PRESCHOOL, EXECUTIVE FUNCTIONS AND ORAL LANGUAGE AS PREDICTORS OF LITERACY AND NUMERACY SKILLS IN FIRST GRADE

BY

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CERTIFICATE OF APPROVAL

The Thesis by SYLVIA MWANZA-KABAGHE is approved as fulfilling the requirements for the award of the Degree of Doctor of Philosophy of the University of Zambia.

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DECLARATION

I, SYLVIA MWANZA-KABAGHE, hereby solemnly declare that, this thesis represents my own work and has not previously been submitted for a degree at the University of Zambia or any other University, and that it does not incorporate any published work or material from another University. This work has been developed and implemented with corporation between the University of Zambia, Zambia and Leiden University, The Netherlands.

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DEDICATION

It is rare that an individual finds an opportunity to thank the people that matter the most in their life. I, therefore, dedicate this work to my parents Mr. and Mrs. Mwanza for their help and support throughout my study. I also dedicate this work to my husband Mr. Wiza Kabaghe for his unending support and encouragement even in times when he had enough of his own work. He was always there for me. Mr. Kabaghe thank you so much, I love you. I also dedicate this work to my two daughters, Sasha Kabaghe and Sayiwe Kabaghe, both born during the process of studying for this PhD. Lastly, I dedicate this work to my Father in heaven for the grace and uncommon favours He has shown to me throughout my life.

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ABSTRACT

Preschool is known to prepare children for formal school. Studies worldwide have shown that children who attend preschool perform better than those who do not attend preschool in early years. There is some evidence that preschool curriculums that incorporate executive functions yield better results in literacy and numeracy in early school. Studies have also shown that oral language skills predict literacy attainment in primary school years. It is not known however, whether preschool prepares children to perform better in literacy and numeracy skills in the first grade in Zambia. This study, therefore, sought to establish the predictive role of preschool, executive functions and oral language in literacy and numeracy in the first grade in Lusaka Zambia.

Specifically, the study sought to establish the extent to which preschool prepares children for learning to read and numeracy in first grade when social economic status (SES) and intelligence are controlled. In addition, the study examined whether preschool is beneficial for the development of executive functions (EF) like working memory and inhibitory skills as well as whether preschool stimulates reading, writing and numeracy through executive functions. The study further assessed whether preschool may interfere with learning to read in first grade if children do not speak Nyanja at home and depend on school for learning to read as well as learning the language of instruction (Nyanja).

The study utilised a quasi-experimental design as children with and without preschool were assessed within the school setting. Eighteen schools took part in the study. The target sample per school was twelve (12) pupils, giving a total of 216. Out of these, 45 per cent were boys and 55 per cent girls (98 without preschool and 118 with preschool). Children were tested individually at the start of Grade one (Phase I). Follow-up testing (Phase II) commenced approximately seven months after the initial testing was completed. Hundred and ninety seven (197) of the children in the original sample were tested in Phase II. The tests were administered in Nyanja (the language of instruction in first grade) in Lusaka.

To assess early literacy skills, the Basic Skills Assessment Tool (BASAT) was used. In addition to word recognition and text comprehension, the BASAT includes tests to assess basic skills like letter knowledge, phonemic awareness and short-term memory. Executive function skills were assessed using the pencil taping test, the Stroop-like test and the BRIEF. Familiarity with language was tested by eliciting a narration from each child and the Peabody Picture Vocabulary Test measured receptive vocabulary. Pattern Reasoning (Kauffman Test Battery for Children) was utilised to measure general intelligence, while information processing was measured using the RAN. A variety of methods were used to analyse the data including, correlations, *t*-test, factorial anova and multi-level regression.

Results revealed that pupils who went to preschool did not outperform pupils who did not go to preschool in first grade. On the contrary, they performed worse than those that never went to preschool. Children with preschool had a head start in alphabetic skills compared to children without preschool in the first grade but on all other literacy and numeracy tests, there were no effects in favour of children who went to preschool. In terms of executive functions, the study revealed that executive functions do predict literacy and numeracy skills. Specifically, working memory and inhibitory control predict literacy and numeracy skills over and above other executive functions. However, preschool did not promote executive functions. But, it was established that executive functions are better predictors of numeracy than literacy. The study further revealed that oral language is important for performance in literacy skills.

The study revealed that linguistic diversity may explain delays of children who attend preschool in the first grade. Children are taught in English in preschool but in a local language, Nyanja when they proceed to first grade. This theory is in line with the finding that children with the most confusing language situation, the non Nyanja speakers, were lowest performers. Non Nyanja speakers speak another language at home, learnt English in preschool and need to learn a third language, Nyanja, in first grade.

The study recommends that the Zambian Government should assess the quality of preschools to ensure that the curriculum has preparatory activities for literacy and numeracy skills, alphabet knowledge, phonological awareness, counting and rhyming. It is also recommended that executive function stimulating activities be part of preschool. In addition, schools should use the same language in preschool and first grade.

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ACRONMYS

BASAT	Basic Skills Assessment Tool
CALP	Cognitive/Academic Language Proficiency
CLA	Comprehensive Language Approach
CSO	Central Statistical Office
ECD	Early Childhood Development
EF	Executive Functions
HLE	Home Literacy Environment
ESL	English as a Second Language
IQ	Intelligence Quotient
K-ABC	Kauffman Assessment Battery for Children
LEA	Language Experience Approach
MOE	Ministry of Education
NBTL	New Break Through to Literacy
PA	Phonological awareness
PRP	Primary Reading Programme
PPVT	Peabody Picture Vocabulary Test
RAN	Rapid Automatised Naming
RAS	Rapid Automatised Switching
RCD	Reading Comprehension Deficits
SES	Socio-Economic Status
SACMEQ	Southern African Consortium for Monitoring Educational Quality
UK	United Kingdom
UN	United Nations
UNICEF	United Nations Children Education Fund
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VIQ	Verbal Intelligence Quotient
WM	Working Memory

CHAPTER ONE

1.0 INTRODUCTION

1.1 Overview

This chapter is organised in four sections. The first section is the background to the study. It deals with background information on the topic of the study as well as the gaps in the information to justify the present study. The second section is the contextual background. This highlights the preschool education profile in Zambia, giving information about the various policy changes that have taken place in the management of preschools from independence to the time of this study. The third section looks at the literacy situation in Zambia from the time Zambia got independence to the time of the study. Lastly, this chapter shows the theoretical perspective that guided this study.

1.2 Background of the Study

Evidence has shown that some literacy and numeracy skills acquired in preschool facilitate learning in school age (Aunio & Niemivirta, 2010; Deguzman, Doniza, Sabio & Teressa, 2010). Pre-reading and pre-numeracy activities may include among others reading to children, singing and counting.

Preschool education is defined as the provision of education for children before the commencement of statutory formal education. This is usually between the ages of three and five, depending on the jurisdiction. Preschool is also known as nursery school or kindergarten (Buysee & Wesely, 2005) and is defined as a place where ‘‘activities and experiences are offered in a variety of settings that promote the development of children from infancy to age five’’. These activities and experiences may be guided by curricular or established practices designed to improve children's development or competences in one or more domains including language, literacy, math, social-emotional development and physical development (Buysee & Wesely, 2005).

In preschool, pupils familiarise with reading, writing and math through alphabet books, picture books and toys. In addition to this, preschool imparts skills to make the child ready for learning in a school setting. In other words, the children are prepared to begin the new challenge which is formal schooling in reading and math (Deguzman *et al*., 2010).

Research has also shown that skills in preschool age predict literacy. There is a correlation between writing letters of the alphabet in preschool and the ability to spell in the first grade. More generally, an extensive research literature has demonstrated strong associations between preschool letter knowledge, phonological awareness and early reading (Adams, 1990; Bryant & Bradley,1985; Wagner & Torgesen, 1987). Preschool letter naming and phonological awareness have also been shown to be strong predictors of grade one writing ability (Berninger, *et al*.,1992).

In a study by Mann (1993), which examined the predictive validity of the phonological accuracy of invented spellings at the end of the Kindergarten year, it was found that Kindergarten spelling performance correlated .58 and .54 with word identification and word attack respectively. These results are all consistent with the position that early writing is important for the development of later reading ability.

Another study by Shatil, Levin and David (2000) reports two key findings concerning the association between writing abilities in kindergarten and grade one decoding and spelling. Kindergarten writing successfully predicted the ability to decode and to spell even after controlling for the contribution of general intelligence among Israeli children. As such, kindergarten writing can be considered a precursor of later literacy development. The current study tested whether preschool prepares children for learning to read and write in first grade by promoting alphabet skills, phonological skills and reading after controlling for Social Economic Status (SES) and intelligence. Likewise, the study tested whether children develop precursors for math skills. An assessment of pre-numeracy skills such as cardinality, counting principles, simple addition and subtraction as well as estimation were assessed at the start of grade one. The main aim was to test to what extent preschool supports the development of these skills.

Executive functioning (EF) is another factor to predict the ability to benefit from academic learning in school. Research indicates that EF is related to early literacy and numeracy skills attainment, McClelland *et al*., (2007). It was hypothesised that executive functions are essential for academic learning and children may be more likely to acquire new reading and math skills in first grade when they have learned to regulate their behaviour in preschool.

Bennette (2008), for example, showed that preschool curricula incorporating the development of self-regulatory skills while solving early math and literacy tasks was associated with improvement in literacy and numeracy skills. Specifically, there is overwhelming evidence that executive functions are related to the attainment of reading and mathematics (e.g., Altemeier, Jones, Abbott & Berninger, 2008; Blair & Razza, 2007; Bodrova & Leong, 2006). Kegel & Bus (2013) found that growth in alphabetic skills concordats with improvement of executive functions which makes plausible that executive functions are causally related to early literacy skills. Altemeier *et al*., (2008) also found that executive functions predicted reading and writing in typically developing children. Specifically, they tested inhibitory control and shifting. These studies were done elsewhere but in Zambia and Lusaka in particular, it is not known if this is the case.

With knowledge that executive functions are important for acquiring reading and numeracy skills in preschool, it was hypothesised that executive functions mediate the effect of preschool on literacy and numeracy skills. The term, executive functions, describes a set of cognitive abilities that control and regulate other abilities and behaviours. Executive functions are necessary for goal-directed behaviour. They include the ability to initiate and stop actions, to monitor and change behaviour as needed, and to plan future behaviour when faced with novel tasks and situations. Executive functions allow us to anticipate outcomes and adapt to changing situations. The ability to form concepts and think abstractly is often considered as an executive function (Lezak, 1995).

Diamond *et al*., (2007) describe the following as core executive functioning skills: (i) inhibitory control, (ii) working memory and (iii) cognitive flexibility and adjusting to change (Shift). The three main types of executive functioning skills can all be beneficial in a school setting. For example, improved working memory allows a child to hold more information for a longer period of time and mentally rehearse the information so that it can be effectively consolidated into long-term memory (Baddeley, 1996). The relationship between behaviour regulation, including executive function, and academic achievement has been widely studied in elementary school children (Alexander, Entwisle and Dauber, 1993; Bull & Scerif, 2001; McClelland, Acock, and Morrison, 2006), but not so often in the youngest groups. On a basic level, positive classroom behaviour leads to greater academic gains; that is, children who are unable to perform effectively in class, in terms of paying attention or completing assignments, do not reap the same benefits of instruction as other children who behave according to classroom rules (McClelland *et al*., 2007).

Blair (2010) found that executive functioning skills are associated with school readiness, turn taking and paying attention. It is assumed that children may only succeed in learning to read if they can stay attentive while carrying out a particular activity, memorise instructions and steps while solving a problem and are able to concentrate on one activity (e.g., Kegel *et al*., 2009). The assumption in this study was that children who have learned to regulate their behaviour in preschool may be more likely to learn to read in first grade ahead of those who did not attend preschool. In addition, the study assesses whether preschool and executive functions predict reading and numeracy skills at the end of the first grade. The first domain of executive functioning to be assessed was attention. Children's ability to focus and sustain their attention is critical to their ability to learn in a variety of contexts. Duncan *et al*. (2007) in a meta-analysis of six large data sets in the US and UK found that attention at ages 5-6 was associated with achievement outcomes in primary school.

The second key area of executive functioning assessed in this study was working memory and inhibition control. This is because research has shown that children with poor working memory are unlikely to retain information into the long-term memory for future use, Baddeley (1996) and are not able to inhibit natural tendencies and concentrate on tasks in the classroom. They may not benefit from classroom instruction.

In addition to growth in executive functions, it is believed that during the early years of a student's elementary school education, oral language skills become the underpinning skill for the acquisition of reading skills. Oral language is not only closely related to development of early reading skills but there are also substantial long-term correlations with reading in the middle years of primary school. When children engage in verbal interactions, they acquire various aspects of language that will ultimately support their reading development (Konza, 2011). In the same vein, Matafwali (2010) argued that Zambian children who are not familiar with the language of instruction might have problems in school learning to read particularly if they have been to preschool where the language of instruction is a third language, English. This study, therefore, sought to establish whether or not children who attended preschool would be disadvantaged in learning to read in first grade especially if they do not use Nyanja at home and depend on school to learn both reading and the language (Nyanja).

1.3 The Preschool Educational Profile-Global Perspective

Early childhood education is envisioned to accommodate children between the ages of two and six years. Originating in the early 19^{th} century, the kindergarten was an outgrowth of ideas and practices of Robert Owen in Great Britain, J.H. Pestalozzi in Switzerland and his pupil Fredrick Fröbel in Germany, who coined the term kindergarten, a 'German word which literary means 'children's garden'(Deguzman *et al.*, 2010). Kindergarten stressed the emotional and spiritual nature of the child, encouraging self-understanding through play activities and greater freedom, rather than the impositions of adult knowledge (Deguzman *et al*., 2010).

The first preschool institution was established in the United Kingdom in 1816 by Robert Owen for a philanthropic cause. The preschool was more of a childcare centre where children of cotton mill workers, aged between one and six years were taken care of while their parents worked in the mills. Owen used free and unstructured play in educating young children. Informal teaching was the rule and Owen did all his teachings through informal, physical methods. His concept led to the founding of many early childhood care centres in Britain (preschool learning alliance, 1990).

Preschool education can be traced as far back as the first quarter of the twentieth century in the United States. The philosophical foundation of preschools can be traced to the belief popularised in the seventeenth century that early childhood is a unique period of life during which the foundation for all later learning is established (Mwanza, 2011). The early preschools often started informally and involved the effort of women who took turns in caring for each other's children. The first public preschool programme begun in 1925 at Franklin School in Chicago with the support of the Chicago women's club.

The popularity of preschool as an option for young children increased dramatically after the 1970s. In 1970, for example, only 20 per cent of three and four-year-olds participated in organised education programmes. In 1998, approximately half of all children in this age range attended a full-time pre-school programme in Chicago. The increasing popularity of pre-school has been fuelled in part by an increase in the number of women entering the work force as well as by a belief among many parents and educators that children need early preparation for elementary school (preschool learning alliance: 1990).

1.4 The Preschool Educational Profile in Zambia

According to the Ministry of Education Strategic Plan (2003-2007), the Education For All Framework of Action (2004), and as reflected in the National Development Plan for Education (2006-2010) in Matafwali (2013), Early Childhood Care and Development (ECCD) has been described as the level of education which a child aged 0-6 years undergoes before attaining the compulsory age (7 years as is the case in Zambia) of entry to a primary school (MoE, 2003). Further, the 1977 Education Reform defines preschool education as education intended for children below the age of seven years who normally will not have started full-time education (MoE, 1977; Matafwali, 2013). It must be noted, however, that there could be variations in the age coverage depending on the country's implementation approach and to some extent the age of entry into grade one. For instance, in Zambia, the existing National Policy on Education of the Ministry of Education, *Educating our Future* (1996) focuses on children 3-6 years, not on the age group 0-2 years. This is simply because ECD in Zambia is currently confined to pre-schooling instead of offering a more comprehensive learning experience.

Provisions for the formation of early childhood education programmes in Zambia were made as far back as 1957 when the Day Care and Nurseries Act (Chapter 313 of the Laws of Zambia) was passed in recognition of the importance of Education for Child Development. The Act provides inter alia for the registration and regulation of day nurseries. Later in 1972, the Lusaka Preschool Association was formed which later became the Zambia Pre-school Association (Matafwali, 2013). However, it was not until the beginning of the 21st century that provisions of early childhood education began to receive solemn attention. This was influenced by the United Nations obligation that all countries around the world provide universal basic education by 2015. Establishing early childhood institutions became a fundamental requirement for Zambia as well (see United Nations, 1990). Thus most of the efforts in Zambia had been directed towards the introduction of early childhood education programmes in as many locations in the country as possible.

From 1977 to 1992, education provision in Zambia was guided by the 1977 Education Reform which provided policy direction in the field of education at all levels. The education reform document recognised preschool as an education sector, although it specified that preschool education would not be compulsory for a long time to come. In fact, preschool education was placed under the patronage of the Ministry of Local Government and the sector was run by the local council and local communities, Non-Governmental Organisations (NGOs) and families (MoE, 1977).

Despite the above pronouncements, the development of early childhood education to cater for more children was encouraged in both rural and urban areas. Although the Ministry of Education policy document of 1996 recognised the important role of early childhood education in the multi-dimensional development of the child, the Ministry of Education took the position that provision and funding of ECD and preschool education would be the responsibility of councils, local communities, NGOs, private individuals and families (National Policy on Education, *Educating* *our Future*, 1996). Thus, like in the 1980s, the Ministry of Education's role as far as ECD was concerned remained that of encouraging and facilitating the putting in place of preschool programmes and training of teachers for this sub-sector (MoE, 2005), as well as child health and nutrition for expectant mothers and children under five (MoE, 2007).

Notwithstanding earlier efforts to early childhood education, real advancements in early childhood education only started in the 1990s following the Jomtien World summit on the *Declaration of Education for All* held in Thailand in 1990 where Zambia was a participant (Matafwali & Munsaka, 2011). At the Jomtien conference, the international community came up with a framework for provision of education for all, where early childhood education set as objective number one. Countries were urged to expand early childhood care and development activities including family and community interventions, especially for poor, disadvantaged and disabled children. This was reaffirmed at the World Education Forum, held in Dakar in the year 2000.

Although there is no data available on enrolment in ECD programmes in Zambia for the 1990s, it is clear that there was no quantitative expansion in as far as access is concerned in this education sub-sector. A household survey that was conducted in 1999 by the Central Statistical Office (CSO) showed that only six per cent of children aged 36-59 months were attending ECD programmes. This survey also revealed marked disparities regarding access to Early Childhood Education between urban (14 per cent) and rural (2 per cent) areas (MoE, 2002). A remarkable achievement in this sub-sector throughout the 1990s was however, in teacher training where the number of trained teachers in preschool education increased from 473 in 1990 to more than 1

200 in 1997. Additionally, there was an increase in the number of preschool teacher training colleges established by private individuals and institutions (UNESCO, 2006).

In 2004, the government through the Ministry of Education took over the manning of preschools in line with the Republic of Zambia Government Gazette No. 547 of 2004 on Statutory Functions, Portfolios and Composition of Government. In view of this, the Ministry of Education has since taken the responsibility to assist preschool institutions by training preschool teachers, monitoring standards, and preparing curriculum guidelines. In order to enhance access at preschool, the Ministry of Education's focus since 2004 has been on the establishment of early childhood programmes for children living in rural areas and poor urban areas. To achieve this, the Ministry has been working with partner ministries, districts and councils, local communities, NGOs, religious groups, families and individuals (UNESCO, 2006).

From the time of the above pronouncements in 2004, the enrolment of children in grade one with preschool or nursery experience has increased significantly although the number remained small in relation to overall enrolment. Nevertheless, the number of children with pre-school experience increased from fewer than 37 000 in 2002 to 75 047 in 2009. This represents an annual average increase of 26.7 per cent (MoE, 2009). Across the nation, 15.8 per cent of the grade one entrants in 2009 and 17 per cent in 2010 had pre-school experience, that is 52 per cent female and 47.6 per cent male. However, participation in preschool varied across provinces with Lusaka province, having the highest percentage of grade entrants with preschool experience (42.8 per cent), followed by Copperbelt province (32.3 per cent). Conversely, Western province had the lowest percentage of grade one entrants with preschool experience (4.0 per cent), followed by

Northern and North Western provinces (4.5 per cent and 6.1 per cent respectively). Notwithstanding these disparities, it is encouraging to note that gender parity has been attained in this education sector (Matafwali, 2013; p.6). The current study was conducted in Lusaka with the aim of assessing whether or not preschool promotes literacy and numeracy skills. This study also aimed at examining whether preschool promotes regulatory skills which later on promote reading and numeracy. Carrying out the study in Lusaka made it possible to explore the detrimental effect of linguistic diversity on literacy and numeracy skills. Children learn English in preschool while Nyanja is the language of instruction in first grade and beyond and most children do not speak Nyanja at home and on the playground.

It has been noted that although preschools are now being run by the Ministry of education in Zambia, it still grapples with a number of challenges which lead to inhibiting access to early childhood education and delivery of quality services to the eligible children (Matafwali, 2013). The aim is high quality early childhood education for all eligible children as is stipulated in the Ministry of Education Strategic Plan 2003-2007. This aspiration is not yet realised because this sector is still under the auspice of the private sector (64.2 per cent) and perceived as a privilege for people in the middle class by many parents (Matafwali & Musaka, 2011). The implication is that many Zambian children have not had a chance to access ECCD, especially those from low income families who cannot afford the high fees being charged by private providers. Currently, only 17 per cent of Zambian children have access to early childhood education. The government's aspiration is to increase access to early childhood education from 17 to 30 per cent by the year 2015 (MoE, Strategic Plan, 2011-2015). In this study, it is tested if Zambian preschool promotes literacy and numeracy, eventually mediated by executive functions, as indicated by several studies in western countries (Altemeier, Jones, Abbott & Berninger, 2008; Blair & Razza, 2007; Bodrova & Leong, 2006).

Although the Zambian government aims at providing early childhood education to all children (Matafwali & Munsaka, 2011), funding and coordination of early childhood education are unclear. Matafwali and Munsaka conclude that the level of participation of the government in early childhood education is too low. In 2012, the Zambian government made pronouncements that preschools would be in-cooperated in public primary schools and the language of instruction from preschool to grade four will be a familiar language (MOESVTEE, 2012). In line with these pronouncements, efforts are being made, for example, selected preschools across the country have been annexed to public primary schools to ensure that all children including those from low income families have access to ECE. In the same vein, in 2014, government deployed ECE trained teachers in primary schools. In addition to this, a preschool curriculum was formulated. Regardless of these developments, most preschools are still run by private individuals who are registered as members of the Preschool Association of Zambia. As the situation stands, anyone who wants to open a preschool in Zambia can do so as long as they have the financial means regardless of their profession and academic background. This has resulted in the mushrooming of preschools in both residential and commercial areas.

Since preschools are run by private individuals, the schools are often insufficiently equipped with appropriate recreational facilities and learning materials. A study by Matafwali and Munsaka (2011) revealed an apparent general lack of teaching and learning materials in Zambian preschools. When it comes to recreational facilities, the scenario is even worse. Where residential plots are used, there is often no space for children to play, an aspect vital for learning. This, therefore, means that teachers may have difficulties teaching children literacy and numeracy skills as these require adequate teaching and learning materials.

Moreover, the curricula used in some Zambian preschools may not be in tandem with the Ministry of Education, Science, Vocation and Early Education (MESVTEE) curriculum, which was developed in 2014. This is because the private schools and the government school curricula were developed at different times and by different stakeholders. Furthermore, a majority of preschool teachers in Zambia are not trained, hence they may not have the required skills and knowledge to teach young children. Howes, Smith and Galinsky (1995) noted that training of teaching staff is vital; without proper training of teachers, even the most comprehensive curriculum may be useless.

At the time that the data collection in this study started, children in Zambian preschools were learning in English. English was seen as an important step toward future educational attainment since English is the medium of instruction for higher grades in primary and secondary schools (Mwanza, 2011). However, when the children proceed to the first grade, the language of initial literacy instruction is a local language. This being the situation, a main research issue may be how the focus on English in preschool influences learning to read in the first grade in Nyanja.

The important contribution of preschool education is in developing and broadening the range of children's learning experiences, to leave them confident, eager and enthusiastic learners who are looking forward to start formal schooling. This encourages parents to enrol their children in preschool education. Many parents believe that preschool will help their children develop skills, especially in reading so that when their children enter first grade, they are capable and ready to face new and bigger challenges and experiences (Deguzman *et al*., 2010). The question, however, for Zambian preschools is whether they add to the children's development in this regard.

1.5 Early Literacy Situation in Zambia

The literacy situation in Zambia can be traced back to a time when missionaries came to Zambia before independence. However, no documentation is available to show literacy levels until after the time of independence in 1964. After independence, English was used as a medium of instruction in Zambian schools, from preschool to university. This meant that children were taught how to read and write in a language that they were not familiar with (Kelly, 2000). This was a challenge as children had to learn both the language and the skill to read at the same time.

Tambulukani (2002) contended that the fact that reading in Zambia was carried out in English, a language that most children knew very little of or had no knowledge about, contributed to the extremely low levels of both reading and writing exhibited by Zambian children. Literature has also shown that children learn to read better if they are taught reading in a language that they are familiar with (Matafwali, 2010).

After thirty years of using English as a medium of instruction, the literacy levels were still not satisfactory (MoE, 1996). The Ministry of Education introduced a new literacy programme. They introduced the Primary Reading Programme (PRP) with the New Break Through to Literacy (NBTL) in the first grade as the main component, which promotes teaching children in a familiar language from the year 1998 (Kalindi 2005; Matafwali, 2005; Mwanza, 2011). With these efforts put in place to improve the literacy situation in the country, subsequent studies consistently show that reading skills in Zambian children are still low (Kalindi, 2005; Matafwali, 2005; Matafwali, 2010; Mubanga, 2010; Mwanza, 2011; Nkamba & Kanyika, 1998; SACMEQ; 1998; Tambulukani & Bus, 2012).

One underlying factor to this problem maybe that children miss basic knowledge for learning to read and learning math because they are not exposed to preschool before they enter the first grade. Preschool may also stimulate executive function skills which are predictors of literacy and numeracy. Because PRP did not take into consideration the effect of preschool where English is used to teach as well as the importance of EF, it was important to assess whether preschool, mediated by executive functions, would predict literacy and numeracy skills in Zambian children as it is believed to do so in western countries.

1.6 Theoretical Model

To show the importance of preschool, executive functions and oral language in the attainment of literacy and numeracy skills, the present study used two theoretical models. One proposed by Anghel, (2010) called Baddeley's multi-component model as suggested by Baddeley (1986, 2000) and the comprehensive language approach by Dickinson and colleagues (2003).

Baddeley's Multi-component Model

Performance on measures of working memory predicts performance on a range of academic skills (Baddeley, Gathercole, & Papagno, 1998; Gyselinck, Ehrlich, Cornoldi, de Beni, & Dubois, 2000). Evidence exists for working memory deficits in children with mathematical disabilities (e.g., Berg, 2008a; Bull & Johnston, 1997; Swanson & Sachse-Lee, 2001). More specifically, working memory occupies an important place in recent research on mathematical performance and is, therefore, likely to contribute to arithmetic calculation. For instance, to solve 4 + 3, a child must concurrently retain two or more pieces of information (the phonological codes representing the numbers ''4' and ''3'') and then employ one or more procedures (e.g., counting) to combine the numbers to produce an answer.

A study by Simons, singleton and Horne (2007) which examined the relationships between phonological awareness, Visual Spatial Sketchpad (VSSP) functioning and arithmetic attainment in young children aged five found that, together, VSSP functioning, phonological awareness, vocabulary, and non-verbal reasoning predicted 41 per cent of the variation in the children's arithmetic attainment. Only phonological awareness and VSSP functioning were significant independent predictors. In contrast, only phonological awareness was a significant independent predictor of reading attainment. These findings are consistent with phonological awareness influencing both the development of reading and arithmetic, whilst VSSP functioning only impacts on arithmetic development

Although research indicates a relationship between working memory and arithmetic calculation, the influence of other cognitive processes such as inhibitory control shifting and organisation have received little attention although they are useful in arithmetic as suggested by the model. In particular, arithmetic calculation has been suggested to be related to two cognitive processes that are directly related to working memory: processing speed (Case, 1985) and short-term memory (Baddeley & Hitch, 1974). The present study, therefore, intended to establish the importance of working memory in mathematical skills and reading as well as the contribution of other important cognitive processes such as inhibition, attention, shifting and planning and organisation to the attainment of reading and numeracy at first grade.

Comprehensive Language Approach

The other theoretical model that was used to guide this study is the Comprehensive Language Approach proposed by Dickinson *et al*. (2003). This approach guided this research by showing how important oral language is to the development of early literacy skills.

Research suggests that language proficiency has influence on word reading skills and that abilities such as receptive vocabulary, the ability to formally define words, and narrative skill would become more critical in middle elementary school (Snow & Dickinson, 1991). Exemplary is the CLA by Dickinson and colleagues (2003) that contends that non-phonological language skills (e.g., semantics and syntax) are important to the acquisition of phonological skills, alphabet knowledge and beginning reading skills. This model contends that although oral language is important for the acquisition of phonemic awareness in grade one, it is even more critical to reading words. Simply put, the CLA assumes that oral language has a direct impact on learning to read.

Based on these two models, the present study anticipated that preschool, executive functions and oral language would be the best predictors of reading and numeracy in grade one. However, bearing in mind that English is the medium of instruction in preschool, it was anticipated that children who went to preschool and were not using Nyanja at home would be disadvantaged in learning to read in grade one where Nyanja was used as the language of instruction in literacy. It was expected that English introduced in preschool may affect learning negatively, in particular when children were not Nyanja speakers but relied on school to learn the language as well as learn to read.

1.7 Statement of Problem

The Zambian government has put up strategies aimed at enhancing literacy skills especially at the lower primary level such as; the Primary Reading Programme with the New Breakthrough To Literacy as its major component (Tambulukani, 2002) and the recent language policy which emphasises the use of the mother tongue in the first four years of schooling. Furthermore, there is a policy shift on annexing preschool to primary schools as a way of ensuring that all children especially those from low income families have access to ECE. Thus far, the Ministry of Education has deployed teachers in selected primary schools, formulation and implementation of preschool curriculum, and development of teaching and learning materials to ensure quality in the provision of preschool education. Despite these efforts however, studies have consistently shown that reading levels among Zambian children remain low (Kalindi, 2005; Matafwali, 2005; Matafwali, 2010; Matafwali &Bus 2013; Mubanga, 2010; Mwanza, 2011; SACMEQ 2010; Tambulukani, 2002; Tambulukani & Bus, 2012). While preschool education has received a lot of attention in the recent years, little is known on whether or not preschool prepares children for learning to read and write in first grade when we control for the SES and intelligence. Since research has shown that preschool promotes executive functions which later on promote literacy and numeracy skills, it was imperative to ascertain whether executive functions would mediate literacy and numeracy skills in the Zambian context. Assuming that oral language skills in the language of instruction are the underpinning factors for the acquisition of reading skills (Dickinson *et al*, 2003), coupled with evidence showing that linguistic diversity may interfere with the reading performance of children in Zambian primary schools (Matafwali 2010, Tambulukani & Bus, 2012, Matafwali & Bus, 2013), the study further tested whether learning English in preschool interferes with learning to read in Nyanja in first grade.

1.8 Purpose of the Study

The aim of this study was twofold. Firstly, to assess whether preschool prepares children to read and write in the first grade when controlled for intelligence and social Economic status (SES) as well as to establish whether preschool promotes executive functions which later promote literacy and numeracy skills in the first grade. Secondly, the study aimed at finding out whether children who do not speak Nyanja at home would benefit from preschool in reading and writing in the first year of school.

1.9 Objectives of the Study

This study was guided by the following objectives:

- To establish the extent to which preschool prepares children for learning to read and numeracy in first grade when controlled for the effect of SES and intelligence.
- Establish whether preschool is beneficial for the development of executive functions like working memory and inhibitory skill.

- To test whether preschool stimulates reading, writing and numeracy through executive functions.
- To establish whether or not preschool interferes with learning to read in first grade if children do not speak Nyanja at home and depend on school for learning Nyanja as well as reading in Nyanja.

1.10 Hypotheses

Hypothesis One

Children with preschool have a better start at the beginning of the first grade in reading and numeracy as appears from letter knowledge, phonological awareness and basic math concepts when we control for SES and Intelligence.

Hypothesis Two

Preschool promotes executive functions which later promote literacy and numeracy skills.

Hypothesis Three

Preschool interferes with learning to read in the first grade because it does not prepare children for learning in Nyanja, this is particularly problematic for non-Nyanja speakers.

1.11 Significance of the Study

This study can be used as a reference point for executive functioning skills among first graders in Zambia as well as an explanation to why preschool education is important in the acquisition of early literacy and numeracy skills.

It is hoped that this study may show the gaps and benefits of preschool education in Zambia as it might attract attention and debate from across the country and beyond. In addition, it is hoped that the information resulting from this study may assist to inform the Ministry of Education, Science, Vocational Training and Early Education and other stakeholders interested in early literacy and numeracy development to come up with best practices aimed at facilitating the attainment of literacy skills from preschool to grade one. The information highlights the role of preschool education in becoming literate, thus testing solutions for backwardness in reading in Zambia and other African countries (Population Reference Bureau, 2002).

Furthermore, the information may add to the existing body of knowledge and literature on preschool and executive functions which might assist establishing a 'beneficial' and 'informed' intervention programme, based on research, not on myth and common sense. Considering, for example, that learning to read is an important aspect in an educational setting that may help children become better citizens of a country.

1.12 Limitations of the Study

For testing effects of preschool, a quasi-experimental design was used. As the choice to participate in preschool was not under control of the researcher, it cannot be excluded that any effects of preschool are the outcome of other uncontrolled factors. It is, for instance, possible that more literate parents choose to send their young children to preschool and that the preschool group differs from the non-preschool group in other ways which may also explain any group differences. Therefore, generalisation of results may be limited.

1.13 Operational Definition of Terms

Ability groups: These are pace groups where children are placed based on their performance level in a classroom

Alphabet knowledge: Ability to demonstrate familiarity with letter-names and letter-sounds.

Childhood: A person's state of being a child.

Curriculum: The subjects comprising a course of study in a school, college or university.

Dyslexia: A disorder involving difficulty in learning to read or interpret words, letters and other symbols.

Executive functions: A set of cognitive abilities that control and regulate behaviours that are required for learning. These include working memory, inhibitory skills, and attention.

Home language: Language mostly used in the home.

Home literacy practice: Activities in the home that build on the child's language and literacy skills.

Language of instruction: A medium of instruction used for teaching purposes.

Language policy: Official guidelines for the use of a language in teaching.

Literacy: The ability to read and write.

Numeracy: An academic skill relating to the knowledge of numbers was used inter changeably with mathematics.

Non-preschool: These are pupils in the first grade who were not exposed to preschool.

Nyanja speakers: These are children who use Nyanja as their home language and at the playground.

Non Nyanja speakers: These are children who use any other language at home and at the playground but not Nyanja.

Phonemes: Sounds in words that relate to letters.

Phonemic awareness: Identifying phonemes in words, for example /k/a/t/ are the phonemes of the word 'cat'.

Phonological awareness: Often used to indicate that sounds of words are distinct from words' meaning. This may include sensitivity to syllables and morphemes (Wong, 1998).

Phonological knowledge: To be aware of the relationships of sounds within or between languages.

Play language: Language mostly used when the child plays with friends.

Poverty: The state of being extremely poor.

Preschool pupils: These are pupils in the first grade who were exposed to preschool before first grade.

Preschool: The term preschool in this study was used to refer to educational institutions that are attended prior to primary school or first grade.

Kindergarten: An equivalent of preschool.

Working memory: A person's short-term memory lasting not more than nine seconds.

1.14 Summary

The goal of this chapter has been to provide an overview on how preschool and executive functions have been seen as predictors of literacy and numeracy in the early years of formal education. What is of outmost importance from the studies cited in this section is that preschool and executive functions do predict literacy and numeracy skill in elementary education. The section has also pointed out the gaps in the studies as well as the issues that were addressed in this study. The preschool education profile from the global perspective as well as the preschool education profile in Zambia has also been discussed. In addition the section has shown that despite efforts by the Zambian government to promote reading in Zambian, elementary schools reading levels remain significantly low. What is lacking, however, are studies to explain whether preschool and executive functioning predict reading and numeracy in the Zambian sample.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview

This chapter is a review of literature on the issues that the study addressed. It begins with an explanation on activities that are done in preschool to promote literacy and numeracy skill development. It is also focused on studies that reveal the predictive role of preschool on literacy and numeracy. Furthermore, executive functions are discussed and how they mediate reading and numeracy in preschool and early years. In addition, the review shows the importance of using a familiar language in learning to read. Lastly, the literature explains the reading situation in Zambia from 1964 to 2015 through policy changes that have taken place as well as studies that have been done to show reading levels among primary school going children in Zambia.

2.2 Preschool Activities that Promote Literacy and Numeracy Skill Development

Preschool is the provision of education for children before the commencement of statutory formal education (Buysee & Wesely, 2005) and is defined as a 'place where activities and experiences are offered in a variety of settings that promote the development of children from infancy to age. It is well established that in western countries, pre-conventional children acquire knowledge about reading and writing through a variety of activities including exposure to print in their environment, reading books, name writing, and the like (Bus, 2001). The National Institute for Literacy (NIFL, 2007) reports that reading skills acquired during kindergarten provide the essential foundational links required for later reading success. During the early years of a student's elementary school education, oral language skills become the underpinning skills for the acquisition of reading skills.

In evaluating the literacy levels of South African children, Pretorious & Ribbens (2005) have proposed Chall's model. According to this model (Chall, 1983), the preschool years characterise the development of emergent literacy, where children acquire attitudes, expectations and skills related to written language and an increasing awareness of literacy behaviours. Following this theory a number of studies have shown that children acquire literacy and numeracy skills before formal education (e.g. Sulzby & Teale, 1991; Graves, Juel, & Graves, 1998). Children at this stage learn how to handle a book and may pretend to read and tell a story while looking at the pictures. They learn how to construct meaning from visual clues on the page. Learners learn the alphabetic principles, some letter-sound relationships, recognise high frequency words, and understand texts, usually narratives containing language and thought processes within their experiential frame of reference. It is from this background that this study was grounded as it was expected that Zambian preschools would play such roles.

According to the National Institute for Literacy (NIFL, 2007), reading is a complex system of deriving meaning from print that requires all of the following: (a) the skills and knowledge to understand how phonemes or speech sounds are connected to print; (b) the ability to recognise words and decode unfamiliar words; (c) the ability to read fluently; (d) sufficient background information and vocabulary to foster reading comprehension; (e) the development of appropriate active strategies to construct meaning from print; and (f) the development and maintenance of a motivation to read (p. 1). It is important to note that there is a correlation between skills which children enter school with and later academic performance (Christopher *et al.*, 2000). Hence those who experience difficulties learning to read are likely to continue experiencing reading problems throughout school years (Bruck, 1998; Felton, 1998; Whitehurst & Lonigan, 1998). In other words, activities done in preschool are very important for acquiring reading skills. The assumption in this study, therefore, is that children who do not attend preschool may miss out on this, hence the need to establish whether this is true or not. Hereafter, preschool activities are listed that are assumed to facilitate reading development.

2.2.1 Preschool Phonological Skills and their Predictive Role in Early Grade Reading

Phonological awareness includes rhyming and identifying syllables, phonemes and onsets/rimes (Anthony & Francis, 2005). It encompasses phoneme awareness, the ability to manipulate individual sounds (phonemes) in words, and basic phonological awareness skills, such as judging whether two words rhyme. Therefore, phonemic awareness is a subset of phonological awareness, it is the ability to hear, identify and manipulate phonemes. A phoneme is the smallest unit of sound that influences the meaning of a word (e.g., the word 'school' has four phonemes /s k u l/). Phonological awareness has been shown to be a very powerful predictor of later reading achievement Lonigan, Burgess, & Anthony (2000). In fact, it is a better predictor than more global measures such as IQ or general language proficiency (Griffith & Olson, 1992). Phonological awareness skills are important because they lead to reading success, prevent reading deficits, leads to success with spelling and also helps children become aware of sounds in the language. Snow, Burns, & Griffin (1998) found that children with high phonemic awareness skills outperformed those with low phonemic awareness on a range of literacy measures. A number of studies have shown that phonological processing abilities and print knowledge are present during the preschool period (Chaney, 1992; Lonigan, Burgess, Anthony, & Barker, 1998), and are predictive of beginning reading and spelling (Lonigan *et al*., 2000;

Bryant, & Bradley, 1985). In this study, it was hypothesised that children with preschool experience would outperform those without preschool experience on phonological tasks.

In other studies, Wagner *et al* (1993) and Wagner *et al*., (1994) identified two latent phonological awareness variables and compared their success in predicting the reading and spelling of 244 children from kindergarten to second grade. The first latent variable was referred to as phonological analysis and included measures of sound deletion, categorisation and segmentation; the second was labelled phonological synthesis and included measures of sound blending. They found that the two variables were highly correlated. However, when both were entered into a single structural equation model, with pre-existing reading ability and spoken vocabulary controlled for, only phonological analysis had a unique influence on first grade reading and only phonological synthesis had a unique influence on second grade reading. These results might be interpreted as supporting the hypothesis that segmentation skills could be important in reading acquisition and blending skills later on. However, the authors urge caution in drawing this conclusion, noting that when two variables are highly correlated, the one with just slightly more predictive power can receive a substantial boost in a structural equation model. This, therefore, may suggest that phonological awareness in preschool may predict early reading skills in first and second grade. As to whether or not this could be the situation in Zambia is the focus of this study.

In addition to this, Jason, Williams, McDonald and Francis (2007) examined the convergent, discriminant, and predictive validity of phonological processing abilities (PPA) in 389 3-, 4-, and 5-year-old children. Confirmatory factor analysis supported the validity of each PPA as separate from general cognitive ability and separate from each other. Multi group structural equation modelling (SEM) with mean structure demonstrated that older preschoolers have better developed latent PPA than younger preschoolers but that the structure of PPA is equivalent. RAN was found uniquely associated with letter knowledge and text discrimination in younger preschoolers. PA was found uniquely associated with word reading skills in older preschoolers. Finally, general cognitive ability was only indirectly associated with emergent literacy via PPA. These results highlight the importance of PPA in the early literacy development of English-speaking preschool children. In the current study, phonological awareness was assessed, the expectation was that children who attended preschool would outperform those who did not attend preschool.

The following is an extensive review of how preschool phonological awareness predicts reading as presented by Castles and Cotheart (2003). They report that Mann and Liberman (1984) tested sixty-two children on a syllable segmentation task in kindergarten and then examined their reading achievement one year later. They found a strong and significant positive correlation between the two skills. However, other extraneous variables, such as IQ, were not controlled for in their study. Therefore, it would be unwise to infer a causal relationship from these results. In the current study, extraneous variables such as IQ, SES and language were controlled. In subsequent analysis, even phonological awareness acted as extraneous variable and was, therefore, controlled for. Badian (1998) examined syllabic segmentation skills in 238 pre-school children using a syllable tapping task (adapted from that used by Mann & Liberman, 1984). He found that performance on this task accounted for no independent variance in reading ability in first or second grade once verbal IQ, socio-economic status (SES), pre-existing reading ability and chronological age had been controlled for. Similarly, Elbro *et al*. (1998), in a study of Danish preschool children at risk for dyslexia, found that neither syllable deletion nor syllable identification contributed independently to the prediction of dyslexia in second grade, while phoneme identification and a measure of the distinctness of phonological representations did.

The only research to provide some evidence for an independent contribution of syllabic awareness is a longitudinal study of 105 Brazilian children by Cardoso-Martins (1995). She tested the children prior to school on a syllable detection task, in which they had to detect the odd one out among three words, one of which either began or ended with a different syllable (an oddity task). Performance on this task made a small but significant independent contribution to reading and spelling ability at the middle and end of the school year, even after key extraneous variables had been controlled for. However, there are two points to note here. First, these results apply to the Portuguese language, which has many multisyllabic words, and may not generalise to English or other languages. Second, the authors themselves question whether their syllabic oddity task was actually tapping syllabic awareness or whether it was being performed using a global judgment of phonological similarity. Given that the words involved were multisyllabic, it is also possible that the oddity task was placing considerable demands on short-term working memory and that it was this skill that was associated with reading and spelling acquisition. In this study, it was hypothesised that children who would perform well on a syllable segmentation test would also perform better in reading and writing.

Another study by Rothou, Padeliadu and Sideridis (2013), which examined the relationships between phonological processing skills, vocabulary and inflectional morphological awareness in a model predicting decoding in grades one and two with 120 first graders and 123 second graders found that in grade one, decoding was uniquely predicted by phonological awareness, whereas in the second grade, none of the predictors explained unique variance in decoding. Their finding in first grade that reading skills were predicted by phonological processing skills is in line with previous studies in other transparent languages such as Dutch, Finish and German (e.g. de Jong & van der Leij, 2002; Landerl & Wimmer, 2000; Leppanen, Niemi, Aunola, & Nurmi, 2006), which have revealed that phonology played a significant role only during the first or second year of schooling. A study by Furnes and Samuelsson (2011) where they examined the longitudinal relationship between latent constructs of phonological awareness and rapid automatised naming at kindergarten and grade one and measures of reading and spelling in grade one and grade two across transparent and opaque orthographies showed that, kindergarten RAN accounted for a small but significant amount of variance in word recognition and phonological decoding in grade one in both the US/Australian and the Scandinavian samples. One year later, grade one RAN continued to predict word recognition and phonological decoding in grade two in US/ Australia. In Scandinavia, grade one RAN was only a predictor of phonological decoding in grade two (3%). The contribution of PA to early development in reading was somewhat different. In US/Australia, kindergarten PA was significantly related to word recognition and phonological decoding in grade one. The contribution from grade one PA to word recognition and phonological decoding in grade two was virtually zero.

These findings replicate research from a variety of transparent orthographies that RAN is a stronger predictor of early reading development than PA (e.g., De Jong & van der Leij, 1999; Georgiou, Parrila, & Papadopoulos, 2008; Lervag *et al*., 2009; Mann & Wimmer, 2002). In fact, this study asserts that PA is not at all a reliable predictor of reading skills beyond kindergarten in transparent orthographies, which were represented by Norwegian and Swedish children. More surprisingly, a similar pattern of findings concerning the impact of PA on reading was found in the US/Australian sample that PA diminishes as a significant predictor beyond grade one. Research conducted within English-speaking countries has shown that PA is a longitudinal predictor of individual differences in reading up to grade four (e.g. Wagner *et al*.,1997). The overall impression from this study was that there are more similarities than dissimilarities in the prediction of reading from PA and RAN in different languages.

In the current study, it was anticipated that phonological skills would predict reading in the first grade since Nyanja is also a transparent language like the ones mentioned above. In this study however, long-term effect beyond grade one could not be assessed as the researcher only assessed phonological awareness and reading in first grade and not beyond.

In a meta-analysis study by Bus and Van IJzendoorn (1999) where they looked at phonological awareness and early reading experimental training, participants received a variety of types of phonological awareness training. In some studies, phonological training was delivered in the context of letter training, reading or writing instruction; while in others, phonetics was taught as a separate lesson. Phonological awareness (including phoneme segmentation, phoneme blending and sound deletion) was the observed outcome measure. They found that the effect of phonemic training on phonological awareness skills was remarkably strong. They also found that the effect on reading was only moderate; they concluded that phonological training is highly effective for improving children's phonemic awareness skills. In addition to this, they discovered that phonological awareness training has weaker, yet still significant effects on overall reading ability, spelling, and reading comprehension. They, therefore, thought that phonological awareness is a predictor of reading. However, it is not necessarily the strongest predictor of reading. It should be provided as one component of a complete early reading programme, not as the entire programme. Their recommendation was that phonological awareness training appears to be most successful when it is combined with letter training. In other words, children benefit more from being exposed to print and being taught that there is a connection between spoken sounds and written letters than from simply playing spoken phonemic awareness games. In the current study, alphabetic skills as well as phonological awareness were assessed. This is because in preschool, both activities to familiarise children with alphabet and phonological awareness are done.

In another study by Cathy and Lucy (1994), seventy-two grade two children were randomly selected from five primary schools to examine whether phonological awareness tasks tap the same or different portions of variance in reading comprehension scores as simple memory span and complex memory span. They also checked whether a battery of phonological awareness tasks can account for significant portions of the variance in reading accuracy. They administered a battery of two tests individually to each across three experimental sessions. They found that reading accuracy was best predicted by phonological awareness scores. In addition, phonological awareness proved to be an excellent predictor of reading comprehension and arithmetic.

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Cross-linguistic data also supports the fact that phonological awareness supports early reading achievement. Mann and Wimmer (2002) compared the phonemic awareness skills of American kindergartners who were taught letters and sounds prior to schooling, with those of German kindergartners, who were not. They found that American children excelled on phonemic awareness tasks compared to their German counterparts, leading the authors to conclude that phoneme awareness develops primarily as a consequence of literacy exposure. Poor performance on phoneme awareness tasks in German kindergarten children has been documented in other studies (Schneider, Roth & Ennemoser, 2000; Wimmer, Landerl, Linortner & Hummer, 1991). Lukatela and colleagues report a similar pattern of relationship between phonological awareness and literacy for Serbo-Croatian illiterates with varying levels of letter knowledge (Lukatela, Carello, Shankweiler, & Liberman, 1995). Findings such as these have supported the conclusion that there is an association between phonological awareness and reading achievement.

To further prove that phonological awareness predicts reading, Quiroga, Lemos-Britton, Mostafapour, Abbott, and Berninger, (2002) examined thirty Spanish-speaking English-as-a-second language (ESL) first graders whose families were Latino immigrants but received all their school instruction in English. They completed an assessment battery with both Spanish and English measures of phonological awareness, Verbal IQ (VIQ), oral language proficiency and single-word reading (real words and pseudo words); they also named English alphabet letters. Phonological awareness in Spanish predicted (a) phonological awareness in English and (b) English word reading; thus, phonological awareness may transfer across first and second languages and across oral and written language. English VIQ and oral language proficiency predicted both English and Spanish word reading, but Spanish VIQ and oral language proficiency did not predict English word reading.

Although there is evidence of phonological processing being a major contributor to early reading skills, other processes beyond phonological processes are also important in reading. For example, Swanson, Trainin, Necoechea and Hamilton (2003) in a meta-analysis of correlational literature on measures of phonological awareness, rapid naming, reading, vocabulary and related cognitive abilities found that, although phonological skills are strongly related to reading, other processes also play an important role. Most notably, measures related to oral language skills such as vocabulary have been found to be related to reading e.g. (Catts, Fey, Zhang & Tomblin, 1999). In the current study, oral language skills were assessed in order to establish whether or not they predict literacy in the first grade.

Another study to illustrate the importance of oral language in reading was done by Catts *et al.* (1999) where they examined oral language and phonological processing profiles of poor and good second-grade readers when they were in kindergarten. They found that poor readers were three to four times likely to have had phonological processing weaknesses and four to five times more likely to have had oral language problems. They also discovered that 73 per cent of the poor readers had shown deficits in some measures of phonological skills or oral language, with most (40 per cent) having a combined deficit profile, about 20 per cent had primary oral language deficits and less than 15 per cent had phonological processing deficits. Almost all of the children who had phonological processing deficits also showed somewhat low scores on tests of oral language proficiency. These findings were observed when poor reading was defined by word recognition or reading comprehension performance. Based on these results, Catts *et al.* (1999) concluded that phonological processing in kindergarten was a good predictor of grade two reading, but oral language skills also contributed substantial and unique variance.

To further illustrate the importance of oral language in predicting reading, a study by Dickinson, McCabe, Anastosopoulos, Peisner-Feinberg and Poe (2003) showed that both phonological awareness and vocabulary make independent variance to predictions of literacy skills among preschoolers. In addition, Proctor *et al*. (2006) suggests that language skills interact with literacy knowledge and phonological knowledge and that both phonological awareness and oral language are important in learning to read. Furthermore, Swanson *et al*. (2008) found that oral language skills play a major role in predicting second language reading, and when oral language syntax and vocabulary was compared to phonological awareness, they found that a substantial amount of variance accounted for reading skills in the third grade. These findings, therefore, take us to another important activity which takes place in preschool to promote literacy skills in early years known as Oral language.

2.2.2 Oral Language Skills and their Predictive Role in early Grade Reading

Another well-studied constraint on reading is oral language proficiency. Shaughnessy, Sanger, Matteucci, and Ritzman (2004) and Blaiklock (2004) supported a strong relationship between oral language skills and reading skill development. If an individual has trouble understanding spoken language, it is highly unlikely that he/she will comprehend written language. Language comprehension is in itself multifaceted. Knowledge and skills involving vocabulary, background information, grammatical structures, metaphorical language and inferential reasoning must be applied in a coordinated manner to understand connected text (Sesma *et al*., 2009). Therefore, it is expected that as children enter preschool, their language skills increase and this is important for their learning to read. One of the consistent findings in studies and literature is that oral language abilities in early childhood predict beginning literacy skills such as letter knowledge, name writing and phonological awareness as well as later reading achievement (Bishop & Adams, 1990; Chaney, 1992; Scaborough, 1990). Further studies were done to look at short and long-term outcomes of preschoolers who were diagnosed (and in most cases treated) at speech-language clinics (Aram & Hall, 1989; Bishop & Adam, 1990) and nearly all these studies confirmed that preschoolers with language impairments are indeed at risk of developing reading disabilities as well as oral language difficulties at older ages. Oral language was classified as one of the five potentially important variables which had relationship with later reading (Kleffer, 2012). In addition, Snow *et al*. (2005) found that kindergarten reception vocabulary had a strong and stable correlation with reading comprehension scores in grades 4, 7 and 10 for the sample of monolingual children from low-income backgrounds. It was expected in the current study that oral language abilities would predict literacy performance.

One large study examining the relation between oral language skills and reading comprehension found that children identified as poor readers in second grade were three to five times more likely to have a history of oral language problems in kindergarten than competent second grade readers (Catts, Fey, Zhang & Tomblin, 1999). Kindergarten oral language skills also accounted for significant variance in second grade reading comprehension after controlling for phonological awareness and rapid naming skills (Catts *et al*., 1999). The relation between language deficits and reading comprehension appears relatively stable over time. Catts and colleagues found that language comprehension deficits still contributed to reading comprehension deficits when their sample reached the fourth grade (Catts, Hogan & Fey, 2003).

A study by Graffin *et al*. (2004) sought to assess whether the level of competence attained in oral discourse skill in the preschool period predicts later success at literacy as part of a larger longitudinal study of language development in a group of children from age five to eight years. They examined early oral discourse for evidence of the ability to control text-level macrostructures, produce informative text and evaluate the significance of the information reported. They related these oral discourse competencies at age five to measures of written language comprehension and production at age eight. They chose to assess discourse abilities at age five because it marks the endpoint of oral language development before formal literacy instruction begins. They also assessed literacy abilities at age eight because this is the age when most children begin to be able to produce and comprehend extended written texts. Their assessments of literacy achievement at eight focused on domains that are the central focus of literacy instruction in the first years of school: reading aloud, demonstrating comprehension of short passages and writing fictional narratives (Kamberelis & Bovino, 1999). They found that children's ability to mark the significance of narrated events through the use of evaluation at age five predicted reading comprehension skills at age eight. Children's ability to represent informational content in expository talk at age five also predicted reading comprehension at age eight. Control of discourse macrostructures in both narrative and expository talk at age five was associated with written narrative skill at age eight. These findings point to a complex and differentiated role for oral language in supporting early literacy.

Another study investigated the relationship between selected child and family demographic characteristics (child age, child sex, child birth order, maternal education and parent language status), family processes (parent-to-child reading at home, and parent expectations about child's educational attainment), and preschool experience with poor Peruvian first-grade children's oral language and reading abilities, and examined whether those factors help to explain differences among children living in poverty. First-grade students (N 137) of five schools in a poor neighborhood of Lima, Peru participated in the study. Children were given picture vocabulary, verbal analogies, letter-word identification, and reading comprehension tests. Information about the children and their families was gathered through parent interviews. Children whose parents had higher expectations obtained higher scores on picture vocabulary, verbal analogies, letter-word identification and reading comprehension. Children who attended private and public preschools obtained higher scores in letter-word identification than those who did not attend preschool. These findings support previous research on the relevance of family beliefs, above and beyond socio-demographic variables, as contributors to children's oral language and reading, and provide some evidence of the benefits of preschool among children living in poverty. In the current study, it was anticipated that children who read at home would perform better in reading as well as those that have been to preschool.

In an innovative study of oral language precursors to later reading achievement, Scarborough (1990) followed fifty-two children from approximately two years of age through second grade and conducted six evaluations of oral language skills (e.g., vocabulary knowledge, grammatical abilities) when children were between two and five years of age. Thirty-four children were at significant risk for developing reading problems due to familial incidence of reading disability. Of these children, twenty-two (65%) developed substantial reading problems by second grade. Detailed examination of these twenty-two children's oral language development over the preschool years showed a relatively greater number of grammatical errors at two years of age and poorer receptive and expressive vocabulary knowledge at four years, relative to those children who did not develop reading problems. To this end, Scarborough (1990) has argued that preschool oral language difficulties represent an early manifestation, or symptom of reading disability. This assertion has been supported by more studies (e.g. Lombardino, Riccio, Hynd, & Pinheiro, 1997). It holds true even for children who are not at explicit risk for developing reading problems (see Snow *et al.*, 1998). It is known, therefore, that children who struggle to develop vocabulary and grammatical skills early in life are more likely to experience literacy problems, relative to children acquiring oral language, according to expected milestone.

It is, therefore, important that development of oral language is encouraged in preschool through various activities such as storytelling and narrative tasks. When children are in the process of acquiring language, it is crucial they benefit from the supportive role of education. Konza (2011) suggested the following teaching strategies to help children acquire appropriate oral language.

Teach Active Listening; this is a core component of oral language as some children can hear but are not active listeners. This skill requires selective and sustained attention, working memory, cognitive processing and information storage and recall mechanisms. These are some of the important executive functions, which were assessed in the current study which will be reviewed in detail later in this chapter. Konza (2011) asserts that teachers can help children develop oral language by giving them tasks such as listening for specific or key information and listening to answer specific questions. Another teaching strategy suggested by Konza is what he called building oral language development into daily routines and classroom activity. Konza postulates that since oral language development occurs anytime and anywhere, it is easy to build oral language into daily routines such as roll call, distribution and collection of materials, classroom organisation, entry and exit routines and instructions. Examples of ways to do this could be during roll call. The teacher could ask questions such as what is the name of one of your friends. The other proposed strategy is that of providing opportunities for social interaction during preschool hours. It is believed that oral language develops through practice but most talking in classrooms is done by the teacher. Sylva *et al.* (2004) found that 73 per cent of preschool children's time in the United States was spent without any direct child-teacher interaction. Sylva and colleagues suggest that only 8 per cent of children's time was spent in elaborated interactions with teachers. The case for Zambia is not known as the current study did not explore this variable. However, it was anticipated that those children who went to preschool could have better oral language skills than those who did not go to preschool, this is because oral language develops most effectively through one to one conversations with a better language user. Therefore, the teacher can come up with ways to increase contact between preschoolers with better language and those with poor oral language in pairs or very small groups, Konza (2011). The other way could be to encourage parents and other volunteers to engage with preschoolers on a regular basis by perhaps sharing a book together, talking about a weekend activity, a celebration or any event that will promote spontaneous language. These activities do not only promote oral language but help children develop other important skills such as turn-taking, intonation expression and eye contact.

There is not much evidence in the literature about the effect of linguistic diversity as many Zambian children experience. They went to preschools where English was used as a medium of instruction but learn to read in Nyanja in first grade while they may speak another home language. In this study, it was anticipated that non-Nyanja speakers who relied on school to learn the language as well as reading could have problems in reading. This assumption was in line with Serpell's (1978) finding that pupils from Bemba-speaking families had by grade six acquired Nyanja competence in reading but only equivalent to that of Nyanja-speaking children in grade three. This shows the importance of familiarity with the language of instruction to facilitate learning to read. The same assumption was also tested by Matafwali (2010) who examined whether the poor reading abilities being exhibited by many children especially in cosmopolitan environments like Lusaka province could be attributed to the fact that children are learning in a language which is not essentially their mother tongue. For instance, she asserts that most of the children in Lusaka who are coming from homes where Nyanja (the language of initial literacy is not the first language) may lack proficiency in the language of initial literacy instruction which conversely affect their learning to read.

The importance of being familiar with the language of instruction cannot be overemphasised. If one knows the meaning of all the words in a sentence, have developed the decoding skills needed to read text and can use background knowledge and context clues to interpret those words correctly, one is immediately able to make sense of what has been read. If there is just one word that one is unfamiliar with, they are still likely to get the gist of the sentence and continual building their knowledge or conversation. However, if too many of the words are unfamiliar to them, it will become difficult to understand what is going on. They may also feel incompetent and believe that no matter how hard they try, they will never understand. In addition, a study by Tambulukani & Bus (2012) tested whether practicing reading in an indigenous language that differs from the language spoken at home and in the playground interferes with learning to read simple words in a Zambian language, even though the language of instruction and the most familiar language are both Bantu languages. The study found that children's most familiar Zambian language and the Zambian language in which basic reading skills are practiced leads to better reading skills in the Zambian language. They also discovered that practicing reading in a familiar Zambian language is an incentive for learning to read in English. The current study assesses oral language as a way of establishing whether it predicts literacy. Children's home language was also used to assess its influence on reading, especially for children who attended preschool.

A recent study by Matafwali & Bus (2013) which sought to examine reading levels among Zambian Children as well as to identify factors that promote acquisition of reading skills in the local Zambian language found that, children who are more familiar with the language utilised to teach reading progress in reading They also established that lack of proficiency in the language of instruction is the hallmark of persistent reading failure observed in the majority of Zambian children.

In Africa, a number of studies have also supported the use of a familiar language to acquire literacy skills. Williams and Mchazime (1999) in Malawian primary schools investigated reading proficiency in English and ChiCewa, the mother tongue in primary schools. They found that reading, listening comprehension and speaking in the language of instruction which is also the mother tongue, ChiCewa, was relatively easier for students than were the same activities when conducted in English.

To further support the use of a familiar language to acquire literacy, Afoloyan (1976,1999) advocated for the use of Yoruba, the mother tongue in the west Nigerian region, as a medium of instruction for the first six years of a child's education as a way of solving Nigeria's early literacy problems. In addition, Umolu (1999) reported the benefits of a familiar language approach with Nigerian students with special needs and those who were non-readers after their primary school education in helping them acquire literacy skills.

2.2.3 Shared Book Reading in Preschool and Children's Reading Acquisition

An activity that may be pivotal for developing precursors of literacy is book reading. Shared book reading is one of the activities done in preschool. A number of studies and intervention programmes have shown that children's vocabulary development is improved through shared book reading (Becker, 2011; Farrant & Zubrick, 2013). The findings of two meta analyses support the efficacy of parent-child book reading as a means of promoting children's vocabulary development (Bus, van Ijzendoorn, & Pellegrini, 1995; Moi, Bus, de Jong, & Smeets, 2008). Book reading is important as it improves children's vocabulary, which is a significant predictor of their later reading comprehension (Sénéchal, 2010; Wixson, 1986), reading proficiency (Beck, McKeown, & Kucan, 2002) and success at school (Snow, Griffin, & Burns, 2005).

To illustrate the importance of shared book reading to language development and to later letter knowledge skills, Laasko *et al.* (2004) explored the relationships between shared reading interest, language and cognitive skills in children with or without a genetic risk for dyslexia who were followed longitudinally from infancy to toddlerhood and beyond. Their first goal was to study whether these two groups of children would differ in the early interest they showed towards shared reading or in their later language or letter knowledge skills. (Elbro *et al*., 1998; Gallagher *et al*., 2000; Pennington & Lefly, 2001; Scarborough, 1990) hypothesised that children in the at-risk group would show poorer development than the control group children in their language and letter knowledge skills. Secondly, they studied the links between shared reading interest and children's general cognitive skills and parental education. Thirdly, they investigated the extent to which early shared reading interest together with children's cognitive skills and parental education predicts children's later language skills. The longitudinal approach also made it possible to study whether the interest exhibited towards shared reading at two age phases, at 14 months and at 24 months, had different associations with later language and letter knowledge skills.

They found that although these two groups of children did not differ in the interest towards shared reading in toddlerhood, they appear to have benefited differently from these early experiences. Only in the children without genetic risk (control group) did the early shared reading measures predict later skills. The study also revealed that children's reading of books was not related to parents' own literacy activities or to their education. Thus, it seems that the genetic factors that partly determine parents' own reading interest and habits do not appear to affect their sensitivity as reading partners. Further, they discovered that shared reading interest made no contribution to predicting later global language or letter knowledge for the at-risk children, whereas for the control children, it accounted for 4 per cent of the variance in global language and 7 per cent of the variance in letter knowledge.

In terms of how shared reading contributed to retention of new words, Horst, Parsons, & Bryan (2011) examined the retention of new words by three year old children in relation to repeated exposures to storybooks. They found that children who repeatedly heard the same stories were more accurate on both the immediate recall and retention tasks than those who heard different stories over the course of one week.

A recent study by Kucirkova, Messer and Sheehy (2014) designed to experimentally investigate whether unknown words appearing in books personalised for a particular child would facilitate the child's acquisition of these words among preschool children. In the supportive context of shared book reading, children were exposed to books with both personalised and non-personalised sections on two occasions, and their acquisition of new words embedded in the books was assessed at three testing points, with a picture, definition and emotional valence test. The results indicated that children acquired more new words that were in the personalised section of the books than those in the non-personalised sections and that this varied across testing points and by type of word knowledge that was assessed. More specifically, for the picture test and definitions tests, there was significantly better performance in the personalised than non-personalised condition at testing points 2 and 3. This implies that when children are exposed to books and are familiar with the characters in the book, they are most likely to improve their vocabulary, which is also important in learning to read.

In addition, controlled studies indicate that children who were read personalised books made greater gains on a number of literacy and social skills measures, including reading comprehension and reading recall, in comparison with the children who were read traditional stories or stories similar to those of personalised ones but with no reference to the child. While such results point to the importance of personalisation in book reading and children's outcomes, the overall contribution of the personalised book features on children's learning is difficult to estimate (Kucirkova *et al*., 2014). The current study, however, did not test book reading whether personalised or not but it was thought that children with preschool exposure could have been exposed to shared book reading more than those who were not exposed to preschool, hence this aspect was controlled for. Information on whether or not a child was read to was gathered by asking the children if they read at home, who helps them read at home and the kind of books they read.

A study by Farrant and Zubrick (2013) investigated the developmental importance of joint attention and parent-child book reading for children's vocabulary around the time of school entry. They found that children who had low levels of joint attention in infancy were significantly more likely to have poor receptive vocabulary at wave 3. They also observed that children who had low levels of parent-child book reading across waves 1.5, 2 and 3 were two and a half times more likely to have poor vocabulary at wave 3. There was also some indication that children who had a low level of parent-child book reading at more than one wave were also at increased risk; children who had low levels of parent-child book reading at waves 1.5 and 2 or at waves 2 and 3 also had a significantly increased risk. These results also underscore the importance of having more (e.g. > 20) rather than fewer children's books in the home from an early age. It is important, therefore, that preschoolers are read to so that their vocabulary can develop to promote future reading.

Bus *et al*. (1995) found that children's oral language as well as print knowledge benefited from interaction during and after reading sessions. High quality book reading as well as frequency of reading may be important factors in supporting basic knowledge of reading. Older children expand print knowledge via book reading. In a meta-analysis by Bus *et al.* (1995) on joint book reading among preschoolers, they found that parent-preschooler book reading is related to outcome measures such as language growth, emergent literacy and reading achievement.

They also reported that the strength of the association between book reading and literacy/language skills is somewhat greater than the influence of one of the most powerful predictors of reading problems, namely, the non-word reading deficit. Bus *et al.* (1995) also found that the effect of the frequency of parent-preschooler book reading is not dependent on the socio-economic status of the families. Even in lower class families with (on average) low levels of literacy, book reading frequency affects children's literacy skills. This result is in accordance with the assumption that book reading is not just a minor part of a literate environment but rather a main condition for developing the knowledge necessary for eventual success in reading acquisition. Even in families with few other incentives to become literate, the frequency of book reading causes an effect.

A meta-analysis by Moi *et al*. (2009) explored the effects of an intervention thought to enhance the quality of adult-child storybook reading in early education and its effect on children's language and literacy development. It was found that children's oral language as well as print knowledge benefited from interaction before, during and after shared reading sessions. Thus, about 6 per cent of the growth in oral language skills could be explained by an interactive reading intervention in an educational setting (r = .25). They argued that the results indicate that the quality of book reading is important in addition to its frequency. They also found that when translated into a binominal effect size display or a change in success ratio, the oral language of children exposed to an interactive reading programme gained 28 per cent more than their peers in a control group, meaning that with interaction, 64 per cent improved in oral language, compared to 36 per cent of children who were not part of the intervention.

A study by Davidse *et al.* (2011) explored the relationship between book exposure, cognitive control and early literacy skills. They found that home literacy environment (as measured by the frequency of book sharing and the parent print exposure checklist) predicts literacy skills. The results also verified their second hypothesis that children's book-cover recognition is an even better indicator of the literacy environment than home literacy variables (frequency of book sharing and parental print exposure). Thirdly, cognitive control influences literacy outcomes, but it did not strengthen or disrupt the positive influence of book exposure. Specifically, short-term memory predicts vocabulary over and above intelligence. In all, the findings support the hypothesis that the book-cover recognition score as indicator of children's literacy environment is a better predictor of literacy outcomes than cognitive measures.

Still in support of book reading in preschool, Lonigan (2006) found that preschool children were able to significantly expand their print knowledge as a result of book reading, whereas younger children's print knowledge hardly benefitted from interactive storybook encounters. One explanation for this might be that kindergarten teachers made more references to print than preschool teachers and/or those children with some knowledge of print may have elicited discussion of print features. Alternatively, a storybook itself might emphasise print and enhance print knowledge by varying font types and sizes, displaying some utterances in text balloons, or using rhyme and alliterations (Justice & Ezell, 2002). Unfortunately, hardly any information was provided about print-salient features within the storybooks that were used in the intervention studies. The current study speculates that children's ability to divide their attention between an adult and a book increases with growing experience in comprehending and interpreting a story's content. As children grow older, they might have control of skills to explore and process other features of the printed text, such as single letters, while listening to and interacting with an adult at the same time, whereas younger children need to invest all efforts in understanding the story.

Clay (1991) asserted that children who have heard many stories read to them develop awareness that book language, or literary forms of language, is different from spoken language. Clay's assertion was supported in a series of applied studies by (Justice & Ezell, 2000, 2002; Justice, Weber, Ezell, & Bakeman, 2002). Their studies showed that adult-child shared storybook reading experiences that involve discussion about print increases children's knowledge of important print concepts. A child with well-developed print concepts knows several essential points that are necessary to reading acquisition. For example, a child may know that:

1. The print tells the story,
2. Text on a page is read from left to right,
3. Progression through text moves from the top of the page to the bottom of the page,
4. When one page of text is read, the story continues on the next page, and
5. The white spaces between groups of letters represent a break between spoken words or word boundaries (Clay, 1993; Justice & Ezell, 2001).

A student's knowledge about concepts of print has been found to support reading acquisition and to moderately predict reading ability in the primary grades (Clay, 1993).

Apart from improving literacy, preschool is also believed to have influence on numeracy development in the early school years. A study by Lopez *et al.* (2007) where they looked at preschool antecedents of mathematics achievement of Latinos found that family resources (parents 'educational level, occupation, and income) predicted home literacy activities. Home literacy activities predicted combined early Spanish literacy and English language proficiencies at kindergarten entry, which predicted elementary mathematics achievement, which in turn predicted middle school mathematics performance. These results and qualitative analyses with a subsample of thirty randomly selected families suggest that literacy and numeracy proficiency go hand in hand. They suggest that combined effort of preschool and early elementary literacy and numeracy interventions programmes are needed to supplement efforts in middle and high school.

2.3 Early Numeracy Skills

Similar to reading, children begin to develop their mathematics skills quite early in life. Research has shown that children are born with some aspect of numeracy skills such as the ability to recognise changes in magnitude (Wood & Spelke, 2005) which can be improved by instruction (Baroody, Eiland & Thompson, 2009). The assessment of preschoolers usually test three highly related but distinct domains. These include numbering, numeral relations and arithmetic operations (Jordan, Kaplan, Locunik & Ramineni, 2007; Pupora, 2009). Numbering entails knowing counting in order, counting principles and the ability to be able to tell the total number of items in a set (Cardinality) by immediately recognising (subitising) or by counting the set. Numerical relations involve knowing how two or more items are connected or relevant to each other and the association between the numbers on the mental number line; Arithmetic operations is a child's ability to understand changes in quantities from the change in the size of sets. These domains are the most studied aspects of early mathematics (Ginsburg, Klein & Starkey, 1998; Jordan, Koplan, Olah & Locunik, 2006) and the concepts of and skills not necessary for the development and formal mathematics such as addition and subtraction. (Jordan, Kaplan, Raminen & Locunik, 2009).

The current study specifically looked at cardinality, counting from 1 to 20, counting principles, number knowledge, number-flash conservation, non-verbal addition and subtraction, addition and subtraction within a story context, addition and subtraction sums and estimation. These were done at the beginning of the first term as they are believed to be pre-numeracy skills while at the end of grade one, children were assessed on addition, subtraction, multiplication and division using the DLE mental arithmetic test in addition to the above skills.

The motivation to assess children's numeracy skills in this study was brought about by evidence that preschool promotes arithmetic in early formal education. A longitudinal study by Aunio and Niemivirta (2010), for example, examined how children's early numeracy assessed in kindergarten predicts their mathematical performance in the first grade, after controlling for the effects of age, gender and parents 'education. They found that the acquisition of counting and relational skills before formal schooling are predictive of the acquisition of basic arithmetical skills and overall mathematical performance in grade one, above and beyond the effects of demographic factors. Adams and Hitch (1997) examined this relationship in children aged 8 to 11 years using simple mental addition (8 + 1) and complex mental addition (231 + 16) problems. They found that solving problems presented verbally was associated with high working memory. Whereas solving problems presented visually was related to low working memory. They also found that the level of problem difficulty was associated with working memory contributions, with higher working memory spans corresponding with higher complexity problems (Braunmiller, 2008).

Another important aspect that was looked at in the current study is executive functioning and how they predict literacy and numeracy in the first grade. It was anticipated that since executive functions are stimulated in the preschool years, they would mediate reading and numeracy in children that had been to preschool. Therefore, it was thought that children who have been to preschool would be able to regulate their behaviour through executive functions and would, therefore, perform better in literacy and numeracy than those that had not been to preschool before starting first grade. The following is a review of what executive functions are and how they predict literacy and numeracy skills.

2.4 Executive Functions

Executive functions refer to a family of top down mental processes needed when one has to concentrate and pay attention (Burgess & Simons, 2005; Espy, 2004; Miller & Cohen, 2001). Executive functions are also defined by Diamond *et al*. (2007) as a set of cognitive abilities that control and regulate behaviour that is required for learning. Defined broadly, executive functioning is self-government for regulating mental functions. Executive functions are important in any problem-solving activity that is not automatic because conscious, reflective problem solving requires inhibiting irrelevant or over learned responses when generating response options, devising and applying strategies during planning and maintaining these strategies and shifting them as needed when pursuing a goal (Zelazo, Carter, Reznick & Frye, 1997).

There is a general agreement that the core executive functions are inhibition (inhibitory control including self-control behavioural inhibition) and interference control working memory (WM) and Cognitive flexibility (also called set shifting, mental flexibility or metal set shifting and closely linked to creativity) (Lehto *et al*., 2003). It is believed that from these core executive functions come other things such as reasoning, problem solving and planning (Diamond, 2013). Executive function skills are essential for success in school. Therefore, an understanding of the development of EF subcomponents during the early years of beginning reading may lead to more effective intervention programmes for children with learning disabilities or at risk for learning problems. Literature has shown that executive functions are important for both reading and arithmetic in the early years (Altemeier, Abbott & Berninger, 2008) formal learning as well as throughout schooling (Altemeier, Abbott & Berninger, 2008; Bull, Espy, Wiebe, Sheffield & Nelson, 2010; Fei-Yin Ng *et al.,* 2014; Foy & Mann, 2012; McClelland, 2007;). It is, therefore, important that an understanding of the development of core executive functions be done. The following is an explanation on the development of the core executive functions as recently given by Diamond (2013).

2.4.1 Inhibitory Control

Inhibitory control involves the ability to control ones attention, thoughts behaviour, thoughts and or emotions to override a strong internal predisposition or external lure and instead do what is more appropriate (Diamond, 2013). Inhibitory control, therefore, allows us to choose how we behave. Inhibitory control of attention (Interference control), for instance, helps to focus on what is perceived as important suppressing attention to other things or stimuli. One can also choose to voluntarily ignore (or inhibit attention to) particular stimuli and attend to others based on their goal or intention. For example, a child solving a math problem can decide to ignore his or her friends playing in the lobby while doing that task.

Self-control is another aspect of inhibitory control which entails controlling ones behaviour and emotions through resisting temptations and not acting impulsively. Self-control also entails having the discipline to stay on task despite distractions and completing a task despite temptations to give up, to move to more interesting work or to have a good time instead (Diamond, 2013).

There are a number of psychological measures that have been used to measure inhibitory control. Among them is the Stroop task (Macleod, 1991), Simon task (Hommel, 2011) Flanker task (Mullane *et al*., 2009), delay of gratification task (Kachanska *et al*., 2001), go/no-go task (Cragg & Nation, 2000). In the current study, a Stroop-like test was used in which children had to switch rules by responding with an opposite, that is, saying 'blue' to a red dog and 'red' to a blue dog (Beveridge, Jarrold & Pettit, 2002). The Stroop tested both inhibitory control (by ignoring the natural tendency to say red to a blue dog or blue to a red dog) as well as working memory where they had to remember to switch rules.

The development of inhibitory control is known to take place quite early in life, during preschool age and is said to be predictive of outcomes throughout life. A study by Moffit *et al*. (2011) investigated 1 000 children born in the same city in the same year for thirty-two years with a 96 per cent retention rate, found that children who at the age of 3 to 11 had better inhibitory control were more likely to still be in school as teenagers, were less likely to engage in risky behaviours. They grew up to have better physical and mental health, earned more and were more law abiding adults thirty years later than those with worse inhibitory control as children. Inhibitory control has also been found as an important predictor of reading and arithmetic (Altemeier, Abbott & Berninger, 2008; Bull & Scerif, 2001; Espy *et al*., 2004; Locascio *et al*., 2010; St. Clair-Thompson & Gathercole, 2006).

2.4.2 Working Memory (WM)

Another core executive function is working memory, which involves holding information in mind and mentally working with it (Baddeley & Hitch, 1994, Smith & Jonides, 1999). The two types of WM are differentiated by content; these are verbal WM and non-verbal working memory. WM is important for making sense of anything that comes overtime, for new things always require keeping in mind an earlier incident and relating it to what happens later. This is necessary for making sense of written or spoken language whether it is a sentence, a paragraph or even reading. Maths also requires one to hold information in WM (Diamond, 2013). WM is also crucial to our ability to see connections between seemingly unrelated things, for example, seeing that when letters are combined together, they can form words which later form sentences and then paragraphs.

Working memory is one aspect of executive function that has been associated with reading ability. Children with dyslexia show deficits on working memory tasks in both verbal and visual domains (Reiter, Tucha, & Lange, 2005). A cross-sectional study examining verbal working memory in children with reading disabilities relative to skilled readers (ages 7 to 20 years) noted that while working memory skills improved with age among the skilled readers, little age-related change was observed in children with reading disabilities, such that the difference between groups increased steadily over time (Swanson, 2003). Verbal working memory also has been linked specifically to reading comprehension, both in normal, highly experienced readers and in impaired readers (e.g., Swanson, 1999; Swanson & Alexander, 1997; Swanson, Ashbaker & Sasche-Lee, 1996; Swanson & Berninger, 1995; Swanson & Jerman, 2007).

There is a connection between working memory and inhibitory control; this is because working memory supports inhibitory control. For instance, one needs to hold the goal in mind in order for one to know what is important and what to inhibit. By concentrating on the information one wants to remember, one is less likely to make mistakes, thereby reducing on inhibitory errors. Teachers are, therefore, encouraged to use visual cues to help children remember what they are told as well as improve their inhibitory control performance. For example, a school programme for 4-5 year olds called, tools of the mind, uses visual aids in an activity called, buddy reading (Bodrova & Leong, 2007). In this task, each child chooses a picture book, pairs up with another child and they are to take turns telling the story that goes with their book. This helps the children realise that they need to listen when it is not their turn to tell the story as well as to wait their turn to tell the story.

In as much as working memory support inhibition, inhibition also supports working memory in the sense that for one to keep their mind focused on a task they endeavour to perform, they must inhibit internal and external distractions. If this does not happen, then the mind will wander, which means that the information we intended to hold in the mind will not be kept there. Inhibitory control also helps working memory by ensuring that our mental workspace is kept free and not clustered with irrelevant information (Zacks & Hasher, 2006).

There are a number of psychological tasks that can be used to assess working memory, among them is the backward digit span, Corsi block test, the self-ordered pointing task and the working memory span tasks such as the counting span or reading span (Diamond, 2013). In the current study, the forward digit span was used to assess working memory in addition to other tests such as the Stroop like task and the peg tapping tasks. However, the forward digit was not used in the analysis as a measure of working memory as it was realised that it is more of a short-term memory test than a working memory test. In the analysis, included were the Stroop like task opposite, pencil taping tasks as well as information that was provided by the teachers through the behaviour rating inventory of executive functions, which had a section on aspects that entail poor working memory.

The ability to hold information in the mind develops quite early in life, for instance, young children can hold one or two things in mind for a long time (Nelson *et al*., 2012). It is known, however, that WM declines with age. Correlational studies have shown that there is a correlation between decline in WM with age and improvements in WM during development (Rozas *et al*., 2008; Zumprich & Kurtz, 2012).

2.4. 3 Cognitive Flexibility

Cognitive flexibility is the third core executive function. This skill builds on the other two functions (inhibitory control and working memory) and comes in much later in development (Davidson *et al*., 2006; Garon *et al*., 2008). One aspect of cognitive flexibility is being able to change perspective spatially. To change perspectives, one needs to inhibit one's previous perspective and load into WM a new perspective. Another aspect of cognitive flexibility involves changing how one thinks about something (Diamond, 2013). Cognitive flexibility also involves being flexible enough to adjust to changed demands or priorities, to admit you were wrong and to take advantage of sudden, unexpected opportunities. There is much overlap between cognitive flexibility task switching and set shifting. It is known that task switching improves during child development and declines during aging (Cepeda *et al*., 2001; Kray, 2006).

Cognitive flexibility is often investigated using a number of task switching and set-shifting tasks. The oldest of these could be the Wisconsin card sorting task (Stuss *et al*., 2000). Most task switching paradigms involve two tasks. Those tasks might be indicating whether (a) a letter is a vowel or a consonant (b) a number is even or odd (e.g. Monsell, 2003). In the current study, no hands on cognitive flexibility tasks were done except reports by the teachers through the BRIEF.

2.5 Executive Functions as Predictors of Reading and Writing

Executive functioning may be related to normal reading and writing development, but the relationship of executive functioning to typical reading development has received scanty research attention (Sesma *et al*., 2009). This is especially so in Africa. Executive functions may govern the integration of visual and linguistic information and the automatic retrieval of linguistic information from memory while learning to read. From the perspective of writing, executive functions have been defined as control processes that guide the self-initiation of thoughts, affect and behaviours used to attain writing goals (Zimmerman & Risemberg, 1997). Executive functions monitor recursive planning, translating and reviewing/revising processes in the problem-solving process of writing (Hayes & Flower, 1980).

Executive functions are known to predict early literacy skill development (McClelland *et al*., 2007). A study by Foy and Mann (2012), examined how executive function skills in verbal and non-verbal auditory tasks are related to early reading skills in beginning readers. Year-end measures of early reading skills included tests of phoneme awareness, letter knowledge, as well as reading (words and non-words). It was found that the children made more errors on the verbal than the non-verbal tasks, suggesting that executive function abilities may differ by task. Adding to the literature on the role of inhibitory skills in reading, verbal inhibitory executive function skills were tied more closely to early reading than other verbal or non-verbal skills when age, short-term memory, and vocabulary were controlled.

To further delineate the importance of EF to reading, Sesma *et al*. (2009) explored whether executive functions, particularly in the areas of working memory and planning skills, represent an additional component of reading after accounting for individual differences in attention, basic decoding skills, reading fluency and vocabulary. Specifically, they hypothesised that executive functions would be significantly associated with reading comprehension skills, but not single word reading accuracy, thereby suggesting executive function as a potential contributor to reading comprehension ability. Results from a hierarchical multiple regression model including all the variables listed above as well as measures of working memory and planning accounted for 63 per cent of the variance in reading comprehension, a large effect size. Within this model, reading fluency, vocabulary, working memory and planning skills all made significant unique contributions to the prediction of reading comprehension.

The same model also accounted for 69 per cent of the variance in single word reading. Decoding skills emerged as a significant contributor to single word reading. Reading fluency and vocabulary skills also remained significant predictors. However, executive function skills (planning and working memory) were not significant contributors to single word reading. These results indicate that executive control skills differentially support reading comprehension but are less necessary for single word reading. They also predicted that both planning and working memory skills would be associated with reading comprehension. Consistent with Sesma and colleagues' prediction, verbal working memory skills (i.e., the ability to 'hold' and mentally manipulate verbal information while performing some other task) and planning skills significantly contributed to reading comprehension after controlling for individual differences in attention, decoding, reading fluency and vocabulary. Specifically, stronger performance on tasks requiring mental manipulation and more efficient planning (i.e., fewer excess moves) on the Tower of London were both associated with higher reading comprehension scores. Their findings provide additional support to previous studies that have reported a link between working memory and reading comprehension. (Swanson, 1999; Swanson & Alexander, 1997; Swanson *et al*., 1996; Swanson & Berninger, 1995; Swanson & Jerman, 2007; Swanson & Trahan, 1996) and suggest that this relationship is present even after accounting for attention, decoding, speed (fluency), and vocabulary skills.

In another study by Altemeier, Abbott and Berninger (2008) where they hypothesised that three executive functions namely inhibition, rapid automatic switching (RAS) and inhibition/ switching would improve over the course of elementary school and would contribute differentially to concurrent literacy skills in typically developing children. The results confirmed that executive functions would contribute differentially to literacy learning for typically developing readers and writers to some degree. However, across tasks and grades, for the most part inhibition alone contributed uniquely, but adding RAS to inhibition showed that RAS contributed uniquely over and beyond its shared variance with inhibition. This finding should not be interpreted that RAS alone is the unique predictor, as this finding held when inhibition was entered first and RAS second into the model. Thus, the results provided concurrent and construct validity for the theory that both inhibition and RAS contribute to the reading and writing achievement of typically developing readers and writers. However, one measure that combined inhibition and RAS did not uniquely explain the concurrent reading and writing achievement better than separate measures of inhibition and RAS. Including RAS in Model 2 or Model 3 also appeared in general, to result in accounting for a larger proportion of the variance in the reading and writing outcomes.

Results also showed that the proportion of variance explained by executive functions in the reading and writing outcome models varies by grade and by task. For reading measures without a timed component, executive functions predicted literacy outcomes the most during the early elementary grades. One possible explanation is that as early readers are learning to decode, executive functions guide the process of learning to relate spoken and written words. At this time, inhibition and rapid automatic switching are needed to suppress irrelevant codes during phonological retrieval of sounds for letters or names for the whole written word and to switch among the constantly changing letters and written words, respectively.

In addition, Sáez *et al*. (2012) examined the role of student attention for supporting kindergarten word reading performance. In particular, they investigated whether observed teacher practices interacted with this relationship. Based on the literature reviewed, they proposed that increases in attention-memory behaviours would boost reading performance because they strengthen a student's ability to remain focused on relevant aspects of reading instruction, thereby guarding against forgetting and mentally organising learning opportunities (Garon *et al*., 2008; Gathercole *et al*., 2008). In other words, they believe that selective attention may scaffold the acquisition of reading skills by helping students to hold on to relevant information and sustain focus, which would reduce the likelihood of forgetting and enhance the likelihood of goal- directed efforts during skill practice. They found that teacher task orienting was negatively related to kindergarten word reading outcomes as ratings of student attention increased. This result suggests that, in general, the better the student attention, the less teacher orienting affects word reading performance. In other words, in the presence of a classroom with average or better attention capabilities, by mid-year, less teacher task orienting and teacher redirecting (which regulate student attention to upcoming task actions) and greater expectations for student management of task routines are warranted to support word reading skill development.

Furthermore, consistent with literature, Saez (2012) established that 'effective' individualised instruction was related to higher reading scores (Connor, Piasta *et al*., 2009). This effect, though, was most pronounced among higher ratings of attention, suggesting that this effect differentially benefits students. That is, for kindergarten students who can self-regulate their attention and sustain focus on learning goals well, individualising instruction helps to promote word reading skill acquisition.

Another study by Locascio *et al*. (2010) examined a wide range of executive function skills among three groups of children: (a) those with Word Recognition Deficits WRD; (b) those with S-RCD, namely, who do not have concomitant deficits in word recognition; and (c) typically developing children demonstrated that children with reading disorders perform poorly on executive function measures. In particular, those children with basic word recognition deficits (most of whom had concomitant deficits in reading comprehension) demonstrated pronounced executive dysfunction across skill areas involving verbal working memory and response inhibition. However, executive dysfunction in WRD group appears in part to be linked to weaknesses in phonological processes, as this group showed less EF impairment after co-varying for phonological processing. These results are consistent with Baddeley's model of an executive system modulated by phonological input (Baddeley & Hitch, 1974; Gathercole & Baddeley, 1993). Thus, while children with WRD may present with executive dysfunction, Locascio *et al.* (2010) indicate that these deficits may in part stem from their core difficulties in phonological processing. Their findings on the whole, strongly suggest that the relationship between executive dysfunction and reading comprehension does not appear to stem solely from processes underlying word recognition, as those children with specific reading comprehension deficits (i.e., those without basic word recognition deficits) demonstrated executive dysfunction in strategic planning, even when phonological processing performance was controlled for in analyses. These results highlight the contribution of executive function skills (over and above skills necessary for basic reading) in the development of reading comprehension and are consistent with the findings of Cutting *et al*. (2009) as well as Sesma *et al*. (2009), who demonstrated this unique contribution in separate cohorts.

In order to further show the importance of executive functions, Nevo and Breznits (2013) investigated the development of working memory from the end of kindergarten to the end of first grade as well as the relationship between working memory in kindergarten and first grade reading skills among ninety-seven children. The children were divided into two groups according to their decoding skills (twenty-four poor decoders and seventy-three typical decoders). They discovered that both groups improved in working memory from kindergarten to first grade, specifically the highest relationship was observed between phonological complex memory and first grade reading. They also found that poor decoders exhibited poor working memory and performed poorly in all reading ability tests (decoding, reading comprehension and reading speed), suggesting that it is important to stimulate working memory even before formal teaching of reading as this maximises future reading achievement.

Not only do executive functions predict reading and writing but are also known to be predictors of numeracy (McClelland, 2007). A study by Van der Sluis, de Jong and Van der Leij (2007) tested the extent to which executive functions, specifically inhibition, shifting and updating relate to the performance of nine to twelve year olds in reading, arithmetic and non-verbal reasoning. They found that updating was related to reading, arithmetic and non-verbal reasoning but that shifting was mainly related to non-verbal reasoning and reading.

Providing further impetus to understand the development and effective measurement of behavioural regulation, or 'executive function in context,' is mounting evidence establishing that behavioural regulation contributes significant, unique variance to children's academic achievement and growth trajectories across preschool years, elementary school, middle school, and even high school. In one study that followed children to middle school, kindergarten behavioural regulation (as part of a broader learning-related skills construct measured by teacher report) predicted reading and math achievement between kindergarten and sixth grade and growth in literacy and math from kindergarten to second grade (McClelland *et al*., 2006).

In addition to this, a recent meta-analysis by Yeniad *et al*. (2013) investigated whether shifting ability predicts math and reading in children. The results indicated that children who are able to switch conceptual representation that is goals, rules or strategies for problem solving to a newer one show better performance in math and reading. The National Institute for Child Health and Human Development Early Child Care Research Network (2003) found that better attention on a tedious computer task predicted better reading and math achievement in 54-month-old children. This, therefore, brings us to an important aspect which was tested in the current study, which is whether executive functions predict numeracy performance in the first grade.

2.6 Executive Functions as Predictors of Numeracy

Baddeley's multi-component model has shown that measurements of central executive functions are strongly correlated with the prediction of mathematical abilities in children (Anderson, 2008; Gathercole *et al*., 2004; Swanson & Beebe - Frankenberger, 2004; Lehto, 1995; Swanson, 1994). Most of these studies have appreciated the central executive functions in the memory tasks, showing that the coordination and monitoring of simultaneous processing and storage of information are important during the performance of arithmetic and mathematical tasks.

To further show the importance of executive functions in predicting numeracy, a study by Anghel (2010) looked at executive function in preschool children and working memory predicting mathematical ability at school age. She found that EF predictions are strongly correlated with children's mathematical skills because executive processes of memory, organisation, flexibility, prioritisation and control are important in mathematical success; they reported that EF convert words into mathematical logic, provides relevant information and keep the words and numbers in WM.

A recent study by Fei-Yin Ng *et al*. (2014) where preschoolers' inhibitory control and early math skills were concurrently and longitudinally examined in 255 Chinese, African, American, Dominican, and Mexican 4-year-olds in the United States. The study showed that inhibitory control at age four, assessed with a peg-tapping task, was associated with early math skills at age four and predicted growth in such skills from age four to age six among these ethnic minority children after adjusting for ethnic background. Chinese children outperformed other groups on inhibitory control at age four and early math skills across ages. Mediation analyses indicated that their advanced inhibitory control at age four partially accounted for their advantage in early math skills concurrently at age four and longitudinally at age six, therefore, highlighting the role of inhibitory control in the early math skills of ethnic minority children.

Literature has also shown that executive functions, particularly inhibitory control, has been found to predict preschoolers' early math skills, adjusting for children's general intellectual ability or vocabulary (used as a proxy for intellectual ability). For example, a composite measure of preschoolers' inhibitory control and working memory was found to be positively associated with their early math skills, adjusting for their vocabulary skills (Bull, Espy, Wiebe, Sheffield & Nelson, 2010). When the three components of EF were assessed and analysed separately, inhibitory control and working memory were positively associated with preschoolers' early math skills, but only inhibitory control made unique contributions to math skills beyond those of the other two EF components and vocabulary (Espy *et al*., 2004).

In a longitudinal study that covered preschool and kindergarten years, children's EF were assessed at three points using a peg-tapping task, the Dimensional Change Card Sort (DCCS; Frye, Zelazo, & Palfai, 1995), and a backward word span task, which reflect children's inhibitory control, cognitive flexibility, and working memory, respectively; their early math skills were also measured, and their math achievement was additionally measured at the end of the kindergarten year. The analyses showed that EF at the beginning of preschool predicted growth in early math skills during the preschool year. Moreover, children's growth in EF during preschool was a unique predictor of their math achievement at the end of kindergarten after taking into account their growth in early math skills during preschool. Another study by Clark *et al*. (2013) indicated that children's inhibitory control and working memory at age three predicted their early math achievement two years later, after controlling for their prior informal math skills, vocabulary and processing speed.

In addition, Kroesbergen *et al*. (2009) investigated how basic cognitive processes are related to math abilities to best determine which children are at risk for developing math disabilities. The role of four distinct basic processes in the development of early mathematics were investigated, these are executive functions, fluid intelligence, subitising, and language. The results showed that both executive functions and number sense were important factors in children's development of counting skills. Both executive functions and subitising explained a significant part of variance in children's counting skills. IQ scores could not add further explanation to the variance in early math. The implications of this study are that it seems promising to use the concept of executive functions for the early identification of children at risk for math learning difficulties.

A study by McClelland *et al*. (2007) investigated predictive relations between preschoolers' behavioural regulation and emergent literacy, vocabulary and math skills. The study revealed that behavioural regulation significantly and positively predicted fall and spring emergent literacy, vocabulary and math skills on the Woodcock Johnson Tests of Achievement. Moreover, growth in behavioural regulation predicted growth in emergent literacy, vocabulary and math skills over the pre-kindergarten year, after controlling for site, child gender and other background variables. Furthermore, Alloway and Passolunghi (2010) tested the contribution of working memory and verbal ability (measured by vocabulary) to mathematical skills in children. A sample of 206 seven- and eight-year-olds was administered tests of these cognitive skills. A different pattern emerged that was dependent on both the memory task and the math skill. In the seven-year olds, visual-spatial and verbal memory uniquely predicted performance on the math tests; however, in the eight-year olds, only visual-spatial short-term memory predicted math scores. Even when differences in vocabulary were statistically accounted, memory skills uniquely predicted mathematical skills and arithmetical abilities. This pattern of findings provides a useful starting point that can add to existing research on the contributions of working memory and vocabulary to different mathematical skills.

Espy *et al*. (2004) investigated the contribution of executive functions to emergent mathematical skills in preschool children. Preschool children (N=96) completed an executive function battery that had empirically reduced working memory, inhibitory control and shifting abilities by calculating composite scores derived from principle component analysis. Both working memory and inhibitory control predicted early arithmetic competency. The observed relations stayed robust after controlling statistically for age, maternal education and child vocabulary. Only inhibitory control accounted for the unique variance in mathematical skills. After the contributions of other executive functions were controlled as well, specific executive functions are related to emergent mathematical proficiency in this range. They suggest that longitudinal studies using structure equation modelling are necessary to better characterise ontogenetic relations.

2.7 The New Breakthrough to Literacy in Zambia and Literacy Studies

In order to establish the predictive role of preschool, executive functions and oral language in reading among Zambian children, it is important to show that efforts have been made in the past to ensure that Zambian children learn to read and write in primary school. The following is a review of literature on changes in reading policies and studies In Zambia.

The education system has changed drastically since independence in 1964. Before independence, there seldom were preschools in the country. During that time, a local language was used to teach in early primary education. This, however, was abandoned for a 'Straight for English' policy after independence (Mwanza, 2011). The reason for the change was that English is the official language in Zambia. The reason this is so is that it adds to the modernity and unity in a country that has so many other languages. In terms of modernisation, it was thought that English, being a language of the global village would enhance commercial development through facilitating international contacts (Kalindi, 2006). However, using English in education to bring about harmony and modernisation has not been an outright success. While English prospered in avoiding conflicts in the educational arena between competing groups, it made it extremely difficult for groups that do not have access to English such as the poor in rural areas to learn in schools. Even with these concerns, English was still used in schools from elementary to secondary school.

According to Tambulukani (2002), the fact that initial reading in Zambia was carried out in English, a language that most children have very little or no knowledge of when they start school largely contributed to extremely low levels of both reading and writing exhibited by most Zambian children. Furthermore, the methods and classroom approaches to reading such as the 'look and say' method which encourages the identification of words through the use of flash cards resulted in most pupils in primary school failing to learn. A study by Williams (1993) showed that in a sample of 227, there was inadequate comprehension in English among, 85 per cent of grade three pupils, 84 per cent of grade four pupils' and 74 per cent of grade six pupils.

William (1993) postulates that language learning is a process that takes a long time whether in a learning system or an informal out-of-class setting. The degree of learning hinges in part on the period, amount of productivity of the input, what the learner hears or reads and the type of language activities in which the learner participates, such as reciting phrases, listening to the teacher, singing songs as well as writing stories. In addition, Cunningham and Zibulsky (2014) state that lack of familiarity with the language dims one incompetent and may lead one to believe that they will never learn to read no matter how hard they try (p. 21).

The understanding that children were failing to read prompted the Ministry of Education to revise its policy and come up with the Primary Reading Programme (PRP) in 1998 stating the following:

Zambia has had almost thirty years' experience of using English as the medium of instruction from grade one onwards. Children who have very little contact with English outside the school have been required to learn how to read and write in this language which is quite alien to them. The experience has not been altogether satisfactory. The fact that initial reading skills are taught in and through a language that is unfamiliar to the majority of children is believed to be a major contributing factor to the backwardness in reading shown by many Zambian children (MoE, 1996: 39).

In light of this, the PRP became the programme to spearhead implementation of this change in policy and produced courses that enabled children to learn in a familiar Zambian language. This programme had 3-pronged objectives to ensure that this purpose is met, that is, to ensure that: (a) children acquire basic literacy skills in a familiar language in grade one and have a basis in oral English language, (b) children transfer the literacy skills into English which remains the main medium for education in grade two and, (c) that children develop and extend these vital literacy skills in grades three to seven to give them access to the entire curriculum. The Ministry of Education attached high priority to the attainment of this goal. This is reflected in the policy document which stipulates that: 'The aim of the curriculum for the lower and middle basic classes (Grades 1-7) is to enable pupils to read and write clearly, correctly and confidently in a Zambian language and in English' (MoE, 1996: 34). This being the case, the current study aimed at testing whether oral language would predict literacy in first grade.

The Primary Reading Programme (PRP) had the New Breakthrough to Literacy (NBTL) as one of its major components in grade one, which used as a language of initial literacy, the local language used in that particular area. The NBTL has proved successful in a number of African countries in the southern region. In Zambia, NBTL was formally evaluated in 1999, after the completion of the Northern Province Pilot Initiative and was rated a shining success story (Kotze & Higgins, 1999). The NBTL emphasised that children learn better when they are taught in a familiar Zambian language as school ceases to be foreign. It is also believed that children learn to read and write better when they are taught in a familiar language.

The general aims of the NBTL according to MoE (2002), was that at the end of the course, learners would be able to: read simple texts fluently and effectively, write their own stories legibly, neatly and in straight lines, develop collaborative and independent learning skills. In all this, the teacher was mandated to ensure that each child in his or her care successfully gained the greatest achievement and gift from education. Even with these high hopes, the NBTL did not take into consideration the effect of preschool on grade one reading. It was, therefore, the aim of this study to ascertain the effect of preschool on grade one reading considering that, in Zambian preschools, English is used as a medium of instruction while a local language is used in the first grade.

There are seven local languages, which are regionally allocated in Zambia. Silozi for Western province, Nyanja for Lusaka and Eastern provinces, Citonga for Southern province, Kikaonde for Northwestern province, Icibemba for Northern, Luapula and Copperbelt provinces and

Cilenje for Central province. Since the New Break Through to Literacy was introduced, the method was translated into the seven local languages by the Curriculum Development Centre (CDC). Particularly, in Government schools, it became a common practice that teachers use one of the seven local languages to teach literacy in grade one. However, despite government's effort to improve reading levels through the PRP, very little progress has been made. A major observation made about research conducted in Zambia is that it focuses mainly on the learner's learning outcomes without establishing a cause and effect relationship with these outcomes, Jere-Folotiya (2014). The examinations performance review (2012), for example, reports factors such as text books, lack of blackboards, class size as possible contributors to the poor performance without considering the influence of other background factors that could affect the child's reading, whether the child has been to preschool or not. This brings us to a question of whether preschools in Zambia adequately prepare children for learning to read and numeracy in elementary school. Does preschool facilitate the stimulation of executive functions that are necessary for learning literacy and numeracy skills as it is in western countries? This study sought to answer these intriguing questions.

2.8 Literacy and Numeracy Levels in Zambia Empirical Evidence

The literacy situation in Zambia from the time of independence has been well documented. However, no much documentation has been done on numeracy. A study by Sharma (1973), which tested Zambian children on words drawn from the Zambian course books in first, second and third grade found that only 4.15 per cent could read all the words correctly, while 5.36 per cent could not read a single word. Seventeen per cent of year three children could read all the year one words correctly, while only 7.2 per cent could read all year one and two words correctly. In addition (Serpell, 1978) found that the reading levels of non-Nyanja speakers in Lusaka province in Zambia who were in grade six could only perform reading equivalent to that of Nyanja-speaking children in grade three. It was, therefore, important to ascertain whether preschool, executive functions and oral language contribute to reading among Zambian children as is the case in western countries.

Moreover, Chikalanga (1990: 69) reports a 1973 study which tested 583 grade five children and concluded that, there is a large group of very poor readers in most classes and they could not cope with the English course of the New Zambia Primary Course at the time. Notwithstanding the above studies, Williams (1993) conducted a study in which he focused on reading levels of Zambian and Malawian pupils in grades three, four and five, both in English and in Chichewa. This study indicated that, on average, pupils in the sampled Zambian schools could not read text two years below their own grade level. The above findings and other studies alluded to in this study led to the change of the curriculum in 1998 to the Primary Reading Programme (PRP), which has the New Break Through to literacy (NBTL) in the first grade, a policy that emphasises the use of a familiar language preferably, a mother tongue to teach reading.

Even after the change to the PRP and using the NBTL in the first grade, studies have continued to show that reading levels among Zambian children are below grade level. A study by Kelly (2000) found that grade six pupils performed considerably below the levels expected of those in sixth grade in reading. He also found that the reading levels of some grade six pupils were as good as those in grade four. While those that were in grade five in both rural and urban schools performed at a level expected for children in grade three. The scores of some grade four pupils in rural and urban schools fell within the performance band of grade two pupils. This may mean that Zambian children are not prepared for formal learning through preschool, hence the justification for the current study.

Other studies on literacy levels in Zambian children found that the children were performing significantly low (Kalindi, 2005; Matafwali, 2005). In addition, a study that sought to establish the importance of language to literacy development in order to examine how lack of proficiency in the language of instruction can help explain reading difficulties observed in the majority of school going children in Zambia found reading proficiency was low as expected. Surprisingly, it was discovered that pupils from grade two did not outperform pupils from grade one in basic skills and reading proficiency (Matafwali, 2010).

Hungi *et al*. (2010) offer information on the reading and mathematics trends observed in the fifteen Southern and Eastern Consortium for Monitoring Educational Quality (SAQMEQ) countries for project II (2000) and III (2007). The scores for reading and mathematics were generated using a linear transformation of scores, which results in the average/mean scores and standard deviation being 500 and 100 respectively. Eight competence levels were identified for each test. The first three levels reflected the mechanical nature of most elementary competencies. The remaining competences reflected the deeper level of understanding of competences that were specific to the subjects. The eight levels of competencies were intended to give information on what pupils and teachers can actually do as well as suggest instructional strategies to pupils who were learning at each level of competence.

The first level focused on pre-reading skills such as matching words and pictures depicting everyday life. Level two looked at emergent reading skills. Level three was based on interpreting meaning in simple text by reading or reading back. Reading for meaning skills were on level four while level five had to do with interpretive reading. Level six related to inferential reading while level seven related to skills in analytical reading. Lastly, level eight assessed critical reading. This report like other SACMEQ reports shows that Zambian children at grade six level perform poorly in reading and mathematics in comparison to other countries in the region. The question, therefore is, are Zambian children adequately prepared for learning. Do they have adequate executive functions to perform literacy and numeracy skills?

In addition, Mwanza (2011) conducted a comparative study on reading performance between children with and without preschool in relation to the new break through to literacy. Specifically, Mwanza hypothesised that there would be a difference in reading performance between children with preschool experience and those without preschool experience. Surprisingly, she found that there was no statistical difference between children with preschool and those without. She also found that generally, the reading levels among children were below grade level. The current study seeks to establish the predictive role of preschool executive function and oral language in reading and numeracy in the first grade.

2.9 Situational Factors that facilitate Literacy

2.9.1 Home Literacy Environment

Studies have highlighted the crucial role of preschool, executive functions and oral language in the development of literacy skills in elementary school. A large body of research has also demonstrated the importance of home literacy environment in the attainment of emergent literacy skills before and after entering school (Burgess, Hecht & Lonigan, 2002; Bus, Leseman & Keultjes, 2000; Cummingham & Stanovich, 1993; Leseman & de Jong, 1998; Senechal, 2006; Serpell, Baker, & Sonnenschein, 2005; Silva Verhoeven & Van Leeuwe, 2008). The importance of the home environment is grounded in the fact that the home serves as a setting in which language and literacy is first encountered. The researcher's argument, therefore, was that the development of executive functions and oral language is embedded in these situational factors. The primary goal of this part of the report, therefore, is to review literature on Home Literacy Environment and its preeminence to the acquisition of reading and mathematical skills in children.

Different scholars have looked at different aspects in the home and have defined them as activities and materials that make up home literacy environment. Senechal *et al*. (1998) proposed aspects such as; number of books in the home, library visits and parent's own print exposure as aspects that make up home literacy environment while Saracho (1997) proposed that parents' literacy level and the availability of reading materials are characteristics of the home environment related to a child's literacy development. In addition, Chansa-Kabali (2014) describes HLE as the extent to which parents read aloud to their preschool aged children, provide books and other print materials in the home and engage with them in appropriate learning opportunities within and away from home. She adds that these learning activities contribute to children's literacy competency. In the current study, HLE is simply having reading materials in the home as well as reading at home with or without the assistance of significant others.

Correlations among home literacy, emergent literacy and early reading acquisition have been reported in many studies and seem to be well recognised (Bus, van IJzendoorn, & Pellegrini, 1995; Scarborough & Dobrich, 1994). In addition, studies of the child's home learning environment have repeatedly shown that the language environment in the home and quality of linguistic interaction and learning experiences with parent have direct and significant association with children's cognitive and language development and emergent literacy competence (e.g., Dickinson & Tabors, 2001; Hess & Halloway, 1994; Kagan, Moore, & Bredekemp, 1995).

In addition, a study by Foy and Mann (2003), explored how features of the home literacy environment are related with phonological awareness in 4-to 6-year olds. Parents answered a questionnaire about home literacy environment were compared to children's phonemic awareness, as well as to their vocabulary, letter knowledge and performance on measures of phonological strength (non-word repetition, rapid naming skill, phonological distinctiveness and auditory discrimination). They found that teaching children in a home and exposure to reading-related media were directly associated with phoneme awareness and indirectly associated with letter knowledge and vocabulary. Exposure to reading-related media and parents' active involvement in children's literature were also directly and indirectly linked with rhyme awareness skills via their association with letter and vocabulary knowledge.

To further show the importance of HLE, Farrant and Zubrick (2013) investigated the developmental importance of joint attention and parent-child book reading for children's vocabulary around the time of school entry. They discovered that children who had low levels of joint attention in infancy were significantly more likely to have poor receptive vocabulary.

Also Davidse *et al* (2011) found that home literacy environment (as measured by the frequency of book sharing question and the parent print exposure checklist) predicts literacy skills, evidence also suggest that home factors account for more variance to literacy development than school factors (Davis-Kean, 2005; Linver, Brooks-Gunn, & Kohen, 2004; Mistry & Benner, 2007). A recent study in Zambia by Chansa-Kabali (2014) found that intimate culture expressed through literacy interactions within the HLE significantly predicted reading skills. In the current study, it was expected that children with better HLE would perform better than those from poor HLE in literacy and numeracy test. It is also important to add that children from vibrant HLE were expected to have better executive functions. This is because as children are being read to in a home and sometimes preschool environment, they develop executive functioning skills such as, concentrating on one activity, paying attention and remembering what they are read to.

2.9.2 Socio-Economic Status (SES)

Another important aspect that is linked to literacy and numeracy skill attainment is socio-economic status. Social-economic status has been known for a long time to be a powerful predictor of children's cognitive development (Sameroff & Channdler, 1975; Scot-Jones, 1984). In support of this assertion, a study by Mcloyd (1998) examined literature on the impact of social-economic disadvantages on children's development. It was found that poverty and social-economic status are predictive of children's early cognitive and language functioning, academic achievement, social competence as well as emotional and behaviour adjustment. Research has shown that children who come from families with lower SES usually demonstrate delays in language and emergent literacy skill (Raviv, Kessenich, & Morrison, 2004). A study by Ngorosho (2011) showed that family possessions and parental education affect reading and writing in Tanzania. Home possessions can be in form of physical as well as social settings. The physical settings include things such as infrastructure, reading materials, space and possessions. In the USA, Purcell-Gates (1997) illustrated the importance of reading materials in the home as a predictor of literacy in low income homes. In addition, a study by Foster *et al*. (2005) that looked at the relationship between family variables, such as social-economic status, social risk factors, home learning environment and emergent literacy competence, and child social functioning among 325 families in the Head Start programme found family social risk and home learning experience mediate the association between social-economic status and heard start children's school readiness in the areas of emergent literacy competence and social functioning.

Social-economic status has also been linked to literacy achievement in southern Africa. Pretorius and Ribbens (2005) discovered that low adult literacy levels are widespread throughout South Africa, especially in disadvantaged areas. They added that, in such circumstances, learners must attain literacy skills and behaviours without the aid of a reassuring home environment. They further stated that literacy stimulation by way of books is beyond the financial means of many parents in disadvantaged areas. In Zambia, Matafwali (2010) found that there was a correlation between home possessions and literacy in the first grade. Home possession, which was used as a measure of social-economic status also predicted reading in first and second grade. Because of the importance of SES to reading, it was necessary to add SES as one of the variables in the current study so that the effect of SES could be controlled.

2.10 Summary

In summing up this chapter, it is clear from the reviewed literature that preschool exposes children to a number of activities that help them acquire literacy and numeracy. It is also clear that language plays a significant role in helping children acquire literacy skills as proposed by Dickinson *et al*. (2003). In addition, there is evidence suggesting that executive functions predict literacy and numeracy skill development in the primary school years. Furthermore, the home literacy environment as well as social-economic status predict literacy. Therefore, it was expected that preschool education, oral language skill and executive functions predict children's reading and numeracy skills in the first grade when controlling for SES and IQ. The subsequent chapter presents the methodological approach applied in the present study.

CHAPTER THREE

3.0 METHODOLOGY

3.0 Overview

This chapter outlines the methods that were used to collect data in this study. It comprises a section on the research design. The chapter also explains the population, sample and sampling procedures that were used. Furthermore, the chapter presents the research instruments, reliability and data analysis methods as well as ethical considerations that were undertaken in the study.

3 .1 Design

This study was quantitative in nature and employed a quasi-experimental design, that is, the researcher compared children that have been to preschool and those that have not been to preschool in the school setting. Quantitative design was used because of its strength to quantify generalisable variables and measure factors in terms of amount, intensity or frequency with the view of explaining, describing and making inferences from obtained results (Mason & Bramble, 1997). Quantitative design also made it possible to use hypothesis in this study, as well as to establish relationships between social facts (White, 2005). In addition, quantitative paradigm made it possible to control for as well as predict variables as noted by White (2005) that ‘quantitative research is usually based on what is called positivist philosophy, which assumes that there are social facts with a single objective reality which is separated from the feelings and beliefs of individuals. This objectivity can be explained, controlled and predicted by natural (cause /effect) laws’ (p.81).

Children from eighteen schools in Lusaka district were tested at the start of grade one (phase I) in January and February 2013. The same children were tested again in November 2013 (phase II) after seven months of literacy and numeracy practice in first grade. A total of 216 children (98 without preschool and 118 with preschool) (118 female and 98 males) took part in the study. One of the schools where data was collected is a girl’s only school, resulting in a higher female ratio in the sample. Only 197 children from the original sample took part in the study in phase II due to attrition (N= 19). The reasons for the attrition varied. Some children had changed schools, others had moved to other places and they could not be located, hence could not be part of the study in phase II.

At the start and end of first grade, both children with and without preschool background were assessed using the BASAT to examine the reading and writing skills. A mathematics battery for initial math concepts was used to assess their math skills at the start of grade one, while the DLE –Test of Mental Arithmetic – DeVos and the mathematics battery (2001) was used to assess mathematics at the end of grade one. The Stroop-like test and the pencil tapping tests were used to measure executive function skills, while the Peabody picture vocabulary test and the familiar language tests were used to tap expressive and receptive language skills. The pattern reasoning test was used to assess general intelligence. Receptive and expressive languages as well as general intelligence were tested because they are predictors of reading (Bishop & Adams, 1990; Chaney, 1992; Scarborough, 1990; Matafwali, 2010; Matafwali & Bus, 2013). The BRIEF was completed for each of the children at the end of grade one by the teacher to rate children's executive functions.

Participants came from Lusaka city, which is the capital city of Zambia. The reason for choosing Lusaka as the delimitation of the study was because it is known that 42 per cent of children who enter grade one in Lusaka province have been to preschool (MoE, 2009). This is a relatively high number compared to other provinces such as the Copperbelt province with 32.3 per cent, Western province with 4.0 per cent as well as Northern and Northwestern provinces with 4.5 per cent and 6.1 per cent respectively (MoE, 2009; Matafwali, 2013). The other reason was that at the time of this study, the medium of instruction in grade one was Nyanja for Lusaka province while preschools generally used English as the medium of instruction.

3.2 Target Population and Sample

The participants were drawn from eighteen public schools in Lusaka town, excluded were all children with special educational needs. Twelve grade one pupils from all ability groups were selected by the researcher from each school with the help of the class teacher. In each school six out of twelve had been to preschool, totaling 216 pupils. The ages varied from five to twelve years. It must be mentioned, however, that more children with preschool education took part (55%) in the study because it was discovered that they had been to preschool after they had already been selected.

3.3 Sampling Procedure

The schools were randomly selected in this study. This was done by putting the names of the schools in a bowl and randomly picking eighteen schools. This was done to enable every school in Lusaka town an equal chance of being selected. Random sampling was used in the selection of children at classroom level. Firstly, children with preschool education were identified and asked to stand then the researcher randomly picked six children from those that were standing. The same technique was used to pick children who did not go to preschool. In picking the teachers, purposive sampling was used. This is because, for teachers to complete the BRIEF, they needed to have been teaching the same children from the start of grade one to end of grade one.

3.4 Procedure

The pupils were recruited at the start of the first grade with the help of the teachers who had information of whether or not children had been to preschool. Children from all five ability groups were selected. Once recruited, children were subjected to an interview that gave details about the child's language of play, home language as well as the classroom language, preschool attendance and the social-economic status of the child. This interview was done in the first term before testing the pupils' reading, math and executive functions in the first and third term. In the third term, all pupils were tested again. During the session, no other pupils were present apart from the ones taking the test and the person conducting the test. This was because we did not want the pupils to be distracted in any way by other present stimuli. The testing took about forty-five minutes per child. The first test was the Basic Skill Assessment Tool (BASAT) followed by the mathematics battery, the Stroop-like task and pencil tapping test. These tests were followed by the following, which were not applied in any particular order: Serial Rapid Naming (RAN), PPVT, familiar language test and pattern reasoning. In the third term, teachers rated children's executive functions (BRIEF). Specific domains that were rated in the questionnaire included working memory, inhibitory control, shift, emotional control and organisation and planning.

The tests were administered by eight trained research assistants who were speakers of Nyanja, the language used in the study. These included two students studying for their Masters degrees at the University of Zambia and six diploma holders. Assistant researchers underwent training for two days on test administration before the pretest and one day training before the posttest. The training was done by the principle researcher. The teachers who filled in the brief were adequately explained to on how to answer the brief that is, they were told the exact way to rate the children and the meaning of each subscale on the brief.

3.5 Instruments and Measures

3.5.1 Background (Biographic Data Form)

This instrument was used to generate biographical data of each respondent such as personal details (name, age, and sex), home possessions, whether the child had been to preschool or not. This activity was conducted on each pupil respondent before the other instruments were administered. The instrument also included the home possession index, which was used to assess the socio-economic status of the pupils. This was a twelve item Home Possession Index (HPI) designed to compile information regarding home possession, including the following questions:

Do you have a television in your home?

Do you have a radio in your home?

Do you have a stove at home?

Do you have electricity at home?

Do you have running water at home?

Do you have a flushable toilet?

Do you have a car at home?

Do you have at least two pairs of clothes?

Do you have at least one pair of shoes?

Do you have a bed with a mattress to sleep on?

Do you live in a house with cement or tile floors?

In which residential area do you live?

The maximum score for the HPI was twelve and the Cronbach's alpha reliability was .632 (N = 216).

Additionally, the Home Literacy Environment Index was generated from the biographic data form. There were five items designed to elicit information regarding the literacy environment and interaction with literacy materials in the home. Areas covered included: quantity and quality of print material, frequency of independent reading and adult support during reading times. It should be noted that this instrument had already been used before in Zambia by Matafwali as a measure of home literacy environment (2010).

3.5.2 The Basic Skills Assessment Tool (BASAT, Nyanja Version)

This is a standardised Zambian instrument prepared by the Ministry of Education (MoE, 2003), specifically designed to assess grade one and two school pupil's literacy proficiency. As scores were low in previous studies (Kalindi, 2005; Matafwali, 2005; Matafwali, 2010; Mubanga, 2010; Mwanza, 2011), some tests were modified. The reading comprehension, for example, was done in such a way that pupils had to point at a word describing a picture that was mentioned by the researcher from a series of four words.

Alphabet Knowledge

Alphabet letter naming task: The letter naming task required each pupil to give the name of each letter from a sequence of twenty-six letters printed in random on a card. The maximum score on this task was twenty-six. Cronbach's Alpha for pretest and posttest equaled .96 (*N*=216) and .95 (*N*=197), respectively.

Alphabet letter Identification: The alphabet letter identification task required the child to point at the letter upon hearing the letter sound. This task also utilised the card with letters in random order. The maximum score on this task was twenty-six. Cronbach's Alpha for pretest and posttest equaled .95 (*N*=216) .93 (*N*= 197) respectively.

Letter sound knowledge: The letter sound knowledge used the same card that was used on letter knowledge; the children were asked to say the sound of each letter. The maximum score on this task was twenty-six. Cronbach Alpha for pretest and posttest equaled .95 (*N*=216) and .94 (*N*=197), respectively.

Sound letter knowledge: The same letter card was used, the examiner pronounced the sound of each individual letter of the alphabet and the children were asked to identify the corresponding letters. The maximum score on this task was twenty-six. Cronbach Alpha for pretest and posttest equaled .94 (*N*=216) and .95 (*N*=197), respectively.

According to a factor analysis that was conducted on all the items of the BASAT, the alphabet naming tasks, letter identification, letter sound knowledge and sound letter knowledge grouped together on component one, meaning that they measure the same aspects (Field, 2013). Hence, the component was called BASAT alphabet knowledge. The Cronbach Alpha for this variable for pretest and posttest equaled .94 (*N*=216) and .95 (*N*=197), respectively.

Phonological Tasks

Three tasks were used to assess different types of children's phonological awareness, syllable segmentation, discriminating of initial and ending sounds and blending.

Syllable segmentation: there were four words consisting of three syllable words respectively. The researcher read the words aloud and the children were asked the number of syllables in each word. The task consisted of four items and the maximum score on this task was four. Cronbach Alpha for pretest and posttest equaled .80 (*N*=216) and .82 (*N*=197), respectively.

Discrimination of initial and ending sound: The task consisted of twenty compound words. Children were asked to identify the initial sounds in the first ten words. The next ten items assessed discrimination of ending sounds. The maximum score on this task was twenty. Cronbach Alpha for pretest and posttest equaled .93 (*N*=216) and .94 (*N*=197).

Blending task: The task required children to combine sound elements to form a word. In each task, three syllables were said aloud to the child. The letters combining the words were put on cards. As each syllable sound was said, a card containing the syllable was placed in front of the child. Use of cards helped to reduce the memory demands of the task. Thus, the task was presented both verbally and in written format. The child was then asked to blend the sounds into a word. The task consisted of ten items. Cronbach Alpha for pretest and posttest equaled .95 (*N*=216) and .94 (*N*=197), respectively.

After factor analysis of dimension reduction was done, it was noted that the three phonological tasks listed above were grouped together and were named (BASAT phonological skills). The Cronbach Alpha for the combined variable for pretest and posttest equaled .62 (*N*=216) and. 52 (*N*=197), respectively.

Reading and Writing Ability

Children were asked to read a series of words and two sentences as well as write. The categories of words fell into four groups: two letter words; one syllable words; two syllable words; three syllable words. The maximum score was eighteen. Cronbach's alpha on reading and writing ability tasks was .89. After the exploratory factor analysis of dimension reduction, the reading and writing task became known as BASAT reading and writing.

Reading Comprehension: Reading comprehension was assessed using Picture Comprehension subtest from the BASAT. The test consisted of items containing pictures and a corresponding word to the picture. Children were required to identify which of the three words was corresponding with the picture. Cronbach Alpha for pretest and posttest equaled .63 (*N*=216) and .64 (*N*=197), respectively.

Memory for Digits: The forward digit span of the BASAT (MoE, 2003) was used as a measure of phonological memory. The test required the child to repeat back series of digits that were first spoken by the examiner. The test began with items containing two digits. The number of digits to be repeated increased from two digits for the first two items to seven digits for the last test items. The score recorded was the total number of items that the child could recall accurately on any single trial.

3.5.3 Rapid Naming Task (Information Processing)

Information processing was measured using Rapid Automatised Naming (RAN). This was necessary because a number of studies, particularly from developed countries have shown that children's scores on the RAN are related to their reading achievement both at the time of the test and in future (Fink *et al*., 2012). The RAN task asks children to look at a series of stimuli which may include objects, numbers, letters or colours and asks them to name them as quickly as possible. The RAN has been used before in Zambia by Matafwali (2005; 2010) and more recently by Fink *et al*. (2012). Based on Matafwali (2010)'s recommendations, the objects RAN test was used in this study. In this task, children were asked to name as fast as possible, depictions of chair, scissors, tree, bicycle and duck. Children were first asked to identify each of the five stimuli individually to ensure that they were familiar with the objects. A practice trial with one line of these objects familiarised the children with the demands of rapid naming. Children were then asked to name the stimuli from top to bottom and left to right as fast as they could in Nyanja, a language that they used in class. At the end of five lines, response time was recorded in seconds.

3.5.4 Oral Language Ability Tests

Two tests were used to tap expressive as well as receptive language skills. Receptive language skills refer to an individual's ability to understand spoken words while expressive language refers to an individual's ability to produce words and express his or her thoughts (Fink *et al.*, 2012).

3.5.4.1 Familiar Language Test

This was used as a measure of expressive vocabulary of the pupils. The child was asked to name objects and actions on a picture depicting common objects and acts in a classroom situation like- books, desks, teacher, blackboard and actions such as teaching, reading and playing. The illustrations showed three settings: children reading, children playing cards and teacher teaching children. Children were asked to name what they saw on the picture in Nyanja. The researcher noted how many words were named by the children. To make scoring easier, the researcher listed the thirty words on a scoring sheet. When children named other words not included in the list of thirty, these responses were scored as well. Children were given five minutes to complete the task. When children did not respond after one minute, the researcher prompted the child by pointing at an object and encouraged the child to name it. This test has been used before in Zambia by Tambulukani and Bus (2011), in their study. However, the test was used to measure familiarity to Zambian languages, while in this study, it was simply used as a measure of expressive language. The maximum score on this task was thirty. Cronbach Alpha pretest and posttest equaled .66(*N*=216) and.77 (*N*=197), respectively.

3.5.4.2 The Peabody Picture Vocabulary Test (PPVT)

This was used as a measure of receptive vocabulary. It is a non-verbal language testing instrument and was meant to test each child's knowledge of common items in the environment. The Peabody Picture Vocabulary Revised version was translated into Nyanja. The test consisted of thirty items which were adapted to the Zambian context. The children were shown groups of four pictures and asked to point to the one representing the meaning of a spoken word described by the examiner in Nyanja. The responses were marked as correct or incorrect. The PPVT has been utilised by many researchers because it is fast, easy to apply, and has been adapted for use in different languages. The PPVT had previously been used in Zambia by Matafwali (2010), who found PPVT scores to be a significant predictor of literacy outcomes (= 0.37, $p<0.01$) at the end of grade two. In the current study, the Fink *et al.* (2012) version was used because it was adapted to the Zambian context. Cronbach Alpha for pretest and posttest equaled .80 (*N*=216) and .82 (*N*=197), respectively.

3.5.5 General Intelligence (Pattern Reasoning Test)

Non-verbal cognitive skills were assessed as an indicator of general intellectual potential. As a measure of non-verbal cognitive skills, a set of items similar to the items used in the Pattern Reasoning subscale of the Kaufman Assessment Battery for Children (K-ABC). The K-ABC had been applied in Kenya, Uganda and Zambia (Bangirana, *et al*., 2009; Fink *et al*., 2012; Matafwali, 2010; Taylor *et al*., 2004). The children were shown a series of stimuli forming a logical linear pattern with one stimulus missing. The child was asked to choose the missing stimulus from four to six options at the bottom of the page. Cronbach Alpha for pretest and posttest equaled .80 (*N*=216) and .84 (*N*=197, respectively.

3.5.6 Executive Function Tests

Two tests and a rating scale were used to tap executive functioning skills of children in this study, namely; the pencil taping test, Stroop-like and the Behaviour Rating scale. BRIEF.

Pencil Taping Test (opposite Taping)

The pencil taping test (opposite taping) was utilised to measure inhibition. The researcher opted to use a Pencil Tapping Test developed for first-graders in Kenya (Brooker, Okello *et al*., 2010). The test is a simple assessment that takes the form of a game played between the child and the assessor. The assessor and each child had a pencil. Child was instructed that when the assessor taps her pencil once, the child had to tap twice and vice-versa thereby, inhibiting his or her natural response to mimic the experimenter's behaviour. After a series of (up to six) practice trials in which the examiner provided feedback to the child, sixteen scored trials without feedback were scored.

3.5.6.1 Pencil Taping Test (Same Taping)

The pencil taping test (same taping) was utilised to measure working memory; this task required the child to copy the experimenter's taps. Each incorrect imitation in this working memory task was awarded one, with a maximum of sixteen. Therefore, the more scores the child had, the poor the working memory.

3.5.6.2 Stroop-like Task (Opposites)

In this task, children had to switch rules by responding with the opposite, that is, saying 'blue' to a red dog and 'red' to a blue dog (Beveridge, Jarrold & Pettit, 2002). The task consisted of ninety-six trials distributed over four conditions (saying boy for girl; blue for red: green for yellow and big for small) in which demands on working memory (remembering the colour of one or two dogs) and inhibition of the most obvious response (e.g., saying 'blue' to a red dog) varied. Each correction was coded as an inhibitory control error and incorrect naming as a working memory error, resulting in a maximum success score of ninety-six for both inhibitory control and working memory.

Skill-category	Number of items	Cronbach alpha
Inhibition	16	.90
Shift	10	.85
Emotional control	10	.85
Working memory	17	.92

3.5.6.3 Behavioural Rating Inventory for Executive Functions (BRIEF)

Plan. and organisation	10	.85
BRIEF TOTAL	63	.97

The BRIEF was used to get information about everyday behaviour associated with specific domains of executive functions. The respondent teacher reported problems with different types of behaviour related to each of the domains. There were sixty-three items of the BRIEF with Cronbach's alpha scales as tabulated in Table 1 below.

3.5.9.3 Brief Descriptives

Table 1: Cronbach Alpha Reliability Scale for BRIEF

The Inhibition scale assessed children's inhibitory control and impulsivity. Inhibitory control helps children to focus on what they perceive as important, suppressing attention to other things or stimuli, for instance, concentrating on reading and ignoring other stimuli such as other children playing outside the classroom. In a classroom, children with inhibitory control difficulties may easily be distracted, stop an activity before completing to start what they perceive as more attractive and may start an activity or task before listening to instructions.

The shift scale assessed the child's ability to move from one activity to another in a classroom setting. Key aspects of shifting include the ability to make transitions, switch attention from one activity to the next and the ability to solve problems.

The emotional control scale measured emotional expression and assessed a child's ability to modulate or control his or her emotions.

The working memory scale measured the children's capacity to hold information in mind to complete a task. Working memory is important to complete mental manipulations such as mental arithmetic and follow complex instructions. Children with deficits in working memory skills have difficulty grabbing and holding on to incoming information. This means they have less material to work with when they are performing a task.

The planning and organisation scale measured the child's ability to anticipate future events; set goals; develop steps; grasp main ideas. Planning and organisation skills are essential to help one achieve, keep focused on doing the right tasks and, set priorities. The scale is comprised of two components: plan and organise. The planning component allows one to anticipate what will happen next in an activity, the organisation component on the other hand, entails the ability to bring order to information learning or communicating information.

3.5.7 Mathematics Assessment Battery (adapted)

Mathematics Assessment Battery was used to assess learners' pre-numeracy skills in the first term. In the second term, the DLE mental arithmetic test was included, specific tests that were done in pre-numeracy included cardinality, counting from 1 to 20, counting principles, number knowledge,; number-flash, conservation, non-verbal addition and subtraction, addition and subtraction within a story context, addition and subtraction sums and estimation.

Cardinality assessed children's ability to count pictorial items displayed on a printed sheet of paper. In this study, the experimenter showed the child a card with stars and asked the child to count the stars insisting on the child pointing to the stars. When the stars are counted, the experimenter turns the card (the child is now unable to see the stars) and asks: how many stars are on the other side of this card? The total score on this task was five.

Counting principles: This task, adapted from Geary, Hoard and Hamson (1999) assessed children's ability to detect violations of counting principles: One-to-one correspondence, order irrelevance and abstraction (Davidse, 2014). Firstly, each child was asked to count numbers in the correct order from 1 to 20. Then children were introduced to a puppet that was just learning how to count and needed assistance. Real objects (Checkers) were used for counting. The puppet would first count, skipping some checkers, and then the experimenter would ask the child if the puppet counted correctly and asked him or her to count the checkers. For example, did he count correctly? Show how you would count. This task consisted of eight items to assess the child's understanding of one-to-one correspondence (n=4) order irrelevance (n=2) implying that you can count from left to right as well as randomly and abstract from features like colour (n=2). The maximum score on this task was 8.

Number knowledge and magnitude comparison: The number knowledge task adapted from Griffin (2002) was used. Children were asked, for instance, which number precedes five and which number comes after seven? We also assessed magnitude comparison by asking the child to say which number is bigger, nine and two or which number is smaller, four and three. This task consisted a total of four items.

Number flash: On a computer screen, children were shown numbers from 0 to 20 and were asked to say them as soon as they appeared on the screen. The numbers appeared in the following order 1, 13, 4, 17, 2, 11, 8, 14, 20, 5, 16, 3, 12, 6, 0, 19, 7, 15, 9, 18 and 10.

Number conservation sought to examine if children understood that the total number of a set remains the same after rearranging the items without changing the number. The experimenter counted a row of checkers and then split them into two rows and asked the child how many checkers were there altogether. The same was also done the opposite way. This task consisted of eight items.

Addition and subtraction with checkers: This task adapted from Jordan, Koplan, Olah & Locuniak, 2006) tested children's knowledge of how to add and subtract items using concrete objects such as stone and counters. For example, children were asked to be attentive and the experimenter would say 'Look I have five stones. Now I am going to cover them. Look carefully, I am adding two stones. How many stones do I have now? Show it to me by using your stones and then tell me the number. The addition and subtraction sums totaled 8.

Addition and subtraction in story context: In this task, the same sums as in addition and subtraction with checkers were used but in a story context. Children were not allowed to use checkers to solve sums. The experimenter asked, for example; Mutinta has 4 guavas. Sililo gives her another 3 guavas. How many guavas does Mutinta have now? This task consisted of 8 sums.

Addition and subtraction in abstract: Asked children to mentally solve sums without using checkers. For example, the experimenter would ask the child 'what is 5 plus 2? This task consisted of 8 sums.

Estimation: tested children's knowledge of approximating quantities of dots presented on printed and laminated A4 paper. Children were shown five cards with 3, 8, 15, 25, and 35 dots placed haphazardly on each card. The test did not demand that a child say the exact number of dots on each card, but to give an estimation of 25 per cent more or less the exact number of dots. The maximum number of scores was 5.

3.5.8 DLE-Test Mental Arithmetic

At the end of grade one, children were assessed on addition, subtraction, multiplication and division using the DLE mental arithmetic test. Children received a form with a total of eighty sums with an increasing order of difficulty. Children had to solve as many sums as they could in three minutes without skipping sums. The score here was the total score of correct sums. Alpha reliability as reported by DeVos (2001) in Davidse (2014) is .96.

3.6 Data Analysis

Data in this study was purely quantitative and was, therefore, analysed quantitatively using SPSS version 19. As a first step, variable totals were created from raw scores to reduce the number of variables which stood independently at the time of data collection. Secondly, data was inspected by descriptive statistics which included the Mean (M), Standard Deviation (SD), Minimum (Min.), Maximum (Max.) Cronbach Alpha Reliability Scale, Skewness and Kurtosis. This was done to show the general performance of the children on all variables as well as to signal outliers, skewed scores and normality.

The following were the pre and posttest variables that were later checked for normality. Alphabet naming; alphabet identification, alphabet writing, writing two syllable words, writing three syllable words, writing words with more than three syllable words, discriminating initial and ending sounds, blending, reading one-syllable words, reading two-syllable, reading three-syllable words, reading short-sentences, relating letters to sounds, relating sounds to letters, digit span, reading comprehension, inhibition, shift, emotional control, planning and organisation, Counting principles, addition with checkers, subtraction with checkers, addition with stories, subtraction with stories, abstract-addition, abstract-subtraction, estimation, number flash naming, writing own name, reading own name, Peabody picture vocabulary, familiar language task, pattern reasoning, DLE math attempted sums, DLE math correct sums, DLE Math correct percentage and Home possessions. Variables that were found to include outliers or extreme scores were winsorised (Field, 2013: 198).

Thirdly, independent samples *t*-tests were run to compare children with preschool experience and those without on different background variables that were assessed in this study. This was necessary because background variables can affect outcome measures; in so far the two groups differed on those, they were controlled for in the main analyses. After this, exploratory Factor Analysis was conducted to reduce the number of variables and prevent multi-collineality. In order to test whether preschool prepares for learning literacy and numeracy in first grade, controlling for SES (home possessions) and intelligence, a mixed models multi-level analysis was utilised. The same analysis was used to test whether preschool was beneficial for development of EF and whether or not preschool is effective in reading and writing through EF. To ascertain whether preschool interfered with learning to read in first grade if children did not speak Nyanja at home and depended on school for learning the language as well as reading, a 2x2 factorial anova was used.

3.7 Ethical Consideration

Written permission to carry out the research was sought from the relevant department of Ministry of Education, Science, Vocational Training and Early Education, as per government requirement. This permission gave the researcher authority to work with the children and the teachers. Teachers and learners were consulted on their willingness to take part in the study. They were informed that they were free to withdraw from the study when they felt the need to. Permission was also sought from the University of Zambia Ethics committee to carry out the study.

3.8 Summary

This study used a quasi-experimental design. The researcher opted to use this design in order to conduct the study in the natural setting (quasi-experimental) as well as to successfully predict literacy and numeracy levels of the children in the study. The study sample included children in the first grade in Lusaka town who are taught literacy and numeracy in a local language (Nyanja). Random sampling was utilised to accord every school in Lusaka town a chance to participate in the study. Random sampling was also utilised at classroom level to successfully pick children who had been to preschool and those who had not.

A wide range of standardised measures were used to assess oral language abilities, basic literacy skills, executive functions, numeracy, and background factors. These measures have extensively been utilised in early literacy and numeracy studies both in national and international studies (Tambulukani & Bus, 2012; Matafwali, 2005; Davidse, 2014; Dickinson *et al.*, 2003; Dunn & Dunn, 1997). A strength in the methodology of the present study is that the researcher applied exploratory factor analysis to avoid multi-collinearity as well as multi-level regression analysis to explore the relation between independent and dependent measures. The next chapter presents the findings of the study.

CHAPTER FOUR

4.0 PRESENTATION OF FINDINGS

4.1 Overview

This chapter presents the research findings; it starts with comparing children with preschool and those without preschool background on various background variables to ascertain how they differ on these variables. The chapter further shows the predictions and other analyses that were performed regarding the predictive role of preschool, executive functions and oral language in the attainment of literacy and numeracy skills.

4.2 Results

4.2.1 Child Characteristics

Table 2: Gender, Age Distribution and Language used at home

	Preschool *N* =120	No preschool *N*=96	Total *N* =216
Boys (%)	52 (43%)	46 (48%)	98 (45%)
Age range (in years)	5 - 10	6 - 12	5 - 12
Languages			
-English	6 (3%)	17 (8%)	23 (11%)
-Nyanja	52(24%)	80(37%)	132 (61%)
-Bemba	32(15%)	22 (10%)	58 (27%)
-Other	2(0.9%)	1(0.4%)	3 (1.4%)

Table 2 shows that the average age of the children was 8 years. Furthermore, more females than males took part in the study partly because one of the schools was a girl's only school. Table 2 further shows the languages mostly used at home. The majority of children used Nyanja at home (61%), followed by Bemba (27%) and English (11%). Other languages, Tonga and Nsenga, were rare (less than 2%).

4.2.2 Differences between Preschool and Non-preschool Children

Table 3: Differences between Preschool and Non-preschool Pupils on Background Variables

(pretests *N*=216, posttests *N*=197)

Variable	Preschool	Mean	*SD*	*t*	df	*p*
SES/Home	No	8.92	1.68	-3.25	214	.001
Possession scale	Yes	9.62	1.43			
(max=12)						
Pattern Reasoning	No	5.17	3.06	-2.07	214	.036
Pretest	Yes	6.13	3.60			
Pattern Reasoning	No	6.21	3.61	-1.38	193	.163
Post test	Yes	6.99	4.25	-		
Peabody pretest	No	25.69	2.60	-.198	214	.843
	Yes	25.76	2.62			
Peabody posttest	No	26.89	2.29	-.232	193	.817
	Yes	26.96	2.27			
Familiar Language	No	8.96	3.90	-.499	214	.691
Pretest	Yes	9.18	3.95			
Familiar Language	No	12.59	4.59	.060	193	.952
Post test	Yes	12.55	4.50			
RAN pretest	No	.629	.143	-1.12	214	.263
	Yes	.653	.164			
RAN posttest	No	.727	.160	1.64	190	.104
	Yes	.690	.154			
Age	No	7.62	1.36	2.16	214	.033
	Yes	7.14	1.23			

This analysis aimed at showing whether the two groups in this study (children with and without preschool) differed on background variables such as age, home possessions, general intelligence, expressive and receptive language as well as performance on the rapid automatised naming. In order to do this, independent samples *t*-tests were conducted on these background variables. From Table 3, it can be derived that children with a preschool background and those without preschool differed on three variables. The t-test analysis for mean differences between children with preschool exposure and those without showed that there were differences in home possessions (p= .001), general intelligence (p=.036) and age (p= .033). Children with preschool background reported more home possessions and scored higher on general intelligence as indicated by pattern reasoning. Children who went to preschool were on average younger than children who did not go to preschool.

4.3 Data Reduction

In order to effectively work with the data and to avoid multi-collineality, an exploratory factor analysis (EFA) was conducted on outcome variables. EFA is a technique applied to a set of variables if the researcher is interested in discovering which variables in the set form coherent subsets that are relatively independent of the other. Variables that are correlated with one another but independent of other subsets are combined into factors (Tabachnick & Fidell, 2013). In this study, EFA was carried out to summarise patterns of correlations among observed variables, to reduce a large number of observed variables to smaller number of factors. Factor analysis was conducted on reading variables (BASAT), the Brief, and the Mathematics tests, for pre- and posttest separately.

The dimension reduction of factor analysis by extraction with varimax rotation was utilised to assess the number of factors with a verge of eigen values above 1. A scree plot gave a selection of components hierarchically arranged based on the eigen values. Below are the EFA that were conducted.

4.3.1 Exploratory Factor Analysis with the Basat Pretest Items (Reading)

Table 4: Summary of Factor Analysis of Basat (Reading) Pretest Items

(N=216)

	Component		
	1	2	3
Alphabet Naming pretest	.892	-	-
Alphabet Identification pretest	.888	-	-
Alphabet sound identification pretest	.829	-	-
Alphabet letter sound identification pretest	.829	-	-
Phonological task totals pretest		-	.751
Discriminating initial and ending sounds pretest	-	-	.642
Blending sounds pretest	-	-	.769
Making syllables pretest	-	.776	-
Reads one syllable word pretest	-	.776	-
Reads two syllable words pretest	-	.761	-
Reads three syllable words pretest	-	.725	-
Alphabet writing pretest	.754	-	-

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalisation.

Table 4 shows results of a factor analysis conducted on the thirteen items of the Basat (Reading) with varimax and keiser normalisation. All loadings were greater than .64, which is well above the acceptable limit of .40 (Field, 2013). Three factors had eigen values over keiser's criterion of 1 and in combination explained 61.58 per cent of the variance. Table 4 shows the loadings of the items on the three factors after varimax rotation. The items that cluster on the first factor suggest that this factor represents alphabet related tasks and were, therefore, named *Basat Alphabet pretest*. Component 2 represents tasks related to reading and writing and was named *Basat reading and writing –pretest.* Component 3 represents phonological related tasks and was named *Basat phonological tasks pretest*

4.3.2 Exploratory Factor Analysis on the Basat Items Posttest (Reading)

Table 5: Summary of Results of Factors Analysis on Basat Posttest Items N=197

	Component		
	1	2	3
Alphabet Identification totals posttest	.872	-	-
Alphabet Naming totals posttest	.866	-	-
Alphabet letter sound Identification posttest	.814	-	-
Alphabet sound identification totals posttest	.763	-	-
Alphabet writing totals posttest	.743		-
Writing words with more than three syllable words posttest	-	.853	-
Writing three syllable words posttest	-	.851	-
Reads three syllable words totals posttest	-	.696	-
Reads one syllable word totals posttest	-	.694	-
Writing two syllable words totals posttest	-	.645	-
Making syllables totals posttest	-	.574	-
Reads two syllable words winsorised	-	.466	-
Phonological task totals posttest	-	-	.815
Discriminating initial and ending sounds combined posttest	-	-	.656
Blending sounds totals posttest	-	-	.570

-Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalisation.

Table 5 shows a factor analysis that was conducted on the fifteen items of the Basat (reading) posttest with varimax and keiser normalisation. All the individual loadings were greater than .46, which is well above the acceptable limit of .40. Table 5 shows the loadings after rotation. Components are similar to the components found for the pretest.

4.3.3 Factor Analysis on the Mathematics Pretest

Table 6: Summary of Explanatory Factor Analysis Results on Mathematic Pretest Items (N=216)

Variables	Component 1
Addition in abstract pretest	.774
Addition in story context pretest	.771
Subtraction in story context pretest	.750
Number flash totals pretest	.721
Addition with checkers totals pretest	.697
Subtraction with checkers totals pretest	.668
Counting principle totals pretest	.625
Subtraction in abstract totals posttest	.608
Estimation totals pretest	.344

Extraction Method: Principal Component Analysis.

Table 6 shows a summary of the EFA on mathematics pretest items. It illustrates a factor analysis on the nine mathematics pretest items with varimax and keiser normalisation. All the individual items except estimation were greater than .40. The first component had eigen values over keiser's criterion of 1 and explained 45.41 per cent of the variance. All variables were loaded on the first component. Table 6 shows the loadings after rotation.

4.3.4. Exploratory Factor Analysis on Mathematics Posttest

Table 7 Summary of Exploratory Factor Analysis Results on Posttest (N=197)

	Component 1
Subtraction with checkers totals posttest	.832
Subtraction in story context posttest	.832
Addition in abstract posttest	.827
Subtraction in abstract totals posttest	.806
Addition in story context posttest	.797
Number flash totals posttest	.729
Counting principle totals posttest	.658
Addition with checkers totals posttest	.609
Total number of correctly attempted sums	.594
Number Knowledge totals posttest	.577
Estimation totals posttest	.525
Extraction Method: Principal Component Analysis.	

a. 1 components extracted.

Table 7 shows a summary of the EFA on mathematics posttest items. It illustrates a factor analysis on the twelve mathematics posttest items with varimax and keiser normalisation. All the individual items were greater than .40. Table 7 shows the loadings after rotation. All items clustered on the first factor, suggesting that this factor represents all mathematics posttests, explaining 51.37 per cent of the variance.

4.3.5 Exploratory Factor Analysis on Executive Functions

Table 8: Summary of Factor Analysis Results on Executive Functioning Skills

	1	2	3
Inhibition totals	.912	-	-
Working memory totals	.907	-	-
Planning and organisation totals	.888	-	-
Shift totals	.862	-	-
Emotional control totals	.836	-	-
Total number of incorrect same taps	-	.781	-
Total number of incorrect opposite taps	-	.737	-
Stroop-like test total number of incorrect responses	-	.561	-
Total number of self-correction opposite taps	-	-	-
Stroop-like test total number of self-corrections		-	.706
Stroop like test opposite incorrect responses			.596
Total number of self-correction same taps	-	-	.539

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalisation.
a. Rotation converged in 5 iterations.

Table 8 shows a factor analysis that was conducted on the eleven items of executive functions tests with varimax and keiser normalisation. All the individual loadings were greater than .53, which is well above the acceptable limit of .40. Four factors had eigen values over keiser's criterion of 1 and in a combination explained for 62.59 per cent of the variance. Three were retained because they were appropriately grouped according to what they intended to assess. Table 8 shows the loadings after rotation. The items that cluster on the same factor suggest that component 1 represents the brief, component 2 represents working memory errors and component 3 represents inhibitory errors.

4.4 Bivariate Correlations between Background and Dependent Variables

Table 9: Correlations of Background and Dependent Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.Age	1	-.079	-.125	-.147*	-.239**	-.001	.085	.090	.190**	.064	.073	.256**	.225**	.131	.059	.058	.026	-.027
2.reads at home			.890**	.091	.052	.292**	.176*	.084	.075	.147*	.094	.173*	.127	.017	.046	.009	-.046	-.074
3.gets help				.119	.063	.265**	.149*	.058	.073	.104	.095	.129	.095	.042	.050	.012	-.039	-.031
4.Preschool					.217**	.160*	.084	.072	-.071	-.001	-.079	.022	.034	.018	.030	-.010	-.003	-.007
5.Home possession						.070	-.010	-.022	-.081	-.105	-.151*	-.131	-.004	-.055	-.094	-.048	-.040	-.064
6. Alphabet Knowledge pretest							.750**	.386**	.468**	.586**	.533**	.507**	.460**	-.160*	-.109	-.099	-.256**	-.272**
7. Alphabet knowledge posttest								.323**	.680**	.574**	.716**	.526**	.586**	-.158*	-.147*	-.158*	-.314**	-.300**
8. Phonological skills pretest									.357**	.284**	.272**	.419**	.373**	-.108	-.025	-.069	-.196**	-.205**
9. Phonological skills posttest										.438**	.625**	.488**	.665**	-.165*	-.092	-.167*	-.321**	-.291**
10. Reading and writing pretest											.766**	.373**	.321**	-.028	-.007	-.048	-.136	-.108
11. Reading and writing posttest												.397**	.394**	-.076	-.052	-.080	-.206**	-.174*
12. Mathematics pretest													.649**	-.115	-.110	-.088	-.267**	-.274**
13. Mathematics totals posttest														-.149*	-.189**	-.108	-.364**	-.327**
14. Inhibition															.718**	.720**	.821**	.777**
15. shift																.728**	.678**	.697**
16. Emotional Control																	.660**	.612**
17. Working Memory																		.855**
18. plan & organisation																		

*. Correlation is significant at the 0.05 level (2-tailed).

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

9 displays correlations among key variables. In order to interpret the above correlations, it is important to note that higher scores on executive functions (inhibition, shift, emotional control, working memory and organisation and planning) indicated more negative behaviour. Children who were rated high on executive functions exhibited more problem behaviour than those who were rated low, hence the negative correlations.

Age correlated negatively with home possessions (r = -.15) and preschool (r = -.24), indicating that children who started school late did not attend preschool and that children not attending preschool reported fewer home possessions. Positive correlations were observed between age and phonological skills posttest (r =.19), age and mathematics pre and posttest (r =.26 and r =.23, respectively). This means that older children performed better than the younger children in the three tasks.

Children who came from homes where they reported reading at home were also getting help when reading (r =.89) and had higher scores on alphabet pre and posttests (r = .29 and r =.18, respectively). This implies that children who read at home also enjoyed learning support and performed better than those who did not read at home in alphabet knowledge both at pre and posttests as well as in reading and mathematics pretests.

Home possession on the other hand, had significant but negative correlation with reading and writing - posttest (r = -.15). This indicates that children who reported more home possessions performed poorly in reading and writing on the posttest.

Alphabet Knowledge pretest strongly correlated with mathematics pre- and posttests (*r* = .51 and *r* =.46, respectively), while it negatively correlated with executive functions; Inhibition (*r* = -.16), working memory (*r* = -.27), and planning and organisation (*r* = -.27). These results show that children who performed well in alphabet knowledge also performed well in mathematics both at pre and posttest. With regards to executive functions, the moderately negative but significant correlations meant that children who performed well in alphabet knowledge also had good inhibitory control, working memory, and organisation. Results were the same for Alphabet knowledge posttest. This test correlated positively with mathematics pre- and posttest (*r*=. 53 and *r*=. 59, respectively) but negatively with all the executive function skills including inhibition (*r*= -.15), shift (*r*= -.15), emotional control (*r* = -.16), working memory (*r* = -.31) and organisation and planning (*r*=.-30).

Phonological awareness pretest correlated positively with reading and writing pretest (*r* = .27), mathematics pretest (*r* = .42) and mathematics posttest (*r*= .37). Phonological awareness pretest also correlated negatively with working memory (*r* = .20) and planning and organisation (*r* = -.21). These results show that children who performed well in phonemic awareness also did well in reading and mathematics. This is in line with the literature showing that phonological awareness is related to later reading (Cardoso-Martins, 1995; Cathy & Lucy, 1994; Matafwali, 2010; Wagner *et al.*, 1993). Studies have also shown that there is a relationship between phonological awareness and mathematics probably because sums are coded as language in the brain (Swanson & Sachse-Lee, 2001; Simons, Singleton, & Horne, 2007). The same pattern was observed for the posttest. Phonological awareness posttest correlated positively with reading and writing - posttest (*r* =. 65), mathematics posttest (*r* = .67) and negatively with executive functions inhibition (r = -.16), emotional control (r = - .16), working memory (r= -.32) and

Table 10: How children with and without preschool differ on dependent variables
4.6 comparison between preschool and non-preschool children on outcome variables

organisation and planning (r = -.29).

Reading posttest correlated positively with mathematics posttest (r = .39) while it correlated negatively with working memory (r = -.21) and organisation and planning (r = -.17) implying that children who did well in reading also performed well in mathematics and were rated high in working memory as well as planning and organisation.

Regarding mathematics both the pre- and posttests correlated negatively with executive functions. In particular the pretest correlated with working memory (r = -.27) and planning and organisation (r = -. 27) while the posttest correlated with inhibition (r = -.15), shifting ability (r = - .19), working memory (r = -.36), and planning and organisation (r = -.33). This implies that children who were rated highly on executive functions by their teachers also performed well in mathematics.

4.5 How Children with and without Preschool differ on Dependent Variables

variable	Preschool	Mean	*SD*	*t*	df	*p*
Basat Alphabet pretest	No	28.67	26.29	-2.37	214	.018
	Yes	37.28	26.72			
Basat Alphabet post test	No	47.12	31.62	-1.17	193	.243
	Yes	51.90	26.59			
Basat Phonological tasks pretest	No	54.81	26.96	-1.06	214	.289
	Yes	58.67	26.20			
Basat Phonological tasks post test	No	63.54	27.58	.984	193	.330
	Yes	59.11	26.2			
Basat Reading and writing pretest	No	15.15	25.58	.015	214	.986
	Yes	15.08	22.78	.		
Basat Reading and writing post test	No	27.94	36.10	1.098	193	.281
	Yes	22.6	31.34			
Mathematics pre test	No	74.03	20.66	-.328	214	.745
	Yes	74.93	19.38			
Mathematics combined posttest (DLE)	No	4.58	3.76	-1.93	180	.954
	Yes	5.72	4.14			
Tapping (inhibition) pretest	No	3.22	2.52	-.958	214	.341
	Yes	3.64	3.71			
Tapping (inhibition) posttest	No	4.89	3.57	-.058	193	.954
	Yes	4.92	3.48			
Stroop (working memory) pretest	No	15.82	12.56	1.56	214	.121
	Yes	13.39	10.38			
Stroop (working memory) posttest	No	6.81	10.78	-.092	193	.928
	Yes	6.93	8.64			
Brief	No	21.57	16.12	.013	205	.989
	Yes	21.54	16.33			

This analysis aimed at showing how the two groups in this study (children with and without preschool) differed on dependent variables such as alphabet knowledge, phonological skills, reading and writing, mathematics and executive functions. In order to do this, independent samples t-tests were conducted on all the dependent variables as shown in Table 10. From Table 10, it is evident that children with preschool background only differed from those without preschool on alphabet knowledge pretest (*p*=.018) suggesting that children with preschool education had a head start in first grade in alphabet knowledge but not in any other skill.

4.6 Preschool as Predictor of Academic Skills controlling for Background Variables

Next it was tested whether preschool predicted academic skills at the start and at the end of grade one controlling for background variables like SES (home possessions), reading at home, intelligence and receptive, expressive language. End-of-the-year scores were corrected for the scores at the beginning of the year. Background variables were entered in step 1; intelligence, language skills and pretests in step 2; and preschool in step 3. One of the hypotheses was that executive functions may also explain academic skills and that preschool might affect learning in first grade through its effect on executive functions. Executive functions were, therefore, entered in a last step to test whether any effect of preschool would disappear after executive functions had been entered. However, for none of the variables was there evidence that preschool affected academic skills through executive functions. Therefore, in the tables below, the final models are presented. We applied multi-level regression models in order to correct for differences in skills that result from differences between schools.

4.6.1 Alphabet Knowledge

Table 11 Regressing Alphabet Knowledge Pretest on Background Variables and Preschool controlling for School

Parameter	Estimate	df	*t*	*p*
Intercept	-57.357016	206.824	-2.982	.003
Home possession	.176689	205.343	.175	.861
Read at home	13.952168	206.987	4.291	.000
Pattern reasoning Pretest	.682171	202.083	1.461	.146
PPVT Pretest	2.150534	205.047	3.470	.001
Familiar Language test	-.045445	198.944	-.114	.910
RAN	39.890739	204.732	4.012	.000
preschool	4.746982	205.863	1.457	.147
Inhibition	.066547	177.495	.433	.665
shift	.055122	181.837	.429	.669
Working Memory	-.177424	174.423	-.990	.324
Emotional Control	.025288	206.992	.190	.850
Plan & organisation	-.245923	206.288	-1.516	.131
Taping (inhibition)	-2.849757	206.052	-1.745	.083
Strooplike (working memory)	-2.922922	160.350	-1.834	.069

a. Dependent Variable: Alphabet knowledge pretest

A multi-level regression analysis was conducted to show whether preschool had an effect on alphabet knowledge at the start of first grade after controlling for home possessions (SES), reading at home, intelligence (pattern reasoning) and expressive (Familiar language test) and receptive language (PPVT), preschool and executive functions. The final model in Table 11 shows that five predictor variables, reading at home, PPVT, RAN, inhibition (tapping) and working memory (Stroop) were significant predictors of alphabet knowledge at pretest but SES, intelligence (pattern reasoning), preschool, familiar language tests and BRIEF items (Inhibition, shift, emotional control, working memory and planning and organisation) were not. Results suggest that the difference in alphabet knowledge between children with preschool and those without preschool may not result from attending preschool but from higher scores on language, rapid naming (RAN) and activities at home.

Table 10: Regressing alphabet knowledge at the posttest on background variables, alphabet knowledge at pretest and preschool. Controlling for school effects

Parameter	Estimate	df	*t*	*p*
Intercept	41.700039	194.542	2.643	.009
Home possession	-.687287	193.313	-.862	.390
Reading at home	-.246052	190.636	-.093	.926
Pattern reasoning	.464980	184.652	1.259	.210
PPVT	-.665296	194.985	-1.285	.200
Familiar language test	.165472	194.930	.520	.603
RAN	10.418727	186.093	1.291	.198
preschool	-2.230975	187.954	-.861	.390
Inhibition	.266671	192.093	2.145	.033
shift	.110976	193.050	1.038	.301
Working Memory	-.358736	192.665	-2.475	.014
Emotional Control	-.105453	188.754	-1.021	.308
Brief plan organisation	-.041054	193.401	-.317	.752
Tapping (inhibition)	-3.333679	188.483	-2.618	.010
Stroop-like (WM)	-2.464538	191.191	-1.890	.060
Alphabet Knowledge Pretest	.734001	192.159	13.308	.000

a. Dependent Variable: Basat Alphabet knowledge posttest

To test long-term effects of preschool on alphabet knowledge at posttest, a multi-level regression analysis was conducted with home possessions (SES), reading at home, intelligence (pattern reasoning), expressive (Familiar language test) and receptive language (PPVT) and executive functions, alphabet knowledge at pretest and preschool as predictors while controlling for school effect. Table 12 shows that alphabet knowledge at the posttest was significantly predicted by both hands on and teacher rated executive functions as well as alphabet knowledge pretest. However, preschool, home possessions, intelligence, RAN and receptive and expressive language did not predict performance on alphabet knowledge assessed at the end of grade one.

4.6.2 Phonological Awareness

Table 13: Regressing phonological awareness pretest on background variables and preschool, controlling for school effects

Parameter	Estimate	df	t	Sig.
Intercept	42.369900	204.885	2.200	.029
Home possession	-1.843580	202.050	-1.822	.070
Reading at home	5.602513	199.578	1.734	.085
Pattern reasoning	.826191	195.044	1.809	.072
PPVT	.831596	202.026	1.338	.182
Familiar Lang test	-.629182	204.417	-1.550	.123
RAN	16.752638	196.500	1.714	.088
preschool	-.028925	196.810	-.009	.993
Inhibition	.194026	206.785	1.219	.224
shift	.146509	206.906	1.100	.272
Working Memory	-.346806	206.873	-1.863	.064
Emotional Control	.003068	199.081	.023	.981
Plan organisation	-.141761	201.769	-.873	.383
Taping(inhibition)	-2.102207	197.711	-1.304	.194
Strooplike (working memory)	-6.442759	206.699	-3.840	.000

a. Dependent Variable: Phonological skills pretest

This analysis was conducted to test whether, controlling for school effect, preschool predicts phonological skills at pretest after controlling for home possessions (SES), reading at home, intelligence (pattern reasoning), expressive (Familiar language test) and receptive language (PPVT), and executive functions. Preschool did not reveal significant effects, with or without inclusion of executive functions, meaning that preschool did not affect learning. As is shown in

Table 13, phonological awareness at pretest was only significantly predicted by working memory.

Table 14: Regressing phonological awareness posttest on background variables, phonological awareness pretest and preschool controlling for school effects

Parameter	Estimate	df	*t*	*p*
Intercept	16.278228	193.872	.855	.393
Home possessions	-.411482	193.009	-.420	.675
Reading at home	2.543916	189.901	.810	.419
Pattern reasoning	1.057534	183.909	2.337	.021
PPVT	.689441	193.852	1.128	.261
Familiar Lang test	-.251212	194.479	-.644	.520
RAN	31.076547	187.590	3.253	.001
preschool	-6.857592	185.880	-2.185	.030
Inhibition	.228504	193.394	1.496	.136
shift	.203375	194.422	1.548	.123
Working Memory	-.305156	193.835	-1.707	.089
Emotional Control	-.210795	187.547	-1.673	.096
Plan & organisation	-.180488	192.625	-1.143	.255
Tapping (inhibition)	-3.635331	186.711	-2.346	.020
Stroop-l(working memory)	-1.988609	194.259	-1.216	.225
Phonological tasks pretest	.260543	194.396	3.905	.000

a. Dependent Variable: Phonological skills posttest

On the posttest, preschool had a significant effect and this effect remained the same after entering executive skills. Other significant predictors were RAN, pattern reasoning, pretest scores and executive functioning (tapping and working memory). Surprisingly, the effect of preschool was negative, meaning that children who went to preschool performed poorer on this task.

4.6.3 Reading and Writing

Table 11 Regressing reading and writing pretest on background variables

Parameter	Estimate	df	t	Sig.
Intercept	1.234728	193.656	.047	.963
Home possession	-2.422225	193.605	-1.789	.075
Reading at home	5.815288	190.894	1.333	.184
Pattern reasoning	1.959462	184.296	3.105	.002
PPVT	.217926	193.968	.258	.797
Familiar Lang test	.411308	193.935	.764	.446
RAN	27.295930	188.669	2.057	.041
preschool	-7.479666	186.540	-1.713	.088
Inhibition	.193821	186.658	.925	.356
shift	.167653	190.199	.929	.354
Working Memory	-.467335	187.429	-1.906	.058
Emotional Control	-.096653	188.480	-.552	.582
Plan & organisation	-.004123	193.129	-.019	.985
Taping (inhibition)	-2.724399	187.503	-1.264	.208
Strooplike (working memory)	-4.169977	189.472	-1.855	.065
Phonological tasks pretest	.234778	188.760	2.563	.011

a. Dependent Variable: Basat Reading and writing post test

Scores on reading and writing at the beginning of grade one were low and, therefore, not analysed. Analysing the scores at the end of first grade, the score of phonological awareness at the beginning of the year was included as pretest. Table 15 shows the effect of preschool on reading and writing at the end of first grade controlling for home possessions (SES), reading at home, intelligence (pattern reasoning), expressive (familiar language test) and receptive language (PPVT), and executive functions. The table shows that the effect of preschool on reading and writing at the end of first grade was marginally significant ($p<.1$). Other significant predictors were intelligence (pattern reasoning), phonological awareness at pretest, and RAN. Again the effect of preschool was negative, meaning that children who went to preschool performed poorer in reading and writing compared to those who did not go to preschool.

4.6. 4 Math Skills

Table 12: Regressing mathematics at the beginning of grade one on background variables and preschool, controlling for school

Parameter	Estimate	df	t	Sig.
Intercept	33.844904	206.278	2.363	.019
Home possessions	-2.069081	203.688	-2.756	.006
Reading at home	8.099304	206.652	3.343	.001
Pattern reasoning	.412139	203.195	1.182	.239
PPVT	1.844719	203.186	4.002	.000
Familiar Lang test	-.241148	195.220	-.811	.418
RAN	18.312978	205.637	2.468	.014
Preschool	-1.777337	206.581	-.731	.465
Inhibition	.252861	170.213	2.225	.027
shift	-.012315	176.293	-.129	.897
Working Memory	-.215866	166.514	-1.628	.105
Emotional Control	-.012685	206.840	-.128	.898
Plan & organisation	-.212842	205.330	-1.763	.079
Tapping (inhibition)	-5.352721	206.633	-4.394	.000
Strooplike (working memory)	-2.245784	152.834	-1.908	.058

a. Dependent Variable: Mathematics pretest percentages combined after dividing.

A multi-level regression analysis was conducted to show whether preschool had an effect on mathematics at the beginning of first grade after controlling for home possessions (SES), reading at home, intelligence (pattern reasoning), expressive (familiar language test) and receptive language (PPVT), and executive functions. Preschool was not a significant predictor. Significant predictor variables were home possessions, reading at home, PPVT, RAN, and executive functions (inhibition and tapping) as shown in Table 16.

Table 13: Regressing mathematics posttest on background variable, mathematic pretest and preschool controlling for school effects

Parameter	Estimate	df	t	Sig.
Intercept	49.094644	193.702	4.632	.000
Home possession	.342752	193.853	.596	.552
Reading at home	.937284	192.185	.519	.604
Pattern reasoning	.479587	185.014	1.901	.059
PPVT	-.074867	193.777	-.212	.832
Familiar Lang test	-.030981	193.629	-.143	.886
RAN	4.996632	187.884	.925	.356
preschool	-.883291	188.077	-.502	.616
Inhibition	.239786	186.132	2.819	.005
shift	-.075183	188.206	-1.037	.301
Working Memory	-.329978	187.252	-3.362	.001
Emotional Control	.052025	190.061	.734	.464
Plan & organisation	-.021578	193.620	-.245	.807
Tapping (inhibition)	-1.440917	187.007	-1.600	.111
Strooplike (working memory)	.130342	184.652	.148	.882
Mathematics Pretest	.417064	189.845	8.480	.000

a. Dependent Variable: Mathematics totals posttest percentages after dividing.

Testing effects of preschool on mathematics at the end of first grade did not reveal any effect. Table 17shows that mathematics posttest was significantly predicted by working memory, inhibition and pretest scores on mathematics.

4.7 Effects of Linguistic Diversity

The second aim in this study was providing an empirical examination of the role of linguistic diversity in predicting the development of reading and writing in the first grade. The specific aim of the current research was to explore to what extent teaching English in preschool might influence learning to read in first grade in Nyanja.

It may be expected that learning English in preschool may interfere with learning to read in first grade in particular, if children do not speak Nyanja at home and depend on school for learning Nyanja as well as learning to read in Nyanja. It was explored to what extent preschool in English interferes with learning to read in first grade, especially when children are taught in unfamiliar language in first grade. The researcher argued that the linguistic diversity is greatest if children do not use Nyanja at home and these children might experience most problems in learning to read and write in first grade. Two by two (preschool x home language) factorial analysis of variance (ANOVA), controlling for all background variables that in previous analyses appeared to be significant predictors of reading and writing was conducted.

4.7.1 Linguistic Diversity

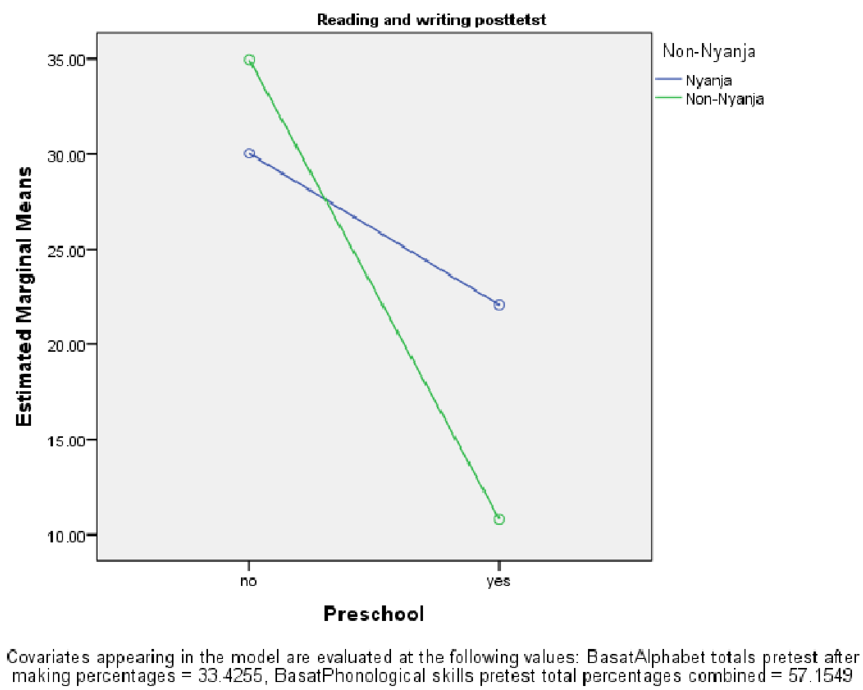
Table 14: Test of between - Subject effects preschool and Nyanja

Dependent Variable: Reading and writing posttest					
Source	Type III Sum of Squares	df	Mean Square	*F*	*p*
Corrected Model	72292.691[a]	5	14458.538	18.642	.000
Intercept	283.657	1	283.657	.366	.546
Alphabet knowledge	52145.929	1	52145.929	67.234	.000
Phonological tasks	855.555	1	855.555	1.103	.295
Preschool	8800.939	1	8800.939	11.347	.001
Nyanja-learner	655.972	1	655.972	.846	.359
Preschool * Nyanja-learner	3155.117	1	3155.117	4.068	.045
Error	144258.868	186	775.585		
Total	338854.167	192			
Corrected Total	216551.559	191			

[a] R Squared = .334

Findings show a significant main effect of alphabet knowledge pretest, meaning that children more familiar with letters at the start of first grade also performed better in reading and writing at the end of the year. Phonological awareness did not predict the ease in which children learn to read and write. In addition, there was a significant main effect of preschool, meaning that children who went to preschool scored lower compared to children who did not go to preschool. There was also a significant interaction preschool x home language (not speaking Nyanja versus speaking Nyanja at home), showing that, in particular non-Nyanja speakers were negatively affected by preschool. This might be so because the non-Nyanja speakers were taught in an unfamiliar language both at preschool and in first grade.

Figure 2: Reading and writing skills at the end of first grade as a function of preschool and familiarity with Nyanja, the language of instruction in first grade



4.3 Summary

The study revealed findings that might provide new insights into the persistent reading failure observed among Zambian school going children. It is clear from the findings that Zambian preschools are not preparing children for learning academic skills in first grade. In particular, learning to read is negatively affected by preschool. Non-Nyanja speaking children suffer most from preschool. They are taught to read in a language (Nyanja) that differs from their most familiar language.

CHAPTER FIVE

5.0 DISCUSSION OF FINDINGS

5.1 Overview

The primary aim of this study was to assess whether preschool prepares children to read and write in the first grade when intelligence and social-economic status (SES) are controlled. The study also aimed to establish whether preschool promotes executive functions which may explain any positive effects of preschool on literacy and numeracy skills in the first grade. Additionally, the study sought to establish how linguistic diversity affects learning to read in first grade, especially for children who do not speak Nyanja at home and are taught in unfamiliar languages in preschool as well as first grade. English is used in preschool and Nyanja in first grade. Three questions were formulated. The first question was to establish to what extent preschool prepares children for learning to read and numeracy in first grade when other background variables such as SES and intelligence are controlled. Secondly, the study explored whether preschool predicts literacy and numeracy at the start and end of first grade through executive functions. Thirdly, the study sought to test whether linguistic diversity would disadvantage children who do not use Nyanja at home but are expected to learn to read in Nyanja in first grade and who were taught in English at preschool.

The chapter is thus organised in four sections. Section one (1) shows the difference in background and outcome variables between children with and without preschool exposure.

Information on preschool and executive functions predicting literacy and numeracy as well as observed gaps in reading achievement will be discussed in section two (2). Special emphasis will be on preschool as a mediator of executive function to promote reading, writing and numeracy. Section three (3) discusses the influence of background variables such as intelligence, SES, rapid automatised naming, language abilities to literacy and numeracy skills as observed in this study and other studies. Section four (4) will show the effects of linguistic diversity on reading and writing.

5.2.0 Group Differences between Children with Preschool and Non-preschool

The questions addressed in this study relate to the importance of preschool in the acquisition of literacy and numeracy in the first grade. A number of studies have shown that skills acquired in preschool are related to later literacy and numeracy skills (Torgesen *et al*., 1999; Scarborough, Dobrich & Hager, 1991). It has also been established that preschools are guided by curricular or established practices designed to improve children's development or competences in one or more domains, including language, literacy, math, social-emotional development and physical development (Buysee & Wesely, 2005).

In view of the above, it was anticipated in this study that children with preschool exposure would differ from those without preschool education on general variables as SES. Results revealed that children who went to preschool came from homes where they had more home possessions than those who did not go to preschool and they were on average younger. The explanation may be that if children are from homes with more home possessions (high SES), their parents are most likely to pay for preschool, whereas parents from homes with less home possessions (low SES) may not be able to afford sending their children to preschool (Ramey & Ramey, 1994). While the legal age for starting school in Zambia is seven, the majority of children with preschool were in the age range of five to eight. From a study into the Early Childhood Development Project (Zuilkowski, Fink, Moucheraud & Matafwali, 2012), it appeared that participation in ECE does not only improve academic outcomes but also encourages a timely enrollment of children in grade one. They further contend that it is possible that parents whose children have been exposed to ECE are motivated to enroll their children in grade one on time because they interpret their child's participation in school related activities as evidence of school readiness.

In line with the literature, it was found that children with preschool exposure scored higher on pattern reasoning (General intelligence) compared to their peers who were not exposed to preschool as shown in Table 3. The advantage over those without preschool could be due to intensive exposure to pictorial related activities in preschool. To favour this finding, the Early Childhood Development Module (2010: 8) stipulates 'significant benefits in terms of cognitive and socio-emotional abilities, which lead children to have greater capacity to problem solve and self-regulate their behaviour and emotions when comparing children who participate in ECCD programmes to those who have not participated in'

Notwithstanding the above finding, however, children with preschool exposure did not differ from those without preschool in pattern reasoning at posttest. This means that at the beginning of first grade, the difference was noticed but after seven months of instruction, the difference diminished. This implies that the effect of preschool on general intelligence may not be longitudinal as suggested by other studies. In order to concretise this finding, it is necessary to conduct multi phased longitudinal studies which can establish the longitudinal links of preschool and intelligence because the current study only tested the children within one year.

In terms of other background variables (expressive and receptive language and RAN), no significant differences were observed between the two groups. It was rather strange that no significant differences were observed in language skills between the two groups. This is because preschool is expected to improve children's linguistic abilities (Graffin *et al*., 2010; Konza, 2011). One explanation may be that Nyanja was not promoted in preschool while this language was tested. The lack of differences in language abilities could also be attributed to the limited opportunities for social interaction during preschool hours. It is believed that oral language develops through practice but most talking in preschool classrooms is done by the teacher. Sylva *et al*. (2004) found that 73 per cent of preschool children's time in the United States was spent without any direct child-teacher interaction. Sylva *et al*, suggest that only 8 per cent of children's time was spent in elaborated interactions with teachers to express themselves during activities. It is, therefore, important that preschools provide opportunities for interaction between teachers and children as well as among children themselves. This assertion is supported by Konza (2011) who contends that oral language develops most effectively through one to one conversations with a better language user. Therefore, the teacher can come up with ways to increase contact between preschoolers with better language and those with poor oral language in pairs or very small groups.

It was further envisioned that there would be differences between children with preschool and those without in executive functions; surprisingly, this was not the case. This was surprising because executive functions are believed to be stimulated during preschool years (Diamond, 2013; Moffit *et al*, 2011). It was, therefore, expected that children who went to preschool would perform better on these skills than those who did not go to preschool. The reason for this expectation was that children in preschool are more likely to be faced with situations where they had to be attentive or to inhibit certain behaviours in order to perform tasks. The lack of variability between the two groups in terms of EF raises a lot of questions on the quality of preschools, such as: do preschools in Zambia incorporate this important skill? If so, why was there no notable difference between children with preschool and those without in this skill as expected? A plausible explanation to this could be that Zambian preschools do not have activities that stimulate executive functions. This outcome is worrisome given the pivotal role of executive functions in early literacy and numeracy development.

The importance of preschools incorporating activities to stimulate EF cannot be over emphasised. A study by Bennett (2008), for example, found that preschool incorporating the development of self-regulatory skills while solving early math and literacy tasks was associated with improvement in skills. Furthermore, Saez (2012) established that 'effective' individualised instruction was related to higher reading scores (Connor, Piasta *et al.*, 2009). This effect, though, was most pronounced among higher ratings of attention, suggesting that this effect differentially benefits students. That is, for kindergarten students who can self-regulate their attention and sustain focus on learning goals well, word reading is easily acquired.

Regarding the differences among the two groups on outcome variables, it was expected that children with preschool experience would perform better than those without preschool in reading and mathematics. On the contrary, the study found that the two groups did not significantly differ in both outcomes. A significant difference was, however, noted in alphabet knowledge at the start of first grade. Children with preschool performed better than those without preschool on this skill; therefore, confirming our hypothesis that children with preschool have a head-start at the beginning of the first grade in reading and writing as appears from letter knowledge. However, subsequent analysis which controlled for school effect as well as intelligence and SES did not reveal the difference, which shows that this difference in favour of preschool could have been the result of other background factors such as intelligence and SES.

The findings in this study and previous studies (Matafwali, 2010; Mwanza, 2011) throw doubts upon the quality of preschools in Zambia. It is clear from the Zambian Education Framework (MoE, 1996) that preschool education was not under the formal education system until in 2005 when the mandate to oversee preschool education was given to the Ministry of Education and recently in 2012, when a declaration was made to annex preschools to primary schools (MOESVTEE, 2012). However, since these pronouncements, not much progress has been recorded; the actual provision of preschool education has continued to be in the hands of the private sector (i.e. the Church, Non-Governmental Organisations, and individuals). Further, curriculum regulation and management has continued to be under the private sector (Matafwali & Munsaka, 2008), which may compromise the quality of preschools. This situation is unfortunate, given the central role of preschool education in laying the foundation for future learning.

5.3.0 Preschool and Executive Functions as Precursors of Literacy and Numeracy Skills

The relationship between preschool, executive functions and literacy and numeracy was explored in this study. Three specific questions were asked: Are there relationships between preschool, executive functions, literacy and numeracy in the first grade? Does preschool independently predict literacy (as tested by alphabet knowledge, phonological awareness and reading syllables) and numeracy skills (as tested by mental arithmetic tests) in first grade? Do executive functions mediate between preschool and literacy and numeracy skills? It was anticipated that both preschool and executive functions would be closely related to each other and that reading and numeracy skills would be related to executive function skills. Such a pattern of results would be taken as support for Baddeley's multi-component model, which suggests that performance on measures of executive functions predict performance on a range of reading and numeracy skills (Blair & Razza, 2007; Bull, Espy, & Wiebe, 2007; Simons, Singleton, & Horne, 2007). This supports the finding by McClelland *et al*. (2006) that executive functions are strong predictors of reading and math achievement between kindergarten and sixth grade and growth in literacy and math from kindergarten to second grade.

To ascertain whether the Baddeley's multi-component model was the best approach to view the relationship between executive functions, reading and arithmetic, it was tested whether the three abilities (executive functions, reading and numeracy) were significantly interrelated, thereby supporting the multi-component model (Baddeley, 1986; 2000). These results are in line with previous studies which inveterate the strength of executive functions in predicting reading and numeracy skills (McClelland *et al*., 2006; Van der Sluis, de Jong, & Van der Leij, 2007; Yeniad *et al*., 2013).

Baddeley's multi-component model was employed to examine the interrelationships among executive functions, reading and numeracy. It was anticipated that children who are able to regulate behaviour during tasks are able to read and perform better in numeracy skills (McClelland, 2007). It was also expected that children that have attended preschool would be better able to regulate their behaviour than those who never attended preschool.

Correlation analysis revealed that working memory accounted for 4 per cent of the variance in reading, while organisation and planning accounted for 3 per cent of the variance. In terms of mathematics, all the executive function skills that were rated in the study significantly correlated with mathematics at posttest except emotional control. Working memory had the highest effect size accounting for 13 per cent of the variance followed by organisation and planning with 11 per cent. Working memory had the highest explained variance because most mathematics skills rely more on working memory; also because one needs to hold information in working memory if they are to successfully perform a math skill (Diamond, 2013).

Executive functions accounted for variation in reading and mathematics even after controlling for the effect of school, social-economic status and intelligence. These results confirm Baddeley's multi-component model that children with high executive functions perform better in literacy and numeracy. It also confirms findings in other studies which have found similar effects (Altemeier, Abbott & Berninger 2008; Anderson, 2008; 2006; Foy & Mann, 2012; Fuchs *et al*., 2005; Sesma *et al*., 2009).

5.4.0Preschool and Executive Functions Predicting Reading and Writing

As already alluded to in the preceding chapters, studies have shown that children who go to preschool perform better than those who have never gone to preschool in reading and numeracy (Lopez *et al*., 2007). In addition, preschool has been found to promote the development of EF, which have subsequently been found to affect literacy and numeracy skills (Blair & Razza, 2007). This study, therefore, examined the predictive role of preschool and executive functions to reading and numeracy in the first grade. A broad range of predictor variables were utilised, which included SES, Intelligence, PPVT, receptive language test, RAN, reading at home, preschool and executive functions.

Multi-level regression analysis revealed that preschool did not significantly predict alphabet knowledge at the beginning and end of first grade. This is contrary to other findings which have shown that preschool predicts alphabetic knowledge (Adams, 1990; Bryant & Bradley, 1985; Wagner & Torgesen, 1987). The explanation could be that children in preschool learn the English alphabet while in the first grade literacy is taught in a local language and children do not learn letter names but instead learn letter sounds in Nyanja. This may confuse the children who could have started learning letters of the alphabet and their sound in English. In the studies where preschool has been seen to predict alphabetic skill, the same language is used in preschool as well as in first grade. The lack of consistency in the language of instruction in Zambia contributes to the poor performance of children which may interfere learning to read (Matafwali, 2010; Mwanza, 2011, Tambulukani & Bus, 2012).

Regarding executive functions, alphabet knowledge significantly correlated with working memory and planning and organisation, which in combination accounted for 27 per cent of the variance. In the posttest, all the executive functions were related to alphabet knowledge performance and in isolation, inhibition accounted for 3 per cent, emotional control for 3 per cent while working memory and planning accounted for the highest variance, 10 per cent and 9 per cent, respectively. The strength of the relation between executive functioning and alphabetic skills was low to moderate in line with results of other studies (e.g., Blair & Razza, 2007; Bull *et al*., 2008; Davidse *et al*., 2010; Kegel & Bus, 2013; Matthews *et al*., 2009). However, testing if executive functions could predict alphabet knowledge after controlling for the effect of school, intelligence, preschool and language abilities showed that only inhibition and working memory predicted alphabet knowledge. At the end of first grade, inhibition and working memory were even stronger predictors of alphabet knowledge even after we controlled for alphabet knowledge at the beginning of the year, confirming the long-term effects of executive functions on alphabet skills consistent with Kegel and Bus (2013). Working memory (measured with a Stroop-like task) explained more improvement in alphabetic skills than did inhibitory control (measured with the pencil tapping test), probably because working memory has a growth spurt in the preschool age (Garon *et al*., 2008). Executive functions proved to be important to perform alphabet skills over and above preschool, therefore, showing that preschool did not stimulate alphabetic knowledge through executive functions but that executive functions independently predicted alphabetic knowledge beyond other influences.

As phonological skills are theoretically and empirically important to reading achievement, (Lonigan, Burgess, & Anthony, 2000), this study examined whether preschool and executive functions would predict phonological skills both at pre- and posttest. To begin with, interrelations were noted between executive functions and phonemic skills in line with other studies and Baddeley's multi-component model (Baddeley & Hitch, 1974; Gathercole & Baddeley, 1993). Specifically, working memory and planning and organisation explained for variation in the pretest while at posttest, inhibition and emotional control accounted for a substantial amount of variation in addition to working memory and planning and organisation.

Further multi-level analyses were carried out to determine the predictability of preschool and executive functions on phonological skills. The results indicated that preschool did not predict phonological skills at pretest. When effects were tested at the end of first grade, the effect of preschool was significant but negative. This means that children who went to preschool performed poorly on this task compared to the children who never went to preschool, contrary to what was expected. It was anticipated that preschool would positively predict phonological awareness in the first grade. This led to rejection of the hypothesis that children with preschool have a better start at the beginning of the first grade in reading as appears from phonological awareness after controlling for SES and Intelligence. It is possible that negative effects result from the different languages that are used to teach at preschool and in first grade. Just as children get confused in learning alphabet names and sounds, it is possible that children who are exposed to preschool would face the same challenge in phonological skills. The English alphabet names and sounds may interfere with learning to recognise the sounds in Zambian language words because they sound otherwise.

Another aspect that was assessed in this study was reading and writing. In this skill, associations were noted between reading and writing posttest and executive functions. Only working memory and organisation were significantly associated with reading and writing at the end of grade one and in combination accounted for 38 per cent of the variation. The rest of the executive skills did not relate to reading and writing. This result is in line with Sesma *et al*. (2009).

Results from the multi-level regression analysis including all executive functions and background variables such as home possessions (SES), reading at home, intelligence (pattern reasoning), expressive (familiar language test) and receptive language (PPVT) showed that only working memory (as rated by the teachers and the Stroop test) significantly predicted reading and writing posttest. Other executive functions, however, were not significant contrary to findings in other studies. One interesting result is that emotional control did not significantly predict reading and writing in this study contrary to Mwanza (2011) who found that emotional control was a significant predictor of reading among first graders in Zambia. Mwanza further argued that poor emotional control was an incentive in overcrowded classrooms of Lusaka. Therefore, children who had angry outbursts or reacted strongly could easily be noticed and help would be rendered. The explanation for the contrast could be that Mwanza (2011) did not control for the effect of other background variables which could have been at play as covariates.

The results from the multi-level analysis showed that preschool significantly predicted reading and writing at the end of first grade. However, the prediction was negative, meaning that children who went to preschool performed poorly on this task compared to those who did not go to preschool. This is contrary to other studies (Lonigan *et al*., 2000; Bryant & Bradley, 1985) where preschool appeared to be a positive predictor of reading and writing. The Zambian situation may differ because of the language. Children who go to preschool may lack proficiency in local languages (for example, Nyanja in Lusaka) to perform well in the first grade. To support this, findings from the situation analysis of Early Childhood Education instituted by UNICEF in 2007 indicate that the teaching at preschools is mainly done in English (Matafwali & Munsaka, 2008)This concretises previous studies in Zambia that have also shown that preschool is not beneficial to Zambian children in first grade (Matafwali, 2010; Mwanza, 2011). The question still remains why not use the same language of instruction in preschool and in first grade? The Zambian government recognises the need to change the policy and use a local language as the language of instruction in preschool (MOESVTEE, 2012). In the same vein, the government stimulates public schools to annex preschools within their system and has deployed preschool teachers to public schools. However, even with these efforts, implementation has been very poor; to date (May, 2015), none of the schools that were involved in this study has a preschool in their premises except one, which had a preschool even before the pronouncements were made. Nonetheless, English is still used as the medium of instruction in that preschool. To make matters worse, parents are not willing to have their children learn in a local language. The study commissioned by UNICEF (2007) found that most parents in the centres preferred their children to be taught in English as opposed to the mother tongue. Matafwali (2010) explains that this might be due to a perception (consciously or unconsciously) held by parents and society alike that English is a symbol of status in the community as it breaks through international boundaries. What these parents need to know is that learning English in preschool seems to hamper the breakthrough to literacy in first grade.

5.5.0 Preschool and Executive Functions Predicting Mathematics.

Studies have shown that preschool predicts numeracy skills in first grade. A longitudinal study by Aunio and Niemivirta (2010), for example, found that the acquisition of counting and relational skills before formal schooling are predictive of the acquisition of basic arithmetical skills and overall mathematical performance in grade one. In addition, Baddeley's multi-component model has shown that measurements of central executive functions are strongly correlated with the prediction of mathematical abilities in children (Anderson, 2008; Gathercole *et al*., 2004; Lehto, 1995; Noel, Seroni, & Trovarelli, 2004; Swanson & Beebe-Frankenberger, 2004; Swanson, 1994). The current study, therefore, tested if preschool and executive functions would predict mathematics performance in the first grade.

Results in this study did not show associations between preschool and mathematics both at the start and end of first grade. This is different from Aunio and Niemivirta (2010) who found that counting and relational skills before formal schooling are predictive of the acquisition of basic arithmetical skills and overall mathematical performance in grade one. The current findings are surprising because preschool is known for activities that facilitate counting and number skills, which are essential for good performance in early mathematics. However, the study found that the general performance in mathematics was good with the mean score being 74.5 per cent correct on the pretest and 84 per cent on the posttest. This means that the group was homogeneous and did not differ in performance whether children had been to preschool or not. This may be so because the curriculum in preschool and first grade is not very different, the principles in mathematics do not change whether English or Nyanja is used as a language of teaching.

Another factor assessed was the influence of executive functions in mathematics performance. The study revealed that executive functions were associated with mathematics performance both at pre and posttest. Specifically, pretest was significantly associated to working memory and planning and organisation while the posttest was associated with inhibition, shifting, working memory and planning and organisation but only working memory made unique contributions to mathematics over and above other executive functions. This is in support of (Bull, Espy, Wiebe, Sheffield, & Nelson, 2010) who found that inhibitory control and working memory were positively associated with preschooler's early math skills. However, in Bull *et al*'s study only inhibitory control made unique contributions to math skills beyond those of the other executive functions. Although it is expected that all executive function skills would enhance the attainment of numeracy skills among children in the first grade, this study established that working memory was the strongest correlation followed by planning and organisation.

A multi-level regression analysis demonstrated that only two executive function skills positively predicted mathematics at both pre and posttest. Working memory and inhibition were significantly related to mathematics after controlling for the effect of school, home possessions, language abilities and intelligence. The explanation could be that cognitive processes involved in number work have more to do with working memory and inhibition than any other executive skill. This is in agreement with Clark *et al*. (2013) who found that children's inhibitory control and working memory at age three predicted their early math achievement two years later, after controlling for their prior informal math skills, vocabulary and processing speed.

5.6.0 General Literacy Levels

Inspection of the means revealed that the reading proficiency level of Zambian first graders is generally low. About 49 per cent of the children scored zero at the start of grade one while 27 per cent scored zero at the end of grade one, suggesting that more than a quarter does not learn any literacy skills in first grade. Nonetheless, the mean scores suggest that more needs to be done to help Zambian children attain grade level literacy. These results are worrying in that children would be expected to make significant progress after seven months of literacy practice. However, no significant progress was seen, thereby confirming earlier findings (Kalindi, 2006; Kaani, 2006; Ojanen, 2007; Matafwali, 2010; Matafwali & Bus, 2013; Mubanga, 2010; Mwanza, 2011) that the reading levels among the majority of Zambian children are still remarkably low in spite of a rich language policy in place and some of them being exposed to preschool.

In terms of numeracy skills, the picture was different with no record of zero scores and the mean being 75 per cent at pretest and 89 per cent at posttest suggesting that children had gained some skills after seven months of learning. Though the tests may not have been challenging enough, it may mean that Zambian children perform better in numeracy than in literacy.

Examination of the group difference revealed that there was no statistically significant group difference between children with preschool and those without preschool in both literacy and numeracy. The only skill which showed a significant difference between the two groups was letter knowledge at pretest, which did not extend to the posttest. This clearly shows that preschool did not influence reading in any way, a situation that is worrying given the evidence that preschool promotes reading and writing in the western world. The question, therefore, is the quality of preschools. Are the Zambian preschools teaching children skills necessary to help them learn to read in the first grade? It was expected that children with preschool would generally perform better than those without preschool. Conversely, it was evident that even children who had been to preschool and had shown some reading skills initially, did not seem to progress in literacy skills despite having learnt for seven months. The lack of progression could be attributed to the language issue which will be explained in detail later. It is noteworthy that the scores on reading and writing posttest were moderately higher than in reading and writing pretest, notwithstanding that the scores were still relatively low for the grade level.

5.7.0 Literacy and Numeracy Outcomes as a Function of Executive Functions and Other Cognitive Processes

Another important aspect in this study relates to the role of cognitive and executive functions to reading and numeracy. A number of studies have shown that cognitive processes are related to both reading and numeracy (Swanson, Trainin, Necoechea & Hamilton, 2003). This study included measures of general (pattern reasoning) and specific (language abilities and RAN) intelligence as predictor variables. The main purpose for including a number of predictor variables in this study was to test the value of preschool after controlling for relevant skills. Results have revealed that both specific and general intelligence predicted reading and writing concurrently and longitudinally. This finding is contrary to Matafwali (2010) who found that only specific intelligence predicted reading and writing. According to this study, cognitive processes differently predicted literacy and numeracy skills with general intelligence predicting more reading skills than mathematical skills.

The results showed that the RAN is a strong predictor of both reading and numeracy over and above all the other specific intelligence predictors when executive functions are included in the model. In terms of reading and writing, in line with the literature (Felton & Brown 1990; Matafwali 2010; Fink *et al* 2012), RAN appears to have considerable predictive power for concurrent and future reading. The relatedness in predicting outcomes by both specific and general intelligence could be attributed to the large variability observed in both specific and general intelligence. This finding would be expected given that the study sample was drawn from the mainstream and thus children were presumably considered to be of average intelligence. These results promote the understanding that cognitive processes are related to reading and numeracy skills. This finding can be useful in coming up with measures to help children in Zambia learn to read considering the low reading levels in the country.

5.8.0 Background Factors Predicting Literacy and Numeracy

Studies have shown that socio-economic status (SES) and home literacy practices predict literacy and numeracy performance. Therefore, these factors that prove to be significant in the prediction of literacy and numeracy outcomes were considered in the present study. It was hypothesised that these factors would explain some level of variance in literacy and numeracy outcomes, adding to that accounted for by preschool and executive functions.

The background factors had moderate to strong relations with outcome variables at the start of the school year. However, the strength of these relations diminished towards the end of the year. A lot of skilled children came from homes with more home possessions and richer home literacy environment. The explanation for this could be that children with more home possessions could have been exposed to a number of literacy skills as parents could easily provide materials needed in the home and were most likely more able to take time to teach their children.

Moreover, since significant correlations were observed between home possessions and preschool, it is likely that children with preschool had more home possessions and entered first grade with emergent literacy skills, which could have made them perform better at the start of grade one. However, progression in skills may have stagnated as a result of the difference in the language of instruction, making their counterparts without preschool background be at par with them in the posttest. These findings are in favour of Matafwali (2010) who also established lack of longitudinal effect of SES, HLE and preschool on reading and writing contrary to the literature (Feldman 2004; Ngorosho, 2011) reporting longitudinal effects of SES and HLE on reading and writing.

Studies have also demonstrated the importance of the home literacy environment in the attainment of emergent literacy skills before and after entering school (Burgess, Hecht & Lonigan, 2002; Bus, Leseman, & Keultjes 2000; Cummingham & Stanovich, 1993). For example, Burgess *et al*. (2002) revealed that the home literacy environment played a crucial role in the development of emergent literacy skills, with storybook reading as one of the most significant home learning activities to increase literacy skills. In addition, studies of the child's home learning environment have repeatedly shown that the language environment in the home and the quality of linguistic interaction and learning experiences with the parent have direct and significant associations with children's cognitive and language development and emergent literacy competence (Dickinson & Tabors, 2001). Also Bus, van IJzendoorn, and Pellegrini

(1995) found a moderate to high relationship between parent child story-book reading and early literacy outcomes.

To find out about the home literacy environment, this study utilised the home literacy practice index generated from the biographical data form. Questions focused on reading at home, how often they read, title of books they read and whether they received assistance when reading at home. The correlational analysis showed that HLE (reading at home) was significantly associated with alphabet knowledge pre and posttest, reading and writing pretest and mathematics pretest. In order to check for the long-term effect, the multi-level regression analysis was conducted. This analysis revealed that literacy experience at home only contributed to outcome variables that were done concurrently but not longitudinally. It was anticipated that home literacy practices would significantly predict literacy outcomes longitudinally in line with previous research in western countries.

A plausible explanation for the lack of longitudinal effect of home literacy experiences could be lack of continuity in home support after children have entered formal education or as already alluded to, the confusion of language surrounding children. Another plausible explanation could be lack of age appropriate reading materials in the language of instruction used at school. At the start of first grade, variability was observed on this variable but later diminished meaning that children could have been exposed to some kind of basic skills before formal school. To support this assertion, Matafwali (2010) contends that 'In typical Zambian communities, the set of objects that surround children does not include children's books, and where books are available, they are not usually in the primary (local) language' (p.143). Further, she contends that the activities that adults and children share and the everyday situations, typically lack the element of literacy events in the sense described in western societies. This, therefore, shows that what western cultures describe as HLE may be different in African countries, thus, reducing its longitudinal effects. However, a recent study in Zambia by Chansa-Kabali (2014) reported that 8 per cent of the variation in reading among Zambian children was related to the presence of reading materials in the home. These differences in findings may be due to the method. While this study solely relied on a questionnaire about HLE, the Chansa-Kabali study incorporated other aspects of HLE such as interview with parents and home visits which could have accorded her a chance to observe as well as get additional information from parents of children, which the present study did not do. It is, therefore, important that an explanation of HLE be emphasised to ensure that it matches that of western countries which have proved to be important for reading development.

Another factor that has been associated to reading and writing is socio-economic status (Raviv, Kessenich, & Morrison, 2004). In the present study, socio-economic status was the measure of circumstances of the homes where children lived; it included a number of 'possessions' that children reported to be present in the home. Thus, the home possession index comprised items such as; television, radio, stove, electricity, running water, flushable toilet and a car, two pairs of shoes, two pairs of clothes, sleeping on a mattress, floor tiles and the residential area the child lived. The items that were present were summed to form an index which reflected the material wealth of the home. For the purpose of coding, children who reported to have no items in the home scored zero (0) and children with all items in the home scored twelve (12). In line with previous work showing that socio-economic status is related to literacy achievement (Thorndike, 1979); the present study found significant associations between reading and writing at posttest with social economic status. Multi-level regression analysis also showed long-term effect of SES on reading and writing. This finding is in support of Chansa-Kabali (2014) who found that 13 per cent of the variability in reading among seventy-two children in her study was related to certain home possessions. The implication of this finding is that children who came from homes with more home possessions also performed well in reading and writing. It is possible that in these children's homes were also play-toys, children's books, television, videos, radio and other modern gadgets to convey literacy messages. In Zambia for example, children from homes with radios have the privilege to listen to a radio programme called 'Learning at Taonga market' an interactive radio instruction (IRI) which was founded as an alternative means to deliver the basic education curriculum to learners who were not able to attend government schools (Jere-Folotiya, 2014).

The importance of SES is supported by literature. For example, Raz and Bryant (1990) argue that children reared in poverty are at risk of illiteracy. They add that socio-economic status is one of the strongest predictors of performance differences in children at the beginning of first grade. Ramey and Ramey (1994) also contend that families with low socio-economic status lack financial, social and educational support that characterise families with high socio-economic status. Poor families in particular, have inadequate or limited access to financial, material, social and human resources that promote children's development and school readiness. In addition, poor parents may be illiterate and as such they may lack adequate skills for activities like reading to and with their children. Pungello *et al*. (2010) also reveal that family income and economic circumstances have a powerful effect on children's development. Like other risk factors, low family income affects children mainly by affecting their home environments and the parenting they receive in ways that hinder optimal development.

5.9.0 Effects of Linguistic Diversity on Reading and Writing

Studies have supported a strong relationship between oral language skills and reading skill development (Shaughnessy, Sanger, Matteucci & Ritzman, 2004; Blaiklock, 2004). If an individual has trouble understanding spoken language, it is highly unlikely that he/she will comprehend written language. Moreover, one of the consistent findings in literature is that oral language abilities in early childhood predict beginning literacy skills such as letter knowledge, name writing and phonological awareness as well as later reading achievement (Bishop & Adams, 1990; Chaney, 1992; Scarborough, 1990). Furthermore, the Comprehensive Language Approach (CLA) contends that although oral language is important for the acquisition of phonemic awareness in grade one, it is even more critical to reading words. Simply put, the CLA assumes that oral language has a direct impact on learning to read.

Given the importance of language abilities in the prediction of reading, the second aim of this study was to provide an examination of the role of linguistic diversity in predicting the development of reading and writing in the first grade. The specific aim was to explore to what extent teaching English in preschool might influence learning to read in first grade in Nyanja.

This study found that, particularly, non-nyanja speaking children who went to preschool experienced problems learning to read and write. The most plausible explanation for this may be the language of instruction. As already alluded to, Zambian preschools use English as a medium of instructions and, therefore, children who are exposed to preschool face problems learning to read in first grade where the language of instruction is a local language. The variety of languages may confuse the process of learning to read in which the sounds in words is vital. It is important that preschool environments build on the child's familiar language in order to succeed in promoting literacy development and to prepare children for successful transition into elementary grades. Thus, this study agrees with Matafwali (2010) who observed that the current practice where preschools are promoting the use of English is in contrast with the Zambian language policy and might be a source of confusion for the majority of children when they enter grade one in public schools.

Another explanation for the negative effect of preschool would be the type of activities that take place in Zambian preschools. Some Zambian preschools are taken as day care centres where children are taken care of while their parents are attending to other businesses. It is, therefore, possible that activities that go on in these preschools do not prepare children for learning to read in elementary classrooms. Thus, while past research has demonstrated that preschool prepares children for learning to read in first grade (Pretorious & Ribbens, 2005), this might not be the case for most Zambian children. Thus, unlike children in western societies where children who are exposed to preschool are expected to learn reading than those who are not exposed to preschool, majority of Zambian children are deprived of this opportunity and as such, most of them enter school without requisite skills.

A significant interaction between preschool and home language was found (not speaking Nyanja versus speaking Nyanja at home), indicating that even though preschool proved to negatively influence reading in Nyanja, the situation was worse for children who did not speak Nyanja at home. As hypothesised, the non-Nyanja speakers performed poorer than the Nyanja speakers. The explanation for this is the unfamiliarity with the language of instruction in grade one. While Nyanja speakers were struggling with transferring the prerequisite skills that they had learnt in preschool to Nyanja as well as learning to read. The non-Nyanja speakers were struggling with both the transfer of skills and learning to read as well as learning the language (Nyanja). This finding is supported by Cunningham and Zibulsky (2014) who contend that young children need to develop certain prerequisite language skills in order to become proficient readers (p.11). They further add that it would be incredibly difficult to try and make sense of written language if the words on the page did not convey meaning to you already. In addition, Matafwali and Bus (2013) assert that a low proficiency in the language of instruction can interfere with early reading skills even when children dispose of some alphabetic skill.

Our finding that lack of familiarity to the language of instructions impedes learning to read concretises an earlier finding of Serpell (1978) who found that pupils from Bemba-speaking families had by grade six acquired Nyanja competence in reading but only equivalent to that of Nyanja-speaking children in grade three. Tambulukani and Bus (2012) also found that if children's most familiar Zambian language is the Zambian language in which basic reading skills are practiced, they are more successful in acquiring reading skills in the Zambian language. It is clear from this study therefore, that familiarity with the language of instruction is an incentive for children learning to read.

5.10 Summary

Overall, these results suggest that children's oral language and executive functions are predictive of early literacy skills. Executive functions are the single most causal factor in their success in early numeracy skills even when effects of intelligence, SES, and school are taken into account. Based on these findings, therefore, it can be concluded that preschools in Zambia are currently not helping children to acquire literacy and numeracy skills. From this study, it can be deduced that both specific (RAN, Language abilities) and general intelligence skills are important in predicting literacy and numeracy skills. This predictive role of executive function to literacy and numeracy exists concurrently and longitudinally. This finding is in tandem with Baddeley's multi-component model.

CHAPTER SIX

6.0 SUMMARY, CONCLUSION AND RECOMMNENDATIONS

6.1 Overview

This study was carried out with the view to ascertain the predictive role of preschool, executive functions and oral language on literacy and numeracy skills. Research in early literacy and numeracy confirms the crucial role these factors play during foundation school years.

The purpose of this study was to specifically assess whether preschool prepares children to read and write in the first grade when we control for intelligence and Social Economic Status (SES). The study also sought to establish whether preschool promotes executive functions, which later promote literacy and numeracy skills in the first grade. The study also aimed at finding out whether children who do not speak Nyanja at home would benefit from preschool in reading and writing in the first year of schooling considering the fact that these children were using another language at home, English in preschool and depended on school to learn reading in Nyanja in the first grade.

Studying the predictive role of preschool, executive functions and oral language serves many purposes in educational psychology. One being assessment of the effects of preschool education on literacy and numeracy skills in first grade. Another purpose is to improve insight into the role of oral language on the process of literacy acquisition. Lastly, it shows the importance of regulatory skills (executive functions) in the attainment of literacy and numeracy skills. A summary of the most significant findings is presented below:

6.2.0 Conclusion

6.2.1 General Literacy Levels

This study revealed that the reading proficiency level of Zambian first graders is generally low. The low performance is worrying, given the increasing number of research pointing to these low literacy levels (Kalindi, 2006; Kaani, 2006, Ojanen, 2007; Matafwali, 2010; Matafwali & Bus, 2013; Mubanga, 2010; Mwanza, 2011).

In the study, it was expected that children with preschool would generally perform better than those without preschool. Results revealed that children who had been to preschool performed similarly in mathematics but lagged behind in literacy skills. The lags in learning to read could be attributed to the language aspect. There was a shift from using English in preschool to using Nyanja in first grade.

6.2.2 Group Differences between Children with Preschool and without Preschool

In line with a number of studies that have shown that skills acquired in preschool are related to later literacy and numeracy skills, the present study anticipated that children with preschool exposure would differ from those without preschool exposure on background variables. The study revealed that children who went to preschool came from homes where they had more home possessions than those who did not go to preschool. Furthermore, children with preschool were relatively younger and exhibited better general intelligence. It is a common belief and practice among parents to assess school readiness by looking at their child's participation in school related activities. This is most likely the case for children with preschool than their counterparts without preschool. Notwithstanding the above finding, children with preschool exposure did not differ from those without preschool in general intelligence at posttest, suggesting that any effect of preschool on general intelligence is not long-term.

In terms of other background variables (expressive and receptive language and RAN), no significant differences were observed between the two groups. This could be attributed to the limited opportunities for social interaction during preschool hours. It was further envisioned that there would be differences between children with preschool and those without preschool in executive functions, but surprisingly, such differences were not found both at pretest and posttest. The lack of variability between the two groups in terms of EF raises a lot of questions on the quality of Zambian preschools.

6.2.3 Preschool and Executive Functions as Processors of Literacy and Numeracy Skills

With regard to executive functions, the study established that alphabet knowledge significantly correlated with working memory, planning and organisation, which in combination accounted for 27 per cent of the variance. In the posttest, all the executive functions were related to alphabet knowledge. The strength of the relation between executive functioning and alphabetic skills was, however, low to moderate. Executive functions proved to be important to perform alphabet skills over and above preschool.

In addition, this study also examined whether preschool and executive functions would predict phonological skills both at pre and posttest. Interrelations were noted between executive functions and phonemic skills. Further analyses indicated that preschool did not predict phonological skills at pretest but did so at posttest. There were also associations between reading and writing and executive functions at posttest. The prediction of preschool on reading and writing was negative.

6.2.4 Preschool and Executive Functions predicting Mathematics

Results did not show associations between preschool and mathematics both at the start and end of first grade. Generally, the performance in mathematics was good. The study revealed that executive functions were associated with mathematics performance both at pre and posttest. In terms of prediction, only two executive function skills positively predicted mathematics at both pre and posttest.

6.2.5 Effects of Linguistic Diversity on Reading and Writing

The study established that linguistic diversity is the main cause of poor reading performance of children who have been exposed to preschool in the first grade. Children who went to preschool scored lower compared to children who did not go to preschool in reading. This study also found a significant interaction between preschool and home language (not speaking Nyanja versus speaking Nyanja at home), implying that, even though preschool proved to negatively influence reading in Nyanja, the situation was worse for children who did not speak Nyanja at home.

6.2.6 Background Factors Predicting Literacy and Numeracy

Since studies have shown the importance of socio-economic status (SES) and home literacy practices in predicting literacy and numeracy performance, the study assessed the influence of these factors on reading and mathematics. HLE (Reading at home) was associated with alphabet knowledge pre and posttest, reading and writing pretest and mathematics pretest. The study further revealed that home literacy environment only contributed to outcome variables that were done concurrently but not longitudinally, strengthening the inference that HLE has no long-term effects on reading as well as numeracy.

The present study found significant associations between reading and writing at posttest with social-economic status. Long-term effects of SES were observed on reading and writing.

6.2.7 Contribution of Executive Functions and Other Cognitive Processes to Literacy and Numeracy Skills

The study explored the role of cognitive and executive functions to reading and numeracy. Results have revealed that both specific and general intelligence predicted reading and writing concurrently and longitudinally. The results also showed that the RAN is a strong predictor of both reading and numeracy over and above all the other specific intelligence predictors. The results promote the understanding that cognitive processes are related to reading and numeracy skills. This finding can be useful in coming up with measures to help children in Zambia learn to read, considering the low reading levels in the country.

6.3 Recommendations

Based on the findings of this study, the following recommendations are made:

I. Preschools in Zambia should incorporate executive function skills in their curriculum so that these important skills can be stimulated in preschool years. This, however, cannot be attained without training the teachers. It is, therefore, recommended that teacher training in both colleges and universities also incorporate how to stimulate executive functions in children.

II. Zambian Government should improve the quality of preschools by building suitable infrastructure so that children engage in meaningful play that is linked to preparation for future learning.

III. The Government should ensure that a specific curriculum is available to all preschools in the country, private and public schools alike.

IV. Government should ensure that preschool environment is built on the child's familiar language in order to succeed in promoting literacy development and to prepare children for successful transition into elementary grades.

V. Home literacy experiences should be strengthened by encouraging parents to take some time to buy books for their children as well as to find time to read to their children so that children can learn to read.

6.4 Implications for Future Practice

I. The study has shown that preschools in Zambia do not help children learn to read and write in first grade. Therefore, there is need for more studies focusing on early literacy skills, particularly at preschool to ascertain it lays a foundation for future literacy and numeracy skills.

II. The study has established that general and specific intelligence is vital for performance in literacy and numeracy. Therefore, further research is needed to establish long-term effects of general and specific intelligence on literacy and numeracy skills development.

III. More research is needed to ascertain the long-term effect of home literacy environment and social economic status on literacy and numeracy skills.

IV. More studies on the effects of executive functions on literacy and numeracy skills should be conducted to provide reasons for academic debate on this important aspect.

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Appendices

Appendix: a Biographical data

BIOGRAPHICAL DATA

DISTRICT:…………………………………………**SCHOOL**:________________________

NAME:____________________________ **ID:**______________

AGE:_____________________________ **SEX:** _____________

CLASS:________

This instrument will be completed by the researcher who will interview one pupil at a time while other pupils will be kept away from the interview room. English language will be used to get information from the pupils, but where necessary, Nyanja will be used in order to get the most desired information.

SECTION 1: LANGUAGE BACKGROUND

	LANGUAGE	**ENGLISH (1)**	**NYANJA (2)**	**OTHERS-SPECIFY (3)**
Q.1	Which language does your mother/caregiver speak best?			
Q.2	Which language does your father/caregiver speak best?			
Q.3	Which language(s) are spoken in your home? Which language is used most frequently?			
Q.4	Which language(s) do you use when playing with others? Which language do you mostly use?			
Q.5	Which language do you mainly use in class?			

Note: More than one option can be chosen from above

SECTION 2: EXPOSURE TO LITERACY ACTIVITIES AT HOME

Q.1 Do you read at home?

1.Yes [ ]   2.No [ ]

Q.2 Note: if the answer the above is, No go to section 3

Q.3 If the response to the question above is yes, ask the child to list titles of books/journals/other reading materials he/she has read.

a) ____

b) Does someone help you when you are reading at home?
1. Yes [ ] 2.No [ ]

Q.4 If so, who?
[Mother] [Father] [Siblings] [Other], please specify_______________

SECTION 3: SOCIO-ECONOMIC STATUS

Q.1 What is your Father's/ caregiver's occupation? --------------------------

Q.2 What is your Mother's occupation? ___________________

Q.3 Did you attend pre-school/nursery school before coming to this school?
1. Yes [ ] 2.No [ ]

Q.4 If the answer to the above is yes, ask the child to state the name of the school he/she went to__________________________________

SECTION 4: HOME POSSESSIONS

Q.1 Do you have a television in your home? 1. Yes [ ] 2. No [ ]

Q.2 Do you have a radio in your home? 1. Yes [ ] 2. No [ ]

Q.3 Do you have a stove at home? 1. Yes [ ] 2. No [ ]

Q.4 Do you have electricity at home? 1. Yes [ ] 2.No [ ]

Q.5 Do you have running water at home? 1. Yes [ ] 2.No [ ]**Q.6** Do you have a flushable toilet?
1. Yes [ ] 2.No [

Q.7 Do you have a car at home? 1. Yes [ ] 2.No [ ]

Q.8 Do you have at least two pairs of clothes? 1. Yes [ ] 2.No [ ]

Q.9 Do you have at least one pair of shoes? 1. Yes [ ] 2.No [ ]

Q.10 Do you have a bed with a mattress to sleep on? 1. Yes [ ] 2.No [ ]

Q.11 Do you live in a house with cement or tile floors? 1. Yes [ ] 2.No [ ]

Q.12 In which residential area do you live?_________________________

Appendix b: Mathematics Assessment Battery

Mathematics Assessment Battery

- Cardinality

- Counting from 1 to 20

- Counting principles
- Number knowledge
- Number knowledge; number-flash
- Conservation
- Nonverbal addition and subtraction
- Addition and subtraction within a story context
- Addition and subtraction sums
- Estimation
- Number line task
- DLE-Test Mental Arithmetic

General comments

- Only use checker pieces of a different color when this is explicitly mentioned in the exercise!
- Checker pieces you're not using need to be out sight of the child
- **Only give feedback like:** ***you're doing great***. Never mention whether the child made an error or not.
- The experimenter sits opposite of the child

Materials

- Five cards with 7, 5, 9, 13 and 11 stars respectively
- Box with checker pieces (20 white and 20 black ones)
- Kalulu Hand puppet
- 5 cards with dots
- Number line forms for numbers 0-100 (24 per person)
- DLE-test Mental Arithmetic exercise sheet

CARDINALITY (items 1 to 5)

Instruction

Item 1

The experimenter shows the card with the 5 stars and says: *you may count the stars. Point to them when counting, and count aloud.* When the stars are counted, the experimenter turns the card (the child is now unable to see the stars) and asks: *how many stars are on the other side of this card?*

When the child is unable to count the stars correctly, the experimenter says: *we will count them together.* Point to the stars when counting aloud, and turn down the card when all the stars are counted and ask: *how many stars are on the other side of this card?*

After responding, say something like: *good job, we will do another one.*

Item 2

The experimenter shows the card with the 7 stars and says: *you may count the stars. Point to them when counting, and count aloud.* Continue as described by item 1.

The experimenter shows the card with the 5 stars and says: *you may count the stars. Point to them when counting, and count aloud.* When the stars are counted, the experimenter turns the card (the child is now unable to see the stars) and asks: *how many stars are on the other side of this card?*

When the child is unable to count the stars correctly, the experimenter says: *we will count them together.* Point to the stars when counting aloud, and turn down the card when all the stars are counted and ask: *how many stars are on the other side of this card?*

After responding, say something like: *good job, we will do another one.*

Item 3

The experimenter shows the card with the 9 stars and says: *you may count the stars. Point to them when counting, and count aloud.* When the stars are counted, the experimenter turns the card (the child is now unable to see the stars) and asks: *how many stars are on the other side of this card?*

When the child is unable to count the stars correctly, the experimenter says: *we will count them together.* Point to the stars when counting aloud, and turn down the card when all the stars are counted and ask: *how many stars are on the other side of this card?*

After responding, say something like: *good job, we will do another one.*

Item 4

The experimenter shows the card with the 13 stars and says: *you may count the stars. Point to them when counting, and count aloud.* When the stars are counted, the experimenter turns the card (the child is now unable to see the stars) and asks: *how many stars are on the other side of this card?*

When the child is unable to count the stars correctly, the experimenter says: *we will count them together.* Point to the stars when counting aloud, and turn down the card when all the stars are counted and ask: *how many stars are on the other side of this card?*

After responding, say something like: *good job, we will do another one.*

Item 5

The experimenter shows the card with the 11 stars and says: *you may count the stars. Point to them when counting, and count aloud.* When the stars are counted, the experimenter turns the card (the child is now unable to see the stars) and asks: *how many stars are on the other side of this card?*

When the child is unable to count the stars correctly, the experimenter says: *we will count them together.* Point to the stars when counting aloud, and turn down the card when all the stars are counted and ask: *how many stars are on the other side of this card?*

After responding, say something like: *good job, we will do another one.*

COUNTING FROM 1 upto 20

Item 6

The experimenter says: *you may from 1 up to 20, ok? Let's start.* A child may start once again when making a mistake (e.g., counting 1, 2, 4…20). Encourage a child when he/she is hesitating: *Just count as far as you can.*

COUNTING PRINCIPLES: ONE-TO-ONE CORRESPONDENCE, ORDER IRRELEVANT, ABSTRACTION (ITEMS 7-14)

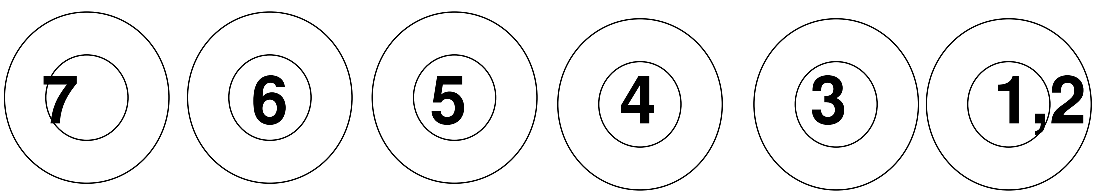
The experimenter says: *look who's here, Kalulu. Kalulu is learning to count, but sometimes makes errors. In a minute, Kalulu will start counting and you may tell whether he counted correct or not. Okay? Let's start.*

After each item, the experimenter says: *Did Kalulu count correctly?* When the child has responded, the experimenter says: *show it, you may count the stones as well.* Be sure the child counts aloud.

> Remark:
>
> The figures below show how the experimenter needs to count from the perspective of the experimenter. The experimenter counts with the handpuppet, thus in fact Kalulu is counting! Always point to the checker pieces (stones) when counting!

Item 7 (one-to-one correspondence: counting from left to right →incorrect)

The experimenter puts 6 stones (of the same color) on a row and counts the stones from left to right. Recall that Kalulu is the one counting! The first stone is counted twice (see picture below).

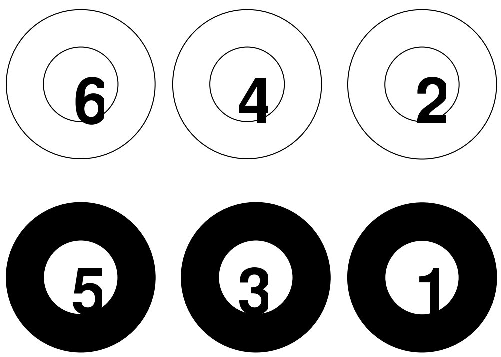


After counting, the experimenter says: *Did Kalulu count correctly?* When the child has responded, the experimenter says: *show it, you may count the stones as well.* Be sure the child counts aloud.

Item 8 (items of different colors are counted, abstraction: pseudo-error)

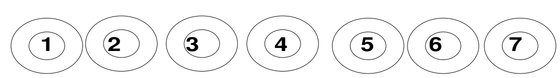
The experimenter puts two rows of three stones on the table (a white row and a black row) and Kalulu counts as specified in the picture below.

After counting, the experimenter says: *Did Kalulu count correctly?* When the child has responded, the experimenter says: *show it, you may count the stones as well.* Be sure the child counts aloud.



Item 9 (one-to-one correspondence, order irrelevant: counting from right to left →correct).

The experimenter puts 7 stones of the same color on the table as specified in the picture below.

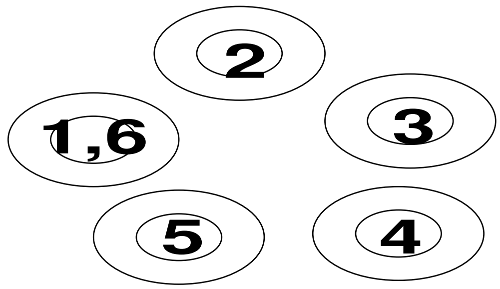


Kalulu counts the stones from right to left.

After counting, the experimenter says: *Did Kalulu count correctly?* When the child has responded, the experimenter says: *show it, you may count the stones as well.* Be sure the child counts aloud.

Item 10 (one-to-one correspondence: counting clockwise →incorrect)

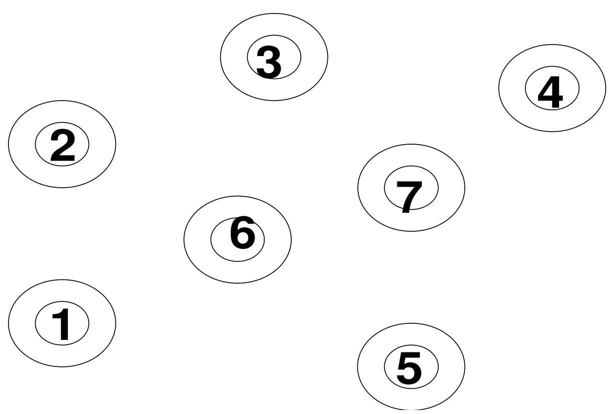
The experimenter puts 5 stones of the same color on the table (see picture below) and Kalulu counts as specified in the picture. Notice that de first stone is counted dubbel.



After counting, the experimenter says: *Did Kalulu count correctly?* When the child has responded, the experimenter says: *show it, you may count the stones as well.* Be sure the child counts aloud.

Item 11(one-one correspondence: counting unarranged stones → correct)

The experimenter puts 7 stones on the table, unarranged (see picture). Kalulu counts the stones as specified below and puts every stone direct aside. After counting, all stones are piled.



After counting, the experimenter says: *Did Kalulu count correctly?* When the child has responded, the experimenter says: *show it, you may count the stones as well.* Be sure the child counts aloud. You don't need to re-order the stones!

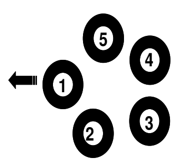
Item 12 (stones of different colors are counted separately, abstraction: pseudocorrect)

The experimenter puts two rows consisting of two stones on the table (see picture). Kalulu will first count the white stones and then de black ones (as described below). Thus when counting the black ones, he doesn't continue counting, but starts again.

After counting, the experimenter says: *Did Kalulu count correctly?* When the child has responded, the experimenter says: *show it, you may count the stones as well.* Be sure the child counts aloud.

Item 13 (one-to-one correspondence: counting in a circle →correct)

Put 5 stones of the same color on the table as specified in the picture below.



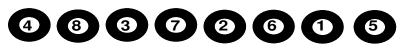
Kalulu counts the stones as specified above and points to them. The first stone is moved to the left when counting 1.

After counting, the experimenter says: *Did Kalulu count correctly?* When the child has responded, the experimenter says: *show it, you may count the stones as well.* Be sure the child counts aloud.

Item 14 (one to one correspondence, order irrelevant: pseudo correct)

Put 8 stones of the same color on the table (see picture below). Kalulu counts the stones as specified in the picture.

After counting, the experimenter says: *Did Kalulu count correctly?* When the child has responded, the experimenter says: *show it, you may count the stones as well.* Be sure the child counts aloud.



NUMBER KNOWLEDGE (ITEM 12-15)

The experimenter says: *Kalulu has become tired from counting and will go to sleep* (put Kalulu aside). *We are going to do another game.*

Item 15

The experimenter asks the child: ***which number comes after 7?***

Item 16

I say two number, you may say ***which one is bigger. 9*** **(short break)** ***2****. Which number is bigger?*

Item 17

We'll do another one. ***Which number precedes 5****?*

Item 18

I will say two numbers, ***which one is smaller? 4*** **(short break)** ***3****. Which number is smaller?*

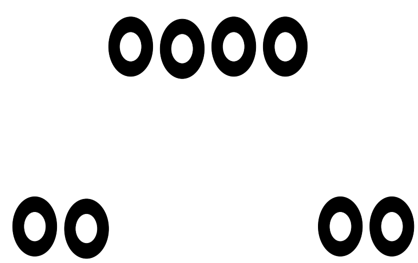
CONSERVATION PRINCIPLE

The experimenter gets the checker pieces.

Item 19

Put 4 stones of the same color in a row and say: *you may count these stones. Please count aloud.* The experimenter corrects the child if needed: *you didn't count correctly, we'll do it together.* Count the stones and point to them when counting.

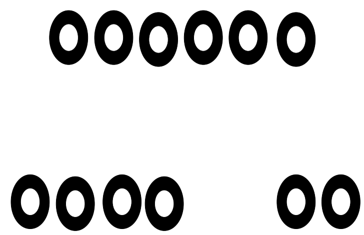
Next, the experimenter says: *look carefully.* Split the row in two parts of two stones and ask: *how many stones are here together?* (the experimenter circles around both pairs of stones at once).



Item 20

Put 6 stones of the same color in a row and say: *you may count these stones. Please count aloud.* The experimenter corrects the child if needed: *you didn't count correctly, we'll do it together.* Count the stones and point to them when counting.

Next, the experimenter says: *look carefully.* Split the row in two parts of 4 and 2 stones respectively and ask: *how many stones are here together?* (the experimenter circles around both pairs of stones at once).



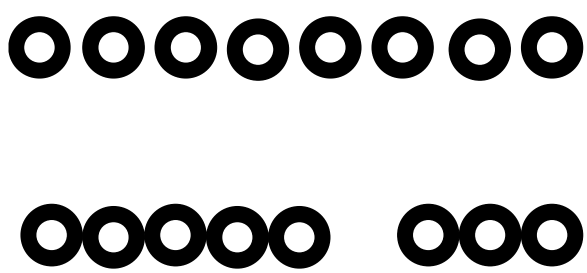
Item 21

Put 8 stones of the same color in a row and say: *you may count these stones. Please count aloud.*

The experimenter corrects the child if needed: *you didn't count correctly, we'll do it together.*

Count the stones and point to them when counting.

Next, the experimenter says: *look carefully.* Split the row in two parts of 5 and 3 stones respectively and ask: *how many stones are here together?* (the experimenter circles around both pairs of stones at once).



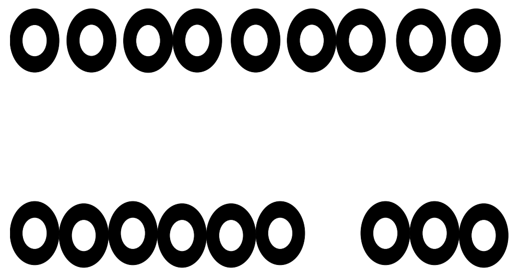
Item 22

Put 9 stones of the same color in a row and say: *you may count these stones. Please count aloud.*

The experimenter corrects the child if needed: *you didn't count correctly, we'll do it together.*

Count the stones and point to them when counting.

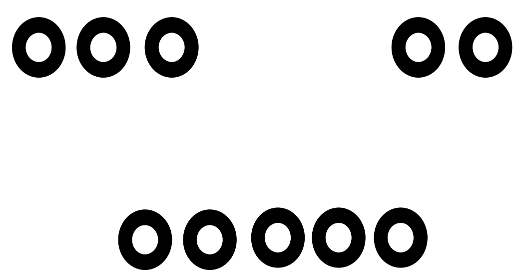
Next, the experimenter says: *look carefully.* Split the row in two parts of 6 and 3 stones respectively and ask: *how many stones are here together?* (the experimenter circles around both pairs of stones at once).



Item 23

Put two groups of 3 and 2 stones respectively on the table and say: *you may count these stones. Please count aloud.* The child has to count the 2 groups together, thus 1,2,3,4,5. The experimenter corrects the child if needed: *you didn't count correctly, we'll do it together.* Count the stones and point to them when counting.

Next, the experimenter says: *look carefully.* Make one row of the two groups and ask: *how many stones are here together?* (the experimenter circles around the row).



Item 24

Put two groups of 4 and 3 stones respectively on the table and say: *you may count these stones. Please count aloud.* The child has to count the 2 groups together, thus 1,2,3,4,5,6,7. The experimenter corrects the child if needed: *you didn't count correctly, we'll do it together.* Count the stones and point to them when counting.

Next, the experimenter says: *look carefully.* Make one row of the two groups and ask: *how many stones are here together?* (the experimenter circles around the row).

OOOO OOO

OOOOOOO

Item 25

Put two groups of 6 and 2 stones respectively on the table and say: *you may count these stones. Please count aloud.* The child has to count the 2 groups together, thus 1,2,3,4,5,6,7,8. The experimenter corrects the child if needed: *you didn't count correctly, we'll do it together.* Count the stones and point to them when counting.

Next, the experimenter says: *look carefully.* Make one row of the two groups and ask: *how many stones are here together?* (the experimenter circles around the row).

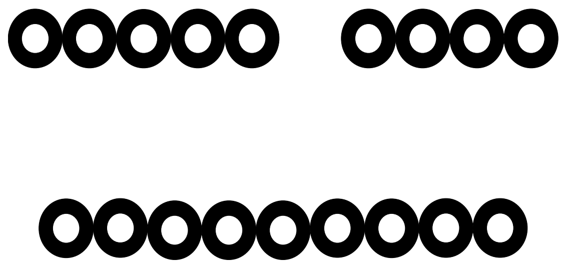
OOOOOO OO

OOOOOOOO

Item 26

Put two groups of 5 and 4 stones respectively on the table and say: *you may count these stones. Please count aloud.* The child has to count the 2 groups together, thus 1,2,3,4,5,6,7,8,9. The experimenter corrects the child if needed: *you didn't count correctly, we'll do it together.* Count the stones and point to them when counting.

Next, the experimenter says: *look carefully.* Make one row of the two groups and ask: *how many stones are here together?* (the experimenter circles around the row).



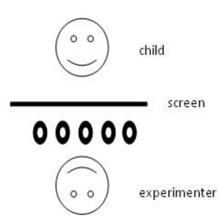
ADDITION AND SUBTRACTION WITH CHECKER PIECES (STONES)

Instruction

Practice item

The experimenter gives the child 10 stones of the same color (the experimenter also has 10 stones of the same color as the child).

Put 5 stones on the table and say: *here are 5 stones, you see?* Next, place a screen between the child and the stones (the child can no longer see the stones) and ask: *how many stones do I have here behind the screen? Use your own stones to show me how many there are and count them.*



After the child's response, the experimenter removes the screen and checks whether the response was correct or not. In case of a correct response, say: *well done!* In case of an incorrect response, say: *this isn't correct. Look, I have 5 stones and you have* ***xxxx*** *stones. So we need to add/remove* ***xx*** *stones.* When finished, let the child put the stones together and start the next item.

Item 1 (2+1)

Put 2 stones on the table and say: *look I have 2 stones.* Put the screen between the stones and the child and say: *I'm placing the screen on the table. Pay attention: I'm adding 1 stone* (the experimenter adds 1 stone to the ones that are already behind the screen). *how many stones do I have here behind the screen? Use your own stones to show me how many there are and count them.*

After the child's response, the experimenter removes the screen and checks whether the response was correct or not. In case of a correct response, say: *well done!* In case of an incorrect response, say: *this isn't correct. Look, I have 3 stones and you have xxxx stones. So we need to add/remove xxxx stones.* When finished, let the child put the stones together and start the next item.

Item 2 (4+3)

Put 4 stones on the table and say: *look I have 4 stones.* Put the screen between the stones and the child and say: *I'm placing the screen on the table. Pay attention: I'm adding 3 stones* (the experimenter adds 3 stones to the ones that are already behind the screen). *how many stones do I have here behind the screen? Use your own stones to show me how many there are and count them.*

After the child's response, the experimenter removes the screen and checks whether the response was correct or not. In case of a correct response, say: *well done!* In case of an incorrect response, say: *this isn't correct. Look, I have 7 stones and you have xxxx stones. So we need to add/remove xxxx stones.* When finished, let the child put the stones together and start the next item.

Item 3 (2+4)

Put 2 stones on the table and say: *look I have 4 stones.* Put the screen between the stones and the child and say: *I'm placing the screen on the table. Pay attention: I'm adding 4 stones* (the experimenter adds 4 stones to the ones that are already behind the screen). *How many stones do I have here behind the screen? Use your own stones to show me how many there are and count them.*

After the child's response, the experimenter removes the screen and checks whether the response was correct or not. In case of a correct response, say: *well done!* In case of an incorrect response, say: *this isn't correct. Look, I have 6 stones and you have xxxx stones. So we need to add/remove xxxx stones.* When finished, let the child put the stones together and start the next item.

Item 4 (3+2)

Put 3 stones on the table and say: *look I have 3 stones.* Put the screen between the stones and the child and say: *I'm placing the screen on the table. Pay attention: I'm adding 2 stones* (the experimenter adds 2 stones to the ones that are already behind the screen). *How many stones do I have here behind the screen? Use your own stones to show me how many there are and count them.*

After the child's response, the experimenter removes the screen and checks whether the response was correct or not. In case of a correct response, say: *well done!* In case of an incorrect response, say: *this isn't correct. Look, I have 5 stones and you have xxxx stones. So we need to add/remove xxxx stones.* When finished, let the child put the stones together and start the next item.

Item 5 (3-1)

Put 3 stones on the table and say: *Look I have 3 stones.* Put the screen between the stones and the child and say: *I'm placing the screen on the table. Pay attention: I'm removing 1 stone* (the experimenter removes 1 stone from the ones that are already behind the screen). *how many* *stones do I have here behind the screen? Use your own stones to show me how many there are and count them.*

After the child's response, the experimenter removes the screen and checks whether the response was correct or not. In case of a correct response, say: *well done!* In case of an incorrect response, say: *this isn't correct. Look, I have 2 stones and you have xxxx stones. So we need to add/remove xxxx stones.* When finished, let the child put the stones together and start the next item.

Item 6 (7-3)

Put 7 stones on the table and say: *look I have 7 stones.* Put the screen between the stones and the child and say: *I'm placing the screen on the table. Pay attention: I'm removing 3 stones* (the experimenter removes 3 stones from the ones that are already behind the screen). *How many stones do I have here behind the screen? Use your own stones to show me how many there are and count them.*

After the child's response, the experimenter removes the screen and checks whether the response was correct or not. In case of a correct response, say: *well done!* In case of an incorrect response, say: *this isn't correct. Look, I have 4 stones and you have xxxx stones. So we need to add/remove xxxx stones.* When finished, let the child put the stones together and start the next item.

Item 7 (5-2)

Put 5 stones on the table and say: *look I have 5 stones.* Put the screen between the stones and the child and say: *I'm placing the screen on the table. Pay attention: I'm removing 2 stones* (the experimenter removes 2 stones from the ones that are already behind the screen). *How many stones do I have here behind the screen? Use your own stones to show me how many there are and count them.*

After the child's response, the experimenter removes the screen and checks whether the response was correct or not. In case of a correct response, say: *well done!* In case of an incorrect response, say: *this isn't correct. Look, I have 2 stones and you have xxxx stones. So we need to add/remove xxxx stones.* When finished, let the child put the stones together and start the next item.

Item 8 (6-4)

Put 6 stones on the table and say: *look I have 6 stones.* Put the screen between the stones and the child and say: *I'm placing the screen on the table. Pay attention: I'm removing 4 stones* (the experimenter removes 4 stones from the ones that are already behind the screen). *how many stones do I have here behind the screen? Use your own stones to show me how many there are and count them.*

After the child's response, the experimenter removes the screen and checks whether the response was correct or not. In case of a correct response, say: *well done!* In case of an incorrect response, say: *this isn't correct. Look, I have 2 stones and you have xxxx stones. So we need to add/remove xxxx stones.* When finished, let the child put the stones together and start the next item.

ADDITION AND SUBTRACTION WITHIN A STORY CONTEXT

Place the checker pieces out sight of the child and put the screen away.

Instruction

The experimenter says: *I'm going to tell you a short story and ask you something about it. Listen carefully.*

After the child's response, continue with the next item. **Do not give feedback about correct or incorrect.**

Item 9 (2+1)

Say: *This story is about John and Mary. John has 2 apples and Mary gives him1 apple. How many apples does John have now?*

Item 10 (4+3)

Say: This story is about Mutinta and Sililo. Mutinta has 4 guavas. Sililo gives her other 3 guavas. How many guavas does Mutinta have now?

Item 11 (2+4)

Say: This story is about Namwinga and Phiri. Namwinga has 2 bananas, Phiri gives her 4 other bananas. How many bananas does Namwinga have now?

Item 12 (3+2)

Say: This story is about Kunda and Suzyo. Kunda has 3 pencils. Suzyo gives him 2 other pencils. How many pencils does Kunda have now?

Item 13 (3-1)

Say: This story is about Peter and Jane. Peter has 3 sweets. He takes away 1 sweet and gives it Jane. How many sweets does Peter have now?

Item 14 (7-3)

Say: This story is about Esther and Ireen. Esther has seven balls. She takes away 3 balls and gives them to Ireen. How many balls does Esther have now?

Item 15 (5-2)

Say: This story is about Dan and Joe. Dan has 5 stones. He takes away 2 stones and gives them to Joe. How many stones does Dan have now?

Item 16 (6-4)

Say: This story is about Luyando and Chileshe. Luyando has 6 mangoes. She takes away 4 mangoes and gives them to Chileshe. How many mangoes does Luyando have now?

ADDITION AND SUBTRACTION

Instruction

NB. If the child is hesitating, please encourage him/her to try. **Do not give feedback about correct/incorrect.**

We'll do another exercise. Listen carefully.

Item 16 (2+1)

Say: *How much is 2 plus 1?*

Item 17 (4+3)

Say: *How much is 4 plus 3?*

Item 18 (2+4)

Say: *How much is 2 plus 4?*

Item 19 (3+2)

Say: *How much is 3 plus 2?*

Item 20 (3-1)

Say: *How much is 3 minus 1?*

Item 21 (7-3)

Say: *How much is 7 minus 3?*

Item 22 (5-2)

Say: *How much is 5 minus 2?*

Item 23 (6-4)

Say: *How much is 6 minus 4?*

ESTIMATION

Remarks

- you need the 5 cards with dots on it (3,8,15,25, and 35 dots respectively)
- **Do not give feedback about correct/incorrect**

Instruction

The experimenter says: *On the cards here are dots. I will show you each card very shortly and then you may guess how many dots there are on the card. You don't have to count them!*

Item 24 (3 dots)

Show the child the card with 3 dots on it and say: *Look at the card, pay attention, I'm turning the card now* (the child can no longer see the dots). *You may guess: how many dots were on the card you just saw?*

Item 25 (8 dots)

Show the child the card with 8 dots on it and say: *Look at the card, pay attention, I'm turning the card now* (the child can no longer see the dots). *You may guess: how many dots were on the card you just saw?*

Item 26 (15 dots)

Show the child the card with 15 dots on it and say: *Look at the card, pay attention, I'm turning the card now* (the child can no longer see the dots). *You may guess: how many dots were on the card you just saw?*

Item 27 (25 dots)

Show the child the card with 25 dots on it and say: *Look at the card, pay attention, I'm turning the card now* (the child can no longer see the dots). *You may guess: how many dots were on the card you just saw?*

Item 28 (35 dots)

Show the child the card with 35 dots on it and say: *Look at the card, pay attention, I'm turning the card now* (the child can no longer see the dots). *You may guess: how many dots were on the card you just saw?*

DLE-TEST MENTAL ARITHMETIC

Get the exercise form and let the child start with the addition sums.

Time limit: two minutes!

Instruction

We're going to do some addition sums. Show the child the exercise form and say: *you need to start at the top corner and make this block of sums. When finished with the first block, continue with the next block and so on* (point on the sheet when telling the procedure). *Fill in the answers right here* (point to the blank spots at the end of each sum). *You're not allowed to skip one! Okay? Are you ready, let's go!* **After two minutes, the child has to stop!**

Also do the subtraction sums, following the same procedure as for the addition sums.

Appendix c:Mathematics Assessment Battery Scoring Sheet

Mathematics Assessment Battery Scoring Sheet

Child's name	
Child ID Number	
School	
Name of the scoring person	
Scoring date	

CARDINALITY	**1st question: how many stars counted?**	**2nd question: answer of the child**
Item 1		
Item 2		

Item 3		
Item 4		
Item 5		

COUNTING TILL 20	**write down till which number the child was able to count**	
COUNTING PRINCIPLES	**Did Kalulu count correctly? Answer of the child: 1 = yes 0 = no**	**How many stones did the child count?**
Item 4 1 – 1 correspondence		
Item 5 Abstraction: pseudo error		
Item 6 1 – 1 correspondence; order irrelevant		
Item 7 1 – 1 correspondence; counting in a circle		
Item 8 1 – 1 correspondence; unordered stones		
Item 9 Abstraction: pseudo error		
Item 10 1 – 1 correspondence; counting in a circle		
Item 11 1 – 1 correspondence; order irrelevant: pseudo error		
NUMBER KNOWLEDGE-NUMBER FLASHED ON COMPUTER SCREEN	**answer of the child**	**correct (1) / incorrect (0)**

Number flashed 1		
Number flashed 13		
Number flashed 4		
Number flashed 17		
Number flashed 2		
Number flashed 11		
Number flashed 8		
Number flashed 14		
Number flashed 20		
Number flashed 5		
Number flashed 16		
Number flashed 3		
Number flashed 12		
Number flashed 6		
Number flashed 0		
Number flashed 19		
Number flashed 7		
Number flashed 15		
Number flashed 9		
Number flashed 18		
Number flashed 10		
NUMBER KNOWLEDGE	**answer of the child**	**correct (1) / incorrect (0)**
Item 15: which number precedes 7		
Item 16: 9 or 2, which number is bigger?		
Item 17: which number precedes 5?		
Item 18: 4 or 3, which number is smaller?		
CONSERVATION PRINCIPLE	**answer of the child**	**correct (1) / incorrect (0) correct is: without counting directly seeing that the number remains the same**
Item 19 (4 stones)		
Item 20 (6 stones)		
Item 21 (8 stones)		
Item 22 (9 stones)		
Item 23 (3 and 2; total 5)		

Item 24 (4 and 3; total 7)			
Item 25 (6 and 2; total 8)			
Item 26 (5 and 4; total 9)			
ADDITION & SUBTRACTION WITH MATERIAL	**Answer of the child. If the answer is different from the number of stones placed on the table by the child, write down both the answer and the number of stones.**		**correct (1) / incorrect (0)**
	number of stones	**answer of the child**	
Item 1 (2+1)			
Item 2 (4+3)			
Item 3(2+4)			
Item 4 (3+2)			
Item 5 (3-1)			
Item 6 (7-3)			
Item 7 (5-2)			
Item 8 (6-4)			
ADDITION & SUBTRACTION WITHIN STORY CONTEXT	**answer of the child**		**Correct (1) / incorrect (0)**
Item 9 (2+1)			
Item 10 (4+3)			
Item 11(2+4)			
Item 12 (3+2)			
Item 13 (3-1)			
Item 14 (7-3)			
Item 15 (5-2)			
Item 16 (6-4)			
ADDITION & SUBTRACTION (ABSTRACT)	**answer of the child**		**Correct (1) / incorrect (0)**
Item 17 (2+1)			
Item 18 (4+3)			
Item 19(2+4)			
Item 20 (3+2)			
Item 21 (3-1)			
Item 22 (7-3)			
Item 23 (5-2)			

Item 24 (6-4)		

ESTIMATION	**answer of the child**	**distance from the exact number of dots +/- …….**	**Within 25% of the exact number of dots 1=yes 0= no**
Item 25 (3 dots)			
Item 26 (8 dots)			
Item 27 (15 dots)			
Item 28 (25 dots)			
Item 29 (35 dots)			

Appendix d: Pencil Taping Test

PENCIL TAPING TEST

MARK SHEET

NAME:____________________________ ID_______________

AGE:______________________________ SEX ______________

SCHOOL:_________________________ GRADE/CLASS________

RATERS ID_______________________

OUT OF 20 TAPS OPPOSITE TAPPING

NUMBER OF CORRECT TAPS----------------

NUMBER OF SELF CORRECTIONS----------

NUMBER OF INCORRECT TAPS---------------

TIME TAKEN---

OUT OF 20 TAPS SAME TAPPING

NUMBER OF CORRECT TAPS----------------

NUMBER OF SELF CORRECTIONS----------

NUMBER OF INCORRECT TAPS---------------

TIME TAKEN--

STROOP LIKE TEST DOGS

OUT OF 96 TAPS

NUMBER OF CORRECT RESPONSES ------------------

NUMBER OF SELF CORRECTIONS----------------------

NUMBER OF INCORRECT RESPONSES -----------------

TIME TAKEN---

STROOP LIKE TEST OPPOSITES

OUT OF 96 TAPS

NUMBER OF CORRECT RESPONSES -------------------------

NUMBER OF SELF CORRECTIONS------------------------------

NUMBER OF INCORRECT RESPONSES -------------------------

TIME TAKEN---

Appendix e: SERIAL RAPID NAMING TEST

SERIAL RAPID NAMING TEST

MARK SHEET

NAME:**__________________________** **ID______________**

AGE:**___________________________** **SEX _____________**

SCHOOL:**________________________** **GRADE/CLASS________**

RATERS ID______________________

PICTURES

TOTAL TIME:__________________ **(Seconds)**

SELF CORRECTIONS:___________

SKIPPED WORDS:______________

MISTAKES:____________________
(skipped words not self-corrected)

LETTERS

TOTAL TIME:__________________ **(Seconds)**

SELF CORRECTIONS:___________

SKIPPED NUMBERS:_____________

MISTAKES:______________________
(skipped numbers not self-correctedAppendix f

Appendix f

BASIC SKILLS ASSESSMENT TOOL (BASAT)

Reading and Writing Skills – Grade 1

Name:__________________________

School____________________________

Grade:___________________________

Teacher: __________________________

Examiner: _________________________

	Year	Month	Day
Date			
Date of birth			
Age			

Province:_________ District:__________

Sex: Female Male Time begun:__________ Time ended:____________

1. Has the child got any of the following impairments? Tick where appropriate	
a. Physical impairment	
b. Visual impairment	
c. Hearing impairment	
d. Intellectual disabilities	
e. Speech/language impairment	

2. Summary of the BASAT (Fill in this table after completing the assessment)

Area	Score and Skill Level
A. Letter knowledge	
B. Letter-sound knowledge	
C. Phonological tasks: 1.Syllable segmentation	
2. Initial Sound Identification	
3. End Sound Identification	
4. Sound blending	
D. Reading	
E. Writing	
F. Reading comprehension	
G. Digit Span	

Use additional paper if needed!

A. Letter knowledge Indicate and count the letters the child knows and estimate the average number of letters the child knows which means that the child can write, name and identify them. Indicate the letters the child knows here		Average Number of Letters Known
1. 1. Ku Chula malembo (naming the letters of the alphabet)		
2. Kudziwa malembo (letter identification)		

B. Letter-sound knowledge Indicate and count the letter-sound relations the child knows and estimate the average number of letter-sound relations the child knows which means that the child can relate the letters to the sound and the sound to the letter Indicate Letter-sound relations here		Average Number of Letter-Sound-Relations Known
1.. Kulinganiza malembo ndi vi gawo vache (letter-sound identification		
2. Ukupalanya ifiunda ku filembo fyafiko (Sound -letter identification)		

C. Phonological tasks:
For each item in section C, mark '1' if the child answers the item correctly otherwise mark '0'. Calculate the total score for each section!

C1. Segments words into syllables: ***Kupatula Mau mzi gawa***		Score
a. Atate (A-ta-te)	c. Ulendo (U-le-ndo)	
b. Chakudya (Cha-ku-dya)	D Zipatso (Zi-pa-tso)	
TOTAL SCORE: SYLLABLE SEGMENTATION (max.4)		

C2. Discriminates initial sounds in Words: ***Kudziwa Zigawo Zoyamba Mmau***	Score	**C3. Discriminates ending sounds in words:**	Score
a. **Wa**bads		a. Ta**te**	
b. **cha**pa		b. Mala**ya**	
c. **so**pa		c. Dzu**wa**	
d. **mo**toka		d. Maku**tu**	
e. **Ma**lume		e. Choi**pa**	
f. **ka**bati		f. Mabu**ku**	
g. **Bu**ku		g. Ndala**ma**	
h. **Va**la		h. Mkwa**ti**	
i. **Fu**lu		i. Ambi**ri**	

j. **Gwi**ra		j. Umo**yo**	
TOTAL SCORE: INITIAL SOUND DISCRIMINATION (max.10)		TOTAL SCORE: END SOUND DISCRIMINATION (max.10)	

C4. Blends sounds into words:	**Kupanga Mau Kuchokera ku aphatikizi zigawo**	Score
a. a/ma/I (amai)	f. ku/no (kuno)	
b. u/yu (Uyu)	g. Mo/to (Moto)	
c.Dzu/wa Dzuwa)	h. Ba/nja (Banja)	
d.Tso/ka (Tsoka)	i. Ma/la/ya (Malaya)	
e.Mu/tu (Mutu)	j. U/tsi (Utsi)	
	TOTAL SCORE: SOUND BLENDING (max 10.	

D. Reading:
For each item mark '2' if the child reads the item perfectly and '1' if the child commits only one minor error, otherwise mark '0'. Calculate the total score for the whole reading section!

	Score		Score
1. . Kuwerenga dzina lache (reading own name)			
2. Combines two letters/sounds/both into a syllable or word: ***Kupanga a phatikizi.***		3. Reads 1-syllable words: ***Kuwerenga liu la mphatikizi umodzi***	
a. y+a=**ya**		a.wa	
b. w+a=**wa**		b. pa	
c. p+a=**pa**		c. Ku	
d. k+u=**ku**		d. dwa	
4. Reads 2-syllable words: ***Kuwerenga mau muli aphtikizi awiri***		5. Reads 3-syllable words: ***Kuwerenga mau muli aphatikizi atatu***	
a.Tate		a. Atate	
b. Mwana		b. Amai	
c. Dzuwa		c. Makolo	
d mai		d. Umwai	
Kulemba			
Kulemba Dzina lache			
Kulemba Malembo			
Kulemba aphatikizi ali ndi			
ba			
pa			
mu			
ku			

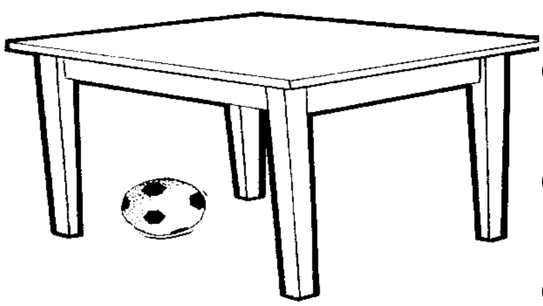
4. Kulemba aphatikizi ali ndi mau atatu (writing three-letter syllables)				
(a) Nga	(b) Kwa			

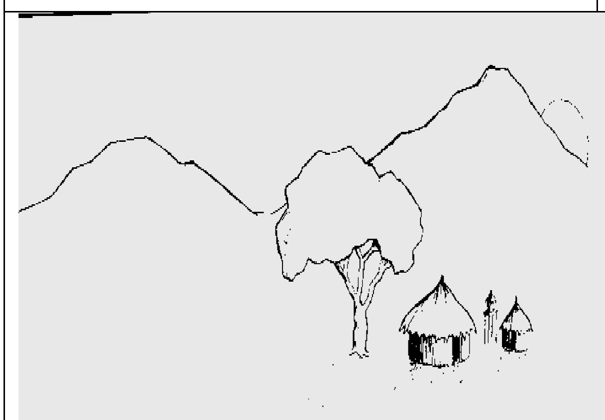
(c) Mwa	(d) Gwa			
5. Kulemba aphatikizi ali ndi mau opitirila atatu (writing words with more than three syllables)				
(a) Wokongola	(b) Amalume			
(c) zodabwitsa	(d) Wopatulika			
6. Kulemba Ziganizo Zapafupi (writing short sentences)				
(a) Mwana watopa.				
(b) Amai ali kuphika.				

Kuwerenga			
6. Kuwerenga Ziganzo			
(a) Abambo aligone . (b) Aphunzitsi ali kuwerenga.			

F.Kuwerenga: Onani ngati mwana akwanitsa kuwerenga. Onani kuti mwana akwanitsa kuwerenga kuchoka pa 1 kufika pa 10	
1. Kodi akumbuka ma nambala awiri otsatirana (Two-number digit span) (a) 4-3	
(b) 1-5	
2. Kodi akumbuka ma nambala atatu otsatirana (Three-number digit span) (a) 5-6-4 (b) 3-1-5	
3. Kodi akumbuka ma nambala anai otsatirana (Four-number digit span) (a) 4-1-6-2 (b) 3-6-5-1	

<table>
<tr><td rowspan="2">4. Kodi akumbuka ma nambala asanu otsatirana. (Five-number digit span)
(a) 5-6-3-1-4
(b) 2-1-4-6-3</td><td></td></tr>
<tr><td></td></tr>
<tr><td rowspan="2">5. Kodi akumbuka ma nambala asanu ndi imodzi otsatirana. (Six-number digit span)
(a) 7-3-5-1-6-2
(b) 1-5-2-7-4-2</td><td></td></tr>
<tr><td></td></tr>
<tr><td colspan="2">Congani mayankho olingana ngati awa ( )
Musabwereze nchito ya ma nambala ngati iyeyo sakumbukila manambala atau</td></tr>
</table>

G. Kuwerenga ndi Kumvetsa (congani mayankho a mwana) (Reading comprehension)	
	(a) Mpila ndi mpando (b) Mpila ndi motoka (c) Mpila ndi Tabulo

	(a) Alikudya (b) Aligone (c) Aluchapa
	(a) Alulemba (b) Aluphika (c) Aluthamanga
	(a) Mtsinje (b) Sukulu (c) Mudzi

Ciwerengelo cazomwe adziwa bwino-bwino	**Congani**
3 kufika pa 4	Inde
1 kufika pa 2	Afunika Thandizo
0	Iyai

Appendix g: Basic Skills Assessment Tool Score sheet

BASIC SKILLS ASSESSEMENT TOOL (BASAT)

SCHOOL: ……………………………………………………………………………………………………..

CHILD'S NAME: ………………………………………………………………… ID: …………………
GENDER: ……………….

ALPHABET KNOWLEDGE SCORING

Letter naming as pointed

Letter identification as said

ALPHABET LETTER	TICK/CROSS		ALPHABET LETTER	TICK/CROSS
a			a	
b			b	
c			c	
d			d	
e			e	
f			f	
g			g	

h			h	
i			i	
j			j	
k			k	
l			l	
m			m	
n			n	
o			o	
p			p	
q			q	
r			r	
s			s	
t			t	
u			u	
v			v	
w			w	
x			x	
y			y	
z			z	
Letter-sound identification			Sound letter-identification	
Sound for a said letter	TICK/CROSS		Letter for a said sound	TICK/CROSS
a= /a/			/a/= a	
b= /b/			/b/= b	
c= /s/ or /k/			/s/ or /k/ = c	
d= /d/			/d/= d	
e= /e/			/e/= e	
f= /f/			/f/= f	
g= /g/			/g/= g	
h= /h/			/h/= h	
i= /i/			/i/= i	
j= /j/			/j/= j	
k= /k/			/k/= k	
l= /l/			/l/= l	
m= /m/			/m/= m	
n= /n/			/n/= n	
o= /o/			/o/= o	
p= /p/			/p/= p	

q= /qua/			/qua/= q	
r=/r/			/r/= r	
s= /s/			/s/= s	
t= /t/			/t/= t	
u= /u/			/u/= u	
v= /v/			/v/= v	
w=/w/			/w/= w	
x= /x/			/x/= x	
y= /y/			/y/= y	
z= /z/			/z/= z	

Appendix h:Pattern Reasoning

PATTERN REASONING

NAME:____________________ **AGE**:____ **SEX**:________ **ID**:_________

SCHOOL:__________________ **RATER'S ID**:________

1	A	B	C	D		
2	A	B	C	D		
3	A	B	C	D		
4	A	B	C	D		
5	A	B	C	D	E	F
6	A	B	C	D	E	F
7	A	B	C	D	E	F
8	A	B	C	D	E	F
9	A	B	C	D	E	F
10	A	B	C	D	E	F
11	A	B	C	D	E	F
12	A	B	C	D	E	F
13	A	B	C	D	E	F
14	A	B	C	D	E	F
15	A	B	C	D	E	F
16	A	B	C	D	E	F
17	A	B	C	D	E	F
18	A	B	C	D	E	F
19	A	B	C	D	E	F
20	A	B	C	D	E	F
21	A	B	C	D	E	F

22	A	B	C	D	E	F
23	A	B	C	D	E	F
24	A	B	C	D	E	F
25	A	B	C	D	E	F
26	A	B	C	D	E	F
27	A	B	C	D	E	F
28	A	B	C	D	E	F
29	A	B	C	D	E	F
30	A	B	C	D	E	F
31	A	B	C	D	E	F
32	A	B	C	D	E	F
33	A	B	C	D	E	F
34	A	B	C	D	E	F
35	A	B	C	D	E	F
36	A	B	C	D	E	F

Appendix i: PPVT

Raters ID--------------------

CHILD INSTRUMENT(NYANJA)

Child family name		Child first name			
Sex	☐ Male ☐ Female	Date			
Test setting	☐`school				
Primary language spoken by child in home	☐ Nyanja ☐ Bemba ☐ Tonga ☐ Lozi ☐ Luvale ☐Lunda ☐Kikaonde ☐ Other_________________				
Assessor		Start time		End time	

PEABODY PICTURE VOCABULARY TEST

PEABODY PICTURE VOCABULARY TEST

Practice:
I want you to look at some pictures with me. [Turn to practice item A]
See all the pictures on this page? [Pointing to each of the four pictures]

I will say a word, then I want you to put your finger on the picture of the word I have said. Let's try. Put your finger on _______.

If the subject is correct:
That's fine. [Turn to practice item B]
Now put your finger on _______.

If the subject again makes the correct response, turn to practice item C, saying:
Good! Show me __________.

If the subject chooses the wrong illustration at any point, before going on to the next item, point out the correct response while saying:
You made a good try, but this is the correct answer.

Test:
Fine. Now I am going to show you some other pictures. Each time I say a word, you find the best picture of it. When we get further along, you may not be sure you know the meaning of the word, but I want you to look carefully at all the pictures anyway, and choose the one you think is right.
Point to [begin test items below]

SET 1

ITEM	WORD	KEY	RESPONSE	ERROR	DK
PPV1	Broken/**Cophwanyika**	2		E	
PPV2	Yawning/**Kuchita mwau**	2		E	
PPV3	**Tortoise/Fulu**	1		E	
PPV4	Dressing/**Kubvala**	1		E	
PPV5	Picking/**Kutenga**	4		E	
PPV6	Pair/Vibili	3			
PPV7	Pulling/**Kuguguza/Kudonsa**	1		E	
PPV8	Pouring/**Kukhutula**	4		E	
PPV9	Empty/**Mulibe**	4		E	
PPV10	Liquid/**Zamadzi**	4		E	
PPV11	Washing/**Kusamba**	4		E	
PPV12	Terrified/**Kuopa kwambiri**	1		E	
PPV13	Sharing/**Kugawana**	2		E	
PPV14	Bucket/**Mugomo**	1		E	
PPV15	Tugging/**Kuguza**	2		E	
TOTAL					

SET 2

ITEM	WORD	KEY	RESPONSE	ERROR	DK
PPV16	Full/**Kudzala**	2		E	
PPV17	Caterpillar/**Matondo/cinkhuwala**	3		E	
PPV18	Arguing/**Kutsutsana**	1		E	
PPV19	Branch/**Nthambi**	2		E	
PPV20	Chain/**Cheni**	2		E	

PPV21	Goat/**Mbuzi**	4		E	
PPV22	Fighting//**Kumenyana**	1		E	
PPV23	Root/**Mizu**	2		E	
PPV24	Coming/ **Kubwera**	3		E	
PPV25	Hoeing/ **Kulima**	2		E	
PPV26	Printing/ **Kulemba cimodzi-cimodzi**	4		E	
PPV27	Time/ **Nthawi**	3		E	
PPV28	Reading/ **Kuwelenga**	4		E	
PPV29	Leaking/ **Kukha**	3		E	
PPV30	Injection/**Nsingano**	4		E	
TOTAL					

Appendix:j Behaviour Rating Inventory for Executive Functions