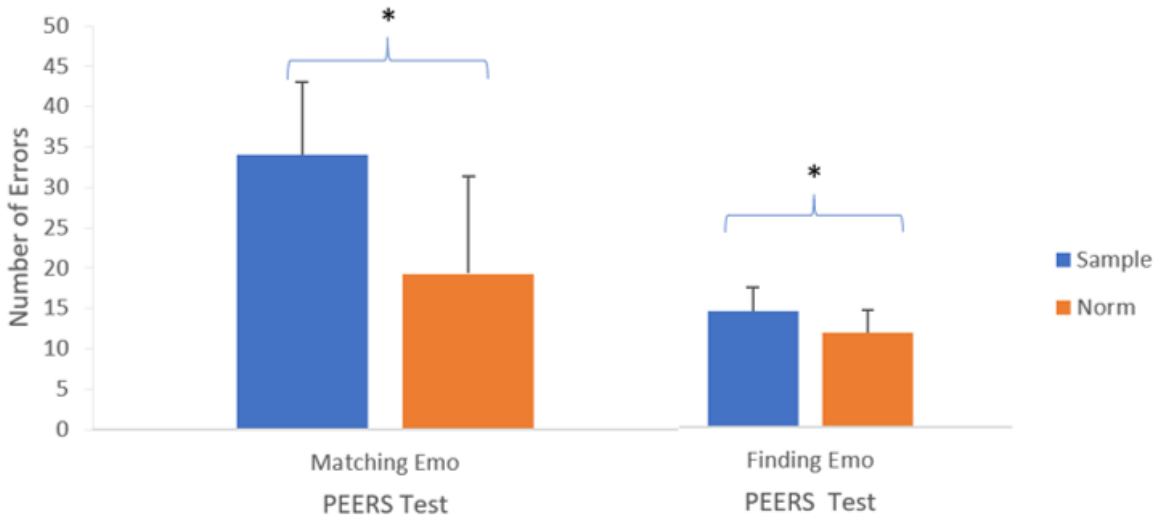

Figure 8: The difference in means of the sample as compared to the norms in the PEERS tests.
*Significance level at 0.05

Correlations.

Table 12 below shows that the reversed scores of both of the PEERS subtests revealed a significant correlation with Acceptance. The *Finding Emo* subtest had a moderate positive relationship with Acceptance (*r* =0.47, *p*= **0.006**), indicating that higher scores of Acceptance (i.e. not using harsh punishment) were related to higher scores on *Finding Emo* (emotion recognition). The *Matching Emo* subset had a weak positive relationship to Acceptance (*r* =0.37; *p*= **0.034**), indicating that higher scores on Acceptance were related to higher scores on *Matching Emo* (emotion perception). There was also a significant correlation between Acceptance and the SEC composite score, r= 0.42; p= **0.014**. This was a weak positive correlation, indicating that higher scores on Acceptance were related to higher scores on social-emotional cognition. None of the

other components of the EC-HOME correlated significantly to the social-emotional cognition outcome variables (*p*'s> 0.066).

Table 12
Spearman's rho correlations between components of stimulation in the home environment and social-emotional cognition and its subtests

Independent Variables from the EC-HOME[a]	**Social-Emotional Cognition Dependent Variables[b]**		
	Reversed Finding Emo	**Reversed Matching Emo**	**SEC**
Learning materials	-0.042	0.089	0,050
Language stimulation	0.178	0.041	0,076
Physical environment	0.143	0.115	0,096
Responsivity	-0.165	-0.111	-0,131
Academic stimulation	-0.292	-0.066	-0,120
Modelling	0.024	0.128	0,074
Variety	-0.225	-0.249	-0,249
Acceptance	**0.465***	**0.365***	**0.419***
Total Home Stimulation	-0.024	0.026	0,004

Note. *Significance at a 0.05 level and indicated in bold
[a]Early Childhood- Home Observation for the Measurement of the Environment
[b]As measured by the Paediatric Evaluation of Emotions, Relationships and Socialisation
N= 34

Table 13 below shows the results of the correlations run on the supplemented EC-HOME and the elements of social-emotional cognition. A significant relationship was found between the revised language stimulation subscale and *Finding Emo.* This strong negative relationship, (*r* =-0.86, *p*= **0.003**) indicates that higher scores on language stimulation are related to lower scores on the *Finding Emo* subtest (emotion recognition). The revised item includes the number of languages the child speaks. There was also a significant correlation between the revised language stimulation variable and SEC composite score (*r* =-0.69, *p*= **0.039**). This negative, moderate relationship indicated that higher scores in language stimulation are related to lower social-

emotional cognition. This correlation revealed no significant relationship between Acceptance and SEC composite score, nor its subtests, as previously seen. There were no other significant relationships between the remaining revised components of the EC-HOME and the elements of social-emotional cognition (*p*'s> 0.085).

Table 13

Spearman's rho correlations between revised components of stimulation in the home environment and social-emotional cognition and its subtests

Revised Independent Variables from the EC-HOME[a]	Social-emotional Cognition Dependent Variables		
	Reversed Finding Emo	**Reversed Matching Emo**	**Social-Emotional Cognition**
R-Learning materials	-0.468	-0.275	-0.332
R-Language stimulation	**-0.856***	-0.581	**-0.692***
Physical environment	-0.035	0.280	0.191
R-Responsivity	-0.600	-0.494	-0.565
R-Academic stimulation	0.037	-0.322	-0.322
R-Modelling	-0.042	0.125	**0.**138
Variety	-0.652	-0.487	-0.518
Acceptance	0.207	0.345	0.411
R-Total Home Stimulation	-0.603	-0.409	-0.477

Note. *Significance at a 0.05 level and indicated in bold

[a]Early Childhood- Home Observation for the Measurement of the Environment

R= Revised subscale with the addition of the supplementary questionnaire

N= 9

Regression.

To ensure that the results of the multiple regression were reliable, the assumptions of the test were assessed (Field, 2009). Upon inspection, there were no univariate outliers, no multicollinearity according to the Tolerance and VIF collinearity diagnostics, and the residuals were uncorrelated according to the results of the Durbin-Watson test. A histogram of the standardised residuals indicated a normal distribution of the residuals. There was

homoscedasticity as revealed by the inspection of the residual scatterplot. There were also no influential cases as indicated by the Cook's distance and Leverage values. Thus, the assumptions of the test were met, and the results of the regression model were reliable.

Three simple regression models were built for the three outcome variables, Emotion recognition (determined by the *Finding Emo* subtest of the PEERS), Emotion Perception (determined by the *Matching Emo* subtest of the PEERS), and SEC composite score. The predictor variable in each model was Acceptance from the EC-HOME measure. Correlations were run between each outcome variable and possible covariates, namely the child's age, the preschool they attended, and their relation to their caregiver. Table 14 shows that none of these had significant relationships, and so were not included as covariates. As no significant sex differences were found, this was also not included as a covariate.

Table 14

Spearman's rho correlations between anticipated covariates and social-emotional cognition and its subtests

Anticipated Covariates	**Social-emotional Cognition Outcome Variables[a]**		
	Reversed Finding Emo	**Reversed Matching Emo**	**Social-Emotional Cognition**
Age	0.270	0.322	0.331
Preschool attended	-0.226	-0.163	-0.186
Relation of caregiver	0.019	0.157	0.137

Note. *Significance at a 0.05 level and indicated in bold

[a] As measured by the Paediatric Evaluation of Emotions, Relationships and Socialisation

N= 34

Table 15 shows the regression results below. The first simple regression model placed Acceptance as the predictor, and Emotion recognition as the outcome variable. In this model

Acceptance predicts 20.9% of the emotion recognition score, and was a significant model (R^2= 0.21, F(1,32)=8.45, p= **0.007**). Model 2 had emotion perception as the outcome variable, and Acceptance as the predictor. This model was not significant (R^2= 0.08, F(1,32)=2.95, p= 0.096). Model 3 had SEC as the outcome variable, and Acceptance as the predictor variable. This mode was significant (R^2= 0.13, F(1,32)=4.71, p= **0.038**), indicating that Acceptance predicts 12.8% of the SEC composite score.

Table 15

Regression analysis with social-emotional cognition and its subtests as the outcome variable and acceptance as the predictor variable

Model	Unstandardised Coefficients		Standardised Coefficients	*t*	*p*	*F*	*R*	R^2
	B	SE	Beta					
Model 1[a]						**8.450***	0.457	0.209
(Constant)	-2.283	3.815	-	-0.599	0.554			
Accept	2.942	1.012	0.457	2.906	**0.007***			
Model 2[b]						2.947	0.290	0.084
(Constant)	17.799	11.840	-	1.503	0.143			
Accept	5.392	3.141	0.290	1.717	0.096			
Model 3[c]						**4.708***	0.358	0.128
(Constant)	16.162	15.082	-	1.072	0.292			
Accept	8.682	4.001	0.358	2.170	**0.038***			

Note. *p<0.05 significance

[a] Outcome Variable in model is Emotion recognition as measured by the *Finding Emo* subtest of the Paediatric Evaluation of Emotions, Relationships and Socialisation

[b] Outcome Variable in model is Emotion perception as measured by the *Matching Emo* subtest of the Paediatric Evaluation of Emotions, Relationships and Socialisation

[c] Outcome variable in model is the combined Social-Emotional Cognition variable

Motor Development

Descriptive statistics.

The means and standard deviations were run on the transformed gross motor and fine motor scores. Due to the negatively skewed distribution of the data, these variables were transformed using the logarithm of the reversed scores to obtain a normal distribution. Table 16 below shows the results of the descriptive statistics. The Mann-Whitney U tests found no significant differences between the means of the boys and the girls for the gross motor scores (U=172.00, p= 0.32, η^2=0.04), or fine motor scores (U=153.00, p=0.73, η^2=0.005) subtests of the ASQ-3.

Table 16

Means and standard deviations of motor ability

Motor Ability Dependent Variables[a]	Total sample M (SD)	Range[b] Min - Max	Boys (N=18) M(SD)	Girls (N=15) M(SD)
Gross motor (transformed)	1.12 (0.17)	1.00 - 1.54	1.08 (0.14)	1.17 (0.19)
Fine motor (transformed)**	1.19 (0.14)	1.00 - 1.54	1.18 (0.15)	1.21 (0.14)

Note. N= 33 after the removal of outliers

[a] As measures by the Ages and Stages Questionnaire-third edition

[b] Observed range

** Transformation of negatively skewed data by using the logarithm of the reversed scores

The Wilcoxon Signed Rank tests found no significant differences between the sample gross motor scores and the test norms (median= 57; Z= -0.19, p= 0.85, η^2=0.001). The fine motor scores of the sample were however significantly different to the norm (Z= 5.19, p< **0.000**, η^2= 0.82), where the sample (median= 55) scored higher than the norm (median= 29.6). Figure 9 illustrates these results.

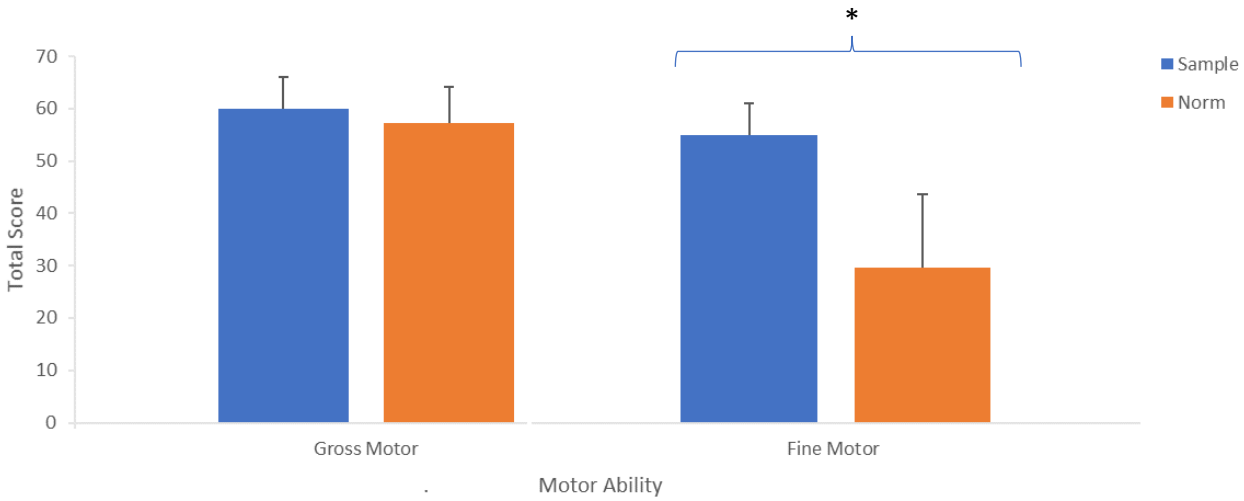

Figure 9: The difference in gross- and fine-motor means of the sample as compared to the norms. *Significance at a 0.05 level

Correlations.

A significant correlation was found between language stimulation and fine motor ability (r= 0.38, p= **0.029)**. This was a weak, positive relationship, indicating that the more language stimulation there was, the higher the fine motor scores. There were no other significant correlations found (*p*'s>0.068). These results are found in table 17.

Table 17

Spearman's rho correlations between components of stimulation in the home environment and gross- and fine-motor ability

Independent Variables from the EC-HOME[a]	Motor Ability Dependent Variables[b]	
	Gross Motor	**Fine Motor**
Learning materials	-0.245	-0.068
Language stimulation	0.120	**0.375***
Physical environment	-0.065	-0.075
Responsivity	-0.094	-0.037
Academic stimulation	-0.196	-0.007
Modelling	-0.317	-0.104
Variety	-0.259	0.091
Acceptance	-0.168	-0.109
Total Home Stimulation	-0.264	-0.055

Note. *Significance at a 0.05 level and indicated in bold
[a]Early Childhood- Home Observation for the Measurement of the Environment
[b]As measured by the Ages and Stages Questionnaire-third edition
N= 34

There were some significant relationships found between the supplemented EC-HOME and the gross- and fine-motor subtests of the ASQ-3. Table 18 shows that the revised learning material subscale was negatively correlated with gross motor ability (r= -.072, p= **0.028)**, indicating that more learning materials available to the child, including electronic devices, were related to lower gross motor ability scores. The revised modelling subscale and the variety subscale were also negatively correlated with gross motor ability (r= -0.87, p= **0.002** and (r= -0.76, p= **0.017** respectively). This indicated that when there was less of these types of stimulation (i.e. caregiver modelling and variety of experiences), gross motor ability scores were higher. No other components of the supplemented EC-HOME correlated significantly to the motor ability (*p*'s> 0.109).

Table 18

Spearman's rho correlations between revised components of stimulation in the home environment and gross- and fine-motor ability

Revised Independent Variables from the EC-HOME[a]	Motor Ability Dependent Variables[b]	
	Gross Motor	Fine Motor
R-Learning materials	**-0.722***	-0.476
R-Language stimulation	-0.171	0.057
Physical environment	0.197	-0.108
R-Responsivity	-0.308	-0.052
R-Academic stimulation	-0.300	-0.340
R-Modelling	**-0.872***	-0.570
Variety	**-0.763***	-0.429
Acceptance	-0.245	-0.661
R-Total Home Stimulation	-0.410	-0.312

Note. *Significance at a 0.05 level

[a]Early Childhood- Home Observation for the Measurement of the Environment

[b]As measured by the Ages and Stages Questionnaire- third edition

R= Revised subscale with the addition of the supplementary questionnaire

N= 9

Regression.

A simple regression model was built with fine motor scores as the outcome variable and language stimulation as the predictor variable. Correlations were run between the outcome variable and possible covariates, namely the child's age, the preschool they attended, and the relation of their caregiver. Table 19 shows that none of these had significant relationships, and so were not included as covariates. As no significant sex differences were found, this was also not included as a covariate.

Table 19

Spearman's rho correlations between anticipated covariates and fine-motor scores

Anticipated Covariates	Fine Motor Score[a]
Age	0.009
Preschool attended	-0.104
Relation of caregiver	-0.227

Note. *Significance at a 0.05 level and indicated in bold

[a] As measured by the Ages and Stages Questionnaire- third edition

N= 34

Table 20 shows the regression results below. The simple regression model placed Language Stimulation as the predictor, and fine-motor scores as the outcome variable. This model was not significant (R^2= 0.11, $F(1,32)=4.01$, p= 0.054).

Table 20

Regression analysis with fine motor scores as the outcome variable and language stimulation as the predictor variable

Model	Unstandardised Coefficients		Standardised Coefficients	*t*	*p*	*F*	*R*	R^2
	B	SE	Beta					
Model 1[a]						4.012	0.334	0.111
(Constant)	33.533	9.456	-	3.546	**0.001***			
Language Stimulation	3.082	1.539	0.334	2.003	0.054			

Note. *p<0.05 significance

[a] Outcome Variable in model is Fine-Motor scores as measured by the Ages and Stages Questionnaire- third edition

Chapter 4: Discussion

Rapid rates of development are seen in preschool children, and is often seen in their cognitive, social-emotional and physical development. This development is influenced by the interaction between the child and their context. This study focused on the context of the home environment, aiming to explore if there is a relationship between stimulation provided in the home environment, and the developmental outcomes of the preschool child, particularly in the domains of cognitive, social-emotional, and physical development. This study also aimed to explore which key stimulants were predictive of better developmental outcomes.

Overall, the results revealed significant relationships between the subscale Acceptance in the EC-HOME (i.e. accepting negative behaviours instead of using harsh punishments) and emotion perception, emotion recognition, and social-emotional cognition. Acceptance was a significant predictor in the models built with emotion recognition and social-emotional cognition as the developmental outcomes. A significant relationship was also found between the Language Stimulation subscale of the EC-HOME and fine motor ability. Language stimulation was however not a significant predictor of fine motor ability. More relationships emerged when the supplementary questionnaire was added to the EC-HOME. Although the developmental of the various domains do not occur in isolation, each of the domains will be discussed and the results interpreted separate to one another.

Cognitive Development

The descriptive statistics on the elements of executive function revealed a bi-modal distribution for cognitive switching, with a portion of the sample scoring 0 and an equal portion performing well. This distribution may indicate differences in the stages of development of this domain. This is seen in the literature, which states that each of the elements of executive function have different developmental trajectories (Best & Miller, 2010; Diamond, 2013). Cognitive shifting, as mentioned earlier, is the last element to develop and emerges after the age of four (Diamond, 2013; Garon et al., 2008). Since the sample included children from the age of three-and-a-half, a difference in their cognitive switching performance is not unexpected.

The results suggest that the cognitive development as measured by executive function of South African children is similar to that of an Australian sample, showing that their rate of development was consistent with a Western sample. Although the Australian sample is made up of individuals that are distributed across relative socioeconomic advantage and disadvantage (Howard & Melhuish, 2017), this does not equate the context of the participating children to the Australian sample. Although not the main focus of this study, it is worth mentioning that based on the difference in context, the sample from Soweto of lower SES was expected to have poorer executive function scores given the relationship between low SES and poor executive function in other countries (Bradley & Corwyn, 2002; Hackman, Gallop, Evans, & Farah, 2015; Raver, McCoy, Lowenstein, & Pess, 2013). Despite this, the participants in this study showed similar cognitive development patterns as the Western norms. This is consistent with other studies on South

African children (Cook et al., 2019; Howard et al., In review). This result may be attributed to two potential influential factors.

The first potential factor is the impact of the children's high levels of physical activity in South African townships (Cook et al., 2019; Draper et al., 2017). As physical activity has been shown to contribute positively to cognitive development, this may have contributed to the results seen. Best (2010), reviewed research that supports the positive relationship between physical activity and cognitive development. The intensity of physical activity also contributes to this relationship, with vigorous exercise intensity shown to increase cognitive inhibition in adolescents (Peruyero, Zapata, Pastor, & Cervelló, 2017). One suggested mechanism behind this relationship is that exercise improves blood flow and oxygen delivery to the brain, thus improving brain function and development (Tomporowski, Lambourne, & Okumura, 2011). In Tomporowski and colleagues review (2011), they review literature that explains how physical activity facilitates the performance of children on tests of attention, decision making, memory and planning. Despite these findings on intensity of physical activity, a recent study in South Africa found that unstructured physical activity was not significantly associated with inhibition and cognitive shifting elements of executive function, and had a negative relationship to working memory (Cook et al., 2019). Physical activity was not measured or controlled for in this study, however future research should explore these relationships.

The other possible contributing factor is the effects of bilingualism on cognitive development. Bilingual children between the ages of seven and nine from low income families in Portugal and Luxembourg were found to perform significantly better in inhibition tasks as

compared to matched monolinguals (Engel de Abreu, Cruz-Santos, Tourinho, Martin, & Bialystok, 2012). Bilingual eight year old children from India and Canada were also found to perform faster on tasks recruiting inhibitory control and cognitive switching as compared to matched monolingual children (Bialystok & Viswanathan, 2009). This effect was also observed in toddlers at the age of two (Poulin-Dubois, Blaye, Coutya, & Bialystok, 2011). Furthermore, it was found that this bilingual advantage was not particular to certain elements of executive function, but was also present when bilingual children were required to recruit all three components to complete a task (Bialystok, 2011). Bialystok (2011) suggested that both languages are always active, and that inhibitory control would be essential in blocking interference from one language as you focus on another language. The participating children in the present study were not first language English speakers yet were familiar with basic English words. Although this study included a supplementary questionnaire that asked how many languages the child was able to speak, it did not capture the child's fluency in multiple languages. The bilingual effect may contribute to the explanation of the executive function scores of the sample.

One age group did however have higher scores as compared to the Australian sample. This was the children aged between five years, and five-and-a-half years. They showed better inhibitory control and cognitive switching elements of executive function when compared to the norm. Although this may have indicated better development in older South African children, this age category had only four participants in it, thus skewing the results of the comparison. Having only four participants in this category is too small a sample to run a comparative t-test on, thus bringing these results into question.

Stimulation in the home environment was hypothesised to have relationships with cognitive development. However, no significant relationships were found between stimulation in the home environment and elements of executive function, implying that the stimulation a caregiver provides in the home environment may not have a measurable impact on a child's cognitive development in this sample. This is contradictory to previous studies that found that elements of the home environment were related to cognitive test performances from the ages of nine months to 13 years old (Bradley & Caldwell, 1976; Bradley et al., 1988, 1988; Bradley, Corwyn, Burchinal, McAdoo, & Coll, 2001; Miquelote, Santos, Caçola, Montebelo, & Gabbard, 2012). These studies found that different types of stimulation in the home environment had stronger associations at different periods of the child's development. One study found that early maternal employment particularly during the first three years of life played a larger role in the child's cognitive outcomes than the quality of stimulation in the home (Brooks–Gunn et al., 2002). Brooks-Gunn and colleagues (2002) explain that although the mother may have less time available to the child, they are able to increase stimulating resources and activities into the child's life. This alternative influential factor may have also been present in this study and was not sufficiently captured by the instrument.

These results, or lack thereof, could reflect validity concerns with regards to the instrument measuring stimulation in the home environment, as it may not measure what it intends to measure. This instrument was developed and refined based on an American population (Bradley et al., 1988), and may not sufficiently capture elements in the South African home environment that contribute to the stimulation available to the child. This includes

elements such as the additional support provided by multiple caregivers in the home, the stimulation provided when playing outside with neighbours and friends, and cultural norms within adult-child relationships. These shortcomings of the EC-HOME will be readdressed and discussed further in the strengths and limitations of this discussion chapter.

The lack of correlations with the elements of executive function was thought to be as a result of the more unitary structure executive function may display at this age, as suggested by Wiebe, Epsy and Charak (2008). However, the single factor executive function was also found to have no significant relationships to stimulation in the home environment for this sample. This may once again be reflective of the questionable validity of the EC-HOME in capturing stimulation in a South African home environment, rather than an absence of a relationship. To avoid this in future studies, the HOME questionnaire needs to be adapted and developed in accordance with a South African context. These results challenge the narrative of the "Township child" as being as vulnerable, dependent, ignorant and passive to the influence of their environment. These children have the ability to actively engage with their environment and find strategies to cope with their compromised situations (McGarry & Shackleton, 2009). These results support the theory that children living in the township have alternative forms of support available to them that promote cognitive development.

Social-Emotional Development

On the measures of social-emotional cognition, the participating children made significantly more errors when compared to the Australian preliminary norms for the PEERS assessment. This suggests that the participating children's emotion perception and emotion recognition skills were less developed in comparison to an Australian sample. There were also no sex differences found, which is consistent with studies amongst children between 3 and 5 years of age in the USA (Guajardo, Snyder, & Petersen, 2009). These results are not comparable to other studies on social-emotional development as different elements of are captured, different definitions of social-emotional development are used, as well as conceptual differences that underlie the various instruments used (Humphrey et al., 2011).

It is however essential to bear in mind that this was measured using an Australian assessment that has not previously been used with South African children. Although basic emotion recognition is consistent across cultures, cultural variation in recognition accuracy is still present (Elfenbein & Ambady, 2002). This has been attributed to language differences in the expression of emotions. This was not a factor in this study as the emotions that the children were required to identify were communicated to them in a language that they understood, thus reducing language differences. This presents a strength in this study, as the influence of comprehension difficulties were reduced.

The cultural variation could also be attributed to the way in which emotions are expressed across cultures. Emotions may be better understood when judging members of the same ethnic or racial group (Elfenbein & Ambady, 2002). In this case, the presence of the other-race effect

may have contributed to the item bias. The participating children have developed facial prototypes based on the types of faces that they have been exposed to. When exposed to unfamiliar racial groups, people make more recognition errors, and thus more emotion recognition errors (Kelly et al., 2007). Since the PEERS included images of Asian, white Australian and Aboriginal people, and there was a lack of black faces, more recognition errors were expected as the participants had no prior exposure to these races.

In answering the research question about the relationship between stimulation in the home environment and social-emotional development, it was found that in cases where caregivers accepted the children's negative behaviour instead of using harsh punishments, relatively higher levels of both emotional recognition and emotion perception were found. Both of these relationships were positive and moderate in strength. This is consistent with previous research that showed, conversely, that parenting styles that were hostile and intrusive correlated with poor emotion recognition (Kujawa et al., 2014). Parenting styles are reflective of whether a child's behaviours will be treated with harsh punishment or not (i.e. the acceptance of behaviour or not). Kujawa and colleagues (2014) suggested that parental anger along with interfering with the child's autonomy may limit the child's experience with a wide range of social and affective cues. This then contributes to the impairment in the development of emotion recognition skills. In the case of this sample, higher levels of behavioural acceptance would indicate less hostile parenting techniques, potentially introducing the child to a wider range of social cues instead of limiting their social experience to negative affective cues.

Contradictory to these results, other research has demonstrated that the use of yelling and spanking as a form of discipline is positively related to emotion understanding (Pears & Moses, 2003). Pears and Moses (2003) suggested that using these strategies as a form of discipline likely involves the expression of strong feelings, and that the child learns to identify and understand these feelings. They also found that the use of consequences as a form of discipline, such as removing privileges, negatively correlated with emotion understanding (Pears & Moses, 2003). The support for this result was the fact that this form of discipline does not necessarily involve the expression of emotions. More research is needed in this area to understand how acceptance of behaviours as indicated by parenting styles contribute to emotion recognition and understanding.

This construct, like executive function, may be more appropriate for this age group when treated as a single latent variable. The combined social-emotional cognition showed a positive significant relationship with acceptance of behaviours, indicating that higher levels of acceptance of behaviours correlate with higher social cognition scores. Correlational analysis however does not give direction to the relationships found between variables. It may be the case that caregivers with higher levels of behavioural acceptance promote the development of an understanding of emotions. It may, however, be that children who have well-developed social cognition and understanding of emotions do not display behaviours that require harsh punishments (Pears & Moses, 2003).

Although all relationships found were significant, the results revealed that acceptance had a stronger relationship to emotion recognition, as measured by the *Finding Emo* subtest, as

compared to emotion perception, as measured by the *Matching Emo* subtest. The strength of the correlation to the latent social-emotional cognition construct was between the emotion recognition and emotion perception subtest correlation strengths. This was most likely as a result of the latent construct being made up of the averaged combination of both subtests. This variation in strength was further supported by the regression models ran. Acceptance was a significant predictor of emotion recognition, explaining 20.9% of the variation in emotion recognition. Acceptance did not significantly predict emotion perception. The third model showed that acceptance was a significant predictor of SEC, explaining 12.8% of the variation seen in SEC. This lower percentage is not unexpected as SEC is a combination of emotion recognition and emotion perception, the latter of which is not a predicted by acceptance. This makes the first model the best model as it explains the most variation. This once again corresponds with Kujawa and colleagues (2014) research that hostile and intrusive parenting styles (i.e. the use of harsh punishment in response to children's negative behaviour) correlated with poor emotion recognition. Thus, conversely, for this sample, the caregivers' acceptance of negative behaviour instead of the use of harsh punishment related to, and predicted, higher emotion recognition.

This result however may be reflective of the shortcomings of the EC-HOME, as the Acceptance subscale only had four items. It is questionable whether four items are sufficient to capture this construct. One of these items was an interview item, asking the caregiver if physical punishment was used on the child during the week (Caldwell & Bradley, 2003). Answering this question most likely reflects a response bias. The remaining three items were based on observations made by the researcher during the home interview process. However, adults and

children are most likely to be on their best behaviours in from of a stranger, once again, not allowing the sufficient capturing of the construct of Acceptance.

Although additional items were not added to the Acceptance subscale of the EC-HOME, the use of the supplementary questionnaire revealed another relationship. The revised subscale of language stimulation was negatively associated with emotion recognition. The addition to this scale was whether the participating child spoke more than one language. A study by Lorette and Dewaele (2015) found no correlation between the number of languages known and emotion recognition scores. The study used audio-visual stimuli to mimic day-to-day situations where we rely on audio, visual and vocal cues simultaneously to gather information about emotion (Lorette & Dewaele, 2015). It was also conducted on people from Britain, Ireland, North America, continental Europe and Asia, with ages between 11 and 85.

Lorette and Dewaele (2015) did however find a relationship between emotion recognition scores and language proficiency. The present study differed in that the emotions were only presented visually and did not rely on the language proficiency of the participating child. Lorette and Dewaele (2015) also found that the cultural background of the participant related to emotion recognition, particularly with Asian participants. This once again supports the above-mentioned possibility of the other-race effect contributing to biases in the items used to assess emotion recognition for this South African sample.

Physical Development

The participating children had gross motor scores in line with comparative norms, and was consistent with previous studies in South Africa (Hsiao et al., 2017). Their fine-motor scores, however, were significantly higher than the norm, contradictory to the results found by van Heerden et al. (2017), who found that South African children from Kwa-Zulu Natal performed significantly lower than the US, Norway and Korea. This difference may be attributed to socioeconomic status (SES), as 78.6% of children in Kwa-Zulu Natal live in income poverty, and compared to the 43.8% of children in Gauteng living in income poverty (Hall & Sambu, 2018). As SES is an influential factor in development, this may contribute to the difference in development between children from Kwa-Zulu Natal and children from Gauteng. The differences in fine motor ability may also be attributed to the quality of stimulation provided at the preschool (Venetsanou & Kambas, 2010). The children participating in this study all attended preschool where the researchers observed exposure and familiarity with the use of scissors and colouring-in equipment. These positively contributed to the score of the fine motor subtest of the ASQ-3, which assessed these particular skills. This result may be representative of children attending preschools that stimulate fine motor skills.

The question of whether stimulation in the home environment is related to physical development was partially answered by the significant correlation found between language stimulation and fine motor scores, where more language stimulation available to the child correlated to higher fine motor scores. This relationship between hand motor movement and language is seen when hand gestures and movements accompany and facilitate word retrieval

during the tip-of-the-tongue phenomenon (Beattie & Coughlan, 1999), where a person knows the word that they want to use but they are unable to access or retrieve the word (Ward, 2015). Furthermore, a study found that in chimpanzees, fine motor manipulation of objects was often accompanied by mouth movements (Waters & Fouts, 2002). This relationship may indicate a shared underlying neural network between areas of the brain responsible for fine motor movements and language. More evidence linking the hand and the mouth is produced by Iverson & Thelen (1999) who provide a chapter detailing linkages from the Babkin's reflex in infants that is accompanied by the opening of the mouth, to the universal use of gestures during speech. Although there was a significant relationship, language stimulation was not a significant predictor of fine motor scores in the regression models. As regression models require larger samples to produce more accurate models, the small sample size may have impacted on this result (Field, 2009).

No other significant correlations were found between stimulation in the home environment and motor development. This is consistent with a study on infant motor development (younger than five months) that also found no statistically significant relationship between stimulation in the home environment and infant motor development (Abbott, Bartlett, Fanning, & Kramer, 2000). This was attributed to the homogeneity of the sample were little variation, and thus little co-variation, is seen, as well as the insensitivity of the HOME instrument. These results are however contradictory to other research on infants, where a positive relationship between stimulation in of the home environment and global motor development was found (Miquelote et al., 2012). A study in Mexico also found positive relationships between

the gross and fine motor development of three-year-old children and home stimulation (Osorio, Torres-Sánchez, Hernández, López-Carrillo, & Schnaas, 2010). The use of basic home stimulation intervention programmes were also found to significantly improve motor ability in children younger than three years old who were infected by the human immunodeficiency virus (HIV; Potterton, Stewart, Cooper, & Becker, 2010). Although the children still had significant motor delays, the stimulation provided at home made a significant contribution to the improvement in their motor development. These children were also underweight and had growth retardation which may have affected their motor development (Potterton et al., 2010).

Using the EC-HOME with the supplemented items indicated a significant negative relationship between learning materials available to the child and gross motor scores. This supplemented subscale included electronic devices as learning materials. The result indicated that the more learning materials available to the child, the lower they score for gross motor ability. This may suggest that children engaging with electronic devices such as tablets, cell phones, computers and television, display more sedentary behaviour. Another study indicated a relationship between the use of electronic devices and fine motor ability, suggesting that infants who actively used a touchscreen device at an early age had developed earlier fine motor abilities (Bedford et al., 2016). This was further supported by research on three-year-old children, who showed that smart device usage was positively correlated with fine motor ability (Moon et al., 2018). With technological advancements in smart devices available to children, more research needs to be done in this area to understand the impact of those devices on motor development.

The supplemented questionnaire also found a negative correlation between parental modelling of behaviour and gross motor scores. The additional item was the caregiver having a consistent bedtime routine during the week. This correlation may indicate a methodological concern as the items that were added to the EC-HOME questionnaire were not statistically confirmed to fall under the chosen subscales. A factor analysis may reveal that this additional item does not load on the modelling subscale of the home questionnaire. This was beyond the aims of this study. However, the inclusion of items does indicate that additional items that capture stimulation in the South African environment may tease out the nuances of the impact that they have on child development. This correlation done on the sub-sample also revealed a significant negative relationship between the variety subscale of the EC-HOME and gross motor scores that was absent when correlated with the sample as a whole. This would mean that a lifestyle that provides a variety of experiences to the child was related to lower levels of gross motor ability in the sub-sample. This variety subscale of the EC-HOME had no additional supplementary items, and as mentioned before, the relationship was not present in the whole sample. This correlation may be a result of the small size of the sub-sample that was used for this analysis.

These results however must be interpreted with caution. The measure used to capture motor ability may not have accurately captured the children's skills. The results from this study are based on the 48-month ASQ-3 questionnaire. Since over 60% of the sample were older than four-and-a-half years old, it is expected that the older children would perform better. This is supported by the skewed distribution of motor ability scores. The correlation found between

language stimulation and fine motor skills however is not impacted by age, as seen in the regression model.

Strengths and Limitations

As this was an explorative study that was correlational in nature, none of the relationships found indicated causality. Although the regression models do make the variables theoretical predictors and theoretical outcomes, the research design does not allow for conclusions that one variable causes a change in the other. The relationships seen also do not rule out the effect of other variables that were not controlled for in this study. However, this study does form the foundation on which future research can be built upon.

Based on the literature reviewed in chapter one, positive relationships were expected to be seen between developmental outcomes and stimulation in the home environment, more specifically the caregiver's responsivity to the child, academic stimulation and learning material available to the child. Many of these relationships were absent and may be attributed to the methodological shortcomings in this study. Methodological concerns include biases in the instruments used to capture the various variables, theoretical oversights, the way in which the sample was recruited and the small sample size.

One important issue is that of the measurements used to capture the various variables. If the measurements did not accurately capture the constructs, the results presented must be interpreted with caution. This was seen in the use of the PEERS to capture social-emotional

cognition. This measure may have had item bias, in which cultural differences and experiences may have affected the results of the participants. This would explain why few significant relationships were found between stimulation in the home environment and elements of social-emotional cognition. The measure also presents a limitation in the restriction of emotion recognition to visual information, whereas in reality, we use visual and auditory information to make judgements about emotion (Elfenbein & Ambady, 2002). However, this is a new methodology applied to study social-emotional cognition in preschool children, an area that is often neglected in early childhood development research.

Furthermore, the use of innovative iPad-based assessments presents a strength in this study. iPad-based assessments made the assessments accessible in all environments without the need for internet access. The colourful game-based tools also allowed the children to become familiar with the iPad and the way it worked, thus reducing testing biases. iPad-based tests are advantageous in that they provide an easy administrative interface, they are readily available, cost effective and accessible, and contain fully-automated scoring. iPad-based tests also provide easy data manageability, are non-threatening to the participants, accurately record reaction times, and are useful in mass yet brief screenings (Bauer et al., 2012; Clionsky & Clionsky, 2014; Onoda et al., 2013; Zhang, Red, Lin, Patel, & Sereno, 2013). This supports the movement towards iPad-based assessments that can be used in various contexts throughout South Africa.

Nevertheless, not all the instruments used in this study were iPad-based. The EC-HOME questionnaire presented a few concerns in capturing stimulation in the home environment. One of the requirements of the questionnaire was to have the child present during the interview. This

made it possible for the researcher to observe the day-to-day caregiver-child interactions and assess them accordingly. The day-to-day activity of the participating children often involved playing outside with neighbours and friends once they returned from preschool. That meant that making the child present during the interview did not simulate naturalistic interactions. This may have also presented a cultural bias as in many African cultures, it may not be appropriate for the child to be present in adult company. A similar concern was noted in a review that found that in Indian traditions, children were not encouraged to talk or participate in adult conversations as a sign of respect (Bradley & Corwyn, 2005). This tradition may be similar in various African cultures. This, once again, questions whether the observed behaviours were representative of the everyday caregiver-child interactions.

Another concern was the caregiver self-report format of the interviews. This presents a strength as the caregiver may provide the most accurate information with regards to the child. However, this format of responses, in an interview setting with a stranger, may have led to response biases where the caregiver gave socially appropriate responses. There was no way to validate the truthfulness and accuracy of the caregiver's responses in this study. Furthermore, in cases where children live in multigenerational homes, as commonly found in South African homes, one caregiver may play a specific role at a particular time such as the grandparent being the disciplinarian after school. Then, once the child's parent is home, they play a different role for the child, thus making a different contribution to the child's overall experiences of stimulation in the home environment. By questioning only one caregiver, we fail to gather information on the child's home environment as a whole.

During the home interview process, it was brought to the researcher's attention that there were situations where the child stayed with one parent or caregiver during the week, and with another parent or caregiver over the weekend. In some cases, these were the homes of different parents and in other cases it was the homes of the grandparents as well as the parents. Conducting the EC-HOME in one context at one point in time does not allow for the consideration of the other context. This begs the question of which context has a more significant role in the development of the child.

Another element that may promote social-emotional development in particular is the number of people living in the house, which is not captured by the EC-HOME. As indicated in the literature review, children in larger social groups will be exposed to more faces and will have to decode more intentions and predict more behaviours (Blakemore, 2008). This factor could promote social-emotional development but was not captured in this study. This is an important element to consider in future research on South African child's development of social-emotional cognition.

Despite the above limitations in the use of the EC-HOME, a strength of this study was the inclusion of the supplementary interview schedule that the research team developed. This allowed for the exploration of factors that may contribute to the overall stimulation available in the home environment that the EC-HOME may not sufficiently capture. Relationships emerged where they had previously not been present, indicating the contribution that additional items make in uncovering the nature of the relationship between the home environment and the child's development. More research is needed to expand on the EC-HOME subscales in order to

fully capture the elements of stimulation present in South African homes. This could contribute to strengthening the validity of the EC-HOME instrument for the South African context.

This study had some theoretical shortcomings. In the case of the EC-HOME, the relativity of the items in each of the subscales can be questioned. For example, the EC-HOME places importance on academic stimulation in the home environment. However, children may be sent to preschool with the assumption that the preschools will provide academic stimulation thus taking that responsibility away from the caregiver. There is also an exclusion of cultural practices that significantly contribute to the practice of stimulation in the home environment. This includes practices such as carrying the baby on the mother's body, feeding on demand, immediately pacifying babies when they cry, as well as mother and baby sleeping together, which could contribute to the subscale that captures caregiver responsivity towards the child (Blair & Raver, 2012; Tomlinson et al., 2005). These are factors that contribute to the child's social-emotional development as well as gross motor skills that were overlooked in this study (Tomlinson et al., 2005).

Another example of subscale relativity is the construct of caregiver responsiveness. What constitutes responsive parenting varies according to different societies and cultural practices (Bradley & Corwyn, 2005). It would be worth exploring which practices South African caregivers consider responsive, and then adapt the EC-HOME accordingly. In terms of the developmental outcomes, the children's development was assessed against a sample of Australian children as the norm. As South Africa's context and physical environment differ to that of Australia, can it be

expected that children will develop in the same way? The establishment of South African norms is thus needed, so that the South African children are compared justly.

The measures used were not the only methodological concern that affected the validity of this study's results. The recruitment of the sample was based on convenience and the volunteer nature of the caregivers, presenting a possible limitation. In its nature, volunteer samples often have traits that may be different to the general population. Their willingness to participate may also demonstrate the interest the caregiver already had in the topic of early childhood development. The use of these non-probability sampling techniques reduces the probability of the sample being random and statistically representative of the larger population (Daniel, 2012). This limits the generalisability of the results of this research project. This sample was, however, appropriate for the present study which targeted a preschool-going population. The results may be transferable to communities with similar historical backgrounds, specifically targeting elements such as the selection of four-year old children attending preschool, thus not disregarding the results found (Daniel, 2012; Durrheim & Painter, 2014).

The lack of significant relationships found may also partly be attributed to the sample size, which was small due to time and resource constraints, increasing the standard error (Babbie, 2013). This means that there was a lower chance of having an accurate estimate of the averages of the population. The small sample size resulted in unequal age category groupings, which limited the comparability of the group performances. The small age categories also have a lower chance of being representative of the population. The sample size was also less than ideal for the regressions that were run. Hence, the results provided must be read with caution. The sample of

34 dyads does however satisfy the central limit theorem which states that samples larger than 30 will have a normal sampling distribution (Field, 2009). This sample size was also appropriate, as it was a pilot study forming part of the larger SUNRISE project, thus contributing to the recruitment and data collection plan of the larger study.

Once the sample was recruited, the procedure in which the data was collected may have affected the results seen above. For example, the EC-HOME required the researcher to conduct interviews in the homes of the participants. This process was somewhat invasive, and the researcher, along with the fieldworker had to navigate this carefully. There were some participating caregivers that greeted the researchers with suspicion, cautious of the researchers that were making judgements about them. This made the process of establishing rapport significant, to lower the defensiveness of the caregiver. Other caregivers took the opportunity to share personal information with the researchers, hoping the researchers could provide aid. This may have shifted the researcher's perceptions of the participants, and although the measures were quantitative in nature, they did rely on the judgement of the researcher. The researcher must be aware of the contribution to the possible biases seen in the study.

Having a field worker as part of the research team was a considerable strength in this study and was very valuable in establishing rapport during the home visits. Participants seemed more at ease once they realised the field worker was a member of their community, thus helping to bridge the cultural barrier. This, as well as her ability to communicate with the participants in their various home languages, was an advantage of having a field worker as part of the research

team. The field worker was also trained in the various instruments used throughout the study, providing her with the information required to avoid any miscommunications with participants.

Recommendations for Future Research

Future research can build on the foundation provided by this study by including extraneous variables that were not captured in this study. This includes parenting styles, attachment of the child to the caregiver, cultural practices, and SES. SES is known to be an influential factor the development of the child and is another contributing component that SUNRISE has included in its pilot studies (Blair & Raver, 2012; Bradley & Corwyn, 2002; Hackman & Farah, 2009). As mentioned earlier, the research partner that formed part of this study's research team is conducting a parallel study with a focus on SES, demographic variables and the development of preschool children. Future papers will include the integration of the data collected in these two studies.

Future research could also develop and validate the instrument used in this study to capture stimulation in the home environment, the EC-HOME. This may provide insights into the types of stimulation in the home environment that promote and contribute to the development of preschool aged children. Ways of strengthening the instrument include the addition of items that contribute to the subscales, a factor analysis to confirm the loading of the items onto each subscale, and the possible inclusion of multiple people in the interview process as a form of cross validation. This may help capture the home environment in its entirety. This, along with the

PEERS instrument should be validated and adapted for the South African context. All of the measures used in this study could also undergo reliability analysis for the South African preschool population. This would require larger sample sizes to produce sound results. This would then provide evidence supporting the use of these measures in the South African context, adding psychometric value to the field of child psychology in South Africa.

Future studies could include comparisons across rural and urban townships in South Africa, high and low SES, across different cultural groups, and across different geographic locations in South Africa to get an idea of the variation of home environments across the country. A follow-up study on this sample after grade one is also recommended, as an examination of whether their developmental advantage during preschool is still present in grade one, and thereafter. All the above recommendations could then contribute to intervention studies, where cost effective interventions can be developed for the preschool child, based on the home environment.

Conclusion

The development of the child is largely influenced by their environment, including but not limited to their home environment. The development that takes place during the preschool years lays an important foundation impacting the trajectory of the rest of their life. This study aimed to explore whether stimulation provided in South African homes were related to the developmental outcomes of preschool-going children. The findings presented are suggestive of

relationships between the caregiver's acceptance of the child's negative behaviours and the development of the child's emotion recognition. There was a relationship found between language stimulation in the home environment and the development of a child's fine motor ability. However, further research is needed in these areas to better understand these associations.

This study places emphasis on the positive impact that the home environment may have, with hopes of changing the narrative of hopelessness in contexts that are not thriving. It may start to shift the narrative of the 'Township Child', as they too have support in their environments that promote development in a unique way. This study builds the foundation in uncovering the types of stimulation present in such homes, with the aim of promoting elements of the home environment that support the development of future generations to come. If we can promote small inexpensive ways of promoting our children's development, we can give them a head start towards achieving their full potential.

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Appendices

Appendix 1:

ASQ-3™ Ages & Stages Questionnaires®

48 Month Questionnaire

45 months 0 days through 50 months 30 days

Please provide the following information. Use black or blue ink only and print legibly when completing this form.

Date ASQ completed: _____

Child's information

Child's first name: _____ Middle initial: _____ Child's last name: _____

Child's date of birth: _____

◯ Male ◯ Female

Person filling out questionnaire

First name: _____ Middle initial: _____ Last name: _____

Street address: _____

Relationship to child:
◯ Parent ◯ Guardian ◯ Teacher ◯ Child care provider
◯ Grandparent or other relative ◯ Foster parent ◯ Other: _____

City: _____ State/ Province: _____ ZIP/ Postal code: _____

Country: _____ Home telephone number: _____ Other telephone number: _____

E-mail address: _____

Names of people assisting in questionnaire completion: _____

Program Information

Child ID #: _____

Program ID #: _____

Program name: _____

GROSS MOTOR

	YES	SOMETIMES	NOT YET	
1. Does your child catch a large ball with both hands? *(You should stand about 5 feet away and give your child two or three tries before you mark the answer.)*	○	○	○	___
2. Does your child climb the rungs of a ladder of a playground slide and slide down without help?	○	○	○	___
3. While standing, does your child throw a ball *overhand* in the direction of a person standing at least 6 feet away? To throw overhand, your child must raise his arm to shoulder height and throw the ball forward. *(Dropping the ball or throwing the ball underhand should be scored as "not yet.")*	○	○	○	___
4. Does your child hop up and down on either the right or left foot at least one time without losing her balance or falling?	○	○	○	___
5. Does your child jump forward a distance of 20 inches from a standing position, starting with his feet together?	○	○	○	___
6. Without holding onto anything, does your child stand on one foot for at least 5 seconds without losing her balance and putting her foot down? *(You may give your child two or three tries before you mark the answer.)*	○	○	○	___
		GROSS MOTOR TOTAL		___

1.5m

1.8m

50cm

FINE MOTOR

	YES	SOMETIMES	NOT YET	
1. Does your child put together a five- to seven-piece interlocking puzzle? *(If one is not available, take a full-page picture from a magazine or catalog and cut it into six pieces. Does your child put it back together correctly?)*	○	○	○	___
2. Using child-safe scissors, does your child cut a paper in half on a more or less straight line, making the blades go up and down? *(Carefully watch your child's use of scissors for safety reasons.)*	○	○	○	___
3. Using the shapes below to look at, does your child copy at least three shapes onto a large piece of paper using a pencil, crayon, or pen, without tracing? *(Your child's drawings should look similar to the design of the shapes below, but they may be different in size.)*	○	○	○	___
4. Does your child unbutton one or more buttons? *(Your child may use his own clothing or a doll's clothing.)*	○	○	○	___
5. Does your child draw pictures of people that have at least three of the following features: head, eyes, nose, mouth, neck, hair, trunk, arms, hands, legs, or feet?	○	○	○	___
6. Does your child color mostly within the lines in a coloring book or within the lines of a 2-inch circle that you draw? *(Your child should not go more than 1/4 inch outside the lines on most of the picture.)*	○	○	○	___
		FINE MOTOR TOTAL		___

5cm

0.5cm

Appendix 2: **Early Childhood HOME**

Bettye M. Caldwell and Robert H.
Summary Sheet

Participant code_____ Date _____ Visitor _____

Address _____ Phone _____

Child participant code_____ Birth date _____ Age _____ Sex _____

Interviewee participant code _____ If other than parent, relationship to child _____

Family composition _____
(persons living in household, including sex and age of children)

Family ethnicity _____ Language spoken _____ Maternal education _____ Paternal education _____

Is mother employed? _____ Type of work when employed? _____ Hrs/Wk _____

Is father employed? _____ Type of work when employed? _____ Hrs/Wk _____

Current child care arrangements _____

Summarize past year's arrangements _____

Other person(s) present during visit _____

SUMMARY

Subscale	Possible Score	Median	Actual Score	Comments
I. LEARNING MATERIALS	11	8		
II. LANGUAGE STIMULATION	7	6		
III. PHYSICAL ENVIRONMENT	7	6		
IV. RESPONSIVITY	7	6		
V. ACADEMIC STIMULATION	5	4		
VI. MODELING	5	3		
VII. VARIETY	9	8		
VIII. ACCEPTANCE	4	4		
TOTAL SCORE	55	40		

Early Childhood HOME Record Form

Place a plus (+) or minus (-) in the box alongside each item depending on whether the behavior is observed during the visit, or if the parent reports that the conditions or events are characteristic of the home environment. Enter the subtotals and the total on the Summary Sheet. **Observation (O), Either (E), or Interview (I) is indicated for each item.**

I. LEARNING MATERIALS		24. Rooms are not overcrowded with furniture. **O**	
1. Child has toys which teach colors, sizes, and shapes. **E**		25. House is reasonably clean and minimally cluttered. **O**	
2. Child has 3 or more puzzles. **E**		**IV. RESPONSIVITY**	
3. Child has a record, tape, or CD player and at least 5 children's records, tapes, or CDs. **E**		26. Parent holds child close 10-15 minutes per day. **I**	
4. Child has toys or games permitting free expression. **E**		27. Parent converses with child at least twice during visit. **O**	
5. Child has toys or games requiring refined movements. **E**		28. Parent answers child's questions or requests verbally. **O**	
6. Child has toys or games which help teach numbers. **E**		29. Parent usually responds verbally to child's speech. **O**	
7. Child has at least 10 children's books. **E**		30. Parent praises child's qualities twice during visit. **O**	
8. At least 10 books are visible in the apartment or home. **E**		31. Parent caresses, kisses, or cuddles child during visit. **O**	
9. Family buys and reads a daily newspaper. **I**		32. Parent helps child demonstrate some achievement during visit. **O**	
10. Family subscribes to at least one magazine. **I**		**V. ACADEMIC STIMULATION**	
11. Child is encouraged to learn shapes. **I**		33. Child is encouraged to learn colors. **I**	
II. LANGUAGE STIMULATION		34. Child is encouraged to learn patterned speech. **I**	
12. Child has toys that help teach names of animals. **E**		35. Child is encouraged to learn spatial relationships. **I**	
13. Child is encouraged to learn the alphabet. **I**		36. Child is encouraged to learn numbers. **I**	
14. Parent teaches child simple verbal manners (please, thank you, I'm sorry). **I**		37. Child is encouraged to learn to read a few words. **I**	
15. Parent encourages child to talk and takes time to listen. **I**		**VI. MODELING**	
16. Child is permitted choice in breakfast or lunch menu. **I**		38. Some delay of food gratification is expected. **I**	
17. Parent uses correct grammar and pronunciation. **O**		39. TV is used judiciously. **I**	
18. Parent's voice conveys positive feelings about child. **O**		40. Child can express negative feelings without harsh reprisal. **I**	
III. PHYSICAL ENVIRONMENT		41. Child can hit parent without harsh reprisal. **I**	
19. Building appears safe and free of hazards. **O**		42. Parent introduces Visitor to child. **O**	
20. Outside play environment appears safe. **O**		**VII. VARIETY**	
21. Interior of home or apartment is not dark or perceptually monotonous. **O**		43. Child has real or toy musical instrument. **E**	
22. Neighborhood is aesthetically pleasing. **O**		44. Child is taken on outing by a family member at least every other week. **I**	
23. House has 100 square feet of living space per person. **O**		45. Child has been on a trip more than 50 miles during past year. **I**	

46. Child has been taken to a museum during past year. **I**		**VIII. ACCEPTANCE**	
47. Parent encourages child to put away toys without help. **I**		52. No more than one instance of physical punishment occurred during the past week. **I**	
48. Child eats at least one meal on most days with mother and father. **I**		53. Parent does not scold or yell at or derogate child more than once. **O**	
49. Parent lets child choose certain favorite food products or brands at grocery store. **I**		54. Parent does not use physical restraint during visit. **O**	
50. Parent uses complex sentence structure and vocabulary. **O**		55. Parent neither slaps nor spanks child during visit. **O**	
51. Child's art work is displayed some place in house. **O**			

TOTALS

I_____ II____ III____ IV____ V____ VI____ VII____ VIII____ TOTAL_____

– – – – – – – –

Appendix 3:

Semi-structured interview schedule

Introduction: A good technique for beginning the interview, and for helping the parent to relax, is to ask them to describe a typical day in the home, using something like the following statement:

You will remember that we are interested in knowing the kinds of things _____ does when she is at home. A good way to get a picture of what her days are like is to have you think of one particular day--like yesterday--and tell me everything that happened to her as well as you can remember it. Start with the things that happened when she first woke up. It is usually easy to remember the main events once you get started.

I am going to ask you some questions about daily life in your household—things the whole family might do together, trips you take and Visitors who come to see you, toys you have for _____ to play with, things _____ likes to do, how you train and discipline_____, and what some of the family routines are--things like that. As I ask them, I may seem to be jumping around from on subject to another. If I go too fast, or if you have any questions, don't hesitate to stop me.

Items 1-7, 11-12. *A good way for us to get started is to talk about some of the toys you've gotten for him/her that s/he likes to play with. I can see some of them in this room* (say only if true), *but there are probably others I can't see.* Then ask, if necessary, about

- Toys that teach colors, sizes, shapes (**Item 1**)
- Puzzles (3 or more) (**Item 2**)
- Tape recorder or CD player plus tapes and CDs (**Item 3**)
- Clay, paints, play dough, crayons and paper (sans coloring books) (**Item 4**)
- Fine manipulation toys (things that can be put together and taken apart (**Item 5**)
- Blocks, number games, dominoes, cards (**Item 6**)
- Children's books (**Item 7**)
- Shapes (other than puzzles) (**Item 11**)
- Toy animals, books about animals, animal puzzles (**Item 12**)

In the above list, **Items 11 and 12** are slightly out of sequence. However, they should be inquired about at the same time as the other learning materials.

Remember to offer friendly comments about the toys, how well they have been cared for, etc.

Items 8-10. *When you have little children, you don't get to do much reading yourself. How do you manage this? Do you take the newspaper?* If she doesn't spontaneously say so, ask, *Do you find time to read it?* Then, *How about magazines?*

Items 13, 14, 33-37. *When our children reach _____'s age, most of us start teaching them little things to say for us or for others. Let's talk about some of the things you have tried to teach _____. Incidentally, you don't have to have been successful in these ventures!* Then inquire about:

- The alphabet (**Item 13**).
- Manners (**Item 14**)
- Colors (**Item 33**)

- Rhymes and songs (**Item 34**)
- Spatial relationships (**Item 35**)
- Numbers (**Item 36**)
- Read a little bit (**Item 37**)

Once you have gotten positive answers to a few of the toy and equipment items, you might use that information as a base to praise the parent's foresight for getting things that help the child learn.

Item 15. *Is _____ a big talker? Does s/he like to talk to you? If s/he goes to a birthday party, can you get him/her to talk about it later? Have you ever tried getting him/her to talk to you about a video or TV program? How does that go?*

Item**s 16, 38.** *Is s/he a good eater? How do you decide what to give him/her for breakfast? For lunch? What if you are a bit slow getting it ready? How does s/he act? What do you do when that occurs?*

Items 17-25. Observation.

Item 26. *S/he's getting pretty big. Even so, does s/he ever want you just to sit and hold him/her? How often would you say that happens?*

Items 27-32. Observation.

Items 33-37. These have already been covered in the discussion of toys and teaching.

Item 38. Included with #16.

Item 39. *TV can be an important companion to mothers of young children. Sometimes it's their only contact with other adults. Do you turn yours on in the morning and leave it on?*

Item 40. *Almost all young children get mad at times, and most express that anger by yelling or hitting. Some throw tantrums. What do you do when _____ gets upset or mad and starts to act like that?*

Item 41. *One thing that really upsets most parents is if their child shouts things like, "I hate you," or even "I wish you were dead." Or they will actually hit them? Has _____ ever done that? What do (or would you do) if /s/he did?*

Item 42. Observation.

Item 43. *Is yours a musical household? Do you think s/he is old enough to be allowed to play (name some musical instrument), use it, handle it, etc?*

Items 44, 45, 46, 49. *Children of _____'s age like to go a lot. Tell me about some of the places you take her/him.* Then, if information does not come forth spontaneously, ask about:

- Family outing (**Item 44**)
- Trip (**Item 45**)
- Museum (**Item 46**)

- Grocery story (**Item 49**). If the grocery store was mentioned, say *That can be a real hassle, with the kids everything they see. Do you let him/her choose anything when you shop?* If it was not mentioned, ask specifically about it and inquire about choice as above.

Item 47. *Are you beginning to try to get him/her to put his/her toys away? How successful have*
you been at this?

Item 48. *Who all is here at mealtime?* If the information is not forthcoming, ask specifically, *What about her/his daddy? Is he here for at least one meal each day?*

Item 49. Already covered. If there is no child's art work in sight, ask about this? *Is s/he old enough to want you to display any of his/her drawings or paintings?* If the response is affirmative and you can't see them, ask *Where do you put them?*

Items 50-51. Observation.

Item 52. Discipline is always a touchy subject, so some little preamble might be given to segue into it. Example: *I have saved one of the hardest topics for last. You mentioned a little earlier that _____ sometimes gets a little rowdy (or sassy or belligerent, etc.). Does s/he ever get so out of control that you feel you have to spank him?* If no disobedience has been mentioned, say *Most children have times when they are moody (or hateful or disobedient, etc.). Does_____ sometimes act like that? When it happens do you feel s/he needs a spanking?* Depending on the response, ask *How often do you have to spank him/her? Think of just the past week. How often did that occur during the week?*

Items 53-55. Observation

Wrap-up. It is important to close the interview with pleasantries and to make certain that the parent has not in any way been upset by the visit. A sensitive interviewer will have no trouble composing a scenario for this part of the visit*: Has she been an easy baby to take care of? Is he harder to take care of than your other children have been? She's pretty big for her age: she must be a really good eater.* And so on. Also we urge Visitors to encourage parents to ask any questions of them at this time and to be quite candid in their answers. Parents will not infrequently inquire as to whether they have been doing the right thing or if they have bought the right toys. These questions should be answered as candidly and as honestly as possible within what the Visitor considers the limits of her own knowledge and expertise. It is important to mention that nobody knows the answers to those questions with complete certainty. Then, most importantly, a cordial thank you for the parent's time must never be forgotten.

Appendix 4: Supplementary Interview Schedule

Learning Materials

1. Is the child allowed to play games on an electronic device (cellphone, tablet, etc.)? If yes, what games do they play? (Assess whether games may be deemed educational)

Language Stimulation

2. What languages does the child speak? (More than one language get one point)

Responsivity

3. Level of Affectivity of the caregiver towards child (Observation: On a scale of one to ten, with one being cold and 10 being warm)

4. How do you respond to the child when they get hurt? (award point for comforting behaviours, such as holding the child and soothing them)

5. How can you tell if something is wrong without the child saying it explicitly? (Sensitivity of caregiver to the child)

Academic Stimulation

6. What is the best way to reward or encourage the child? (Acknowledgement and encouragement of achievements)

Modelling

7. What is your bedtime routine? How often do you follow the routine? (modelling of routines and structure)

Appendix 5:

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Dr Catherine Draper et al

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M180490

NAME: (Principal Investigator)	Dr Catherine Draper et al
DEPARTMENT:	MRC/Wits Developmental Pathways for Health Research Unit HSRC Office, Sweetwaters - KZN
PROJECT TITLE:	International Surveillance study of Movement Behaviours in the Early Years (SUNRISE)
DATE CONSIDERED:	Ad hoc
DECISION:	Approved
CONDITIONS:	A Sub-study under Primary Study M160534 Dr C. Draper. The PI must obtain written permission prior to data collection for each study site and the Provincial Ethics Committee
SUPERVISOR:	
APPROVED BY:	Professor CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	15/05/2018

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in **April** and will therefore be due in the month of **April** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

Appendix 6:

MRC/Wits Development Pathways for Health Research Unit
Department of Paediatrics and Child Health

Health behaviours and development of preschool children

Dear parent / legal guardian,

Who are we, and why are we doing this study?
I am Dr Catherine Draper, a researcher in the Department of Paediatrics at the University of Witwatersrand. Our research team is doing a study about physical activity, screen time and sleep in 4-year-old preschool children, and how this relates to their development and their home circumstances.

How are you involved?
We would like you and your son/daughter to participate in our study, since we are also interested in your perspective as a parent (or caregiver) of a preschool child and would like to find out more about your home circumstances.

What will we be doing with your child?
First, we will measure your child's height and weight. Your child will then do some tests to assess his/her physical, social, emotional and cognitive development. Someone who is able to speak your child's home language will help to make sure that your child is able to understand the tests and what is happening at all times. Some of the tests are done on an electronic tablet and are enjoyable for children!

We will also place a small electronic device called an accelerometer around your child's waist to measure his/her physical activity levels and the amount of time he/she sleeps at night. The accelerometer is about the same size as a small matchbox, and your child will wear it on a belt around his/her waist for eight full days (at school and at home), and while they are sleeping. The only time they should take it off is when they bath, shower or swim. At the same time, we would also like your child to wear a device that is attached to their leg with a sticky bandage. The bandage does not hurt them and should not cause any irritation to their skin. This device is placed in a waterproof pouch and should stay on for 8 days. After 8 days, the investigator will come to your child's preschool to collect both devices.

All the tests and the height and weight measurements will be done during the day at your child's preschool, and on the same day. We know that testing can be tiring for children, so we won't require them to spend longer than about 30 minutes per testing session. If they become tired or irritable during the testing, we will allow them to have a break, since we know it can be hard for young children to sit and concentrate for a long time! For the eight days that your child wears the devices, he/she does not need to do anything special, other than continue as he/she would normally with school, playing, activities and sleeping.

What we will be doing with you
Firstly, we would like you to complete 2 questionnaires. One questionnaire will ask you to tell us about your child's physical activity, screen time and sleep, and some things within

your home that influence these behaviours. The second questionnaire will ask about your circumstances at home, such as: who lives in the house, access to facilities such as running water and electricity, ownership of certain household goods, use of TV and sugar sweetened beverages, and information about the children in the home. Each questionnaire will take about 20-30 minutes to complete and will be done with you at your home. The questionnaires will be in your home language, or in English, depending on what you prefer.

Secondly, we would like to invite you to participate in an interview and a home observation about the following:

- Personal information about you and your family
- Learning possibilities at home for your preschool child
- The physical environment of your home
- Your beliefs and behaviours as a parent/caregiver
- Your family lifestyle

The interview and observation will take place at your home. The home visit will take about 45 to 90 minutes; this may vary depending on your answers. The interview will be conducted in your home language, or in English, depending on what you prefer. There are no right or wrong answers to the questions you will be asked in the interview, and it is important for you to answer these questions as honestly as possible so that we can fully understand your views on these issues. With your permission, we would like to audio record the interview to help us remember the details more accurately. For the observation, it is important that you and your preschool child are present and awake. Other family members or guests may be present, but their presence is not necessary. During the observation you and your child perform activities and interact as you would do in your day-to-day life.

Thirdly, we may invite you to be part of a small group discussion to hear your views about physical activity, screen time and sleep in preschool children. The group will be made up of about 8 parents from your community and will take about 60-90 minutes. At the focus group, a researcher will be present to help guide the discussion. A note taker will also be present, but just to be sure we remember everything that is said, we would like to audio record the discussion as well, with your permission.

Are there any risks to you or your child related to participating in this study?
There are no physical risks for you or your child related to participating in this study. None of the tests we will do will put your child at risk, or cause them physical harm. If we pick up any developmental problems when we are doing the assessment with your child, we will be able to assist with referring your child to someone who will be able to assist them. This might be someone like an occupational therapist, speech therapist, or doctor, depending on the problems your child is experiencing. We will also provide you with feedback at the end of the study.

Some of the things we will talk about in the focus group might make you feel uncomfortable or might cause you to feel stressed. They will not be forced to answer any questions if they don't want to. And if you feel uncomfortable or stressed during the focus group or interview, you can let us know that you would like to stop.

How will we protect you and your child during the study?
We will not use your name or your child's name or the name of your child's school when we report on the results of our study. Neither your name nor your child's name will be linked to any of the data we collect, so your identity will be protected.

The focus group discussion will be audio recorded, and your identity will be known to the other focus group participants. We will ask everyone to respect other focus group participants and not share what was said by specific people in the focus group, but we cannot guarantee that they will do this. The recordings and notes from the focus groups and interviews, along with all the other data, will be kept safe by the researchers on the project, and only the researchers will have access to this information. All of the information will be destroyed after 5 years.

You and your child will not be forced to take part in the study, and you will both be free to stop participating at any time if either of your feels uncomfortable or unhappy. If you or your child do not want to participate, this will not affect your involvement in any other activities at their preschool. If you do not wish to give consent, this will not have a negative effect on your relationship with your child's preschool.

As the research team, we may not be able to keep confidential, information about known or reasonably suspected incidents of deliberate neglect or physical, sexual or emotional abuse of a child. If we are given such information, we may report it to the authorities such as child welfare or the police.

How will you and your child benefit from this study?
There is no direct benefit to you and your child for taking part in the study. However, this study will help us to better understand the behaviours of preschool children, and how this relates to early childhood development. This information will hopefully help us to provide useful advice on how to promote healthy behaviours amongst preschool children, and we believe these healthy behaviours will help them reach their full potential.

If you have any questions about the study, please contact Dr Catherine Draper at 021 650 4570 or catherine.draper@wits.ac.za. Your signature also indicates that you understand the aims of the study and have had the opportunity to ask any questions which have been answered in your home language. Please also indicate if you give us permission to record the focus group discussion and interview.

If you have any queries about the study, please contact Dr Catherine Draper at (021) 650 4570, University of Cape Town. If you have any questions related to the ethics of this study please contact: Prof Penny, Chairperson of the University of the Witwatersrand, Human Research Ethics Committee (HREC), which is an independent committee established to help protect the rights of research participants at (011) 717 1234 or (011) 717 2301.

If you are happy to take part in the study, please read and sign the attached consent form and we will commence with the questions.

Thank you for your time and attention

Kind regards
Dr Catherine Draper

Consent form for child's participation in the study

I agree for my child to be a participant in this study. The goals and methods of the study are clear to me. I understand that the study will involve him/her doing some tests of his/her physical, social, emotional and cognitive development. All the details and purposes of this study have been explained to me. I understand that my child's data will not be anonymous to the researchers involved. I understand that I have the right to refuse for my child to participate in the study.

I agree for my child's participation in the study on condition that:
1. My child can withdraw from the study at any time voluntarily and that no adverse consequences will follow on withdrawal from the study.
2. My child has the right not to answer any or all questions posed in the focus group and not to participate in any or all of the procedures / assessments.
3. The University of the Witwatersrand Human Ethics committee has approved the study protocol and procedures.
4. All results will be treated with the strictest confidentiality.
5. Only group results, and not my child's individual results, will be published in scientific journals and in the media.
6. The study scientific team is committed to treating participants with respect and privacy through interviews conducted in private and follow-up counselling available on request.

Name of child: _____

Name of parent: _____

Signature / mark / thumbprint of parent: _____

Witness (if mark / thumbprint): _____

Date: _____

Name of research assistant: _____

Signature of research assistant: _____

Date: _____

Consent form for parents' participation in the study

I agree to be a participant in this study. The goals and methods of the study are clear to me. I understand that the study will involve completing questionnaires, being interviewed, and possibly being involved in a focus group. All the details and purposes of this study have been explained to me. I understand that my data will not be anonymous to the researchers involved. I understand that I have the right to refuse to participate in the study.

I agree for my participation in the study on condition that:
1. I can withdraw from the study at any time voluntarily and that no adverse consequences will follow on withdrawal from the study.
2. I have the right not to answer any or all questions posed in the questionnaires, interview and focus group and not to participate in any or all of the procedures / assessments.
3. The University of the Witwatersrand Human Ethics committee has approved the study protocol and procedures.
4. All results will be treated with the strictest confidentiality.
5. Only group results, and not my individual results, will be published in scientific journals and in the media.
6. The study scientific team is committed to treating participants with respect and privacy through interviews conducted in private and follow-up counselling available on request.

Name of parent: _____

Signature / mark / thumbprint of parent: _____

Witness (if mark / thumbprint): _____

Date: _____

Name of research assistant: _____

Signature of research assistant: _____

Date: _____

Consent form for audio recording

I have read and understood the project information sheet, and I understand that it is up to me whether or not the interview and focus group are audio recorded. I understand that if I do not wish to be recorded, it will not in any way affect how the interviewer and focus group facilitator treats me. I understand that if the interview and focus group are recorded, the tape will be destroyed five years after the interview. I understand that I can ask the person interviewing me and facilitating the focus group to stop recording, and to stop the interview and focus group completely at any time. I understand that the information that I give will be treated in the strictest of confidence, and that my name will not be used when the results are typed up.

☐ Yes, I give permission for the interview and focus group to be audio recorded.

☐ No, I do not give permission for the interview and focus group to be audio recorded.

Name of parent: _____

Signature / mark / thumbprint of parent: _____

Witness (if mark / thumbprint): _____

Date: _____

Name of research assistant: _____

Signature of research assistant: _____

Date: _____