EXPOSURE TO CINYANJA DIGITAL STORIES AND RHYMES IN PRE-SCHOOL AS PREDICTORS OF READING SKILLS AMONG GRADE ONE LEARNERS IN LOW-RESOURCE COMMUNITIES IN LUSAKA PROVINCE, ZAMBIA

BY

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DECLARATION

I, MUBANGA MOFU, declare that this thesis titled **"Exposure to Cinyanja digital stories and rhymes in pre-school as predictors of reading skills among grade one learners in low-resource communities"** is my work and has not previously been submitted for a degree at the University of Zambia or any other University. It does not incorporate any published work or material without acknowledgement.

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This thesis by MUBANGA MOFU is approved as fulfilling the requirements of the award of the degree of Doctor of Philosophy of the University of Zambia.

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DEDICATION

This work is dedicated to my beloved three children: Eudor and Lutanda, my dear sons, and Kaweme, my beautiful daughter. My children, you have inspired me greatly during this journey. Always remember that you can achieve whatever greatness you want, different from what I would have liked. My role is to provide an enabling environment for you to blossom into your greatness. I love you all.

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ABSTRACT

This study sought to establish the long-term effects of exposing preschool children to digital stories and rhymes on acquiring reading skills beyond alphabetic knowledge, phonological awareness, and vocabulary skills at the end of first grade. The objectives of this study were to find out the effect of exposure to digital stories and rhymes in preschool in supporting phonological awareness, alphabet knowledge and vocabulary among grade one pupils, test whether exposure to digital stories and rhymes in preschool supports learning to read among grade one pupils; and test the difference in response to digital stories and rhymes between pupils from more and less stimulating home literacy environments and their reading skills in grade one.

This study was guided by positivism; hence a quantitative approach was used. This pre-test-post-test randomised controlled trial randomly sampled 241 children (mean age = 98.18 months; *SD* = 15.05) from 14 public preschools annexed to primary schools of Lusaka Province. The children were randomly assigned to three conditions: an intervention group exposed to digital stories and rhymes in the language of instruction (*n* = 81), a control group I exposed to a non-literacy game (*n* = 81) and a control group II that continued with the usual classroom play activities (*n* = 79). Children in the intervention group attended brief digital stories and rhymes on tablets for six weeks (48 minutes/week). Follow-up assessments were conducted in grade one approximately 15 months after exposure to the digital stories and rhymes. The data was collected using rhyming and vocabulary tests, the Peabody Picture Vocabulary Test (PPVT), and the Basic Skills Assessment Tool (BASAT). Data on parental literacy levels, home possession (a measure of SES), and home literacy environment were also collected.

Data were analysed quantitatively using IBM SPSS version 23. Descriptive and bivariate correlation statistics were conducted before utilising linear mixed model regression to determine the long-term effects of the digital stories and rhymes on the reading skills of grade one pupils. The results showed that children in the intervention group scored significantly higher on reading their names (p = .025) and reading words and sentences (p =. 007) than the two control groups when parental literacy was controlled for. In addition, children in the intervention group outperformed children in the control groups in letter knowledge skills (p = .004) and vocabulary (p = .003). These findings support the hypothesis that children exposed to Cinyanja digital stories and rhymes will have better reading skills at the end of grade one. However, the digital programme did not significantly affect first-grade rhyming skills. The study recommends enriching the preschool curriculum with Cinyanja digital stories and rhymes as supplementary to the traditional curriculum materials. These may also enhance the home literacy environment with more opportunities for children to play with the language of instruction before formal schooling.

Keywords: **P*reschool, Digital stories and rhymes, grade one pupils, reading, low socio-economic status, parental literacy***

LIST OF ACRONYMS

BASAT	Basic Skill Assessment Tool
ECE	Early Childhood Education
HLE	Home Literacy Environment
MOE	Ministry of Education
MESVTEE	Ministry of Education Science Vocational Training and Early Education
NBTL	New Breakthrough to Literacy
PA	Phonological Awareness
PLP	Primary Literacy Programme
PPVT	Peabody Picture Vocabulary Test
PRP	Primary Reading Programme
SES	Socioeconomic Status
USAID	United States Agency
ZamCAT	Zambia Cognitive Assessment Tool

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CHAPTER ONE: INTRODUCTION

Overview

This chapter introduces the study by highlighting background information on the study area, Zambia's literacy situation, and justification for carrying out this study. The background contextualises the use of digital stories and rhymes in Zambia and discusses the policies on the language of instruction. This chapter further presents the statement of the problem, research objectives, hypotheses and the significance of the study findings. The chapter also highlights the limitations of the study, definition of terms and ends with a summary of the chapter.

1.1 Background to the Study

Reading is the core indicator of the quality of early-grade education and an essential part of the school curriculum. Consequently, failure to learn to read in primary school is among the most prominent predictors of future educational, social, and economic disadvantage (Chansa-Kabali, 2014; Wagner, 2014). In this technologically advancing world, reading is one of the most critical skills for children's communication and educational success. Reading is a process of decoding written text to arrive at meaning. It is a language-based activity, and unlike speaking, it does not develop naturally (Kaani, 2014). Reading is a complex process requiring children to have multiple capabilities, such as phonological awareness, alphabet knowledge, vocabulary, and oral language, and these can be facilitated by exposure to literacy activities such as stories, rhymes, and songs in school and at home. Thus, it must be taught directly and systematically. For children to be able to read, they must be read to and be exposed to literacy activities that promote reading at an early age. During the preschool stage, children are expected to learn new words from listening to stories, begin to understand

story structure and begin to retell stories. By so doing, they develop a foundational understanding of how reading works. Thus, mastering pre-literacy skills such as alphabet knowledge, enhancing phonemic awareness, and building vocabulary is a prerequisite to children developing their reading skills. This is followed closely by phonics instruction that teaches children how to map sounds to letters and sound out words. As children become familiar with more words, they begin whole-word recognition and sight reading (Ehri 2022; Ehri & McCormick, 1998). However, many children fail to acquire these pre-reading skills and this puts them at risk of reading failure.

1.1.1 Gaps in children who fail to acquire expected reading skills

Noticeable gaps exist between children who read and those who fail to acquire the expected reading skills. Children who can read, or are good readers, have well-developed phonemic awareness skills, understand the alphabetic principle and have strong vocabularies. However, difficulties in these areas can delay reading development or lead to reading failure. Thus, children who cannot read and exhibit difficulties doing so may struggle in processing sounds, as their sense of phonemic awareness is underdeveloped. They struggle to identify, isolate, and manipulate most minor sound units in spoken words. Consequently, they fail to comprehend the letter-sound relationship. These reading difficulties may be attributed to little literacy stimulation in the home environment (Bohrer, 2005; Chansa-Kabali, 2014; Mwanza-Kabaghe, 2015), while for some, it may be due to poor or inadequate reading instruction (Ohio State University, 2019). Children with stimulating literacy experiences from birth onward have an added advantage in vocabulary development and print awareness and may understand reading goals compared to children who begin preschool or formal schooling without these early literacy experiences. However, children who start preschool and formal schooling

without such literacy experiences are most at risk for reading failure (Dinler & Cevher-Kalburan, 2021).

For instance, Colker (2014) has reported a 30 million-word gap between children from low and high SES backgrounds in the number of words they are exposed to in the first three years of life. In addition, Logan et al. (2019) found that parents who read at least one picture book with their children daily expose them to an estimated 78,000 words each year. Thus, it is estimated that such children from literacy-rich homes hear a cumulative 1.4 million words throughout five years before entry into preschool. This disparity widens the gap between weak and strong readers (Coyne et al., 2019). Thus, exposure to enriched literacy activities that promote vocabulary growth is highly beneficial for children as oral language development is essential for reading acquisition. Most poor readers have not consistently engaged in activities that allow them to play with language and they may have limited exposure to literacy activities hence poor reading levels.

Despite strides in literacy education globally, low reading levels persist in certain regions, highlighting persistent educational challenges. In developed countries like North America, significant numbers of elementary school children struggle with reading proficiency, as evidenced by the National Assessment of Educational Progress (2019). Similarly, Metsala and Kalindi (2022) identify shortcomings in reading achievement across several Atlantic Canadian Provinces, where a substantial proportion of students in grades 2 and 3 fail to meet expected reading standards. Disparities in reading abilities are even more pronounced on a global scale, particularly between regions like South Asia and sub-Saharan Africa and the rest of the world (Verger et al., 2016). Sub-Saharan

Africa, in particular, grapples with alarmingly low literacy rates, with the overall literacy rate standing at just 66 percent in 2020 (World Economic Forum, 2022). Loye et al. (2022) underscore this issue, reporting that a significant majority of Grade 2 students in 14 sub-Saharan African francophone countries lack the literacy skills necessary to pursue their learning effectively. These findings underscore the urgent need for targeted interventions to address literacy disparities and ensure equitable access to quality education.

Research conducted in Zambia shows that many children fail to achieve grade-level reading as they do not possess basic skills of reading, and these problems of poor reading have persisted over the years (Jere-Folotiya et al., 2014; Matafwali, 2010; Mkandawire, 2018; Ministry of Education [MOE], 1992, 1996; Ministry of Education, Science, Vocational, Technical and Early Education [MESVTEE], 2013; Nshimbi et al., 2020; United States Agency for International Development [USAID] Education Data activity, 2019, 2020, 2022). Despite the Ministry of Education's efforts to improve literacy, there has been little progress achieved in improving literacy levels among Zambian learners.

USAID Education Data activity (2020) randomly selected 582 grade one learners, of whom 317 had Early Childhood Education (ECE) participation and 265 did not have ECE participation. The baseline results show that grade one learners, on average, scored lowest in the emergent literacy domain compared to other domains. The grade one emergent literacy average score was 51% (those with ECE scored 54%, and those without ECE scored 48%). The lowest scores were in letter identification (20%) and phonemic awareness (34%). An end-line study was carried out on the same sample, but on children

who had participated in ECE. The average score in emergent literacy skills among grade one learners was 50.5%, representing a statistically significant reduction from the baseline score of 54% (USAID Education Data Activity, 2020). These results suggest that despite ECE participation, grade one learners still exhibit low scores in emergent literacy skills. This indicates that children may not be adequately prepared with foundational reading skills before entering grade one, highlighting potential gaps in the effectiveness of ECE programmes in fostering emergent literacy skills. Overall, these findings underscore the importance of further investigation into the factors influencing the efficacy of ECE programmes in preparing children for grade one literacy skills, as well as the need for targeted interventions to address deficiencies in emergent literacy among young learners.

Another baseline study by USAID Education Data Activity (2019), conducted in 5 provinces of Zambia that included a random sample of 15,071 grade 2 learners from 816 primary schools, showed that most Grade 2 learners could not read fluently and comprehend grade-level text. Only 10.2% of learners could read fluently and comprehend grade-level text at the end of Grade 2. Even though the results indicated that learners who attended ECE performed slightly better than those who did not, these differences were not statistically significant except for listening comprehension. Additionally, the report indicated that attending ECE could not significantly predict oral reading fluency scores. This study provides evidence that preschools in Zambia may not be stimulating children's literacy skills as there were no significant differences in the pre-reading skills between those with and without a preschool background. The findings indicate that a large proportion of grade 2 learners in Zambia struggle with reading fluency and

comprehension, with only 10.2% able to read fluently and comprehend grade-level text by the end of Grade 2. This suggests a widespread literacy crisis that may hinder academic progress and future opportunities for these learners. The results of this study call for further research to better understand the factors contributing to low literacy levels among primary school learners in Zambia and to identify effective strategies for improving literacy outcomes. Additionally, there is a pressing need for targeted interventions and policy reforms to address the literacy crisis and ensure equitable access to quality education for all children in Zambia.

A baseline study by Friedlander et al. (2014) in Lufwanyama district of Zambia, among 383 grade 3 pupils from 24 schools, found low scores on reading fluency. Only 1.5% of the pupils had a score for fluency, and 2.9% had a score on reading accuracy on a reading passage in the language of instruction, Bemba. Similar results were recorded on the English test, where only 1 % of pupils had an English fluency score, and 2.6 % had an English accuracy score. Additionally, the pupils correctly identified, on average, only 30% of the letters of the alphabet. The study further indicates that forty-one per cent (41%) of these pupils had repeated at least one grade (either first grade or second grade). This implies that these children spent four years in school, yet they could only identify one-third of the letters of the alphabet.

Difficulty learning to read usually does not become evident until the end of first grade. By then, children are at serious risk for continuing reading difficulties (Lawson-Adams et al., 2022; Snow et al., 1998; Turnbull et al., 2022). Thus, early literacy experiences are cardinal for young children, as they help build a solid foundation for reading. This foundation helps children to gradually familiarise themselves with letter

forms and other knowledge relevant to reading as they develop in the emergent literacy stage. Part of this early literacy experience is children understanding that print letters relate to sounds that, if combined, blend words. Children should be exposed to such literacy experiences in their home environments before they begin first grade.

A growing body of evidence shows that literacy development starts early in life, long before first grade, and has long-lasting effects (Beauchat et al., 2009; Juel, 1988; Kegel et al., 2009; Skwarchuk et al., 2014; Spira et al., 2005; Zuilkowski et al., 2012). Children begin to learn literacy skills early in life through everyday interactions such as sharing books, telling stories, singing songs, talking to one another, pointing out and naming objects, or drawing and writing (Bohrer, 2005; Daimant-Cohen, 2007; Ghoting & Martin-Díaz, 2006) within their home environments. Such activities seem integral to parent-child interactions in higher socioeconomic status (HSES) homes and homes where parents are literate. Contrary to this, families from low socioeconomic status (LSES) backgrounds and homes with low parental literacy have limited engagement in literacy activities such as shared reading, songs, and rhymes with their children.

LSES families, particularly of minority groups, face structural barriers such as inflexible and extended work schedules, as well as language barriers and lack of information or familiarity with the educational system that prevent caregivers from regularly interacting with their children's schools (Rey-Guerra et al., 2022). In Zambia, in particular, some parents from LSES backgrounds do not know how to read (Friedlander et al., 2014) and write, while others may not be familiar with the language of instruction (Tambulukani & Bus, 2012), and some may be ignorant of their role in their child's literacy acquisition (Chansa-Kabali, 2014), while others may be too busy with income

generating activities to support their families (Mkandawire, 2018). These conditions compromise children's early acquisition of pre-literacy skills in the home environment.

In addition to what children should be exposed to in their homes, schools must strive to create a literacy-rich environment for acquiring pre-reading skills that support children's home literacy environment (HLE) and reading upon formal school entry. However, public preschools in low-resource communities, just like the HLEs, lack incentives for laying the foundation for learning how to read. The above limitations and the absence of literacy-enriching activities, such as shared reading, rhymes, and songs, in the home and school environments make it imperative to find interventions that may enhance the acquisition of pre-reading skills. Thus, identifying risk factors early, and providing interventions to prevent reading difficulties, is essential. Clay (1967) did not advocate a change in instructional methods because any approach would have weak areas for some children. Clay advanced that difficulty with literacy learning should be detected early and additional teaching time made available to address the reading problems of struggling children. Clay further advised that schools should consider what special or supplementary provisions could be made for groups of children within the general framework of the present scheme (Clay, 1967). In addition, Clay (1972, p. 110) urges that "... flexible and experienced teachers, well versed in individualised teaching techniques, and specially qualified in a wide variety of approaches to reading instruction, must be available for intensive and sustained re-teaching of low progress children." Furthermore, Matafwali (2005) urges early intervention because it is difficult for children to acquire grade-level reading skills when they lag behind unless intensive measures are implemented. This current study explored stories and rhymes in the local language as one

such intervention. This study proposes the use of digital stories and rhymes in Cinyanja, the language of instruction in Lusaka province, where the study was conducted, as a tool to enhance children's literacy even in the absence of direct adult support. The following section considers how stories and rhymes facilitate the development of these pre-reading skills.

1.1.2 Stories and Rhymes and Development of Pre-Reading Skills

Children learn new words and concepts through stories and rhymes from an early age. These literacy activities progressively increase children's attention span due to the captivating storylines and exciting rhyme features. Literacy activities help expand children's vocabularies and broaden and enrich their playful experiences with language (Ki, 2005; MacLean, 2008). Thus, they help to develop basic reading skills needed for reading success in school (Fiore, 2001), such as identifying and manipulating sounds, a skill known as phonemic awareness. Repetition of rhymes exposes children to phonemic segmentation, the most potent predictor of future reading success (Heroman & Jones, 2010; Van Der Meer, 1999). Engaging children in stories and songs help them acquire pre-reading skills such as alphabetic knowledge, phonological awareness, print awareness, narrative skills, vocabulary, and oral language that lay the foundation for learning how to read.

Stories help lay the foundation for learning how to read. Stories are essential to early childhood learning, as they promote young children's cognitive and literacy development (Li & Bus, 2023; Miller & Pennycuff, 2008). Stories can either be read (story reading) or be told (storytelling) to children. Storytelling as a successful educational strategy significantly improves early literacy development (Phillips, 1999;

Rahiem, 2021). Storytelling helps develop young children's oral and spoken language, vocabulary and reading strategies. Phillips (1999) asserts that storytelling helps form a link between children's established oral language and their developing literacy skills. Through listening to stories, children encounter a broad range of language, such as new words, expressions, phrases, rhymes, and metaphors, which help children establish an extensive oral language base required for building literacy skills. These literacy skills include word recognition, spelling, grammar and understanding of literacy conventions and comprehension. Furthermore, stories familiarise children with words, sounds, and syllables they may not ordinarily hear in everyday conversations, broadening their vocabularies. A rich vocabulary is essential to proficient reading (Wang & Chen, 2018).

In addition to stories, children's rhymes also enhance children's literacy attainments. When children are given opportunities to listen to rhymes, they find enchanting words and phrases that they repeat and/or mimic, and they enjoy doing so (Sayakhan & Bradley, 2019). It is from the enjoyment of rhymes that children develop an array of reading, writing and vocabulary skills, such as naturally segmenting sounds in spoken words and playing with actual and pseudo words. It is the rhythm, repetition, and rhyme in the stories and verses that young children appreciate. They focus on imaginative language and storylines. Early and systematic exposure to the language used in reading and writing may be of even more value in languages where there is a large gap between the spoken vernacular and written version (Egbariah-Ghanamah et al., 2022), a situation equally reported in Zambia (Matafwali & Bus, 2013; Tambulukani & Bus, 2012). This programme chose rhymes because they are musical, with a strong sense of rhyme and rhythm, making them delightful and easy to remember.

Traditionally, in the Western world, nursery rhymes were passed on orally. Hence, they were meant to be heard rather than read (Sayakhan & Bradley, 2019). It is easier to teach a song than read it out, and Kuppen and Bourke (2017) indicate that when content is sung, it is easier to process and retain than when spoken. Thus, nursery rhymes allow children and adults to engage in language-enhancing activities in the absence of shared reading. According to Sayakhan and Bradley (2019), oral language precedes written text; thus, nursery rhymes are considered an important tool to teach a language to both young and older learners because of the rhythm, simplicity, easy to memorise, fun for wordplay, they extend and enrich word vocabulary, develop phonemic awareness and phonics. According to Bryant et al. (1989), familiarity with nursery rhymes enhances children's sensitivity to their language's sound components, consequently affecting their reading and spelling skills. Research has indicated potential benefits for early exposure to oral language (Egbariah-Ghanamah, 2020). Thus, oral language proficiency in preschool may facilitate the acquisition of reading and writing.

Undoubtedly, stories and rhymes facilitate children's literacy and language attainments in preschool. These literacy attainments set the stage for children's short and long-term reading success (Arnold et al., 2008; Beauchat et al., 2009), and the paths of progress children establish in first grade predict where they would be two and three years later (Clay, 1966 in Ballantyne, 2007). The current study focused on using stories and rhymes in preschool to enhance children's literacy outcomes, specifically reading skills in first grade. This section has discussed how stories and rhymes promote pre-literacy skills, and the follow-up discussion briefly focuses on digital stories and rhymes.

1.1.3 Digital Stories and Rhymes and the Development of pre-reading skills

Storytelling in the traditional way has been practised in education for a long time. However, the emergence and proliferation of digital technologies ushered in modern pedagogical initiatives that combine conventional storytelling with a range of contemporary digital tools, transforming traditional storytelling into digital storytelling (Maya & Halim, 2021). Digital storytelling can be used as both a teaching method and a learning resource to support children's learning and allow teachers to adopt innovative and improved teaching methods (Rahiem, 2021). Storytelling using electronic or digital books has been shown to improve literacy skills among early-grade learners (de Jong & Bus, 2004; Korat, 2010; Korat & Shamir, 2008; Smeets & Bus, 2014; Yacizi & Bolay, 2017). Research on the impact of electronic books with multimedia features on acquiring emergent literacy skills suggests that enhanced electronic books can facilitate story comprehension and learning of new vocabulary, among other things (Li & Bus, 2023; Takacs et al., 2015). The lively and attractive features in electronic books might present practical means for supporting young children's foundational literacy skills, such as text comprehension and understanding complex grammar and vocabulary without direct adult presence and guidance (Korat & Shamir, 2008; Takacs et al., 2015).

Learning using digital storybooks gives children a more enhanced learning experience compared to traditional books. Digital storybooks do the reading, an experience that is qualitatively different from what traditional books offer (Bus et al., 2015). Using digital storytelling as a medium of language learning is beneficial for young learners as it provides music, pictures, and motion, enabling teachers to introduce new concepts, materials, and knowledge meaningfully. Additionally, digital storytelling

combines different aspects of learning pedagogy, such as learner engagement, reflection for deep learning and technology integration (Maya & Halim, 2021). However, it should be noted that the social and economic context of the Western world where these studies have been conducted differs from the African context, especially Zambia a Low-Income country. Thus, current reading theories may not be appropriate or applicable for contexts in Low and Middle-Income Countries (LMICs) with distinctive and many local languages and dialects (Wagner, 2011). Research shows that when children learn to read in a language that is not their mother tongue, they risk failing to develop reading comprehension skills (Matafwali & Bus, 2013; Tambulukani & Bus, 2012).

Furthermore, children from LSES backgrounds are more likely to begin school at a disadvantage in early math and reading (Turnbull et al., 2022). In most African countries, children from low-income families grow up in environments where parental involvement in their education is either minimal or absent (Bayat & Madyibi, 2022; Munje & Mncube, 2018; Shukia and Marobo, 2024). Socioeconomic well-being, particularly their parent's education and income, is among the significant factors influencing children's lack of literacy development (Ngwaru, 2014). As much as the Zambian context differs from the Western context that has extensively investigated digital literacies for younger children, digital literacy programmes may be of significance to the Zambian context if well adapted. The following section discusses the advantages of these digital literacies for a country like Zambia.

1.1.4 Advantages of Digital Stories and Rhymes in the Zambian Context

The educational resources found within schools have expanded beyond traditional chalkboards and textbooks to include new educational technologies and digital resources.

The age of new information and communications technologies (ICTs) to improve education has been discussed throughout the 20th and 21st centuries as technology has evolved. Radio, television, movies, computers, the internet, mobile phones, and tablets have each been expected to 'revolutionise' learning processes (Wagner, 2014).

In Zambia, the child's familiar language and language of instruction are not homogenous and this has created learning challenges as it impedes reading development. In as much as research has demonstrated that children's literacy achievements are better acquired when literacy instruction is done in their mother tongue or familiar language (Matafwali & Bus, 2013; MOE, 1996; Serpell & Nsamenang, 2014; Tambulukani & Bus, 2012), language in the Zambian society is not homogeneous (Luangala, 2017). Matafwali and Bus (2013) report that the regional languages used for instruction may be unfamiliar to children as their home and play language may differ from the language of instruction. Consequently, children may have problems learning to read when unfamiliar with ordinary sounds, words, and rhythm/cadence of the language of instruction (Matafwali & Bus, 2013; Tambulukani & Bus, 2012). Furthermore, Kombe and Mwanza (2019) report that some teachers were teaching in both English and the local language, while some taught in the familiar local language but gave activities in the English language. In addition, Tambulukani and Bus (2012) postulate that actual pedagogic practices may be insufficient to promote all children's understanding of letter-sound relationships, which may explain severe reading delays. This is partly attributed to the quality of phonics training and the teachers' ability to apply phonics instruction (USAID, 2020). It is against this background that exposing children to digital stories and rhymes in the language of

instruction may benefit children in multilingual Zambian societies like Lusaka, where there is no close fit between the child's familiar language and the language of instruction.

Currently, in most Zambian public preschools, children aged 3 and 4 are not enrolled as prescribed by the National Literacy Framework as enrolments are mostly reserved, due to limited infrastructure, for children aged six to prepare them for first grade. Consequently, most Zambian children miss out on the experience of being exposed to pre-reading activities at an earlier age as they stay at home until age six. In the home, parents and caregivers are a child's first teachers and are, therefore, a very influential factor in a child's early educational development. However, not all children grow up in a literacy-rich environment or have parents who read to them. Additionally, parents' SES is another predictor of pupils' reading achievement (Mumba & Mkandawire, 2020; Mwanza-Kabaghe, 2022; Ngwaru, 2014; Thorndike, 1973). Some parents or caregivers do not have the financial resources to purchase books or provide children with literacy-based activities. Studies have recommended enhancing the HLE to stimulate emergent literacy in Zambia (Chansa-Kabali, 2014; Mwanza-Kabaghe, 2015), and this study proposes digital stories and rhymes to help minimise these gaps in the home environment exacerbated by the lack of enrolment in preschool at the right age.

Upon enrolment in preschool, the large teacher-pupil ratios make it difficult for teachers to attend to each child's learning needs, implying that slow learners and those from disadvantaged backgrounds are further left behind. In big classes that may also not have sufficient books, digital stories and rhymes may make it possible for all children to be exposed to activities that support the acquisition of basic reading skills. Mwanza (2020) notes that literacy textbooks are fundamental to literacy success as they help

children learn to read. In the absence of texts, teaching the mechanics of reading becomes impossible. The Cinyanja digital stories and rhymes advanced by this study may help supplement this scarcity of literacy materials. The following section discusses the various literacy policies in Zambia.

1.1.5 Literacy Policies in Zambia

Zambia has experienced different language policies starting with the 1928 Phelps-Stokes Commission Report, which recommended using four local languages (Lozi, Tonga, Bemba, Nyanja) from grade 1 to 4 and, after that, English (Manchishi, 2004; Simwinga, 2003). However, even with this policy, reading levels were still low partly because the regional language of instruction was unfamiliar to some learners (Mwanza, 2020). Thus, another policy followed this in 1953, implementing an unofficial local language in grades one and two. This unofficial language was not a regional (official) local language but the most familiar or dominant local language spoken in a particular area. This was done to enable children to learn in a familiar local language. According to Mwanza (2020), it enabled learners to transition more steadily from the home or familiar language to the regional language. In the next two years (third and fourth grade), teaching was done using the official regional language. After that, from the fifth grade onwards, English was used as a medium of instruction (Mwanza, 2020). Likewise, the 1953 policy did not prove effective. It was replaced by the 1966 Language Act, which stipulated English only as a medium of instruction (Matafwali & Bus, 2013) from grade one to university. The seven official languages were introduced as subjects. However, the Educational Reform Document (1977) reported that teaching in English, which was not a mother tongue nor a familiar language, disadvantaged the learners, as the literacy levels did not improve. It took time for the government to give any direction on addressing the

declining literacy levels. It was only in 1992 that the government recommended that teachers had the liberty to determine the primary local language to be used as a language of instruction (MOE, 1992). It should be noted that even with this recommendation, the 1966 policy was still in use.

The education policy of 1996 recommended the use of a local, regional language in grade one before transitioning to English in grade two. However, it acknowledged that "Zambia has had almost 30 years' experience of using English as the medium of instruction from grade one onwards. The experience had not been altogether satisfactory" (MOE, 1996, p.39). The low reading levels were attributed to the use of an unfamiliar language in the teaching of basic reading skills. Thus, to improve literacy skills at the primary level, the 1996 language policy introduced the Primary Reading Programme (PRP), which was implemented in 1999. The PRP involved the teaching of literacy through the New Breakthrough to Literacy (NBTL), Step In To English (SITE), and Read On Course (ROC) approaches. NBTL was used in the first grade to teach children to read and write using any of the seven local, regional languages (Bemba, Kaonde, Lozi, Lunda, Luvale, Nyanja and Tonga). Grade one pupils had to be taught reading skills in a familiar language, preferably their mother tongue (Matafwali & Bus, 2013). In grade two, learners had to 'Break through to literacy' in a familiar language before proceeding to the next literacy approach, SITE. SITE was used to teach literacy in the second grade using English. However, it must be noted that English as a language was taught alongside NBTL and SITE for learners to build oral competence in English in preparation for ROC. The transition from SITE to ROC was intended to improve literacy skills in the local language of instruction and English among grade three to seven learners. However, the

PRP lasted until 2013, and another language policy, the Primary Literacy Programme (PLP), was introduced. The continued low literacy levels prompted this shift in policy.

Chibamba et al. (2018; p.84) report that "PLP was developed to address the weaknesses under PRP and improve literacy levels among learners in primary school". The weaknesses under the PRP included among others, disparities in language background of both teachers and pupils (Mwanza-Kabaghe et al., 2015), mismatch between the child's familiar language and language of instruction (Matafwali & Bus, 2013; Tambulukani & Bus, 2012), a lack of training in PRP for most teachers, inadequate teaching-learning materials and high pupil-teacher ratios (Chibamba et al., 2018).

The current Primary Literacy Programme (PLP) policy was implemented in 2014. Learning is done in a local language, starting from preschool to grade four and then transitioning into English at grade five. It is under this policy that Early Childhood Education centres or preschools annexed to primary schools were introduced (MESVTEE, 2014a). The preschool level has two components, nursery (3 to 4 years), with a focus on the promotion of social interaction, and reception (5 to 6 years), focused on preparing children to transition to grade one (MESVTEE, 2013). The current PLP uses a phonics-based reading approach (Ministry of General Education, 2018) in which learners are meant to acquire literacy by learning letter-sound relationships. Instructions begin with learning the first five vowels and then blending these with consonants to form syllables and words (Chibamba, 2020; Sampa et al., 2018).

Under the PLP, grade one children are taught reading instruction (phonemic awareness, phonics, fluency, vocabulary, and comprehension) in the language of instruction, and there is a one-hour literacy allocation per day on the timetable. In the first

week, children are taught the following pre-reading skills: sound awareness, conversational skills, visual discrimination, and concepts of print (MESVTEE, 2014a). In the second week, children are taught the five vowel sounds (/a/ /e/ /i/ /o/ /u/). One vowel is taught per day. After that, consonant sounds are taught in the third week one at a time, beginning with the most commonly used consonants /Kk/ and /Mm/. These consonants are taught in conjunction with the vowels. The five vowels are added to produce syllables when the sound /Kk/ is introduced. After that, children learn the blending of the sounds /a/ /e/ / /i/ /o/ /u/ and the syllables "ka", "ke", "ki", "ko", and "ku" to make words such as "koma", "uka", "ake", "ku". This process is repeated for all letter sounds (e.g., *ma me mi mo mu; mama uma, mu*), and only two syllables may be taught per week. The remaining literacy time is used for other pre-reading skills instruction. Children are then exposed to reading short sentences using the syllables and words learnt. For oral reading fluency, learners are provided with words, short sentences, and stories to read. Only words, sentences and paragraphs learners can decode using the sounds they have been introduced to, are used. Teachers are recommended to create stories in Nyanja and write them for learners to practice reading (MESVTEE, 2014b).

Despite all these policy changes in the language of instruction since 1928, learners still do not read at their grade level. There have been consistent reports (Friedlander et al., 2014; Kalindi, 2005; Kashoki & Mann, 1978; MOE, 1996; USAID, 2017; USAID Education Data Activity, 2019, 2022) of reading levels that are below average among Zambian learners. It is evident that regardless of the language used or how long teaching is done in the language of instruction (Mwanza, 2020; Matafwali & Bus, 2013) or the literacy approach used, low reading levels have persisted among primary school learners

in Zambia. Additionally, Mwanza-Kabaghe (2015) argues that among the factors for the persistent low reading levels could be that children miss out on learning basic knowledge for learning to read because they are not exposed to preschool before they enter first grade. She further argues that the PRP did not consider the effect of preschool, where English was used as a medium of instruction. The current PLP considered these factors by introducing preschools where the medium of instruction is the local language. However, low reading levels are still recorded (Mkandawire, 2018; Mwanza, 2020; USAID Education Data Activity, 2019, 2020, 2022; World Development Report, 2018). This study argues that this situation could also be attributed to a lack of literacy incentives in the preschools and home environment for children to play with the language of instruction to acquire pre-reading skills that facilitate reading upon entering formal school. Thus, it is essential to test whether such incentives in the form of digital stories and rhymes in the language of instruction may stimulate pre-reading skills such as phonological awareness, letter knowledge and vocabulary, which are all predictors of reading. It was thus imperative to establish the efficacy of exposure to digital stories and rhymes in preschool in promoting reading skills at the end of first grade.

1.2 Statement of the Problem

Learners in first grade are expected to be able to learn to read. However, research has consistently provided evidence of low reading and literacy levels among Zambian children (Jere-Folotiya et al., 2014; Matafwali, 2010; MESVTEE, 2013; Mumba & Mkandawire, 2020; Mwanza-Kabaghe et al., 2015; UNICEF, 2022; 2023; USAID Education Data Activity, 2022). Learners who are poor readers at the end of the first grade stay behind in their literacy attainments and, consequently, education (Ergül et al., 2023; Juel, 1988; Stanovich, 1986). These consequences of poor reading levels also impact

negatively on national goals and global frameworks such as attainment of SDG4 that emphasises quality learning. Specifically, Target 4.2 states that "by 2030, ensure that all girls and boys have access to quality early childhood development, care and preprimary education so that they are ready for primary education" (Saini et al., 2022, p.2039). However, Zambia is still facing challenges on this target compromising the quality of ECE learning (Republic of Zambia, 2020).

The step into reading in the local Zambian language officially designated as the language of instruction may be facilitated by making children play with language, thus familiarising children in their early years with stories, songs, and rhymes in the language of instruction analogous to what happens in the homes of millions of children before they start first grade. Exposing children to stories and rhymes before formal schooling helps prepare them for reading acquisition later in first grade. Studies, especially in the Western world, have demonstrated that exposing children to stories and rhymes in the early years before they begin reading instruction lays a strong foundation for developing reading skills. This study assumed that the low success reading rates in Zambian public schools relate to a lack of playful experiences with the language of instruction that familiarises children with words and sounds and the cadence of the language of instruction before formal schooling.

Research consistently indicates that digital stories and rhymes have the potential to improve literacy skills among early-grade learners (de Jong & Bus, 2004; Egbariah-Ghanamah et al., 2021; Korat & Shamir, 2008; Korat, 2010; Maureen et al., 2018; Smeets & Bus, 2014; Takacs et al., 2015). However, the potential of providing access to stories and rhymes in the language of instruction through digital devices, as literacy intervention

approaches, has not been investigated in Zambia, where reading has been a challenge, and children rarely come across such materials. These Cinyanja digital stories and rhymes may offer many advantages in the Zambian context, not just from the school and home perspectives but also the society, hence the need for this study.

1.3 Purpose of the Study

This study aimed to investigate the potential of digital stories and rhymes in the language of instruction in facilitating learning to read among first-grade pupils in low-resource communities in Lusaka Province of Zambia. Preschool children exposed to Cinyanja stories and rhymes through digital devices in their second term of learning were expected to have better pre-reading and reading skills at the end of grade one compared to children not exposed.

1.4 Research Objectives

The study sought to:

i. Determine the effect of exposure to digital stories and rhymes in preschool in supporting phonological awareness and rhyming skills in grade one pupils in low-resource schools in Lusaka Province.

ii. Examine how preschool exposure to digital stories and rhymes supports alphabetic knowledge among grade one pupils in low-resource schools in Lusaka Province.

iii. Establish the extent to which exposure to digital stories and rhymes in preschool supports vocabulary among grade one pupils in low-resource schools in Lusaka Province.

iv. Test whether exposure to digital stories and rhymes in preschool supports learning to read among grade one pupils in low-resource schools in Lusaka Province.

v. Test the difference in response to digital stories and rhymes between pupils from high and pupils from less stimulating home literacy environments and their reading skills in grade one in Lusaka Province.

1.5 Study Hypotheses

This study was guided by the following hypotheses

i. **H_{1a}** Listening to Cinyanja digital stories and rhymes in the language of instruction in preschool will facilitate basic reading skills such as phonological awareness, letter knowledge, and vocabulary in first grade.

Ho Listening to Cinyanja digital stories and rhymes in the language of instruction in preschool will not facilitate basic reading skills such as phonological awareness, letter knowledge, and vocabulary in first grade.

ii. **H_{1b}** Children exposed to Cinyanja digital stories and rhymes will progress in reading skills (name, word, and sentence reading) in grade one.

Ho Children exposed to Cinyanja digital stories and rhymes will not progress in reading skills (name, word, and sentence reading) in grade one.

iii. **H_{1c}** Children from less stimulating Home Literacy Environments would benefit more from exposure to digital stories and rhymes at the end of grade one than children from more stimulating Home Literacy Environments.

Ho Children from less stimulating Home Literacy Environments would not benefit more from exposure to digital stories and rhymes at the end of grade one than children from more stimulating Home Literacy Environments.

1.6 Significance of the Study

The outcomes of this study may be used as a point of reference by various stakeholders in education on the critical role of digital stories and rhymes in the acquisition of pre-literacy skills at the preschool level and how these lay the foundation for future reading skills in grade one. This study may provide further insight into how technology through digital stories and rhymes may augment teaching-learning for better preschool and grade one educational outcomes. The findings of this study may assist the Ministry of Education as well as other stakeholders in coming up with educational practices and policies that are aimed at facilitating literacy skills using digital media starting from the preschool level, which seems to be one of the most under-researched areas in the field of education in Zambia.

The study adds to the literature by determining whether digital stories and rhymes support children's phonological awareness, alphabet knowledge and vocabulary in preschool and subsequent reading skills in first grade. This is a landmark study in the discourse of low literacy levels with a digital intervention focused on stories and rhymes in the language of instruction. Thus, it adds a unique perspective to literature at both the local and international levels. Locally, it highlights the critical role of digital stories and rhymes as a media for playing with language, as research done thus far does not look at children playing with language using digital rhymes and stories in the local language.

Internationally, few studies of this nature have been conducted in the global South. Thus, adding a voice from the Zambian context is essential.

The study explored the effectiveness of digital literacy media outside of traditional instruction in emergent literacy in fostering reading skills among first graders. Additionally, this study explored pre-schoolers' emergent literacy skills through digital stories and rhymes and analysed the effects of word and sentence reading based on socioeconomic and parental literacy factors. The results from this study demonstrate that digital stories and rhymes are practical contexts for reading instruction in the early years, especially amongst the disadvantaged population.

This digital literacy programme also fits the current language policy as technological gadgets can be loaded with multiple languages based on the regional language of instruction, providing a visual-auditory learning channel essential to learning to read.

Finally, the 2018 cholera epidemic and the COVID-19 pandemic resulted in school closures, presenting challenges in the public education system to adapt classroom lessons to home learning. Public schools could not adapt their teaching and learning methodologies to offer lessons for children in their homes. This makes digital programmes like this one more relevant in such contexts, as technology can play an essential role in achieving the objectives of the preschool and primary curriculum if well adapted to diverse end users.

1.7 Limitations of the Study

The onset of the cholera epidemic at the beginning of the 2018 academic school year and the subsequent closure of schools led to a delay in pre-test assessments of preschool children and the commencement of the intervention. Nonetheless, these activities were moved to the second term of the school calendar (May-July) instead of the intended January to March period. For specific tests, children were at a relatively lower cognitive level than expected for their grade level. As a result, this posed a problem with using some tests, such as the writing component of the BASAT and one rhyming test. Data were collected, but further analysis could not be done due to too many zero scores. However, the long-term effects of the intervention were still measured for pre-reading and reading skills.

1.8 Delimitation of the study

The scope of this thesis is delimited to typically developing preschool children within Lusaka Province. Consequently, the findings may not be generalised to children with atypical development. However, the study's framework is transferable and can be replicated among children with similar characteristics in other provinces. Additionally, while Cinyanja was the primary language of interest, it is acknowledged that in languages featuring transparent orthographies, such as those prevalent in Zambia, children tend to exhibit accelerated progress in reading skills. Hence, the digital stories and rhymes developed in this study could be replicated in other languages sharing similar orthographic characteristics.

1.9 Definition of Terms

Alphabet knowledge: This is familiarity with letter-sound correspondence.

Cinyanja Digital Stories and Rhymes: Animated stories and rhymes in the language of instruction.

Cultural capital: This is the accumulation of knowledge, behaviours, and skills that one can tap into to demonstrate one's cultural competence and social status. Although it constitutes an immaterial and subtle capital, it should be regarded equally with social and economic capital.

Cultural capital, embodied: Symbolic elements such as linguistic competence, mannerisms, and cultural knowledge.

Cultural capital, objectified: Exists in the form of materials such as cultural goods, pictures, books, phones, tablets, etc.

Environmental print: This is familiar print in the child's surroundings, such as logos, food labels, street names and road signs. Environmental print is found in the home, outside on the roads, and in restaurants and stores.

Emergent literacy: The idea that learning to read and write begins very early in life and follows a continuum instead of appearing in distinct stages (Clay, 1966).

Early Childhood Education: Education provided to young children of 3-6 years that prepares them for formal schooling (MESVTEE, 2013).

Familiar Zambian Language: This is a local language that children in a particular locality commonly use. It could be a zone or a community language (MESVTEE, 2013).

Language of Instruction: This is the officially designated language of instruction. In Lusaka province, the language of instruction is Cinyanja.

Multimedia learning: The presentation of materials using verbal and pictorial formats to promote learning. Multimedia materials can be static or animated (Mayer, 2009).

Phonics: A strategy used to teach reading. It involves learning letter sounds and combinations of letter sounds (phonemes) associated with their corresponding letter symbols (graphemes).

Phonemes: Units of sounds in words that correspond to letters. For instance, the word map has three phonemes /m/a/p/.

Phonemic awareness: The recognition that words comprise individual speech sounds. This differs from phonics, which includes knowledge of the relationship between letters and sounds.

Phonological awareness: Involves identifying and manipulating larger parts of spoken languages, such as whole words, syllables, initial consonants, and word chunks at the end of words, referred to as onsets and rimes. Phonemic awareness and phonological awareness are precursors to learning phonics.

Play with language: Involves using words that sound similar or have several different meanings cleverly or funnily (Merriam-Webster dictionary, 2022). In the context of this study, play with language means exposing children to the various sounds and words in

the local language through stories and rhymes in a fun, playful and entertaining way (animated digital media) to improve or develop their sound sensitivity, phonological awareness and vocabulary.

Reading: Refers to the understanding of meanings of written words and texts that allow people to communicate.

Rhymes: Encompass rules of repeating sounds in words rather than whole sounds of words or phrases. Rhymes repeat the same or similar sounds in the last syllable of two or more words. It is this repetition that makes them easy to remember.

Rhymes, nursery: These are songs (or poems) for young children with repetitions of end sounds between two different words, with the repeated sound coming after the last stressed syllable of each word. For instance, fight-sight, “mbuzi-buluzi”, “mtengo-mikango”. Their purpose is to entertain and educate children. They are essential in language acquisition and discrimination between sounds. In this study, rhymes and nursery rhymes will be used interchangeably.

Chapter Summary

This chapter has provided an overview of how digital stories and rhymes facilitate pre-reading skills (phonological awareness, letter knowledge, vocabulary) and reading skills in preschool and early years of schooling, respectively. It began by giving a background on the low literacy levels among early-grade learners and the implications of the HLE, especially parental literacy and SES, on literacy acquisition. The chapter then narrowed its focus on children's use of digitalised stories and rhymes to enhance reading skills. The chapter has also discussed the advantages of using digital stories and rhymes

for the Zambian population. The literacy policy in Zambia has also been discussed, as discourse on literacy in Zambia suggests that the low literacy levels are partly due to the mismatch between learners' familiar language and language of instruction. Research conducted in Zambia shows that the Zambian government has put in much effort to improve the literacy situation in the country. However, even with the current literacy policy with the PLP approach, low literacy levels are still being recorded. Perhaps this literacy approach lacks adequate literacy incentives for children to play with the language of instruction. Thus, it was imperative to establish the efficacy of exposure to digital stories and rhymes in preschool in promoting reading skills at the end of first grade.

CHAPTER TWO: THEORETICAL FRAMEWORKS

Overview

Although, in most cases, one theory has been adequate to explain phenomena, this study shall utilise two theoretical approaches, and the reason is to advance enhanced comprehensiveness and depth of the study. Using multiple theories or theory triangulation gives varying perspectives to the issue under study as it provides more insights to explain a phenomenon better and analyse collected data against several theories for deeper understanding (Bans-Akutey & Tiimub, 2021; Grant & Osanloo, 2014; Turner & Turner, 2009). This gives a broader perspective of the study by advancing the different aspects of the theories. One aspect of this study aims to understand why we have low literacy levels despite having promising policy frameworks and how children respond to digital literacy interventions. The other aspect focuses on exploring multiple learning mechanisms from multimedia materials. Thus, combining two theories will offer an opportunity to comprehensively examine the variables under study. The theories will also help address the study from different levels of analysis: one is the deficit model, where children do not have adequate cultural capital and have low literacy levels, and the other is a learning model. The first theory is Bourdieu's 1986 cultural capital theory, which explains why many Zambian children start reading instruction poorly prepared and how children respond to literacy interventions. A second theory had to be used to explain the design of the intervention materials. Thus, in designing the intervention materials (digital stories and rhymes), Mayer's (2001, 2009, 2021) cognitive theory of multimedia learning was used.

Children from low-resource schools and homes may have fewer cognitively stimulating experiences, limited access to educational materials, lower frequency of rich conversational dialogue, and fewer (Kuppen & Bourke, 2017) or lack shared reading experiences (Chansa-Kabali, 2014). The Cinyanja Digital stories and rhymes were designed to offer children literacy opportunities to play with sounds, new words and oral language in the language of instruction. Thus, designing and structuring these materials using the cognitive theory of multimedia learning was imperative to offer the best benefits for children in low-resource schools and homes, where the HLE is less stimulating. The chapter will end with a summary of the theoretical frameworks.

2.1 Cultural Capital Theory

Pierre Bourdieu was a French Sociologist and a critical theorist. His cultural capital theory explains educational success and cultural reproduction. Pierre Bourdieu (1977, 1986) defined cultural capital as the accumulation of knowledge, behaviours, and skills that a person can tap into to demonstrate one's cultural competence and social status. He differentiated cultural capital (cultural resources) from economic capital (economic resources) and social capital (social networks). He argued that cultural capital constitutes an immaterial and subtle type of capital that should be regarded equally as the other two (Anderson & Jaeger, 2015; Gayo, 2016). Additionally, being a resource, it is a generalised currency that can be exchanged into social and economic capital. Bourdieu's theory of cultural capital posits that parents transmit cultural capital to children, and children convert this acquired cultural capital into academic success. Consequently, families with cultural capital have a comparative advantage, which helps them to reproduce their privileged socioeconomic position (Bourdieu, 1977).

Cultural capital is all the advantages that accrue to people of a particular class that have nothing to do with money and everything to do with social status. This implies that cultural capital is mainly an outcome of a family's educational resources and not the family's financial position, implying parental finances seem far from being a decisive factor in cultural capital (de Graaf et al., 2002; Gayo, 2016). This is reflected in societies where private schools are negligible, and education is free. The government financially supports children from LSES, who attend the same schools as children from HSES (de Graaf et al., 2002). According to Sullivan (2002, p.146), 'the educational advantage which higher-class parents pass on to their children may not be entirely caused by economic factors, and the notion of cultural capital is therefore, worthy of serious attention'.

Types of cultural capital. According to Bourdieu (1977, 1986), cultural capital is in three forms: 1) embodied or symbolic elements such as linguistic competence, mannerisms, and cultural knowledge; 2) objectified, which exists in the form of materials such as cultural goods, pictures, books, phones, tablets etc.; and 3) institutionalised (how society values our skills) which exists in the form of educational credentials. Scholars have emphasised cultural capital gained from parents as an indicator of linguistic and cognitive skills (de Graaf et al., 2002), socialising cognitive qualities, especially reading habits and linguistic skills (Farkas, 2017). Sullivan (2002) reports that parental reading habits are strongly associated with their children's academic success, whereas parental participation in traditional culture (visiting museums, art galleries, etc.) is not. In this study, embodied cultural capital included literacy interactions such as book-sharing, storytelling, interacting with literacy materials (and frequency of these interactions) and

parental literacy skills. In contrast, the objectified cultural capital included literacy and reading materials such as books, rhymes, literacy games, technological gadgets, etc. Institutionalised cultural capital would be parental qualifications. This current study introduced objectified cultural capital to preschool children through a digital literacy programme that contained stories and rhymes in the local language.

Models of Cultural Capital. Empirical studies have reported positive correlations between cultural capital and educational success (Andersen & Jaeger, 2015; De Graaf et al., 2000; DiMaggio, 1982; Xu & Hampden-Thompson, 2012). However, two competing models predict the effects of cultural capital on high and low-achieving learners. These are cultural reproduction and cultural mobility. Bourdieu's cultural reproduction model predicts that learners from high-achieving school environments have higher returns of cultural capital than learners from low-schooling environments (Andersen & Jaeger, 2015). The reasons for this are twofold: In high-achieving school environments, learners and teachers appreciate cultural capital, and learners have similarities in academic performance and cultural norms. Cultural mobility (DiMaggio, 1982) is the other model of cultural capital. It advances that learners from low-schooling environments have higher returns of cultural capital than those from higher-schooling environments. This is because cultural capital is scarcer in low-achieving learners, and if possessed, it makes a more significant impression. High-achieving learners only benefit a little from cultural capital because they have accrued all the advantages of an enabling home and school environment. Thus, resources in the form of embodied and objectified capital will benefit children who are disadvantaged more than those who are advantaged.

Cultural Capital in the home environment. Families or parents possess cultural capital. It is inherited by children consciously through investments or passively through primary socialisation, and it becomes an integral part of the children's endowments and dispositions, their habitus (Anderson & Jaeger, 2015; Jaeger, 2011; Xu & Hampden-Thompson, 2011). Parental cultural capital influences children's educational attainment as it transmits specific cultural dispositions on the one hand and facilitates the intergenerational transmission of linguistic and cognitive skills on the other hand (Farkas, 2017). It is not all cultural practices that are inherited across generations that are found to be significant factors in explaining academic achievement. Crook's (1997) results implied that cultural capital transmission from parents to children must be contextualised because parents will only transmit the type of capital possessed and practised (Gayo, 2016). Crook (1997) concluded that in Australia, it is parental reading habits and a home climate in which reading is emphasised, rather than the intergenerational transmission of cultural arts participation (highbrow arts), that positively impacts a person's educational career.

When parents are literate and read frequently, they are more likely to possess verbal, linguistic and cognitive skills that are rewarded in school. This predisposes them not only to pass on these educational skills but also to help their children cope with academic demands compared to parents who do not frequently read (Crook, 1997). Additionally, parents who read are most likely informed about how their children's academic functioning in school can be improved compared to parents who do not read. Gayo (2016) reported that middle-class mothers are more inclined to share homework or intellectual activities with their children than working-class mothers. However, working-class mothers are more likely to focus on the quantity of work they need to do to provide

the economic conditions that will enable their children to go to school. As a result, providing more academic support is usually beyond these working-class mothers.

Cultural Capital and Schooling. Bourdieu further stated that cultural capital, usually acquired in early childhood, is a precious educational resource as it significantly affects educational outcomes (Xu & Hampden-Thompson, 2011). When children are familiarised with reading in the home environment, it helps them perform well at school. This is because when they encounter reading at school, such cultural practices do not come as a shock to them, as they have already encountered such practices at home. Children acquire linguistic and cognitive skills at home, which significantly contribute to their human capital and educational success (de Graaf et al., 2002; Horbury & Cottrell, 1997). Additionally, children with more cultural capital are neither startled nor do they experience a hostile school cultural environment by what they learn in school because they easily communicate with teachers (Farkas, 2017). Teachers usually come from middle-class backgrounds, which means they possess middle-class skills and knowledge, making it easier for them to relate to pupils with a similar habitus. However, since the educational system inherently values cultural capital, learners with a working-class habitus can be interpreted negatively or unconsciously as less academic or intelligent. At the same time, middle-class children are often ascribed academic brilliance (Jaeger, 2011). Thus, schools tend to enable learners from well-to-do families to succeed, while those from low-income families often face challenges and may eventually drop out.

To conclude, children born into families endowed with cultural capital or attending schools in a cultural capital community find it easier to acquire better reading skills. This is because they are socialised to embody the values and behaviours society

rewards. For instance, if a child is part of a family where the parents are literate and engage in activities such as reading books, shared-book reading, playing literacy games, or being read to each night before bedtime; this will benefit them before entry into school. A child with some understanding that words are composed of sounds typically experiences fewer difficulties learning letters in school and tends to belong to the group of better-achieving children, affording them more opportunities for success. Conversely, a child born into a family with low cultural capital who attends a school with similar characteristics is more likely to lag behind in reading skills, which may subsequently affect their performance in other subjects. Consequently, the child may fall behind by two or more grades, resulting in poor performance and eventual dropout from school. According to Bourdieu (1986), cultural capital is a form of social inequality. Children from high cultural capital communities will do better than those from low cultural capital communities. However, DiMaggio (1982) argues that when children from LSES are presented with cultural capital, they benefit more from it than children from a higher class fraction. This study presented stories and rhymes (embodied cultural capital) through a digital tool (objectified cultural capital) to children in preschool to establish the long-term effect it would have on children's emergent literacy skills and reading skills at the end of grade one.

2.2 Cognitive Theory of Multi Media Learning

Richard Mayer's (2001, 2009, 2021) experimental studies were designed to establish whether people learn more intensely when ideas are expressed in words and pictures (multimedia learning) or just in words without pictures (purely verbal learning). Multimedia materials should have both words and pictures, and the words should be

presented verbally using print or spoken text. In contrast, pictures should be presented either in static graphics (photos, pictures, illustrations) or dynamic graphics (animations or videos) (Kian & Huey, 2022; Mayer & Fiorella, 2021). This implies that multimedia materials can be non-digital (a textbook with words as text and pictures) or digital (narration and animations). Multimedia learning has been defined by Mayer (2009, 2014, 2021) as the presentation of materials using both verbal and pictorial formats to promote learning. Mayer's design of multimedia instruction is based on research grounded in a theory of how people learn from words and pictures, the cognitive theory of multimedia learning.

The cognitive theory of multimedia learning (Mayer 2009; 2021) is based on three assumptions. Firstly, people have separate visual and auditory channels. Secondly, these channels are limited in capacity. Lastly, meaningful learning involves actively selecting, organising, and integrating incoming visual and auditory information (Castro-Alonso & Sweller, 2021; Li et al., 2023; Mayer, 2009). According to the cognitive theory of multimedia learning, digital multimedia presentations must adhere to four key principles. Firstly, they should include both narration and pictures rather than narration alone, as presentations with narration only are not considered multimedia. Secondly, the presentation should be integrated, meaning that corresponding portions of the animation and narration should be presented simultaneously. Thirdly, the presentation should be concise, focusing solely on core cause-and-effect explanations without any extraneous or irrelevant elements. Finally, on-screen text should be avoided, with words presented solely as narration. By adhering to these principles, the presentation optimally engages both the auditory and visual channels. Mayer (2009) contends that the most effective

computer-based multimedia presentation should incorporate all four factors discussed, and he labels this approach as a concise narrated animation (CNA).

This study also refers to Mayer's (2009) individual-differences condition, a boundary condition for multimedia design principles. According to the individual boundary condition, some design effects are stronger for low-knowledge learners than high-knowledge learners, implying that certain design principles help low-knowledge learners and not high-knowledge learners (Kalyuga, 2021; Mayer, 2009). The primary instructional implication is the need to tailor instructional formats and procedures to changing levels of learners' knowledge (Kalyuga, 2021). This is because high-knowledge learners may be able to create and use images independently, so they may not need well-designed multimedia presentations (Mayer, 2009). For instance, integrating words and pictures is helpful for learners who lack experience in a particular domain because, unlike high-knowledge learners, they may need to be presented with images. As a result, they are more likely to benefit from multimedia presentations.

Mayer's (2009) multimedia learning design principles are 12 principles grouped into three main principles: i) principles for reducing extraneous processing, ii) principles for managing essential processing, and iii) principles for fostering generative processing. This study used selected principles from all three groups to develop digital multimedia stories and rhymes. Only the principles used in this study will be discussed.

1. Principles for Reducing Extraneous Processing: Extraneous processing occurs when learners engage in cognitive processing irrelevant to the instructional goal due to the suboptimal instructional design of multimedia materials **(**Fiorella & Mayer, 2021a**)**. Under the first principle, the following three principles were considered:

*Coherence Principle***:** People learn better when extraneous words, pictures, and sounds are excluded rather than included (Fiorella & Mayer, 2021a). When extraneous material is presented, working memory may become cluttered with irrelevant words and images, making it more challenging to hold corresponding relevant words and images in working memory simultaneously, and this can negatively affect learning outcomes (Li et al., 2023). Thus, when children are presented with only relevant material, their working memory is more likely to hold corresponding relevant words and images simultaneously. This situation facilitates a crucial step in meaningful learning: integrating corresponding words and images.

Redundancy Principle: Children will learn better from pictures/animation and narration than from a combination of pictures/animation, narration, and on-screen text (Fiorella & Mayer, 2021; Mayer, 2009). When the on-screen text referred to under this principle as redundant text is removed, it eliminates the need to engage in extraneous processing. Redundancy refers to any unnecessary or irrelevant information or presentation of the same information in multiple forms (Kalyuga & Sweller, 2021). Redundant information interferes with learning. Thus, instructional designs that eliminate redundant material can be superior to those that include redundancy.

Temporal Contiguity Principle: Learning is better when corresponding narration and pictures are presented simultaneously because the learner is more likely to simultaneously hold corresponding verbal and pictorial representations in working memory (Fiorella & Mayer, 2021; Mayer, 2009). However, when corresponding words and pictures are presented successively or separated from one another in time, the learner is less likely to

be able to hold corresponding verbal and pictorial representations in working memory simultaneously (Bus et al., 2020; Li et al., 2023).

2. Principles for Managing Essential Processing: Only the Modality Principle was considered under the Principles for Managing Essential Processing. According to this principle, children learn better from pictures/animations and narration than from animation and on-screen text. On screen-text, just as animation, both require visual attention. This causes split attention because the on-screen test and animations compete for the same visual channel (Li & Bus, 2023; Mayer, 2009). In contrast, when words are presented as speech, they use the auditory channel, allowing the visual channel to be used only by the animations (Castro-Alonso & Sweller, 2021). This makes it possible to promote critical steps in meaningful learning, including integrating corresponding words and pictures.

3. The third group of principles is the Principles for Fostering Generative Processing, and the following three principles were considered;

Multimedia Principle: Children learn better from words and pictures than words alone (Mayer, 2021). When both words and pictures are presented, learners can also select images, organise images, and integrate words and images. Integrating relevant words and images is a crucial step in meaningful learning and is facilitated by presenting an explanation using words and pictures rather than words alone (Mayer & Fiorella, 2021). In a study by Li & Bus (2023), learners who received both text and illustrations or narration and animation performed better on transfer tests than learners who received text alone or narration alone.

Personalisation Principle: People learn better from multimedia lessons when words are conversational rather than formal. The personalisation and voice principles are consistent with the idea that social cues prime a conversational stance in the learner, in which the learner sees the instructor as a conversational partner (Fiorella & Mayer, 2021b). People try harder to make sense of the presented material in a conversation; they are more likely to engage in generative processing.

*Voice Principle***:** People learn better when the narration in multimedia lessons is spoken in a friendly human voice rather than a machine or robotic voice (Mayer, 2009). Additionally, based on the image principle, the presence of an instructor or virtual agent on the screen does not necessarily enhance learning (Fiorella & Mayer, 2021b).

In developing the digital stories and rhymes, this study used nine of Mayer's principles to ensure the children get the optimal learning experience from the digital literacy programme. Thus, it was hypothesised that preschool children exposed to digital stories and rhymes would have better emergent literacy skills and reading skills at the end of first grade compared to the children in the control group.

These two theories were complimentary in addressing the objectives of the study. The individual-differences condition of the multi-media theory states that some design effects are stronger for low-knowledge learners than high-knowledge learners, and this study focused on low knowledge. The cultural capital theory helped to explain outcomes of the study within the context of low cultural capital, by showing how school learners that are disadvantaged or have low cultural capital respond when cultural capital is introduced to them.

CHAPTER THREE: LITERATURE REVIEW

Overview

The main objective of this study was to establish the potential of digital stories and rhymes in facilitating learning to read among first-grade pupils in low-resource communities in Lusaka, Zambia. It sought to establish the emergent literacy skills children learn in pre-school that enhance reading skills in grade one. The literature reviewed in this study is based on the three study hypotheses. It was hypothesised that preschool exposure to digital stories and rhymes would facilitate the acquisition of phonological awareness (PA), alphabetic knowledge, and vocabulary as basic reading skills. The second hypothesis was that first-grade children exposed to digital stories and rhymes would have better reading skills at the end of grade one than those not exposed to the digital literacy programme. The third hypothesis was that children from less stimulating home literacy environments would be more susceptible to the digital programme. The chapter, therefore, is organised based on these hypotheses. This literature analysis discusses key themes and findings from other studies based on the variables under investigation. The literature discussion will include identifying gaps in the studies reviewed and the gaps that this study will address. The chapter will end with a summary of the literature reviewed.

3.1 The Role of Digital Stories and Rhymes on Phonological Awareness (PA), Alphabetic Knowledge, and Vocabulary as Precursors of Reading

This section of the literature discusses the role of stories and rhymes in enhancing the acquisition of PA, alphabet knowledge and vocabulary as basic reading skills. Stories and rhymes' role in phonological awareness as an essential reading component will be discussed, followed by alphabetic knowledge, vocabulary, and their importance in

facilitating emergent literacy skills. Empirical studies will be reviewed on how stories and rhymes enhance these basic reading skills and how they relate to learning how to read among grade-one children. However, there is a dearth of literature on how stories enhance PA and letter knowledge.

3.1.1 Role of Digital Stories and Rhymes on phonological awareness as a Precursor of Reading

Students from lower SES demonstrate lower PA skills compared to children from more affluent backgrounds. This disparity is attributed to differences in children's opportunities to practice PA activities before entry into preschool (Snow et al., 1998). Phonological awareness instruction and intervention are effective for children from different socioeconomic backgrounds Ehri et al., (2001), and intervention can help avoid later reading difficulties in children (Burns et al., 2018; McGuiness, 2005). It is imperative that before children are introduced to alphabetic knowledge, they develop PA, awareness that words are made up of phonemes and that these, when put together, form words (Sá et al., 2022). PA is the understanding that oral language can be broken into sentences, individual words, words into syllables, and syllables into individual sounds or phonemes (Bradley & Bryant, 1983; Sá et al., 2022; Snow, 1998; Yeh & Connell, 2008). PA activities lie in a continuum from less complex to more complex, starting with rhyming and alliteration, syllable segmentation and blending, onset and rime blending and segmentation, and phonemic awareness (Chard & Dickson, 1999). Children demonstrate PA through identifying onsets and rimes (alliteration and rhyming activities), syllable segmentation, and phonemic awareness (Heroman & Jones, 2010; Ki, 2005; MacLean, 2008; Yeh & Connell, 2008).

Children's ability to learn how to read is in part supported by their PA skills. Therefore, PA is an important skill in early childhood education and it plays a crucial role in facilitating reading skills development. PA promotes the child's ability to read and form words (Burns et al., 2018; Chard & Dickson, 1999; Grofcikova & Macajova, 2020; Matafwali, 2010). This makes it even more important to stimulate PA in preschool as it will make it simpler for children to acquire letter-phoneme correspondence skills, consequently making the development of reading and writing skills easier. For instruction in PA skills to be more effective, children should have some experience with these skills at an earlier age (Bus & IJzendoorn, 1995). Children typically begin to show initial PA through an appreciation of rhyme and alliteration by becoming aware of sounds from exposure to nursery rhymes, lullabies, songs, and stories starting in infancy. Appreciation of rhyme begins very early in language development (Chard & Dickson, 1999). Reading stories based on rhyme and alliteration can also facilitate rhyme awareness in children. By three years of age, children might recite nursery rhymes in part or in whole. Research (Bryant et al., 1989; Chard & Dickson, 1999) indicates that knowledge of nursery rhymes enhances children's phonological sensitivity, which in turn supports reading development. This makes it imperative to train or teach skills for phonological awareness through rhymes and phonemic awareness. Rhymes followed by phonemic awareness will be briefly discussed.

Rhymes may facilitate PA in children at the foundational level. Rhyming is a fundamental skill associated with phonological awareness and emphasizes the importance of developing rhyme awareness in preschool and early primary education. Thus, there is a relationship between rhyming, phonological awareness (PA), and early literacy

development. Studies have reported significant relationships between early rhyming and PA (Bradley & Bryant, 1991; Grofcikova & Macajova, 2020). Rhyming is one of the basic skills associated with phonological awareness. Rhyme awareness is the ability to become aware of and produce rhymes. The ability is essential and should be developed in preschool and at the beginning of primary education. Children who struggle to recognise rhyming words often struggle to learn to read (Baleghizadeh & Dargahi, 2010). Familiarity with rhymes and songs that contain repetitions and predictable elements supports children's early efforts to associate learning with printed words and their successful reading (Manzo, 1995 in Baleghizadeh & Dargahi, 2010). Singing songs with rhymes and reciting rhymes repeatedly makes children aware of sounds in words and different sound patterns that help with decoding unfamiliar words. For example, the rime */at/* in f*at* and c*at* would familiarise children with its sound pattern and use in other words. Nursery rhymes, rhyming, alliteration, and rhythmic activities facilitate phonemic awareness. In support of this, Strickland and Schickedanz (2004:19) state, "A rhyme's repetition can sensitise the children to the individual units of sound, known as phonemes, which make up words. Having developed sensitivity to language, children are ready to think about the sequence of sounds in a whole word, a skill that is crucial for learning to read". Bryant et al. (1989) suggest that the roots of phonemic awareness, as a powerful predictor of later reading success, are found in traditional rhymes and word games.

Phonemic awareness is a more complex component of PA and a potent predictor of reading in the early years. Phonemic awareness is the ability to manipulate individual sounds or phonemes in spoken words (Chard & Dickson, 1999). These phonemes or sounds combine to form syllables and words. For example, the word "eye" has three

phonemes e/y/e. These are the smallest units of a word. Studies show that phonemic awareness is the best predictor of how children will learn to read in the first two years of school instruction (McGuiness, 2005; Yeh & Connell, 2008), as it does not only correlate with reading ability at a given time point but it also predicts later reading ability (Share et al., 1984). A study by Share et al. (1984) reported a moderate correlation of phonemic awareness with Australian student's reading performance in preschool (r ¼ .66) and first grade (r ¼ .62). Children who lack phonemic awareness skills like phoneme segmentation and blending upon entering first grade are likely to be poor readers in 4th grade (Yeh & Connell, 2008). Thus, rhyming should be taught to children as young as four years old to promote future reading ability, while phoneme segmentation and blending should be reserved for pre-grade, just right before first grade (Burns et al., 2018).

PA skills help children with sound manipulation skills and these may facilitate later reading and writing. Sá et al. (2022) conducted a randomised controlled trial on 49 four to six-year-old European Portuguese children with typical language development enrolled in public preschools in Portugal. The study aimed to analyse the efficacy of a Phonological Awareness Digital Programme (PADP) in Portuguese. The PADP had three levels of PA, namely, syllabic, intra-syllabic, and segmental awareness. It controlled for word length, syllable structure, word stress, and segmental properties. Children were randomly assigned to a control and experimental group and were followed up two months later. The follow-up study showed that the PADP was an effective programme in promoting the development of PA, giving children the ability to manipulate and reflect on phonological units.

Additionally, the PA digital tool was in Portuguese, which makes it more culturally appropriate for the sample under study. The PADP can be used by parents with their children, with the guidance of professionals, and it comes with an examiner's manual. In addition to PA, the current study tested the longer-term efficacy of the digital stories and rhymes on other emergent literacy skills (alphabet knowledge and vocabulary) and reading. The current study designed the tool for children to use independently without adult guidance. The sample in the current study is predominantly LSES, and some parents cannot read. Thus, it was imperative to factor this into the tool's design. In the absence of parents, children may explore the tool independently.

Integrating different emergent literacy skills may lead to enhanced phonological awareness skills and literacy. A quasi-experimental study conducted in Jordan by Rababah (2017) established the extent to which participation of Arabic-speaking kindergarten children in storybook reading sessions and writing journal activities influenced print and phonemic awareness. Fifty children (mean age 62.19 months) were randomly assigned to either a control or an experimental classroom. Children were subjected to a pre-test, then a 12-week intervention period to enhance their print and phonemic awareness skills, and then to a post-test. Children in the experimental group participated in 24 small group reading sessions and 14 writing journal sessions. Print awareness assessments included print concepts, words in print, alphabet knowledge and letter discrimination, and literacy terms. Phonemic awareness assessment included initial and end sound identification, rhyme supply, phoneme blending and segmentation. Results show that the experimental group had a statistically more significant increase in print and phonemic awareness over time than the control group. This study provides a more

thorough evaluation of phonological awareness (PA) compared to previous research efforts, like Evans et al. (2006). Additionally, this study, along with the research by Shaefer & Koetze (2019), explored a broader range of emergent literacy aspects, including letter knowledge. Existing literature also suggests that integrating rhyming skills with other emergent literacy components, such as letter training, can lead to enhanced literacy and phonological awareness abilities, as indicated by studies like those conducted by Bus & Ijzendoorn (1999), Bradley & Bryant (1983), and Bradley (1988).

Intensive PA training in the early years is widely held to be beneficial for children with poor phonological awareness. For instance, Shapiro and Solity (2008) conducted a study in the United Kingdom (UK) to examine whether integrating PA training into whole class, mixed ability reading lessons could improve the PA of poor readers and benefit typical developing readers. The teachers, trained 251 preschool children in intensive PA and phonics to whole classes of children from preschool to the end of grade one. This group was compared to a control group of 213 children receiving formal training. The children's literacy skills were assessed at the beginning, end of reception and end of grade one, and a year after the end of the intervention. Children's reading skills for typical readers and those with poor PA skills significantly improved. This implies that PA skills and phonics training are highly effective for children with poor PA, even when incorporated into whole-class teaching. The current study designed a programme with digital stories and rhymes where children freely play with language. Such an approach is more feasible, especially in settings where intensive training may not be achievable. Additionally, intensive training for whole-class teaching may be a challenge for Zambian public schools, where teacher-pupil ratios have

been reported to be as high as 1:80 (Mumba & Mkandawire, 2020) and USAID Education Data Activity (2022) reported a 1:74 teacher-pupil ratio instead of 1:25-30 for reception class and 1:15-20 for nursery class, as stipulated in the ECE standard guidelines.

Additionally, children learn better and benefit more from explicit instruction in PA. This was demonstrated through an experimental study by Cunningham (1990) of 42 kindergartens (mean age 5 years 11 months) and 42 first-grade children from a predominantly middle SES school in United States of America (USA). The study used two approaches for phonemic awareness to determine which approach would influence reading. Both children in the experimental and control groups received training twice a week for ten weeks. The first approach was a skill and drill approach that taught procedural knowledge of segmentation and blending phonemes. The second approach taught the same procedural knowledge. To this, a metalevel knowledge explicitly emphasised phonemic awareness's application, value, and utility for the reading activity. In the control group, children listened to a story and answered questions about the story. Results revealed that phonemic awareness is causally related to reading achievement for both kindergarten and grade one experimental group. Children in the metalevel approach performed significantly better on a transfer measure of reading achievement than the skill and drill experimental group. These results show that training in phonemic awareness improves children's reading ability and is consistent with previous experimental studies (Bradley & Bryant, 1983, etc.). The current study did not teach PA explicitly but implicitly through digital stories and rhymes. In contexts where instruction is problematic, and class sizes do not allow for the meta-level approach such as most

Zambian schools servicing LSES children, digital literacy tools remain viable as children can benefit from them without explicit instruction.

In addition to integrating different emergent literacy skills in teaching reading, intensive and explicit PA training, teacher-support interventions help enhance literacy abilities among first graders. A Randomised Control Trial (RCT) by Schaefer and Kotze (2019) of 1347 randomly selected first graders from predominantly rural low SES South African schools to determine which first language skills predict English as a second language and literacy abilities in grade one. The average age of the learners was 6.65 years at the end of grade one. The teacher-support interventions included structured lesson plans, reading coaches, additional materials and strengthening of teachers' instructional practices. The learners were individually assessed in PA (initial and end sound discrimination) letter-sound knowledge, vocabulary, listening comprehension, reading fluency and spelling in their first language (isiZulu and Siswati) and English skills at the start and end of grade one. Results confirmed the importance of first-language PA and letter-sound knowledge for later word reading in L1 and English. Decoding skills were reported to have improved, but 45.7% and 35% of learners could still not read a first language or English word correctly in 1 minute, respectively. Most children in LSES homes lack the literacy incentives necessary for later reading acquisition (Chansa-Kabali, 2014; Mwanza-Kabaghe; 2022). The current study introduced an exciting way for children to play with language using digital stories and rhymes, and assessed more varied components of PA.

Rhyming skills play a central role in enhancing PA skills and other emergent reading skills. Goswami (1999) found rhyming promotes phonological awareness and

emergent literacy skills such as letter identification, phonics, phonemic awareness, and word decoding. In contrast, other researchers have not found this connection between rhyming and phonemic awareness (Martin & Byrne, 2002). Yeh and Connell (2008) conducted a study in the USA and randomly assigned 128 four-year-olds from highly disadvantaged backgrounds into three literacy instruction groups: 1) phoneme segmentation, blending, and letter sound, 2) rhyming instruction, and 3) vocabulary instruction. The results showed that phoneme blending and segmenting instruction more effectively promoted phoneme segmentation skills and future reading ability than rhyming instruction. Chard and Dickson (1999) equally postulate that instruction in segmenting and blending seems to provide the most significant benefits to reading acquisition compared to instruction in rhyming. In as much as the study by Yeh and Connell (2008) may not have found a connection between rhyming and phonemic awareness, most research favours this connection. Several factors could explain the findings by Yeh and Connell (2008). However, they found that phonemic awareness predicted reading skills, a more complex component of PA. Therefore, preschool should provide an enriched experience filled with repeatedly reading and singing rhymes, poems, or stories with rhyming words to help children notice sound patterns in words. These activities will help young children develop PA tasks such as syllable awareness, alliteration, and phonemic awareness because exposing children to rhyming is an excellent strategy to help them develop phonological awareness (Bryant et al., 1989).

3.1.2 Role of Digital Stories and Rhymes on Alphabetic Knowledge as a Precursor of Reading

Letters of the alphabet are part of every nursery or preschool that uses the English alphabet; one may say there is no preschool learning without letter learning. Thus, to

support later reading achievement, it is essential to implement preschool literacy programmes that promote PA and other critical pre-literacy skills, such as alphabet knowledge (Sa et al., 2022). Evans et al. (2006) state that despite the alphabet being an integral part of the preschool curriculum, few studies have been done to investigate the acquisition and factors that may influence the learning of the alphabet. However, research thus far shows that knowledge of letter names can provide a bridge to learning letter sounds, and letter-sound knowledge is the strongest predictor of later reading abilities in young children (Adams, 1990; Foulin, 2005; Snow et al., 1998). For children to read, they need to be able to identify letters of the alphabet, know the sounds that these letters make, and learn the connection between letters and sounds, or grapheme-phoneme connection.

Furthermore, letters are visible objects (as in letter shape), so giving the letter a name fits a child's expectations that objects are named. The child must discover how the letter represents an arbitrary sound, and the letter name provides essential clues. For children to master the alphabetic principle, they should be able to construct mental representations of letters and link them to related sounds. They should also be able to construct the allowable combinations of letters or graphemes and the orthographic position of letters within words (Ehri, 2005; Ehri, 2022). The four phases of reading development for sight word learning are based on alphabetic knowledge. These phases are pre-alphabetic, partial alphabetic, entire alphabetic and consolidated alphabet. Children do not know much about the alphabetic system in the pre-alphabetic period as they do not form letter-sound connections to read words. They may read words merely by remembering certain visual features.

Additionally, the environmental print will not be read from letters but from contextual cues. If an environmental print such as the "STOP" sign was altered to "SOPT", the children in this pre-alphabetic phase will not notice the change. Thus, in this phase, they are not yet readers (Ehri, 2005). In the second phase, the partial alphabetic phase, children learn either names or sounds of alphabet letters. Children will use the letter sounds or letter names to read words. However, they form connections for boundary letters or sounds, the first and last sounds of a word. For instance, in the word "stop", they may form a connection for "stp". At this stage, it is easy for children to confuse words with the same boundary letters, e.g. "stamp" and "stop". This happens because children cannot segment the words into all the phonemes, and they especially lack full knowledge of the alphabet system, hence being in the partial alphabetic phase (Ehri & McCormick, 2008). They also omit some sounds, especially vowels. Children are also unable to decode unfamiliar words. In the full alphabetic phase, children can learn sight words by forming complete connections between letters in spellings and phonemes in pronunciations because of knowing the main letter-sound correspondences (Ehri, 2022).

In addition, children can segment pronunciations into phonemes that match the letters they see. In this phase, children can decode unfamiliar words and remember word spellings better than readers in the partial phase. In the consolidated phase, Ehri (2005) postulates that letter-sound connections found in most words become consolidated into larger units, such as rimes, syllables, morphemes, and whole words that have become unitised. Knowing letter chunks is valuable for remembering how to read multisyllabic words; for example, when the word unstoppable is presented, children will not read it using this letter-sound correspondence such as /u/n/s/t/o/p/p/a/b/l/e they will use larger

units such *as un-stop-ap-able* to read the word. Ehri (2005: p.175) reports that readers aware of the necessary segments can "learn a word such as *interesting* more easily because fewer connections are required to secure the word in memory". Goswami (2002) states that for English, both small and large units are essential for the successful acquisition of literacy. However, phoneme-level skills develop fastest in languages with consistent orthographies with a simple CV syllabic structure. It must be noted that these phases are not prerequisites for the subsequent phases; for instance, word reading at the pre-alphabetic phase does not contribute to word reading during the later phases.

Children's alphabetic skills in the early years may be enhanced by using digital tools such as literacy apps and tablets. A study by Neumann (2018) in Australia explored the effects of using literacy apps and tablets on emergent literacy using a pre-test-post-test randomised control group design. English-speaking children aged 2–5 years (N = 48) were given a nine-week iPad literacy intervention programme. They were tested on various emergent literacy skills (letter name and sound knowledge, letter name and letter writing, and print concepts). The iPad literacy programme focused on three new alphabet letters each week. Following the programme, children in the iPad group showed significantly higher letter name and sound knowledge, print concepts and name-writing skills than children in the control group. In Neumann's study, letter knowledge was taught to children as young as two years. This indicates that alphabet knowledge can be taught to young children in the pre-conventional stage before they even start preschool. In addition, the intervention time was nine weeks, which seemed longer compared to other studies (Egbariah-Ghanamah, 2021; Yazicik & Bolay, 2017). Neumann's (2018) three literacy apps explicitly taught letter knowledge (letter names, sounds, letter writing and

print concepts). The current study did not explicitly teach letter knowledge; children listened to digital stories and rhymes independently.

Alphabet knowledge further predicts children's word identification. Evans et al. (2006) conducted a longitudinal study in Canada of 149 English-speaking kindergarten children aged five from predominantly middle SES. They wanted to establish if letter names, sound knowledge, phonological awareness, and cognitive abilities (receptive vocabulary, non-verbal reasoning, RAN colours) would predict grade 1 phonological awareness and word identification. Children were assessed in non-verbal reasoning, receptive vocabulary, short-term memory, RAN, alphabetic knowledge, PA, reading, and PA. Ten months later, when children were in grade one, their PA and reading skills were tested. The findings showed that children performed better in vowel (V) sounds and consonant-vowel (CV) words than in vowel-consonant (VC) words or words that were not related much to their sounds. Furthermore, results showed that cognitive abilities and phonological memory significantly contributed to alphabetic knowledge and PA.

3.1.3 Role of Digital Stories and Rhymes on Vocabulary as a Precursor of Reading

Vocabulary is vital in helping children learn how to read. According to Share et al. (1984), letter naming, phoneme segmentation and vocabulary are among the best predictors of how well children will learn to read in preschool and first grade. MESVTEE (2014a) has defined vocabulary as the ability to understand the meaning of words and use them orally and in writing. Vocabulary offers younger children great aural opportunities to learn the meaning of words and the sounds with which they are constructed (Mullen, 2017). Ehri (2022) outlines several ways vocabulary contributes to reading among early readers; vocabulary helps children recognise the meanings of words they have never read.

Additionally, if words have irregular or changeable letter-sound patterns that may require flexible decoding, then vocabulary will help children figure out the possible pronunciations to find the right word. Sometimes, when reading, children may be tempted to skip unfamiliar words rather than try to read them and figure out their meaning. Nevertheless, if children have an extensive vocabulary, this reduces the need to learn the meanings of unfamiliar words from print (Ehri, 2022). Early vocabulary knowledge is crucial for comprehending oral language and written text and can predict children's later reading success in formal schooling (Catts et al., 2003; Dickinson et al., 2010; Snow et al., 1998; Storch & Whitehurst, 2002). For young children, low initial knowledge about academically valued words at school entry can serve as a barrier to accessing text and sustaining reading achievement in school (Lawson-Adams et al., 2022). Vocabulary knowledge in the early grades predicts later reading comprehension and academic success and can be facilitated by listening to stories and rhymes. The following paragraph focuses on how these stories and rhymes facilitate vocabulary acquisition.

Nursery rhymes are made up of words in a somewhat meaningful string. The sentence patterns help children first develop and remember the oral language and later develop other skills, such as reading. When children listen to their favourite nursery rhymes, sing them with joy, and participate in related activities, all these can facilitate and support the development of their language skills. One of the reasons for using nursery rhymes and stories with rhyme or repeated words is that children find them motivating and fun (Sayakhan & Bradley, 2019). Nursery rhymes can help them develop positive attitudes towards the target language and language learning. Children can create a desire to continue learning. Wright (1995:p4) argues that "…children want to find meaning in

the songs and stories they hear, so they listen with a purpose. If they find meaning, they are rewarded through their understanding of the language. If they do not understand, they are motivated to improve their ability to understand". Another reason is that nursery rhymes allow children to internalise the language and internalise previously learned points. According to Hill (1996), when individuals learn their native language, they intuitively absorb the language's rules and vocabulary through exposure, thereby constructing their mental knowledge of the language.

Children enjoy listening to nursery rhymes and stories repeatedly. This frequent repetition allows certain language items to be acquired while others are overtly reinforced (Baleghizadeh & Dargahi, 2010). Language can be developed using digital storytelling; hence, listening to digital stories is one way to enhance the capacity to learn the language (Loniza et al., 2018). Maya and Halim (2021) examined the effectiveness of digital storytelling in enhancing vocabulary mastery of 23 fifth graders learning English as a foreign language at an Islamic Elementary school in Indonesia. The researchers postulated that digital storytelling in English as a learning medium could be an easy and effective tool for attracting young learners to learn English as a second language and enhance their vocabulary. The results revealed a significant difference between pre-test and post-test results. This showed that digital storytelling engaged the learners in mastering and improving their vocabulary mastery.

Vocabulary predicts later reading success and it is more effectively taught using song than direct methods. In the USA Lawson-Adams et al. (2022) examined patterns in children's word learning when words were taught with a combination of songs and picture cards and when words were taught using picture cards only. The study further investigated

whether word learning varied based on children's socioeconomic and linguistic backgrounds. Participants were recruited from four preschool classrooms within the same urban school district. Each preschool served children from traditionally non-dominant groups of 56 students (mean age = 57.57 months). Each preschool class participated in three 15-minute sessions over two weeks. Words were taught with i) picture cards only, ii) a song that was sung with a melody, and iii) a song that was rhythmically spoken with no melody. Vocabulary knowledge was measured using a receptive task and a productive word definitional (PWD) task that assessed children's depth of word knowledge. The study's findings showed that both types of songs led to more significant gains in children's depth of word knowledge compared to words taught with picture cards only. Results showed that previous work with songs revealed significant growth in preschool children's word learning when songs were heard two or four times.

The finding further showed that teaching words with songs enhanced children's receptive and productive definitional knowledge of target words. Children had significant pre-to-post-test growth on the receptive task when words were taught with a sung song (d = 0.41) and when words were taught with a rhythmically spoken song (d = 0.52). Results from the Productive Word Definition (PWD) (depth of word knowledge was measured using a researcher-created PWD) task similarly showed significant considerable pre-post-test growth for words taught with a sung song (d = 0.96) and a rhythmically spoken song (d = 1.12). These findings provide initial evidence that combining songs with explicit vocabulary instruction supports receptive and productive definitional word knowledge for preschool children.

The results of the Lawson-Adams et al. (2022) study hold several implications for teaching vocabulary through songs in preschool settings. First, songs provide a practical context for word learning when combined with picture card instruction of words. Second, teachers do not have to spend much instructional time supporting word learning through songs. Each song activity (sung and rhythmically spoken) took approximately five minutes. Three 15-minute sessions of vocabulary instruction spread across two weeks led to significant growth in word knowledge. Songs provide a quick, practical approach to supporting vocabulary in the preschool classroom and occur during an activity period standard in many classrooms but typically not intentionally used to foster vocabulary learning. Third, the modality in which songs are performed does not significantly affect children's word learning; however, rhythmically spoken songs may better enhance the depth of word knowledge. The results provide initial evidence that teachers can support vocabulary through rhythmically spoken songs that do not involve singing, allowing teachers the flexibility to use a song modality that is most comfortable for them. This study proves that teaching words/vocabulary using songs is effective, especially when using rhythmic songs. Children can significantly learn new words within two weeks. This exposure time provides new insights as it is relatively shorter than similar literacy interventions (Neuman, 2018; Loniza, 2017; Egbaria-Ghanamah et al., 2021; Yazici & Bolay, 2017). Perhaps this shows that interventions, when well-structured, need not take long. This has important implications for low-resource communities similar to the current study population, in that interventions need not be expensive for giving literacy remedies to children.

The addition of visual and auditory enhancements features to digital literacy tools can significantly enhance their effectiveness in promoting word learning. Li and Bus (2023) experimented on 183 three-five-year-olds in the USA to investigate the effects of visual and auditory enhancements in digital picture books on comprehension and incidental word learning. The results showed positive effects on incidental word learning from repeatedly listening to a digitally enhanced story. Thus supporting the relevance of multimedia learning principles in digital picture books, such as Mayer's (2021) multimedia principle of temporal contiguity.

Children's vocabulary growth promotes PA skills that are crucial for reading development. According to Metsala (1999), children's phonological processing abilities are critical for reading development, and phonological awareness skills are tied to fundamental vocabulary growth. In Metsala's study conducted in North America, 100 grade-one pupils with a mean age of 76.06 months formed the sample. The results revealed that grade 1 children with higher scores on vocabulary performed better on isolating initial phoneme and phoneme blending tasks, as well as phoneme blending of both high and low age-of-acquisition words. Another finding was that both groups of grade one children with high and low scores on vocabulary scored better on the word than non-word stimuli, with the high vocabulary group outperforming the low vocabulary group. Additionally, children performed better in the phoneme blending task on words acquired earlier than on words acquired later. These findings on grade one pupils did replicate Metsala's earlier findings with an experiment conducted on younger children aged 4-5. This study's findings showed that vocabulary affects PA as both 4-5-year-olds

and children in Grade One were found to perform PA tasks better for familiar versus less familiar words and better for words versus pseudo words.

Thus, familiarity with words promotes vocabulary among children. Friedlander et al. (2014) had similar findings as Metsala (1999) that children performed better on reading familiar versus non-familiar words. In a baseline study by Friedlander et al. (2014) in the Lufwanyama district of Zambia, grade 3 pupils were, on the one hand, presented with 20 most and 20 least used words in Bemba, and 20 most and 20 least used words in English on the other hand. These 20 most used words were identified as 'most used' by tabulating the number of times a word appeared in learners' language textbooks, as opposed to the pupil's vocabulary. Perhaps it was easier to use words in the language textbooks in class than the child's vocabulary for standardisation purposes. The pupils had the easiest time reading the most used words (12%) and the most challenging reading the least used words (6%). In the current study, digital stories and rhymes were used to enhance children's PA and vocabulary by using words that children were familiar with.

Thus, preschool should offer various activities that can help boost children's vocabularies, like stories, rhymes, and songs in a language that children are familiar with. Therefore, the more words children know in the language of instruction, the more quickly they will decode in print. An enriched vocabulary helps children transition from recognising oral language to recognising words in print and reading (Matafwali & Bus, 2013). Thus, children's literacy development begins with language (Eghbaria-Ghanamah et al., 2020). However, it should be noted that the home literacy environment has a bearing on the vocabulary acquisition of young children. This makes it imperative to provide interventions for young children before school entry.

Furthermore, the SES of families impacts children's vocabulary acquisition and can affect their future literacy attainments. A longitudinal study by Hart and Risley (1995) in the USA was one of the first to explicitly link vocabulary size to the socioeconomic status of very young children. They studied the circumstances of early language learning and the fundamental role of home and family in the emergence of language and word learning. The vocabularies of 42 children were studied from when they first began to say words around ten months until they were about three years old. These children came from three SES backgrounds: professional, middle class and welfare families. Children from all three groups of families started to speak around the same time and developed good structure and use of language. However, in a year, children in professional families heard an average of 11 million words. In comparison, children in working-class families heard an average of 6 million words and children in welfare families heard an average of 3 million words.

Consequently, by age four, a child from a welfare-recipient family could have heard 32 million words fewer than a classmate from a professional family. The study revealed a correlation between SES and the children's later linguistic/academic development, attributed to the quality of conversations parents had with their children. For instance, in low SES families, they report that parent-child interaction tended to involve directives given to the child. In contrast, in families with higher SES backgrounds, interactions between the parents and children were more conversational. Mayer (2009, 2021) states that stories told conversationally rather than formally are more beneficial for children. In Risley and Hart's study, conversational parent-child interactions are likely reasons why children from lower SES do not perform as well as

children from middle SES backgrounds on standardised vocabulary tests. They conclude that children born into homes with fewer economic resources learn fewer words, and fewer experiences with words characterise their interactions with others. Consequently, they acquire a vocabulary of words more slowly. Lawson-Adams et al. (2022) report that disparities in academically valued vocabulary outcomes are associated with socioeconomic and linguistic divides, making it challenging for children from diverse, minority backgrounds to comprehend school texts and sustain reading achievement in school.

3.2 Role of Digital Stories and Rhymes in the Acquisition of Reading Skills

Nursery rhymes are more effective in promoting ability to read compared to traditional explicit instruction. An intervention by Baleghizadeh and Dargahi (2010) revealed that reciting nursery rhymes without reading the texts promoted word reading among seven to nine-year-old Iranian learners learning English as a second language compared to learners traditionally taught word reading. This study by Baleghizadeh and Dargahi (2010) examined which of the two methods of sound teaching, the use of nursery rhymes (experimental condition) or the traditional sound approach (control condition), is more effective in promoting the ability to read words among EFL (English as a Foreign Language) children. In the two groups, the children were taught the same letter sounds, and they concluded that the children introduced to nursery rhymes did better on reading the target words than those taught using the traditional approach. In addition to rhymes, stories have been reported to enhance children's literacy skills. Yazıcı and Bolay (2017) investigated the effects of story-based activities on literacy skills among 86 preschool children in Turkey. They reported that when story-based activities were implemented for

30 hours within six weeks, significant gains in reading, alphabet knowledge, phonological awareness, vocabulary, and pronunciation in preschool children were recorded.

The mismatch between the language of instruction and familiar language affects acquisition of oral language and reading skills, rhymes are among the reading interventions used to bridge this language mismatch gap. Egbariah-Ghanamah et al. (2021) postulated that the discrepancy between spoken and standard Arabic might restrict the benefits of oral language proficiency to subsequent literacy skills. Thus, they conducted a randomised control trial in Israel to test whether an intervention programme implemented in preschool that familiarised children with rhymes in standard Arabic through recitation facilitated reading and writing in first grade. One hundred thirty-six preschool children were followed up in first grade (mean age, 6:6). All the children were native speakers of Arabic and came from a middle-low socioeconomic background. The study randomly selected and assigned equal numbers (n=27) of children to four intervention groups and one control group (n=28). The four intervention groups were reciting alphabet-related rhymes, listening to alphabet-related rhymes, reciting non-alphabet-related rhymes, and listening to non-alphabet-related rhymes. Children in the control group engaged in non-linguistic activities. Each group had 28 animated rhymes in standard Arabic supplemented by pictorial illustrations. The rhymes had eight words for each, with the fourth and eighth words rhyming. These rhymes had content relevant to the children's lives, and research indicates that children's literacy activities must be culturally relevant (Phillips, 1999). The intervention sessions were 30 minutes each twice a week for six weeks. The interventions were done in groups of four to five preschool children. Grade one assessments were done a year after the intervention at the end of

grade one. In Standard Arabic, children were individually assessed in reading and spelling abilities and oral language proficiency (phoneme isolation, receptive vocabulary). Univariate General Linear model analyses followed by simple contrast analyses showed that children in the four intervention groups outperformed the control group in reading and spelling. Results further indicate that children in the two rhyme-based intervention groups (reciting and listening groups) performed significantly better on reading and spelling than the non-rhyme-related groups.

It did not matter which intervention group the children were in; they still outperformed the control group in faster reading rates. The two reciting groups read words within a minute more accurately and spelt them more accurately. Children who were given interventions in reciting and listening to nursery rhymes in preschool had significant advantages in reading and spelling a year later in first grade compared to learners in the control group. Children in the intervention groups significantly outperformed children in the control group in phonemic awareness and vocabulary skills. This study also tested the intervention and text (alphabet and non-alphabet) effect on reading. They report that recitation groups had a more significant main effect than the listening groups. At the same time, there is no significant main effect of the type of text used, whether alphabetic or none alphabetic, on reading and spelling. According to the authors, these results also highlight the role of oral language exposure and oral language proficiency in a new language that differs from the spoken language in the child's home environment, specifically concerning the mastery of reading and spelling in the new language. (In this study, the trainers explained the difficult MSA words of each rhyme using pictorial illustrations for the practice session for the two active recitation groups. In

the current study, children independently listened to the rhymes repeatedly, with no added explanations of difficult words. Additionally, the current study included stories in the intervention programme, with a grade one follow-up period of 15 months compared to this study, of 12 months.

Exposure to nursery rhymes have long term effects of pre-schooler's reading attainments, later in first grade. Bryant et al. (1989) found a strong correlation between preschool knowledge of nursery rhymes and reading and spelling success in grade one leaners in Britain. They hypothesised that acquaintance with nursery rhymes affects children's reading ability. To establish whether this, they collected longitudinal data over three years from 64 children aged 3, 4 to 6, 3 that were native English speakers. The children came from diverse backgrounds in terms of social status and parents' level of education. By the time the children were six, most had been in school for a year and had begun learning to read. Their study focused on establishing the relationship between knowledge of nursery rhymes and children's reading and spelling acquisition after three years. They also aimed to establish whether the effect of rhymes on phonological sensitivity could explain the link between knowledge of nursery rhymes and reading. Children's knowledge of nursery rhymes was measured by asking the child to recite five very popular rhymes. For phonological sensitivity, children were given a rhyme detection task at ages 3;4 and 4;7, a phoneme oddity task (both initial and end sound) at ages 5;7 and 6;3, and an object naming test at age 4;11. For the reading tests, children at 5;11 and 6;3 were asked to underline the word representing a picture or finish a sentence from a choice of four to six words. Spellings were also given to the children at 5;11. Children's

vocabulary was also measured at ages 3;4 using a version of the Peabody Picture Vocabulary test.

They found a strong relationship between early knowledge of nursery rhymes and success in reading and spelling at age 6;8 over two to three years, even after controlling for social background, intelligence, and initial PA skills. This implies that the reading and spelling outcomes cannot be attributed to the children's background, intelligence or initial phonological sensitivity. The results imply that early and entirely informal experiences or knowledge of playing with language in the form of nursery rhymes play an essential role in children's acquisition of skills for learning how to read, especially when we factor in the time children were tested for rhyme knowledge at age 3;3 and tested for reading at age 6;8. The rhymes were reported to enhance phonological sensitivity, and it is this sensitivity that helps children learn how to read. Path analysis showed that the paths from nursery rhyme knowledge to rhyme and phoneme detection and through to reading were strong, while a direct path from rhymes to reading was insignificant. Chard and Dickson (1999) equally postulate that instruction in simpler PA skills, such as rhyming, may not directly benefit reading acquisition. However, instruction in segmenting and blending seems to provide the most significant benefits to reading acquisition. This study collected longitudinal data, and the authors acknowledge that in as much as their study is consistent with a causal claim, they do not entirely establish that the claim is correct and postulate that evidence from intervention studies is needed. This current study used an intervention in the form of a randomised control trial to establish the effect of rhymes on reading acquisition.

Letter knowledge specifically letter names has been reported to improve reading skills. Evans et al. (2006) correctional study conducted in Canada among 149 middle SES children reported that knowledge of letter names showed an independent causal influence on the ability to read words (β= .51, p=.001). However, neither cognitive ability nor PA in kindergarten was statistically significant for word reading in grade one. When letter sounds were substituted for letter names in the model, letter sounds independently contributed to the prediction of grade one reading (β=.41, *p*=.001); again, PA was not statistically significant. (When cognitive abilities and PA were controlled for, letter-name knowledge predicted a 51% increase in word identification in grade one, while letter-sound knowledge predicted 41% after controlling for the other variables). This study confirms that letter names and letter sounds strongly predict word reading in grade one. However, the researchers caution that the study was naturalistic and did not have control over potential school effects. This current study controlled for school effects and factored in the influence of LSES, as it has been found to affect children's literacy outcomes (Mwanza-Kabaghe, 2015, 2022). The methodology used by Evans et al. (2006) does not prove the causal influence of one variable to the other, a limitation that could be overcome in experimental designs. Cunningham (1990) postulates that the nature of the relationship between phonemic awareness and reading cannot be determined based on correlational findings and argues that additional experimental studies are needed. In the study under review, the PA test that was used in kindergarten only had one aspect of PA (initial sound), while the grade one test on PA only focused on end-sound. Perhaps this could explain why, in Evan's study, PA did not predict letter-sound knowledge and reading.

3.3 Home Literacy Environment and Response to Digital Literacy Interventions

When children do not adequately respond to reading instruction, interventions are often implemented to address deficiencies in basic or component skills associated with reading performance (Norris, 2020). Children need to be exposed to experiences that allow them to interact with letters in pre-school and at home. Exposure to written material in the home cultivates an awareness of print even without direct instruction (Chansa-Kabali, 2014). Hess and Halloway (1984) identified the following aspects of the home literacy environment as being related to reading achievement in children: members of the family seen reading at home, telling or helping the child to interact with reading materials, amount of print materials at home, reading to children in the home and telling children stories. Activities in the home, such as storytelling, singing, assisting children with school work, shared book reading, and naming everyday items within the immediate environment, are related to improved reading and maths skills among children (Ndijuye, 2020).

Additionally, how children are exposed to printed words in the home and how much access they must have to books and print to practice their emerging reading skills are fundamental aspects of the HLE. The HLE is not only about materials in the home but also how such materials are used to engage children (Friedlander et al., 2014) in literacy activities. However, some homes fail to provide rich HLE to support children's emergent reading (Bohrer, 2005). Tambulukani and Bus (2012) visited a few homes in three Zambian districts. They revealed hardly any print (e.g., advertisements, calendars, coupons, TV guides, invitations, books, magazines, and newspapers) or other incentives for becoming literate.

Shared book reading between adults and children promotes reading development among children. Literature has consistently shown the advantages of shared reading at home (Furenes et al., 2021; Shahaeian et al., 2018; Shen & Tufo, 2022). A home literacy environment enriched with shared reading, songs and rhymes has been beneficial in supporting children's academic achievement from low SES. A study by Chansa-Kabali of 72 Zambian first graders aged 7-8 from low-income communities of Lusaka revealed that family possessions (a measure of SES) significantly explained the unique variations in orthographic awareness (letter knowledge and recognition) decoding competence tests. At the same time, parental reading attitude and literacy activities significantly predicted decoding competence. Home possession accounted for 13% (d=.36, p=.01). Her research considered children between 7 and 8 years old and from a similar SES as the current study. Her study focused on the home literacy environment, providing a rich context that most studies do not focus on in total isolation.

However, some factors influence how children respond to reading intervention. Research shows that socioeconomic status is a well-known correlate of academic achievement (Mwanza-Kabaghe, 2015; Lawson-Adams, 2022; Norris et al., 2020; Rey-Guerra, 2022). In the USA, Norris et al. (2020) sampled children (N=1,651) who were in treatment groups from an earlier project that combined data from nine RCT interventions. These RCTs focused on the reading component skills of children at risk of reading difficulties. The interventions took one school year. The sample studied by Norris et al. (2020) ranged from 4.8 to 10.8 years old (age M = 5.73 years, SD = 1.09 years) and 48% of the children were from high SES. The pupils were from preschool to third grade. They hypothesised that family-SES would be associated with response to reading intervention.

They used a Letter-Word Identification (LWID) subtest and an expressive vocabulary subtest to measure reading decoding and vocabulary. Participants were required to individually read aloud printed letters for pre-schoolers or words for older children. The results showed that higher family SES was more strongly associated with greater responsiveness to intervention for both reading components under study (decoding and expressive vocabulary skills).

Furthermore, in homes with rich literacy interactions, children are exposed to activities that give them an experience with letters and letter sounds from an early age. Such activities include but are not limited to storybook reading, songs and games (Randolph, 2012). Since children learn to read through active engagement and construct their understanding of written language, adults in the home can help children by modelling behaviours, such as writing a shopping list. However, Luangala (2017) states that such activities as writing shopping lists are rarely done in most Zambian homes. However, even more meaningful than modelling literacy behaviours are the adult-child literacy interactions around print, reading together from pictures and texts (Clay, 1967), a practice rarely done in most low SES homes. To reaffirm the critical role of the HLE, Nkhata et al. (2019) in Mumba and Mkandawire (2020) reported that children with high literacy behaviour performed better than their counterparts with low literacy behaviour, regardless of whether they had preschool education. Therefore, providing children in low-resource schools and homes where the HLE is less stimulating with Cinyanja digital stories and rhymes may help boost their literacy skills.

Family SES and HLE are predictors of early reading skills. Ndijuye (2023) conducted a longitudinal study in Tanzania exploring how family SES and HLE

differences predict preschool children's school readiness and early reading and maths skills. A sample of 400 children with an average age of 5.9, ranging from 62 to 73 months, from low and middle-income families informed the study. Their findings show that HLE predicted the trajectory of children's school readiness and early reading skills, and family SES predicted children's early reading and math skills at the end of preschool. However, HLE and family SES did not significantly predict early reading or math skills change from pre-primary to grade one. The possible explanations could be that all children were exposed to early reading instructions that enhanced their skills during grade one regardless of family SES backgrounds. Furthermore, it could also be due to the high stability in early math and reading skills from preschool to grade one. Their findings further indicated that no significant differences resulted from differences in family SES and that the differences in family SES found during pre-school years persisted into grade one.

The current study used digital media in a local language to test the efficacy of such an intervention in promoting reading among grade one learners. By so doing, this study fills up the following gaps: the few longitudinal studies from preschool to first grade that used digital interventions for grade one reading used either stories or rhymes (Egbariah-Ghanamah et al., 2021), the current study used both stories and rhymes to augment the effects of each component in the development of reading skills. While some preschool longitudinal studies on digital interventions focused on one aspect of reading (PA, vocabulary, or letter knowledge), this study looked at the effects of the digital intervention on grade one reading skills in addition to prereading skills (PA, alphabet knowledge, rhyming and vocabulary) among first graders. In addition, most studies that

gave reading interventions were not longitudinal (for example, Sa et al., 2022). Some studies reviewed (Evans et al., 2006) recommended using experimental designs as they are more robust in establishing cause-and-effect. When the data collected was longitudinal, the studies reviewed ended at reporting results for preschool-level pre-reading skills. The current study goes beyond the preschool level to the end of first grade.

Longitudinal studies reviewed on reading intervention did not use digital interventions but instead taught intensive phonological awareness and phonics (for example, Shapiro & Solity, 2008). However, the current study did not explicitly teach literacy instruction to the children; instead, children were given literacy materials that enabled them to play with the language of instruction as an intervention measure. In the absence of intensive reading or literacy instruction, as in most low-resource public schools in Zambia, such an intervention that does not require adult involvement is resourceful. Some longitudinal studies were conducted among grade one children, but did not offer digital interventions (for example, Shaefer & Kotze. 2019).

Chapter Summary

This chapter provided an overview of the long-term effects of digital stories and rhymes on prereading skills and reading in grade one. Studies show that stories and rhymes are part of children's literacy foundations as they help facilitate phonological awareness, rhyming skills, vocabulary, oral language and reading skills, and spelling. Experimental studies show that exposing children to digital stories for as little as two to four weeks can facilitate reading and spelling at the end of first and second grade. These skills help with later academic skills of children. In addition, children need to be exposed to literacy activities in their early years to promote acquiring later reading skills upon

formal school entry. Thus, if children miss out on early literacy experiences in the home and school, they are at risk of reading failure. Furthermore, the HLE, especially parental literacy and the home SES, have been reported to highly influence children's reading acquisition and affect how children respond to reading interventions. The next chapter presents the methodological approach used in this study.

CHAPTER FOUR: METHODOLOGY

Overview

This section outlines the methods used in this study. It presents the research paradigm, the population, the sample size and the procedures used. It further details the intervention and assessment tests used in the study. A process of how the data was analysed is also presented, including ethical considerations.

4.1 Research Paradigm

This study is anchored in positivism, which posits that the social world or observations should be studied according to the same principles as the natural sciences, and explanations of a causal nature can be provided. Auguste Comte (1798-1857), the pioneer of the positivist paradigm, asserted that the exclusive and valid approach to advancing knowledge in comprehending human behavior involves employing a scientific method characterised by experimentation, observation, and reasoned analysis grounded in empirical evidence (2013). Positivists aim to objectively test a theory or describe an experience through observation and measurement to predict and control phenomena (Tubey et al., 2015). Obtaining reliable knowledge is based on direct observation or manipulation of natural phenomena through empirical, often experimental means. Positivism assumes that, nature of reality (ontological assumption) is objective meaning that reality is independent, and exists out there in the world and it needs to be discovered using conventional scientific methodologies. In positivism, the researcher takes on an independent stance from the research. The researcher stays distant or detached for they do not consider themselves as an important variable in the research, because the philosophical basis is that the world exists and is knowable.

Furthermore, positivists see social sciences as an organized method for combining deductive logic with precise empirical observations of individual behavior in order to discover and confirm a set of probabilistic causal laws that can be used to predict general patterns of human activity. Empirical facts exist apart from the researcher's ideas or thoughts; they are governed by laws of cause and effect, patterns of social reality are stable and knowledge of them is additive. Thus, positivism gives rise to a quantitative methodology.

Research approach

The present study employed a quantitative approach, chosen for its capacity to explain phenonema in numerical or quantifiable terms of how variables interact, influence events and cause outcomes. This approach enables researchers to understand causal inferences and examine the relationship between independent and dependent variables. The results of quantitative analysis have the capability to either confirm or refute hypotheses through statistical methods, with the added advantage of replication (Mukherji & Albon, 2015). Thus, one of the strengths of quantitative methods lie in its reliability. Quantitative methods involve the numerical analysis of collected information, allowing for generalization of results to the broader population. The objectives of the present study were quantifiable, necessitating statistical analysis to evaluate the long-term effectiveness of digital stories and rhymes on reading outcomes. Aligned with a positivist approach, this research explored innovative strategies for guiding young children toward literacy and examined the format through an experimental study.

Research Design

This study utilised an experimental design based on its ability to test hypotheses. Thus, to establish the effects of exposing preschoolers to digital stories and rhymes on

their ability to learn to read in first grade an experiment was utilised. In an experiment, subjects are randomly assigned to either an experimental or control group. This random assignment is essential for creating comparable groups to reduce the potential of confounding variables. The experimental group receives a treatment, and the results are compared with a control group that did not receive the treatment (Bell, 2010). This involves the researcher manipulating the independent variable to see its effect on the dependent variable (Creswell, 2014). This study's independent variable was digital stories and rhymes, while the dependent variable was reading skills.

The researcher randomly assigned the preschoolers to three groups: one was the treatment group exposed to digital stories and rhymes; the other two were control groups. Children were randomly assigned to digital non-literacy games in one control group, while the other control group was not exposed to anything. Randomisation was used in this study with the aim of establishing comparable groups, thereby mitigating potential biases arising from systematic differences among subjects. As noted by Fleiss et al. (2013), the purpose of randomisation is to minimise bias by ensuring that subjects across different groups do not differ in any systematic manner. This approach helps safeguard against biased research outcomes that could result from systematic group disparities, such as variations in age and sex. Additionally, this study was not designed to treat but to test the efficacy of the digital stories and rhymes; thus, the three groups needed to be comparative regarding skills and other background variables. As a result, there were no specific criteria for assigning children differently to the three groups. All the preschoolers in the three groups, the intervention group and the two control groups, were followed up

15 months later at the end of grade one to determine the long-term effects of the digital stories and rhymes on reading ability.

4.2 Population and Sample Size

The target population in this study comprised approximately 803 children from 23 public ECE centres in three districts of Lusaka province. The parents of these children enrolled at the selected ECE centres also formed the target population. The sample size was calculated using Yamane Taro's (1967) formula. This formula is used to obtain the optimal feasible sample size. Yamane's formula has been used by several scholars (Lungu, 2021; Ninlawan, 2015; Sarmah & Hazarika, 2012). Below is the formula and the sample size calculation that was used to determine the current study's sample;

Formula: $n= N/ K + N (e)^2$

Where :

n= sample size required,

N = population,

K =constant (1) and

e = degree of error expected (.05).

Since N=803, the sample size (n) calculation was as follows;

$803/1+803(.05)^2$

$803/1=803(.0025)$

$803/1+2.0075$

$n = 267$

However, to factor in attrition at the end of first grade, 108 pupils were added to this sample. Thus, the final sample was 375 preschool children. In Lusaka District, 225 children were sampled from the eight schools; in Kafue District, 105 children were sampled from the four schools; and in Chilanga District, 45 children were sampled from the two schools. Thus, three hundred seventy-five (375) preschool children were randomly sampled from 14 low-resource sources in Lusaka province.

Table 1: Sample Characteristics

Characteristics	**n**	**%**	**N**
Children's Gender			
Boys	169	47.87	
Girls	184	52.13	353
Primary Language			
Cinyanja	259	73.37	
Other	94	26.6	353
Parent Education Level			
No education-basic education	213	67.6	
Senior secondary education	76	24.1	315
Post-Secondary	26	8.3	
Parental Literacy			
Not at all	64	20.3	
A bit	82	26	315
Fairly well	87	27.6	
Very well	82	26	

However, 353 children (M_{age}*=81.09 months; SD=15.69*) completed pre-test assessments and participated in the intervention. There were 169 males and 184 females, and 259 (73%) of these children spoke Cinyanja; the rest came from homes where Bemba, Tonga, English and Lozi were spoken. The participants were predominantly from low

socioeconomic backgrounds. Of these, 46.3% of parents were illiterate or had low literacy levels, and approximately 67% of the parents had only obtained basic education or less. Only 8% of the parents had obtained post-secondary education (see Table 1). In addition, the average income per household was below the poverty line. The United Nations Development Programme (UNDP) (2023) indicates that as of 2018, 48.4% of the Zambian population lived in poverty, earning less than US $2.15 per day.

4.3 Sampling Procedures

Recruitment of pre-schools. The pre-schools in this study were recruited from the following three districts of Lusaka province: Lusaka District, Chilanga District and Kafue District. Lusaka province was targeted because of its multilingual nature (Mkandawire, 2023; Mwanza-Kabaghe et al., 2015; Tambulukani, 2015) resulting in multiple languages of instruction (LoIs) (USAID, 2021). Information from the District Education Board offices indicated approximately 803 preschool children in 23 public pre-schools annexed to public primary schools. Ten of these schools were in Lusaka district, seven in Chilanga district, and six in Kafue district. Of these 23 preschool centres, 14 were selected for inclusion in the study. The schools included in the study were selected based on two criteria. The first was the enrollment number of preschool pupils, as the schools needed a minimum number to select 15 or 30 pupils from each class randomly. The second criterion was that public preschools needed to be located within 15km of each district's administration centre to monitor the intervention effectively. The 14 public pre-schools meeting the criteria were all included in the study. The number of schools that met these criteria in the three districts was as follows: eight schools in Lusaka district, four schools in Kafue district and two schools in Chilanga district.

Selection of children. Children were selected using simple random sampling. In a random sample, every person in a sampling frame has an equal chance of being selected for inclusion. One way of obtaining a random sample is to write all the possible names on separate pieces of paper and shake them up in a container (Mukheji & Albon, 2015). In the present study, class lists were obtained in order to use them to select the children randomly. This was done by individually writing the children's names from the class list on pieces of paper. These pieces of paper were wrapped up to conceal the names fully and were put in an opaque bag. The papers were shuffled, and researchers picked either 15 or 30 names, depending on class size, by drawing names one at a time from the bag. Specifically, in a school with three classes, a total of 45 children were chosen, fifteen from each class.

Assignment of children. Children were randomly assigned to one of three conditions: digital stories and rhymes, digital non-literacy games, or business-as-usual. To ensure balanced sample sizes across the three groups, block randomization was employed, with block sizes being multiples of the number of groups. As outlined by Fleiss et al. (2013), block randomization aims to distribute subjects evenly across groups, thereby facilitating equal sample sizes. Consequently, within each school, an equal number of children were randomly allocated to each condition: digital stories and rhymes, digital non-literacy games, and no intervention. For instance, in schools where 30 children were randomly selected, ten were assigned to the first condition of digital stories and rhymes, 10 to digital non-literacy games, and another 10 to the group not exposed to anything. The random assignment was done by writing each child's name from a particular class on separate pieces of paper. These pieces of paper were put in a box, and

the researchers did the random assignment; every first child drawn was assigned to the digital stories and rhymes group, every second child drawn was assigned to the digital non-literacy games group, and every third child drawn was assigned to the group that was not exposed to anything. By the end of the random assignment, the 375 pre-schoolers were assigned in equal numbers to the three groups: the treatment group (125 children) and the two control groups (each had 125 children). All the guardians of the selected children were also part of the study.

4.4 Data Collection Instruments

4.4.1 Intervention Materials

The intervention materials comprised four Cinyanja digital stories and seven Cinyanja digital rhymes. These intervention materials were developed using the preschool teachers' and pupils' books for 3-4 and 5-6-year-old, approved by the Zambia Curriculum Development Centre. These preschool books are written in the language of instruction, which is standard Cinyanja used in the classroom. Thus, using Cinyanja words, e.g., *Mikango, Nkhunda, Mitengo, Maluwa, Nthoci, Lalanje, Mbuzi, Gulugufe*) from these books ensured that the correct Cinyanja words used to come up with the content for the intervention materials. This also ensured that age-appropriate words and language were used. The researchers adapted three of the four stories used in the intervention from the stories in the Zambia Primary Reading programme published by Cambridge University Press. The storylines from these storybooks were maintained. However, most of the story's characters and items were changed to include words used in the preschool books. The researchers created the fourth story using content from the preschool pupil's books. The researchers developed the rhymes with the help of

preschool teachers and language experts from the University of Zambia School of Education.

These digital intervention materials were presented using 7-inch Samsung Galaxy tablets. The stories and rhymes had the following multimedia features: animations, background sound, oral narration and music. The shortest story lasted 48 seconds, while the longest was 140 seconds. Similarly, the shortest rhyme lasted 35 seconds, while the longest was 81 seconds (*see Table 2&3*). The total length of the stories was 339 seconds (5. 39 minutes), and the rhymes were 378 (6.18 minutes) seconds in length.

Table 2: Cinyanja digital stories

Stories	**Words**	**Seconds**	**Target words**
Cule ndi kamkunkhuniza (The Frog and the Beetle)	51	88	Buluzi [Lizard], Cule [Frog], Kamkukhuniza [Bettle]
Zipatso ndi zamasamba (Fruits and Vegetables)	171	140	Zipatso [Fruits], Zamasamba [Vegetables], Ntochi [Bananas], Lalanje [Orange]
Ukonde (Net [*butterfly net*])	44	63	Cinkuwala [Caterpillar], Ukonde [Net], Cidiza [Grasshopper], Minga [Thorn], Cule [Frog], Lumpha [Hop], Thawa [Run], Maluwa [Flower], Gwira [Catch]
Piko yamwana Wankhuku (The Chick's Feather)	21	48	Piko [Feather], Mphungu [Eagle], Nkunda [Pigeon], Mbuzi [Goat], Thawa [Ran], Galu [Dog]
	287 total words	339 total seconds	

An example of one of the stories adapted from the Zambia PRP is that of *Cule ndi Kamkunkhuniza* (The Frog and the Beetle). In this story, the beetle accidentally woke the sleeping frog, which caught the beetle on its tongue and wanted to eat it. The beetle pleaded with the frog to let it free. The frog let the beetle go, and the beetle expressed gratitude to the frog. One day, the frog was stuck in a hole and could not jump out, and all the animals that passed by could not help the frog out of the hole. The beetle came by and offered to help. However, the frog wondered how the beetle would manage to free it. The beetle started to roll balls of dung into the hole. When the hole was filled to a certain level, the frog leapt onto the dung heap and jumped out. The frog thanked the beetle. Below are the dump screens for the story.

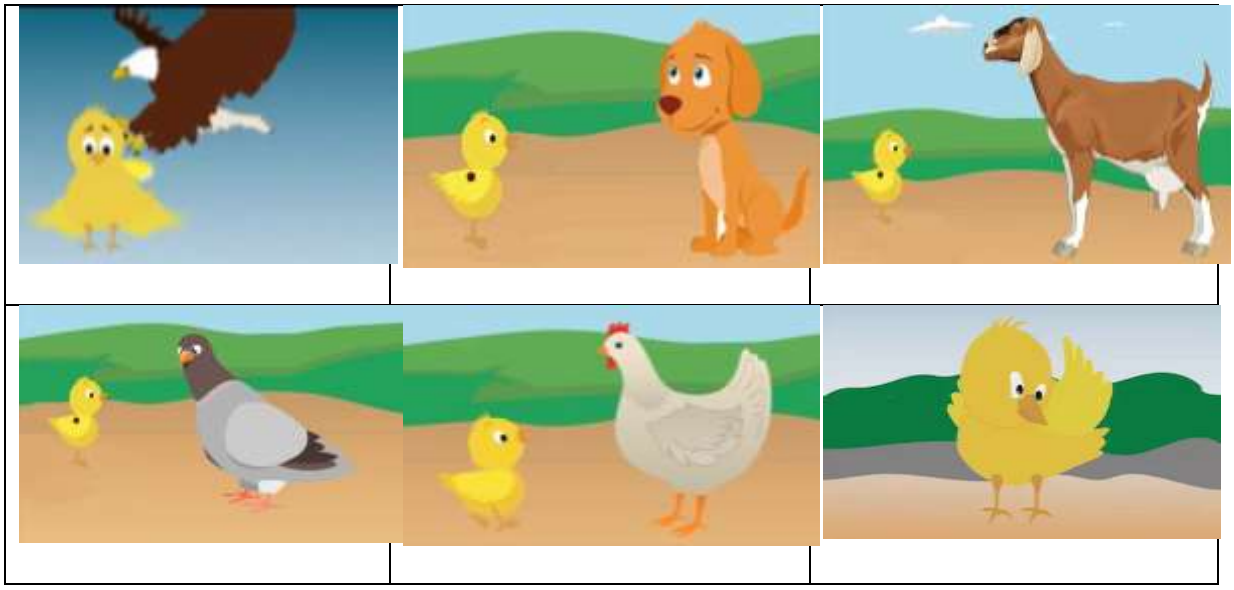
Figure 1: Screen dumps from the digital story of the Cule ndi Kamkunkhuniza (The Frog and the Beetle)

Table 3: Cinyanja digital rhymes

Rhymes	Words	Seconds	Rhyming words
Patu (Our Home)	22	36	Nyumba-nkumba, Nkunda-Munda, Zobvola-Cobvala
Tumbewa (Mice)	17	81	Uwa-Kathawa-Twathawa-Tumbewa-Kambewa
Amalume ndi mbalame (Uncle and the Bird)	16	40	Amalume-Mbalame Mpando-Nyundo Tyoka-Mbululuka
Cithunzi-thunzi (Picture)	31	68	Moto-Poto Mbudzi-Mudzi
Cona (Cat)	28	55	Ziwiri-Kwambiri Asanu-Pacisanu Adyeratu-Zitatu
Kumudzi kuli agogo (My Grandmother's Village)	16	63	*Mikango-Mtengo,* Zifana-Zimuna
Fisi (Hyena)	11	35	*Chipupa-Fupa-Onenepa*
	141 total words	**378 total seconds**	

An example of a story used in the study was *Piko Lamwana Wankhuku* (The Chick's Feather). This story was about a chick who lost a feather while freeing itself from an eagle that had caught it. The chick asked different animals if they had seen her lost feather, and all the animals responded with a "No". However, when the chick went to its mother to ask if she had seen the lost feather, the chick realised that its feather had grown back. Below are the dump screens for the rhyme.

Figure 2: Screen dumps from the digital story of the Piko Lamwana Wankhuku (The Chick's Feather)



4.4.2 Research Instruments

This study used a combination of standardised or already existing measures and author-devised measures (*see Tables 4 &5*).

Table 4: Standardised measures

Test /Measure	Number of items	Pre-test		Post-test		Post-post test	
		N	Alpha (α)	N	Alpha (α)	N	Alpha (α)
Alphabet Knowledge							
Letter naming	24	353	.880	342	.897	242	.929
Letter identification	24					239	.938
Letter sound	24	352	.832	343	.847	242	.928
Letter sound identification	24	353	.912	342	.909	242	.952
Phonological Awareness							
Syllable segmentation	4					240	.846
Initial sound identification	10					240	.943
End sound identification	10					241	.938
Sound blending	10					241	.929
Vocabulary							
Familiar language	20	353	.463	342	.409	242	.311
Peabody	30						
Reading							
Own name							
Two letter words	4					241	.874
One syllable words	4					241	.847
Two syllable words	4					241	.872
Three syllable words	4					241	.883
sentences	2						
Reading comprehension	4						
Writing							
Own name							
Letters of the alphabet	26					239	.946

Table 5: Researcher–developed measures

Test /Measure	Number of items	Pre-test		Post-test		Post-post test	
		N	Alpha (α)	N	Alpha (α)	N	Alpha (α)
Phonological Awareness	20	352	.228	341	.541	xxx	xxx
Rhyme recognition	20	356	.849	340	.846	242	.865
Rhyme production	20	351	.786	338	.817	241	*.815*
Picture rhyming							
Vocabulary							
Receptive test	29	351	.466	339	.690	242	.573
Expressive test	30	352	.772	341	.775	242	.786

Below is a description of all the instruments used in the current study.

Background (Biographic data)

The caregiver/parent questionnaire collected information on the child's biographical data (name, age and sex), family size, school attended, residential area, home literacy environment and family's socioeconomic status. The following is a description of the components of the parent questionnaire.

The Socio-Economic Status Questionnaire (ZAMCAT) was used to measure home possessions. This has been used in Zambia by Matafwali (2010) and Mwanza-Kabaghe (2015). The parents answered this questionnaire, which included the following questions;

What type of roof does your house have?
What type of flooring is in your house?
Do you have water in your home?
Do you have electricity in your home?
Do you have a television in your home?
Do you have a radio in your home?
Do you have a stove?
Do you have a flushable toilet?
Do you own land, animals, a car, a bicycle?
Does your child have at least one pair of shoes, two pairs of clothes, sleep on a bed?

The family Literacy Questionnaire was adapted from the following: The Home literacy questionnaire Subtest of the ZAMCAT developed by the Zambian Early Childhood Development Project (ZECDP), the HLE questionnaire adapted from Mwanza-Kabaghe (2015), and Chansa-Kabali (2014). This instrument was used to collect information on the home literacy environment. It included the following aspects: parental education, parental literacy, quantity and quality of reading materials in the home,

frequency of independent and shared-book reading, incentives for reading and homework participation.

Alphabet Knowledge

Sub-tests of the Zambia Cognitive Assessment Tool, ZamCAT and Basic Assessment Tool, BASAT, were used to measure the children's alphabet knowledge. The ZamCAT was developed by the Zambian Early Childhood Development Project, launched by the Zambian Ministry of Education, Examination Council of Zambia, UNICEF, UNZA and the Centre on the Developing Child at Harvard University. The BASAT is a standardised Zambian instrument developed by the Ministry of Education. The BASAT is an individual assessment tool primarily assessing basic reading and writing skills in the first and second grades. These assessment tools have been used in Zambia by Kalindi (2005), Matafwali (2010), Fink et al. (2012) and Mwanza-Kabaghe (2015), among others.

Letter naming/knowledge test, BASAT & ZamCAT sub-test: This was a time 2-minute test used to assess the children's letter knowledge. Children were presented with 24 randomly arranged letters on a template and asked to name each letter as the assessor pointed at them. The assessor ticked the letters as the child was saying them. Correct letters were scored "1", and incorrect responses were scored "0". At the end of the two minutes, the assessor scored the correct scores and indicated them at the bottom of the core sheet.

Letter name identification, the ZamCAT sub-test, was also used to assess the learners' letter knowledge. Children were presented with 24 randomly arranged letters on a template and had to point at the letter upon hearing the assessor name it. All correctly

identified letters were scored “1,” and incorrect responses were scored “0”. At the end of the two minutes, the assessor scored the correct scores and indicated them at the bottom of the sheet.

Letter sound knowledge, BASAT sub-test: This was a two-minute timed test to measure the learners' letter-sound knowledge. Each learner was presented with 24 randomly arranged letters on a template and was required to point and produce the sound of each letter. At the end of the two minutes, the assessor stopped scoring the test, counted the correct responses and indicated the total score at the bottom of the score sheet. All correctly identified letters were scored “1”, and incorrect responses were scored “0”. At the end of the two minutes, the assessor scored the correct scores and indicated them at the bottom of the sheet.

Letter sound-identification, ZamCAT sub-test: This test was also used to measure the learner’s letter-sound knowledge. The learner was presented with 24 randomly arranged letters on a template and asked to point at the letter corresponding to the sound articulated by the assessor. Factor analysis of dimension reduction was done for all the letter tests, and the variable was named Letter knowledge. This was done at all three phases (pre-, post and post-post-test).

Phonological Awareness

To measure phonological awareness, both existing and research-developed tests were used. The BASAT measured *syllable segmentation, blending, and discrimination of initial and end sounds.* The researcher developed tests on rhyme production, rhyme recognition, and picture rhyming to measure the children’s rhyming skills.

Syllable segmentation (BASAT subtest): This assessed the learners' syllable segmentation skills. Learners were asked to name the number of syllables in each word read to them, consisting of 4 items.

Blending (BASAT subtest): This test measured the learners blending skills. Learners were required to blend the sounds into words. The test consisted of 10 items, and they were scored by indicating a "1" against each correct response and a "0" against each incorrect response. The total score was also indicated at the end of the test.

Discrimination of initial sound (BASAT subtest): The learner was required to identify the initial sounds in words. The test consisted of 10 items, and they were scored by indicating a "1" against each correct response and a "0" against each incorrect response. The total score was also indicated at the end of the test.

Discrimination of ending sounds (BASAT subtest): The learner was required to identify the ending sounds of words. The test consisted of 10 items, and they were scored by indicating a "1" against each correct response and a "0" against each incorrect response. The total score was also indicated at the end of the test.

Cinyanja rhyme recognition test: The children's ability to identify two rhyming words was assessed using this test. The assessor mentions two words that rhyme or do not rhyme, and the child must state whether the pair of words rhyme. Examples of rhyming words used in the test were *poto* and *moto*; examples of non-rhyming words were *mphando* and *nyumba*. To score this test, the assessor circled "1" for the correct response and "0" for the incorrect response. A total score was also written on the score sheet at the end of the test items.

The Cinyanja picture rhyming test measured the children's ability to identify two rhyming pictures. The test had three practice items and 20 test items. The child was presented with four pictures on the Samsung tablet for each test item and asked to look at four pictures. The child was asked to identify the pictures in the local language. If the child could not do so, the assessor told the child the item's name. Then, the child would be asked to repeat the names of the four items to ensure that the child was familiar with all items. After that, the child was asked to say two names of the pictures that ended with the same sound (rhyme). In one of the test items, the child was presented with pictures of *nyundo* (hammer), *tebulo* (table), *foni* (phone) and *mpando* (chair). The assessor circled "1" for the correct response and "0" for the incorrect response. A total score was also written on the score sheet at the end of the test items.

The Cinyanja rhyme production test assessed the children's ability to produce a word that rhymes with a word the assessor mentions. The assessor circled "1" for the correct response and "0" for the incorrect response. Children were given words to produce rhyming words: *gona, supuni, n'gombe dzinja*. A total score was also written on the score sheet at the end of the test items. All three rhyming tests were factorised into one variable at each phase (pre-, post and post-post test).

Vocabulary Skills

Vocabulary was measured using the two researcher-developed tests, the receptive one-word picture vocabulary test and the expressive one-word picture vocabulary test. Receptive Task. Receptive knowledge of words was measured using a researcher-created task modelled after the fourth edition of the Peabody Picture Test of Vocabulary (Dunn & Dunn, 2007). In addition, two existing tests were also used: Tambulukani's (2015)

familiar language test (however, this test was dropped due to low internal consistency) and the Peabody Picture Vocabulary Test, PPVT used by Matafwali (2011) and Mwanza-Kabaghe (2015).

Cinyanja Receptive One-Word Vocabulary test assessed pupils' ability to express themselves orally. It had a total of 30 items. The pupil was presented with four pictures on the tablet screen and was instructed to say the picture that most closely shows the word's meaning. After the child says the word, another set of pictures will appear with the next item. Four sample items are provided at the beginning of the test to orient the child to the task. The criteria for selecting distractors for this test were as follows: First, all the items were familiar to children from various socio-economic and Zambian cultural backgrounds. During testing, a child was shown four picture images and asked to select the image that depicted the target word. The target images were similar, but not identical, to those used in the instructional activities. The three images that did not match the target word were related to the word by concept, theme, or phonological form. Second, phonologically similar (e.g. if the target word was *galu*, a distractor would be *fulu*) to the target picture and semantically related to the target picture (e.g. *galu* and *pusi*). The assessor circled "1" for the correct response and "0" for the incorrect response. A total score was also written on the score sheet at the end of the test items. All three rhyming tests were factorised into one variable at each phase (pre-, post and post-post test).

Cinyanja one-word picture expressive vocabulary test: This test measures expressive vocabulary knowledge. This test had a total of 29 items. These were a mixture of nouns and verbs. The child was presented with a picture on the tablet screen, and the examiner asked the child to name the item on the picture. The child is instructed only to

use one word to name the item or activity on the picture. The assessor circled "1" for the correct response and "0" for the incorrect response. A total score was also written on the score sheet at the end of the test items. The Cinyanja receptive test, Cinyanja expressive test and the familiar language test were factorised into one variable.

Familiar language test: This test is based on individual pictures of items on Samsung tablets. Learners were individually asked to look at each picture and name the item or action in the picture in the Zambian language. This was adapted from the FLT used by Tambulukani (2015). In Tambulukani's study, the child was presented with a picture depicting different activities and was required to narrate what was happening. The assessor carefully listened to the child's vocabulary and ticked against words used on the score sheet under the appropriate language (Chichewa, Cinyanja, English).

The Peabody Picture Vocabulary Test (PPVT), adapted from Dunn & Dunn (2007), was used to measure the pupils' receptive language. This PPVT is a non-verbal language assessment tool with 30 test items. The learner is shown groups of four pictures and asked to point to the one representing the meaning of a spoken word by the assessor. The PPVT Revised version was translated into the test and adapted to the Zambian context. A version of the PPVT adapted to the Zambian context that was used by Matafwali (2010), Fink et al. (2012) and Mwanza-Kabaghe (2015) was used in this study.

Reading Skills

Pupils' reading skills were measured using the reading sub-test of BASAT. This sub-test had the following components: reading own name, two-letter words, one-syllable words, two-syllable words, three-syllable words and reading sentences.

Reading own name: The assessor wrote the child's name, and the child was asked to read the name. Each successful read was scored a 1, and the unsuccessful read a 0.

Reading two-letter words: In this sub-test, the child is presented with two letter templates, one at a time, and placed apart (assessors do not say the name/sound of the letters). The child is asked to put them together and read the syllable/word formed by the two letters. For example, the child would be presented with /y/ and /a/ and asked to put them together to form *ya;* the child would be scored correctly after successfully reading the word *ya*. This test had four items.

Reading one, two and three-syllable words: The assessor would present the child with templates with one, two or three-syllable words and ask the child to read. These three tests had four items; the assessor started with the one-syllable words and ended with the three-syllable words. Each correct was scored "1", and each incorrect response was scored "0". Examples of one-syllable words included *wa, pa;* two-syllable words, *tate* (*ta-te), mwana* (*mwa-na*); and three-syllable words, *amai* (*a-ma-i*), *makolo* (*ma-ko-lo*).

Reading Comprehension

Reading comprehension was assessed using the picture comprehension sub-test of the BASAT. The test consisted of 4 items. Each of these items has a picture, and against each picture, there were three words or phrases, one of which describes the picture. The child was required to identify by pointing and saying the word/phrase from among the three that describe the picture. For example, there was a picture of a person sleeping (*aligone*), and beside this picture were the following words: *alikudya* (eating), *aligone* (sleeping), and *alucapa* (washing).

Writing Skills

Pupils' writing skills were assessed using the writing sub-test of BASAT. This sub-test had the following components: writing your name, letters of the alphabet, two-letter words, one-syllable words, two-syllable words, three-syllable words and short sentences. However, analysis of writing skills was not conducted due to numerous zero scores.

4.4.3 Quality of Measurements

Training of data collectors: A total of 18 data collectors (assessors and research assistants) were recruited and trained to collect data at all four data collection points: pre-test, intervention, post-test, and post-post test. The pre-test and post-test training were done in May 2018, while the post-post-test data collection training was done in October 2019, and the main focus of the training was the BASAT. However, a re-training in other tests used at the pre and post-test was done. The data collectors also participated in interviewing the parents. The recruitment criteria included a GCE (grade 12) certificate, a minimum college qualification, fluency in speaking and reading both English and Cinyanja and experience working in a similar research setting. Data collectors who met the criteria and indicated their commitment to the research and to work in all three districts were recruited. The researchers intensively trained the data collectors to administer all the assessment items for one week. The training commenced with discussions on the data collectors' roles, duties and responsibilities. The importance of the research, proper conduct and ethics in the research were also discussed. The data collectors were trained in administering and scoring all the test measures, and they were allowed to assess children and report their experiences. In addition to data collection

payments, food and transport allowances were given to the data collectors. All the materials needed to collect data were also provided before the data collection. This ensured preparedness and time-saving.

Translation of research instruments into Cinyanja: The research was conducted in the local language of instruction, Cinyanja. As a result, all the instruments and intervention materials were translated into the standardised classroom Cinyanja. A professional language translator did the forward and back-translation of all the research instruments.

Pilot tests: The intervention instruments (10 animated rhymes and six animated stories) and all the test measures were piloted before data collection. These pilot tests helped the researchers prepare for the main study, mitigate anticipated challenges, and adjust the assessment tests, especially the researcher-developed tests. During the pilot tests, the duration of administration of the assessment measures was established, and this helped the researchers to plan the best way to assess the children. For instance, the entire assessment measure took over an hour for each child; considering the age of the children, it was decided that the assessments be done in two sessions. After the pilot study, only four stories and seven rhymes were chosen for the intervention. Data collectors also participated in one of the pilot studies; this helped refine their skills in using the instruments and prepared them for the primary data collection.

4.5 Reliability and Validity

Reliability refers to the extent that an instrument yields the same results over multiple trials, while validity refers to the extent that the instrument measures what it was designed to measure (Taber, 2018). To establish the reliability of the instruments used,

this study tested the internal consistency of the tests. The test-retest method could not be used for some measures due to the long-time interval between the pre-test and grade one assessments, and other measures such as the reading tests were only administered once. Cronbach's Alpha (α) is used to assess the internal consistency of the items. Cronbach's alpha coefficient normally ranges between 0 and 1, with coefficients closer to 1.0 indicating greater internal consistency of the test items (Gliem & Gliem, 2003). A guideline by George and Mallery (2003, p.231) indicates that a coefficient of "_> .9-Excellent, _> .8- Good, _> .7- Acceptable, _> .6-Questionable, _> .5-Poor, and _< .5 Unacceptable". The Cronbach alpha coefficients of the measures used in this study are presented in tables 4 and 5.

Ensuring precise measurement of the factors under study is essential for the validity of instruments. In this study, content validity was employed to evaluate the accuracy of collected data. Content validity measures the extent to which the items in a test accurately represent the information being assessed (Roebiato et al., 2023). For example, in a vocabulary test, content validity would consider whether the items effectively measure vocabulary. To ensure that the tests accurately reflected the intended constructs, the researcher-designed tests were grounded in principles from established standardized tests (e.g., Dunn & Dunn, 2007) and multimedia design (Mayer, 2001, 2009, 2021). Additionally, the instruments underwent thorough evaluation by preschool teachers and experts in ECE, literacy, and language. Furthermore, to ascertain the clarity of language and images, the instruments underwent three rounds of piloting, ensuring tasks were both accurate and easily understandable.

Construct validity is equally crucial for obtaining meaningful, accurate, and justifiable inferences. It is about how well a test measures the concept it was designed to measure (Taber, 2018). In this study, construct validity was verified by factor analysis (see tables 10- 12). Another way to measure construct validity for children's tests, is to ensure familiarity of items being used for assessment.

For instance, for Picture Vocabulary Tests (PVT) to exhibit construct validity, it is essential that the pictures employed are familiar to the children, as emphasized by De Bruin (2010). In addition to standardized tests, the current study utilised researcher-developed assessments such as the PVT and picture rhyming tests. The images in the intervention materials and tests were chosen from familiar sources, primarily preschool and grade one pupils' books. Ensuring the absence of ambiguity in the selected pictures was equally important. Furthermore, during the picture rhyming test, it was imperative to confirm the child's ability to correctly identify the pictures before proceeding with the assessment.

Furthermore, for intervention instruments to possess construct validity, it is essential that both the test designer and the test taker are acquainted with the cultural context of the participants involved in the assessment. If a notable disparity exists between the cultural backgrounds of the test designer and the test taker, the validity of the test could be compromised (De Bruin, 2010). Therefore, in the design of intervention instruments, it was crucial to ensure that voice-overs were performed by individuals familiar with the language of instruction, Cinyanja. This ensured accuracy in the cadence, sounds, and pronunciation of the language used.

In order to enhance internal validity and minimise bias during the data collection process, all the assessors, research assistants, researchers, and participants were double-blinded to group assignments. A researcher assigned to work in a different district assigned the participants to the intervention and control groups for another district. For instance, the researcher for Chilanga district assigned children to different groups in Kafue district, and the researcher for the Lusaka district assigned learners in Chilanga district. By so doing, the researchers and data collectors in each district were blinded to the group assignments. At the post-test and grade one assessment stages, researchers and data collectors switched districts and were only given the random selection of children, not the lists with random assignments. Throughout the study data were collected without knowing which group a child belonged to. Thus, everyone who participated in data collection was unaware of the assignment conditions when doing the assessments.

4.6 Data Collection Procedure

Before data collection, informed consent was obtained from all the guardians of the participating children. All the school head teachers and teachers of the participating children had been briefed about the research, the approximate length of the assessments per child and the duration the researchers and data collectors would work in the schools. The need for an assessment and intervention room was also explained in advance to give the schools enough time to prepare for the data collection process. All data collectors were introduced to the schools and familiarized with the head and class teachers. The data for this study were collected in three phases: pre-test, post-test and grade one assessments *(see Table 6).*

Table 6: Data collection phases

Activity	Period	Duration
Pre-test assessments Parent interviews	22nd May - 8th June, 2018	Three weeks
Intervention	11th June - 20th July, 2018	Six weeks
Post-test assessments Time-media interviews	27th July - 9th August, 2018	Two weeks
Grade one assessments	21st October -1st November, 2019	Two weeks

Pre-test: The first data collection phase was the pre-test in term two of preschool (May 2018). Pre-test data were collected by the three researchers with the assistance of 18 trained data collectors (these were grouped into 11 assessors and seven research assistants). The pre-test was conducted over three weeks. All tests were done individually and took place in the schools. In order to minimise or avoid distractions, a room or a testing area was explicitly designated to conduct the pre-tests. During the pilot study, it was established that the pre-test took about 60 minutes to complete for each child. It was decided that each child would be tested in two separate sessions. Pre-test items for sessions one and two were put together but separated so that each assessor would know where to stop for the first session. Thus, the order of the tests was the same for all children. The sessions were administered over two days. The first session had the following tests: letter knowledge, letter-sound identification, familiar language test, rhyme recognition test, picture rhyming test and rhyme production test. The second session had the Rapid Automatised Naming test (RAN), Expressive One-Word Picture Vocabulary test and Receptive One-Word Picture Vocabulary test. The scores were recorded on the attached

score sheets and arranged in the same order as the tests. All 375 randomly selected children took part in the pre-test.

The Intervention

Treatment group (digital stories and rhymes): Children were exposed to digital stories and rhymes presented on individual 7" Samsung Galaxy tablets. There were a total of 24 sessions in 6 weeks. The children had four sessions per week. In total, the intervention was 4.8 hours. The children listened to the entire 12-minute length of the digital stories and rhymes in each session, starting with the stories followed by the rhymes. These intervention materials were all arranged in the same order for all children. During the sessions, the children were solely engaged in listening to and watching the intervention materials; no other activities were conducted. The intervention occurred within the schools in a separate room from the classroom. The research assistants and researchers turned on the tablets and opened the file containing the stories and rhymes for the children. However, the children were instructed on how to play the rhymes and stories; all they had to do was press the "play" icon. Since the stories and rhymes were on auto-play, they only needed to press the "play" icon once. The children used headphones to listen to the intervention materials. At the end of each session, the researchers instructed the children not to replay the digital stories and rhymes.

Control group I (digital non-literacy games): Children played a digital non-literacy game (sub-way runner) about a young boy or girl being chased by Santa Claus. The game was filled with rewards the runner could obtain while on the run. This was played on a similar Samsung tablet that the treatment group used. Children in this group also used headphones while playing the game, which had different sounds and voice

prompts depending on what was happening. Likewise, the research assistants and researchers opened the file containing the game, and the children pressed the start icon on their own to play the game. The children in this group had the same exposure time and sessions as the treatment group. The children were free to restart the game whenever it was over, provided it was within the 12-minute exposure time. The researchers and research assistants always told the children to stop playing the games at the end of the 12 minutes. During each session, children in this group were not allowed to do any other activities but play the game. In each preschool, the two groups used the same room, one with digital stories and rhymes and the other with digital games. However, these were arranged so that these two groups sat opposite each other across the room to prevent the groups from being exposed to the materials the other group was engaged with.

Control group II (business as usual): The third group that was not exposed to anything continued with other classroom play activities. It should be noted that the intervention took place during the class time scheduled for free play, and this time was opted for in order not to disturb the usual classroom learning activities.

Post-test: Phase two was the post-test (July/August 2018), conducted eight weeks after the commencement of the pre-test. The post-test data collection started one week after the intervention was done. The instruments used and the process followed were the same as the pre-test data collection process.

Post-post test (grade one): The third phase was the post-post test done in grade one, 15 months after the pre-test (October 2019). Pre-school pupils randomly assigned to the following three groups (digital stories and rhymes, digital games, and nothing) in preschool were followed up in term three of grade one to assess their reading skills. All

tests were done individually and took place in school. In addition to the post-test assessment items, the BASAT and Peabody, one test item, the rhyme recognition test, was dropped. The assessment procedure was the same as the post-test.

Parent interviews: The parents were interviewed at two points because the two instruments were lengthy. The first round of parent interviews took approximately 20 minutes and was conducted during the same period as the pre-tests. Since the children were mainly assessed in the morning, the parents were interviewed in the afternoon. However, after the pre-test assessments were done, parent interviews were conducted in the morning. The parents were interviewed to collect information on the family background, home possessions, family literacy, and the child's socio-emotional well-being. The second round of interviews was conducted during the post-test period. Parents were interviewed on their family media time use. All parents were interviewed at their child's pre-schools. The schools provided a room for conducting the interviews. The researchers, research assistants and assessors conducted these interviews.

4.7 Data Analysis Strategy

Data processing and diagnostics. Data were coded and entered into IBM Statistical Package for Social Sciences, SPSS V23. Cronbach Alpha reliability scale was used to establish the internal consistency of the tests. Normality tests were run to check for Skewness and Kurtosis; data with extreme outliers were winsorised. Data that were not normally distributed were transformed to normalise them. Factor analysis was done on some variables to reduce the number of variables.

Data analysis. Data in this study were analysed quantitatively using IBM SPSS version 23. Descriptive statistics were generated for all variables, such as mean scores,

standard deviation, and minimum and maximum scores. Correlations were also conducted for the independent and dependent variables and covariates to check for group differences in the three groups. Regression analyses, specifically mixed model analysis, were utilised to determine the long-term effects of the digital stories and rhymes on the reading skills of grade one pupils. Effect sizes were also calculated to establish differences between the intervention and control groups where there were significant differences. Cohen's (1988) scale was used to interpret the effect size, where an effect size of 2 is a small effect, 5 is a medium effect and 8 is a large effect.

4.8 Ethical Considerations

Ethics in research encompass a set of moral principles of a study or research project to ensure protection of participants while maintaining scientific rigour of research (Aubrey et al., 2000; Maglio & Pherali, 2020). Among the key moral principles in social research are informed consent, freedom to participate, transparency about the true nature of the research, avoidance of deceit and violations of participants' rights to self-determination, respect for participant privacy, fair treatment of participants, and protection of participants from harm, including physical or mental stress (Robson, 2011). Additionally, ensuring anonymity, voluntary participation, and proper handling of data recording, storage, and usage are equally crucial aspects of research ethics. In the context of early childhood research and low-resourced populations, careful consideration of ethics is particularly important due to the vulnerability of children at this developmental stage and the socioeconomic challenges faced by the population.

This study carefully adhered to a number of moral principles in conducting the research, thereby upholding ethical standards throughout the study process. Prior to the commencement of the study, ethical clearance was obtained from the Ethics Committee

of the Humanities and Social Sciences of the University of Zambia (Approval no. 2018-Feb-001). Ethical clearance was renewed before the follow-up data collection in grade one. Permission was sought from both the Provincial Education Office and District Education offices to conduct the study in the sampled schools. The researchers also sought permission from the school administrators to conduct the research in the schools.

Given the involvement of children in the study, written consent was sought from their parents or guardians during both pilot testing and data collection for the main study. Parents and guardians were briefed about the study and its objectives before signing the informed consent forms. They were assured of privacy, anonymity and were also informed of their right to withdraw their child from the study at any time. As highlighted by Mukherji and Albon (2015), the underlying assumption of signed informed consents is that parents or guardians have a full understanding of the information provided in the document. Notably, in this study, nearly half of the parents were illiterate, necessitating the reading of the informed consent letters to them in a language of their choice. According to Heerman et al. (2015), for low-income underserved populations, informed consent procedures should commence with the traditional approach of utilising a formal informed consent document, which should be reviewed in the participant's preferred language and signed before participation. Additionally, this process can be complemented by employing enhanced communication approaches, such as low-literacy communication techniques, to ensure comprehension.

Additionally, assent was obtained from the children by offering a concise explanation of their involvement and expectations in the study. However, it's crucial to recognise that informed assent with children is an ongoing process and researchers ought to continuously check and ascertain if the children still wish to participate (Heerman et al., 2015; Maglio & Pherali, 2020). In the current study, children were encouraged to openly communicate if they felt fatigued, required a break, or desired to discontinue the assessments at any moment. Assessors were trained to recognise signs of dissent from the children and were instructed on how to redirect them throughout the study without the use of force or incentives. However, if dissenting behaviour persisted, assessors were advised not to attempt to re-engage the child. Given the young age of the children and the duration of the assessments, which were approximately 60 minutes each, the assessments were divided into two 30-minute sessions, and children were tested over a period of two days.

Chapter Summary

This research was conducted as a Randomised Control Trial to more efficiently test the effects of a digital programme on reading outcomes for first-grade learners. Preschool children were randomly chosen from preschool classes in public primary schools and given pre-tests. They were then randomly assigned into three groups: one received digital stories and rhymes in the local language of instruction, another played non-literacy digital games, and the third group continued with their business-as-usual activities. The digital stories and rhymes intervention lasted for six weeks, after which the children's reading skills were tested at the end of the first grade, 15 months later. The instruments used in this study are commonly utilised locally and internationally to assess reading skills in early childhood education and first grade. A linear mixed model

regression was conducted to establish the intervention's efficacy. The following chapter will present the study's findings.

CHAPTER FIVE: PRESENTATION OF FINDINGS

Overview

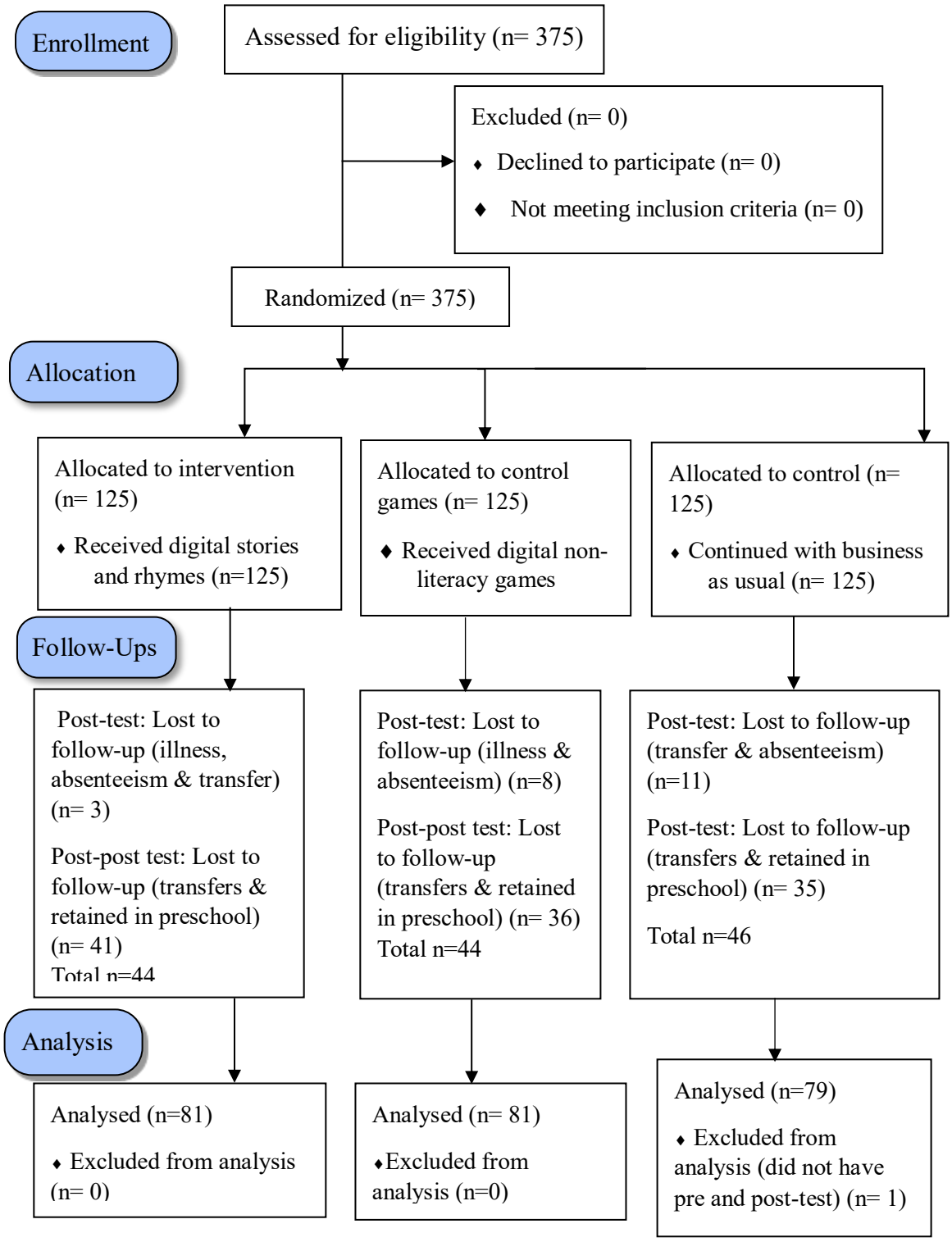
This study hypothesised that preschool children exposed to digital stories and rhymes would improve their literacy skills in grade one compared to children not exposed to these digital stories and rhymes. This study focused on the long-term effects of digital stories and rhymes on children's reading achievements in first grade. The outcome variables were letter knowledge, rhyming skills, phonological awareness skills, vocabulary and reading. This presentation of findings is based on the following three hypotheses of the study: i) exposure to digital stories and rhymes in preschool will facilitate the acquisition of basic reading skills: phonological awareness, alphabetic knowledge, and vocabulary; ii) children exposed to digital stories and rhymes in preschool will have better reading skills at the end of grade one, iii) children from less stimulating home literacy environments will be more susceptible to the digital programme. A flow chart (Figure 3) has been presented to show the recruitment and allocation of the experiment. This is followed by a comparison of children's background variables and test variables in the three condition groups. Analysis showing the effects of the intervention on the outcome variables was conducted using the linear fixed model, and these form the last part of the data presented.

5.1 Participants Flow Chart and Recruitment

The first data collection phase was the pre-test in term two of preschool (22nd May to 8th June 2018). Initially, 375 pre-schoolers were randomly selected, tested and assigned to the treatment group (125 children) and the two control groups (each included 125 children). Phase two was the post-test (27th July to 9th August 2018), conducted eight weeks after the commencement of the pre-test. However, there was attrition of about 5.8%

(22 children), leaving a total of 353 children at post-test aged between 46 and 119 months, with 169 males and 184 females. The third phase was the post-post-test, done in grade one from 21st October to 1st November 2019, 15 months after the pre-test. This phase had a total of 241 children.

Figure 3: CONSORT Participant Flow Diagram



Due to attrition, only 241 children from the intended sample of 375 took part in the assessments at the end of grade one. The *attrition* at the post-post-test stage (grade one) was 35.4%. That is, 133 children did not make it to the last phase of the study. This *attrition* was mainly due to two main factors: about 13.6 % (51) of children had been transferred to other schools that were not part of the study, and 16.3% (61) did not transition to grade one. These remained in preschool because they did not meet the assessment requirement to proceed to first grade, so they were dropped from the study. The other 5.5% were constantly absent throughout the study. The age of children tested at the end of grade one were 68 to 133 months, with a mean age of 98.18 (SD 15.05). In the three conditions, the average age was similar: animations (M=99.56, SD=15.51), control I (M=98.30, SD=15.38), and control II (M=96.32, SD=15.30). The digital stories and rhymes treatment group had 81 children, the digital non-literacy games control group had 81, and the business-as-usual control group had 79 children. Attrition was balanced across the three groups, with the intervention and control group I each having an attrition of 44 and control group II of 46. Additionally, ANOVA tests revealed no differences in mean scores at the end of grade one for all three groups for variables under study, indicating no differential attrition.

5.2 Group Differences of Sample Characteristics and Background Data

Since background variables could affect outcome measures, ANOVA analyses were conducted to compare mean scores in the three conditions to see if there were any differences despite the random assignment. The results showed no differences among the three conditions in the background characteristics at pre-test (see tables 7 & 8).

Table 7: Means, standard deviations, and ANOVA tests for demographic characteristics

Variable	Intervention			Control I			Control II			
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*p-value*
Age in months	122	80.16	15.3	117	82.2	16.1	114	80.92	15.78	.60
SES (HPI)*	111	7.95	2.08	106	8.00	2.03	100	7.92	1.95	.96
Home-book reading	98	4.07	2.16	96	3.95	1.99	90	3.96	2.11	.90

**SES (HPI): The Home Possession Index measures socioeconomic status. Among the items asked were if the household owns a TV, quantity of clothing, shoes, water and electricity.*

Participants in the three conditions did not differ on child age F (2, 350) = 0.52, p = .60, socioeconomic status measured using Home Possession Index (HPI), F (2, 314) = 0.04, p = .96), and home book reading experiences, F (2, 281) = .12, P = .90 (see table 7). Chi-square tests also showed that there were no differences in the three conditions on gender, $\chi 2$ (2, n = 353) = 0.62, p = .73, primary language spoken at home, $\chi 2$ (2, n = 353) = 0.22, p = .9 and parent/caregiver's education level $\chi 2$ (10, n = 316) = 9.89, p = 45 (see table 8). The number (n) of children in each group has been reported as they were not the same for all variables.

Table 8: Frequencies and Chi-Square results for demographic characteristics at pre-test

Variable	Intervention		Control I		Control II		Total		
	n	%	n	%	n	%	n	%	p-value
Gender									.62
Boys	55	15.58	57	16.15	57	16.15	169	47.87	
Girls	67	18.98	60	17.00	57	16.15	184	52.13	
Primary Language									.22
Cinyanja	91	25.78	86	24.36	82	23.23	259	73.37	
Other	31	8.78	31	8.78	32	9.07	94	26.6	
Parent Education Level									.45
No education	5	1.59	7	2.22	4	1.27	16	5.08	
Primary	38	12.06	35	11.11	34	10.79	107	33.97	
Junior Sec.	37	11.75	27	8.57	26	8.25	90	28.57	
Senior Sec.	26	8.25	25	7.94	25	7.94	76	24.12	
Post-Secondary	3	0.95	12	3.81	8	2.54	23	7.30	
Bachelor's Degree	2	0.63	0	0	1	0.32	3	0.95	
Parental Literacy									.43
Not at all	22	19.8	25	23.6	17	17.3	64	20.3	
A bit	28	25.2	30	28.3	24	24.5	82	26	
Fairly well	29	26.1	23	21.7	35	35.7	87	27.6	
Very well	32	28.8	28	26.4	22	22.4	82	26	

5.3 Group Differences in the Pre-test Scores

This analysis showed whether the three groups in this study (intervention, control I, and control II) differed on the following pre-test variables subtests of alphabet knowledge, rhyming, and vocabulary, as well as the forward digit span and RAN. ANOVA and Kruskall Wallis test was done on these variables, as shown in Table 9.

Table 9: Group differences in the pre-test (N=353)

	Intervention			Control I			Control II			
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	p-value
Letter Knowledge										
Letter naming	122	1.75	2.24	117	1.85	2.56	114	1.71	2.32	.93
Letter sound	122	2.52	2.79	116	2.5	2.89	114	2.37	3.06	*.65*
Letter sound identification	122	1.72	1.62	117	1.67	1.58	114	1.90	1.72	*.63*
Rhyming										
Rhyme recognition*	122	10.45	2.54	116	10.19	2.58	114	10.54	2.12	.54
Rhyme Production	121	2.01	2.52	117	2.29	3.07	118	2.64	3.62	.85
Picture rhyming*	121	5.13	3.96	117	5.27	3.58	113	6.11	4.15	.12
Vocabulary										
Receptive language*	120	13.96	3.28	117	13.56	3.51	113	13.85	3.58	.66
Expressive Language*	122	4.34	2.07	116	3.87	2.18	114	4.19	1.75	.19
Familiar Language*	122	7.77	1.97	117	7.50	2.30	113	7.95	2.15	.27

*ANOVA tests were applied to these variables, and Kruskal Wallis was used on the other variables.

ANOVA tests were run on rhyme recognition, picture rhyming, familiar language, receptive and expressive language and forward digit span, and Kruskal-Wallis was run on the other variables. The results of the ANOVA and Kruskal-Wallis showed that children's scores on the pre-test measures did not differ in the three conditions.

5.4 Data Reduction

Exploratory Factor Analysis (EFA) was carried out to reduce the data to smaller sets of summary variables. EFA summarises data for easier interpretation and

comprehension of the relationships of observed variables in a particular measurement tool. Factor analysis of dimension reduction was performed on the variables of interest at pre-test, post-test and grade one to check if they loaded on the same component, implying that they measure the same factor.

Pre-test data reduction

The three pre-test vocabulary tests (expressive language test, receptive language test and standard language test) were combined into one variable named pre-test vocabulary. The three pre-test rhyming tests (rhyme recognition, rhyme production and picture rhyming tests) were combined into one variable named pre-test rhyming (see Table 10). The three pre-test scores for letter naming, letter sound, and letter sound identification were summarised into a single variable called 'letter knowledge'.

Table 10: Factor analysis for pre-test variables

Principle component analysis item	**Component 1**
Pre-test Rhyming	
Rhyme recognition	.597
Rhyme production	.778
Picture rhyming	.696
Pre-test Vocabulary	
Expressive language	.808
Familiar language	.814
Receptive language	.317

Post-test data reduction

All three post-test outcome variables measuring letter knowledge, rhyming and language skills were separately reduced, as shown in Table 11.

Table 11: Factor analysis for Post-test variables

Principle Component Analysis Item	Component 1
Letter knowledge	
Letter naming	.783
Letter sound	.853
Letter sound identification	.860
Rhyming	
Rhyme recognition	.742
Rhyme production	.676
Picture rhyming	.680
Vocabulary	.823
Expressive language	.630
Familiar language	.663
Receptive language	

Post-post-test Data Reduction

Factor analysis of dimension reduction was conducted on the four-letter knowledge tasks, and they all loaded on the same component, implying that they measure the same construct. The three language tests were grouped and named grade one/post-post-test vocabulary. The subtests of phonological awareness (syllable segmentation, initial and end sound discrimination and blending), rhyming subtests (rhyme production and picture rhyming) and reading subtests (reading one, two, three and syllable words, and sentences) were separately combined to form the following variables phonological awareness, rhyming and reading respectively.

Table 12: Factor analysis for Post-post-test variables

Principle component analysis item	Component 1
Letter knowledge	
Letter naming	.869
Letter name identification	.888
Letter sound	.860
Letter sound identification	.858
Vocabulary	
Expressive language	.814
Familiar language	.711
Receptive language	.695
Reading (words &sentences)	
Combines two sounds and reads	.819
Reads one-syllable words	.912
Reads two-syllable words	.943
Reads three-syllable words	.917
Reads sentences	.803

5.5 Bivariate Correlations

Correlations were inspected to check for linear relationships among the independent variables and between the dependent and independent variables. Correlations also helped check for multicollinearity, which should be avoided in regression. Based on Table 13, this multicollinearity assumption was not violated, as the correlation coefficients for the variables under study were below 0.7 with the exception of pre-test rhyming and grade one rhyming.

Table 13: Bivariate Correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13
1.Childs's age		-.087	-.189**	.063	.056	.127*	-.030	.306**	-.062	.154*	-.038	.181**	-.032
2. Parental literacy			.122*	.083	-.021	.099	.098	.075	.187**	-.064	.073	.021	.002
3. (SES) HPI				.158**	.031	-.049	-.018	-.006	.042	-.017	-.016	-.135*	.042
4. Reading Resources					.186**	.028	.009	-.080	.146*	-.079	.002	-.066	.080
5. Primary language						.098	.122*	.049	-.024	-.050	.120*	.036	.003
6. Pretest_letter_Knowledge							.120*	.230**	.396**	-.181**	.097	.226**	.304**
7. Pretest Rhyming								.256**	.235**	-.308**	.876**	.185**	.199**
8. Pretest Vocabulary									-.019	-.019	.228**	.335**	.077
9. Grade-1Letter Knowledge										-.415**	.211**	.310**	.666**
10. Grade-1 Phono. Awareness											-.353**	-.324**	-.528**
11. Grade-1Rhyming												.181**	.200**
12. Grade-1 Vocabulary													.351**
13. Grade-1 Reading													1

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

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

Table 13 shows that age correlated positively with pre-test letter knowledge ($r = .13$, $p < .05$), pre-test vocabulary and grade one vocabulary ($r = .31$ $p < .01$ and $r = .18$, $p < .01$), respectively. These correlations imply that older children performed better than younger children in these three tests.

Parental literacy also positively correlated with grade one letter knowledge ($r = .19$, $p < .01$), implying that the children from homes with higher parental literacy performed better in letter knowledge. SES positively correlated with reading resources ($r = .16$, $p < .05$). However, SES negatively correlated with grade one vocabulary ($r = -.14$, $p < .01$), implying that children with more home possessions performed poorly in vocabulary.

Pre-test letter knowledge had significant positive correlations with grade one letter knowledge ($r = .40$, $p < .01$), grade one vocabulary ($r = .23$, $p < .01$) and reading ($r = .30$, $p < .05$), indicating that children who performed well in alphabet knowledge at pre-test also performed well in letter knowledge, vocabulary and reading at the end of grade one.

Pre-test rhyming positively correlated with grade one letter knowledge ($r = .24$, $p < .01$), grade one rhyming ($r = .88$, $p < .01$), grade one vocabulary ($r = .19$, $p < .05$) and grade one reading ($r = .20$, $p < .05$). These correlations imply that children who performed well on rhyming at pre-test also performed well in rhyming, vocabulary and reading at the end of grade one.

Pre-test vocabulary positively correlated with grade one rhyming and vocabulary ($r = .23$, $p < .01$ and $r = .34$, $p < .01$ respectively). This shows that children who performed well in vocabulary also performed well in rhyming and vocabulary at the end of grade one.

However, the pre-test scores for letter knowledge and rhyming showed significant negative correlation with grade one phonological awareness ($r = -.18$, $p < .01$ and $r = -.31$, $p < .01$).

5.6 Analyses of the Long-Term Effects of Digital Stories and Rhymes on Literacy Achievements in Grade One

The children's literacy skills in grade one were assessed using the following pre-requisite reading skills: phonological awareness, rhyming ability, letter knowledge, and vocabulary. Reading skills were also measured by using the variables 'reading own name' and 'reading' (this included words and two short sentences). The results were tested across the intervention group, the non-literacy games control group, and the business-as-usual control group to establish whether the digital stories and rhymes improved children's literacy in grade one. Linear mixed model analyses were conducted to account for school differences. Table 14 shows the mean scores for the factors scores for all outcome variables.

Table 14: Mean scores for outcome variables

Variable	Intervention			Control I			Control II		
	N	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Rhyming	79	2.82	.977	78	2.84	.864	78	2.97	1.05
Phonological Awareness	79	1.49	.298	78	1.59	.323	78	1.55	.33
Letter Knowledge	79	.0094	.998	78	-.107	1.02	78	.053	.976
Vocabulary	79	.288	1.1	78	-.186	.88	78	-.139	.851
Reading	79	.987	.74	78	.794	.795	78	.87	.811

5.6.1 Digital stories and rhymes as predictors of phonological awareness, letter knowledge and vocabulary in grade one

Digital stories and rhymes as predictors of phonological awareness. It was hypothesised that listening to animated stories and rhymes in the language of instruction in preschool is associated with improved phonological awareness skills in grade one. Phonological awareness was assessed through measures such as rhyming skills (rhyme production and picture rhyming) and BASAT phonological awareness (segmentation, end and initial sound discrimination and blending). A mixed model analysis was employed to establish whether the intervention directly affected grade one phonological awareness and to control for school effects. The grade one rhyming skills were analysed first, followed by BASAT phonological awareness skills.

Effects of digital stories and rhymes on rhyming skills in grade one. The post-post-test rhyming was normally distributed. The skewness in the intervention group was .058 (SE=.220), and kurtosis was -.882 (SE= .437). In the games control group, skewness was .283 (SE=.224), and kurtosis was -0.96 (SE=.444), while in the business-as-usual control group, skewness was .070 (SE=.227), and kurtosis was -.353 (SE= .451). The ICC

was .17/(.17+.80) = .175, suggesting that 17.5% of the post-post-test rhyming skills were due to school differences. This variance was significant, p = .042.

A mixed model analysis of grade one rhyming skills was run to establish if the intervention had a main effect on grade one rhyming skills as the dependent variable and the conditions as the independent variable. The results showed no main effect of the intervention on grade one rhyming skills, β= -.01, SE=.03, p=.098, CI [-.12, .01]. There were also no significant differences between the control groups. Equally, when pre-test rhyming was added to the model, there was no significant main effect (β = .02, SE= .017, p=.206, 95% CI [-.05, .01]).

Effects of digital stories and rhymes on BASAT phonological awareness in grade one. The BASAT measured the other variables of phonological skills in grade one. Data were normally distributed in the intervention group with a skewness of 1.47 (SE=.269) and kurtosis of -.933 (SE= .532). In the games control group, skewness was -.118 (SE=.269), and kurtosis was -.960 (SE=.532), while in the business-as-usual control group, skewness was .065 (SE=.271), and kurtosis was -.880 (SE= .535). The ICC was first calculated to establish the school effect, and ICC was 006/ (.006+.096) = .058, suggesting that about 5.9% of the post-post-test phonological awareness skills were due to school differences. In the first step of the model, only the intervention, control groups and phonological awareness were added.

Table 15: Mixed model analysis for grade one phonological awareness

Parameter	Estimate	Std. Error	df	T	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	1.56	.03	13.88	52.36	.000	1.49	1.62
Intervention**	-.03	.01	229.73	-2.01	.046	-.06	-.00
Control groups***	.01	.02	230.53	.52	.605	-.04	.06

Significance is at 0.05. **Contrasted intervention with control groups. ***Contrast between the two control groups.

The results in Table 15 show that the digital stories and rhymes had a statistically significant main effect on phonological awareness skills in grade one for the intervention group (β = -.03, SE= .01, p=.046, 95% CI [-.06, -.00]) with an effect size of .18. There were no significant effects across the control groups, p=.605.

Digital stories and rhymes as predictors of letter knowledge. It was hypothesised that listening to digital stories and rhymes in the language of instruction in preschool is associated with improved letter knowledge in grade one. Results showed that the intervention did not have a main effect on grade-one letter knowledge. However, when the variable home possession index (HPI) is added to the model, there is a main effect on the intervention (p = .004). The random effects are presented in Table 16, followed by the fixed effects in Tables 17, 18 and Figure 2. The post-post-test letter knowledge had no outliers, and data in the three conditions were normally distributed. The skewness for the intervention group was .330 with a standard error (SE) of .269, while the kurtosis was -.920 with a SE of .532. The games control condition has a skewness of .333 (SE=.271), kurtosis was -.848 (SE=.535), and the business as usual control condition skewness was .232 (SE=.271) while the kurtosis was-.885 (SE=.535).

Table 16: Estimates of Covariance Parameters (School effects on grade one letter knowledge)

Parameter	Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Residual	.71	.07	10.59	.000	.59	.86
Intercept [subject = SCHOOL]	.26	.11	2.26	.023	.11	.62

Significance is at 0.05

The Intraclass Correlation Coefficient (ICC) for letter knowledge was .260/ (.260+.712) = .267, suggesting that a substantial part (26.7%) of the variance for letter knowledge was due to school differences (see Table 16).

Table 17: Mixed model analysis for grade one letter knowledge controlling for school

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	-.42	.16	90	-2.68	.009	-.73	-.11
Intervention**	-.16	.11	90	-1.42	.158	-.39	.06
Control***	-.32	.19	90	-1.67	.098	-.69	.06
Pretest_letter_knowledge	.49	.12	90	3.95	.000	.24	.74
Intervention* pretest_letter knowledge	-.00	.09	90	-.08	.940	-.18	.17
Control* pretest_letter knowledge	.12	.15	90	.75	.455	-.19	.42

Significance is at 0.05. **Contrasted intervention with control groups. ***Contrast between the two control groups.

The linear mixed model regression analysis results in Table 17 show that the digital stories and rhymes (intervention) did not have a main effect on grade one letter

knowledge skills for the intervention group (p=.158). The letter knowledge results for the control groups were also not (p=.098).

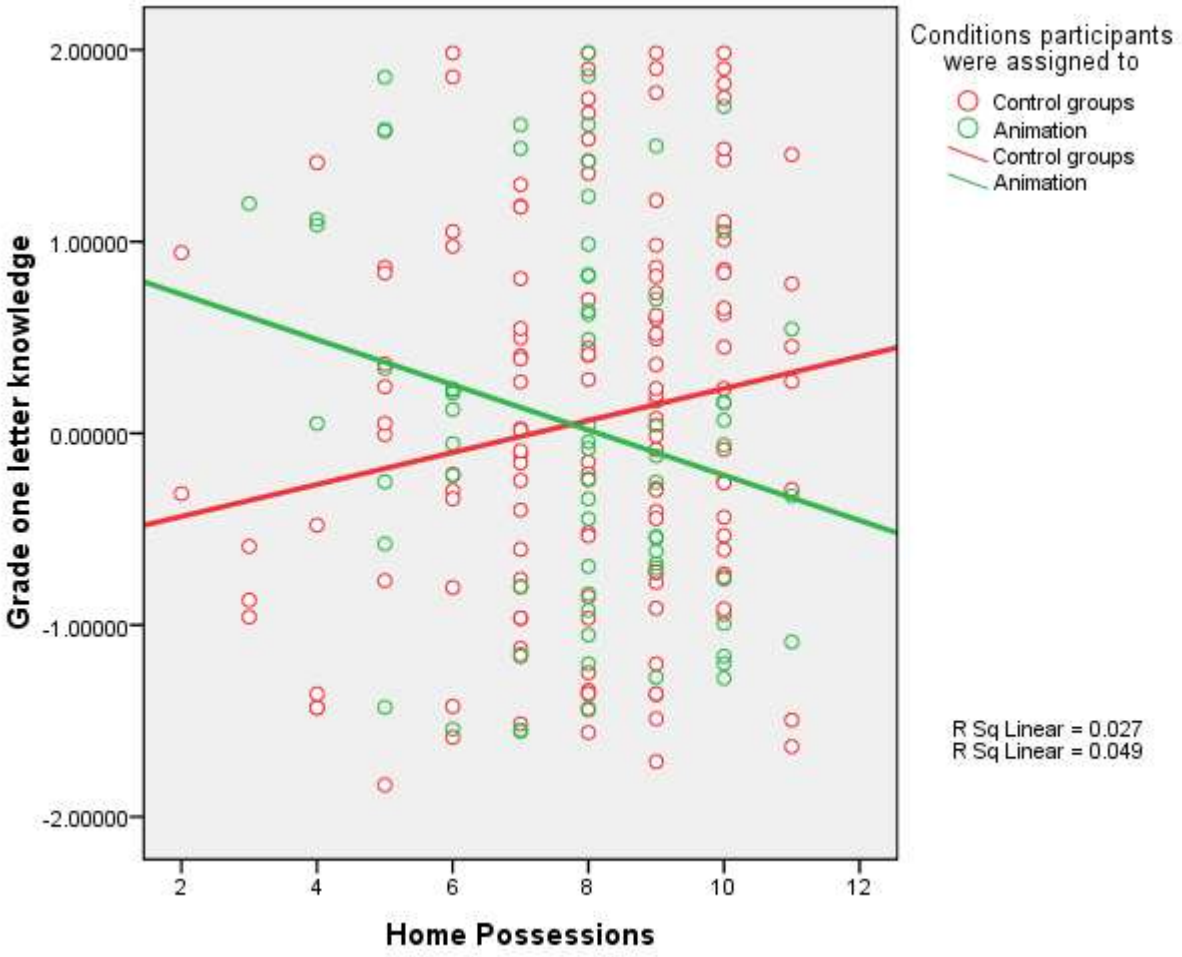
Table 18 shows that when the covariates, home possession and pre-test letter knowledge were added to the model, there was a statistically significant main effect for the intervention (β = .05, SE= .17, p=.004, 95% CI [.16, .84]) with an effect size of .2. There was also a significant interaction between the intervention and home possession (β = -.06, SE= .02, p=.004, 95% CI [-.01, -.02]). Figure 4 shows a graph of the interaction.

Table 18: Mixed model analysis for grade one letter knowledge controlling for school, pre-test letter knowledge and home possession

						95% Confidence Interval	
Parameter	Estimate	Std. Error	df	t	Sig.	Lower Bound	Upper Bound
Intercept	-.80	.28	128.3	-2.85	.005	-1.36	-.24
Intervention**	.50	.17	203.2	2.96	.004	.17	.84
Control***	.03	.29	204.4	.09	.922	-.56	.62
Home Possession	.03	.03	210.2	1.17	.242	-.02	.09
Intervention * Home possession	-.06	.02	203.7	-2.86	.004	-.09	-.02
Control * Home possession	-.02	.03	204.6	-.57	.568	-.09	.05
Pre-test letter knowledge	.44	.07	205.9	5.85	.000	.29	.59
Intervention * pre-test letter knowledge	-.05	.05	204.3	-1.01	.315	-.15	.05
Control * pre-test letter knowledge	.08	.091337	203.72	.91	.366	-.09	.26

Significance is at 0.05. **Contrasted intervention with control groups. ***Contrast between the two control groups.

Figure 4: Grade one letter knowledge interaction plot for intervention and home possession



The interaction between the intervention and home possession (SES) indicates that for the intervention group, home possession did not predict the scores for the post-post-test letter knowledge because the high score in letter knowledge did not depend on having more home possessions. This could imply that children in the intervention group with low home possessions benefited from the intervention as they performed better in alphabet knowledge. However, for the control group II, home possession predicted grade one letter knowledge, as the scores in letter knowledge increased with an increase in home possessions. The intervention is most helpful for children from poorer families and least beneficial for children from families with more home possessions.

Digital stories and rhymes as predictors of vocabulary in grade one. It was hypothesised that listening to digital stories and rhymes in the language of instruction in preschool is associated with improved vocabulary in grade one. A linear mixed model analysis was done to test whether the digital stories and rhymes improved children's vocabulary in grade one or if this improvement occurred solely through post-test rhyming and post-test vocabulary. The model included post-post-test vocabulary as the dependent variable, with pre-test vocabulary, the contrasted intervention condition, and control groups serving as the independent variables. In the intervention group, the post-post-test vocabulary was normally distributed with skewness of .771 (SE=.267) and kurtosis of 1.040 (SE= .529). In the games control group, skewness was .621 (SE=.267), and kurtosis was 1.605 (SE=.529), while in the business-as-usual control group, skewness was .450 (SE=.271), and kurtosis was .862 (SE= .535). The ICC for vocabulary was .142/(.142+.868)= 0.14, suggesting that about 14% of the variance for vocabulary was due to school differences.

Table 19: Mixed model analysis for grade one vocabulary controlling for random effects (school)

						95% Confidence Interval	
Parameter	Estimate	Std. Error	df	t	Sig.	Lower Bound	Upper Bound
Intercept	-.018	.11	11.42	-.16	.873	-.25	.22
Intervention**	.12	.04	224.71	3.05	.003	.04	.20
Control***	.05	.07	226.38	.67	.503	-.09	.19
Pre-test vocabulary	.30	.06	229.72	4.70	.000	.18	.43

Significance is at 0.05. **Contrasted intervention with control groups.
***Contrast between the two control groups.

The results in Table 19 show that the digital stories and rhymes had a long-term effect on children's vocabulary skills in grade one, as the main effect in the intervention group was statistically significant (β = .12, SE= .04, p=.003, 95% CI [.04, .20]) with an effect size of .25.

5.6.2 Digital stories and rhymes as predictors of reading in grade one

It was hypothesised that listening to animated stories and rhymes in the language of instruction in preschool would improve reading skills (name and word and sentence reading) in grade one. The presentation begins with results on the effects of the intervention on reading own name, and then the effect of the intervention on reading words and sentences is presented.

Effects of digital stories and rhymes on reading own name in grade one. There were no significant differences among the three groups regarding the ability to read their names. In the intervention group, 62% of children could read their names, while in the games control group and business-as-usual group, 60% and 53% of children could read their names, respectively. Of the 239 children, only 41% could read their names (See Table 20). The ICC for reading own name was .007/ (.007+.234) = .029, suggesting that only 2.9% of the variance for reading own name was due to school differences.

Table 20: Frequencies on child reads own name

		Conditions				
		Intervention	Control 1	Control 2	Total	Per cent
Child reads their name	Incorrect	30	32	37	99	41.4
	Correct	49	49	42	140	58.6
Total		79	81	79	239	100

Table 20 shows that about 58% of the children in grade one managed to read their first names. The child's name was written on a piece of paper, and the child was asked to read it.

Table 21: Mixed model analysis for grade one reading own name controlling for school

						95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	.58	.04	13.28	14.76	.000	.49	.67
Intervention	.02	.02	232.02	.72	.470	-.03	.06
Control	.03	.04	231.57	.91	.363	-.04	.11

Significance is at 0.05

Table 21 shows that the intervention had no main effect (p=.470) on reading own name. Likewise, the control had no main effect on reading own name. However, when parental literacy was added to the model, there was a significant main effect of the intervention on reading own name (β = .09, SE= .04, p=.025, 95% CI [.01, .17]) with an effect size of .38 as well as a significant interaction between the intervention and parental literacy (β = -.03, SE= .02, p=.031, 95% CI [-.09, -.00]) (see table 22 and figure 5).

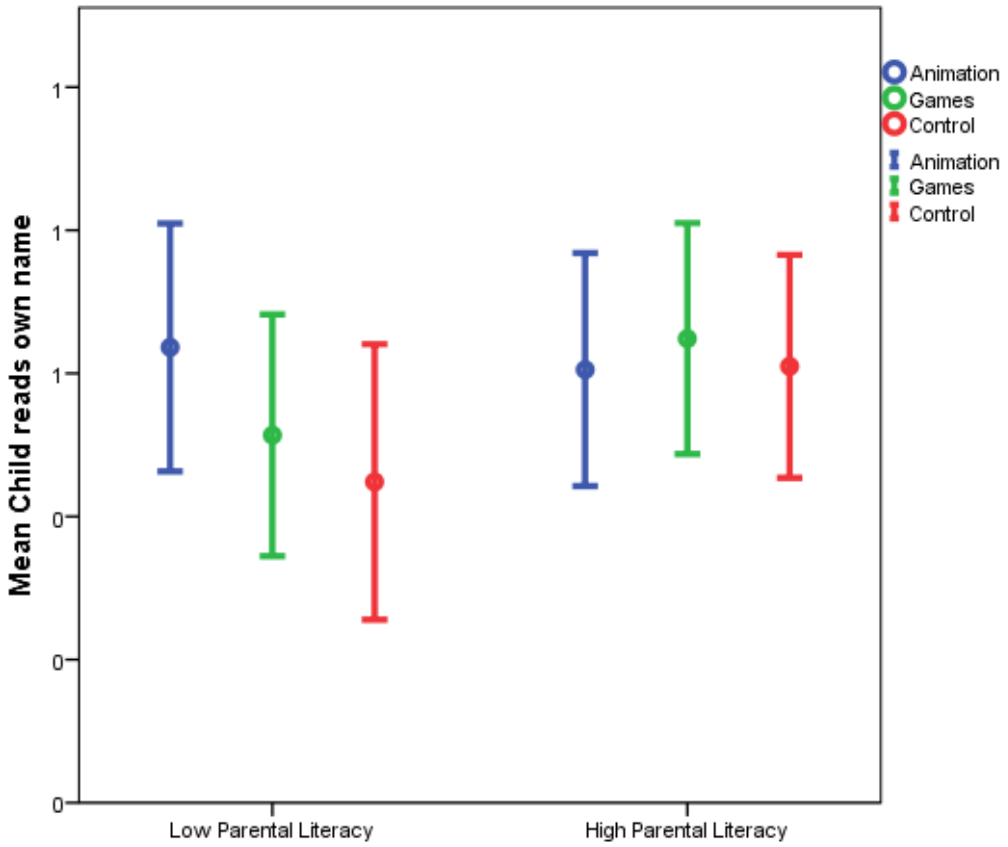
Table 22: Mixed model analysis for grade one reading own name controlling for school and Parental literacy.

						95% Confidence Interval	
Parameter	Estimate	Std. Error	Df	t	Sig.	Lower Bound	Upper Bound
Intercept	.53	.06	51.59	8.35	.000	.41	.66
Intervention**	.09	.04	208.71	2.25	.025	.01	.17
Control***	.05	.07	210.44	.73	.467	-.09	.19
Parental Literacy	.03	.03	211.70	.93	.356	-.03	.09
Intervention * P. Literacy	-.05	.02	213.62	-2.17	.031	-.09	-.00
Control* P. Literacy	-.02	.04	210.06	-.53	.600	-.09	.05

Significance is at 0.05. **Contrasted intervention with control groups. ***Contrast between the two control groups.

Interaction between intervention and parental literacy

Figure 5: Reads own name: low vs high parental literacy



The interaction between the intervention and parental literacy indicates that for the intervention group, parental literacy did not predict the scores for reading their name because children who read their names had caregivers with low literacy skills. The children in the intervention group with parents with low literacy levels significantly performed better in reading their names than children in the control group with parents with low literacy skills. However, the intervention group with high parental literacy did not outperform the control group with high parental literacy. The intervention seemed more beneficial for children from disadvantaged parental literacy backgrounds and least helpful for children from homes with better parental literacy levels.

Effects of digital stories and rhymes on reading (words and sentences) in grade One. This variable assessed the child's ability to (1) combine and read two letters into a syllable or word, (2) read one-syllable words, (3) read two-syllable words, (4) read three-syllable words, and (5) read sentences. All these components had four items each, apart from the sentences, which were only 2. These items were all combined to form one variable (reading: words and sentences). Even though this variable was combined into one, frequencies have been presented to show children's actual performance on each component before the inferential statistics of the combined variable.

This variable reading (words and sentences) was normally distributed with a skewness of 0.20 (SE=.271) and kurtosis of -1.159 (SE= .535) in the intervention group. In the games control group, skewness was .329 (SE=.269), and kurtosis was -1.373 (SE=.529), while in the business-as-usual control group, skewness was .236 (SE=.271), and kurtosis was -1.421 (SE= .535). The ICC for reading was .016/(.016+.400)= .004,

suggesting that about 4% of the post-post-test reading skills were due to school differences.

Table 23: Mixed model analysis for grade one post-post-test reading (words & sentences)

						95% Confidence Interval	
Parameter	Estimate	Std. Error	df	t	Sig.	Lower Bound	Upper Bound
Intercept	.92	.07	57.01	12.34	.000	.77	1.07
Intervention**	.12	.04	308.47	2.71	.007	.03	.21
Control***	.00	.08	309.91	.05	.964	-.15	.16
Parental Literacy	.01	.03	314.00	.35	.723	-.05	.079
Intervention * Parental Literacy	-.03	.02	312.48	-2.41	.017	-.10	-.01
Control * Parental Literacy	-.01	.04	308.34	-.17	.868	-.09	.08

Significance is at 0.05. **Contrasted intervention with control groups. ***Contrast between the two control groups.

When parental literacy was added to the model, there was a significant main effect (β =.12, SE= .04, p=.007, 95% CI [.03, .21]) with an effect size of .37 of the intervention on reading (words & sentences). There was a significant interaction between the intervention and parental literacy (see Table 23). This interaction is presented in Figure 6 under 4.6.

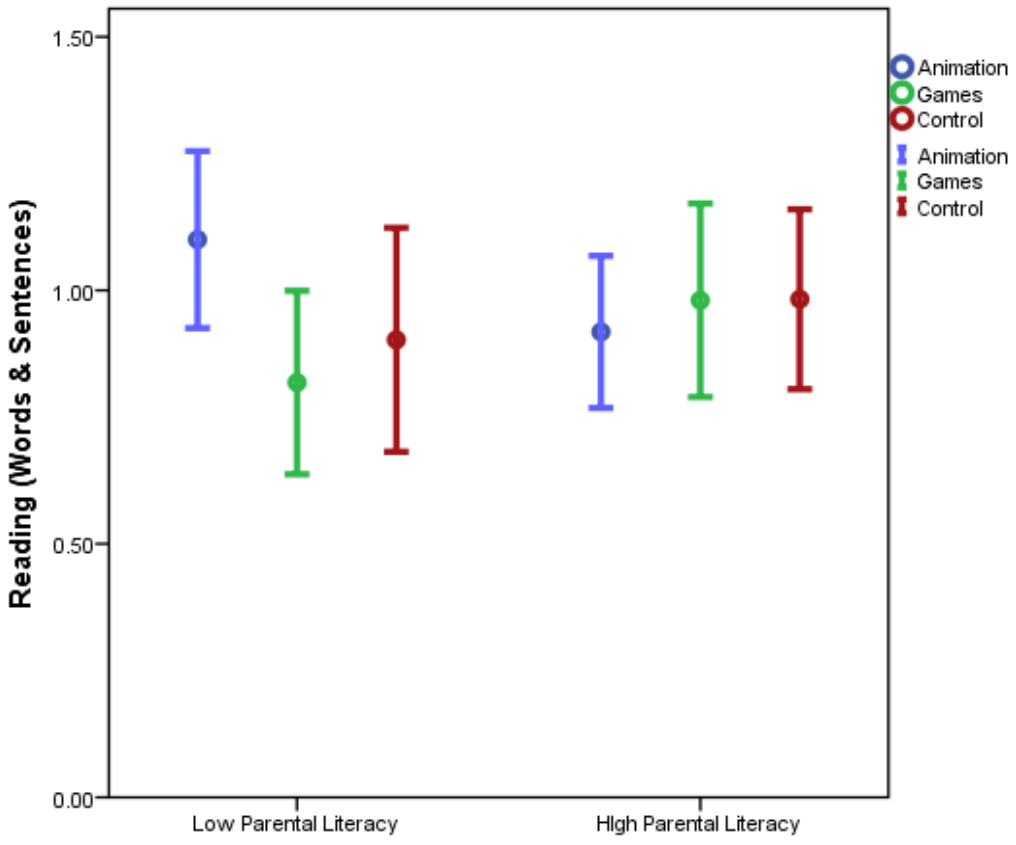
5.6.3 Home Literacy Environment and Response to Digital Literacy Interventions

It was hypothesised that children from less stimulating HLEs would benefit more from the intervention than children from better HLEs. Literacy materials, home literacy activities, frequency of literacy activities, parental education and parental literacy characterised the HLE. Figure 4 shows that parental literacy levels influenced how

children responded to the intervention as there was a statistically significant interaction between the intervention and parental literacy (β = .01, SE= .03, p=.017, 95% CI [-.10, -.01]). However, the other four aspects of the HLE did not affect how children responded to the intervention: HLE resources (β = .02, SE= .02, p=.447, 95% CI [-.03, .06]); HLE activities (β = .02, SE= .02, p=.177, 95% CI [-.01, .05]); HLE frequency (β = .02, SE= .03, p=.471, 95% CI [-.03, .07]); Parental education (β = .02, SE= .03, p=.502, 95% CI [-.04, .02]).

The interaction between the intervention and parental literacy shows that children in the intervention group with caregivers with low literacy levels benefited more from the intervention as they scored better on reading.

Figure 6: Reading (words and sentences) low and high parental literacy



However, children in the intervention group with higher parental literacy levels scored at a similar level on reading whether in the intervention or one of the control conditions. Thus, if the caregiver is unable to read, children benefit from the intervention and have higher scores on reading.

Chapter Summary

This study had three hypotheses; it hypothesised that listening to digital stories and rhymes in the language of instruction in preschool facilitates basic reading skills such as phonological awareness, letter knowledge, and vocabulary in first grade. This study did prove this hypothesis, as children's basic reading skills with the exception of PA were statistically significant for letter knowledge (p=.025) when SES was controlled for; and vocabulary (p=.001). The second hypothesis was that, children in the intervention would progress in reading skills (name, word, and sentence reading) at the end of grade one. The results did prove this hypothesis as there was a statistically significant main effect of p=.025 for reading own name and reading words and sentences (p=. 007) when parental literacy was controlled for. The third hypothesis was that children from less stimulating home literacy environments would derive greater benefits from exposure to digital stories and rhymes at the end of grade one. The results showed that children from homes with low parental literacy levels benefitted the most from the intervention, thus supporting the hypothesis that children from HLE with less literacy stimulation would benefit more. Implications of these results are discussed in the next chapter.

CHAPTER SIX: DISCUSSION OF FINDINGS

Overview

This chapter discusses the longitudinal findings of the study with relevant literature. The study focused on the long-term effects of digital stories and rhymes on children's literacy achievements in first grade. This study hypothesised that preschool children exposed to Cinyanja digital stories and rhymes would improve their literacy skills at the end of grade one compared to children not exposed to these digital stories and rhymes. The study sought to establish the extent to which exposure to Cinyanja digital stories and rhymes in preschool supports alphabetic knowledge, rhyming skills, phonological awareness, and vocabulary among grade-one pupils in low-resource schools. Further, the study aimed to determine how much digital stories and rhymes exposure would support basic reading among grade-one pupils. It was also part of the hypotheses of this study to test the difference in response to digital stories and rhymes between pupils from more and less stimulating home literacy environments and their basic reading skills in grade one.

The organisation of this chapter is in four sections. The first section will discuss the relationship between exposure to digital stories and rhymes, phonological awareness, alphabetic knowledge, and vocabulary as basic reading skills among first graders. The second section of this chapter will focus on how exposure to digital stories and rhymes in preschool supports basic reading skills and how these may facilitate learning to read in grade one. The third part of this chapter will discuss whether children from less stimulating home literacy backgrounds benefit more from this intervention (Cinyanja digital stories and rhymes) than children from more stimulating home literacy backgrounds. Lastly, the findings will be discussed in relation to the two theoretical

frameworks used in the study. A conclusion will follow, highlighting the main points of this discussion.

6.1 Digital Stories and Rhymes as Predictors of Phonological Awareness, Letter Knowledge, and Vocabulary in Grade One

The study hypothesised that listening to animated stories and rhymes in the language of instruction in preschool is associated with improved phonological awareness skills, alphabet knowledge, and vocabulary in grade one. Consequently, children in the experimental group will have better reading skills than children in the control group. The study further hypothesised that children from less stimulating HLE will be more responsive to digital stories and rhymes than children from more stimulating HLE.

6.1.1 Digital Stories and Rhymes as Predictors of Phonological Awareness

Phonological awareness. PA is an essential skill that children need as it helps to lay the foundation for future reading. Phonological awareness was measured by rhyming skills (rhyme production and picture rhyming) and PA (syllable segmentation, end and initial sound discrimination, and blending). The chapter begins by discussion the effect of the digital intervention on phonological awareness and rhyming skills. It should be noted that rhyming is a low-level component skill of phonological awareness (Burns et al., 2018; Chard & Dickson, 1999) compared to the other components of phonological awareness.

The Cinyanja digital stories and rhymes were expected to significantly affect grade-one children's rhyming skills and phonological awareness skills. However, this was not the case. The mixed model analysis revealed that the digital programme did not

improve these aspects of basic reading skills even though the mean scores for the intervention group were higher for phonological awareness, they were not statistically significant. Several reasons could explain why the hypothesis was not supported, and no long-term effects of the digital programme were evident. Research shows that children benefit more from rhyme exposure, around the ages of 3 to 4 years (Bryant et al., 1989). Children begin to show an appreciation of rhyme awareness by becoming aware of sounds very early during infancy in the stages of language development from exposure to rhymes and alliteration in storybooks, songs, and nursery rhymes (Chard & Dickson, 1999). Such exposure in the early years of a child's life usually occurs through shared book reading. However, this aspect needs to be improved in most low-SES Zambian homes, as it is lacking (Chansa-Kabali, 2014). Singing nursery rhymes repeatedly also helps children to become aware of sounds and their differences. However, results from the current study have clearly shown that this aspect needs to be improved in these children's early years. There are few literacy interactions in the homes of most children from LSES backgrounds (Chansa-Kabali, 2014; Friedlander, 2014; Luangala, 2017; Tambulukani & Bus, 2012). This clearly shows no stimulation of initial phonological awareness in the home environment. Children miss out on this stimulation at a very critical stage of their lives. It is only after developing sensitivity to language that children become ready to think about the sequence of sounds in words (Strickland & Schickedanz, 2004). However, Zambian children fail to develop sensitivity to language not only in the home environment but in the school environment as well. There is also very minimal stimulation of phonological awareness skills through rhyming activities in preschool.

Even though the preschool curriculum under the PLP is designed to cater to two age groups (3-to-4; and 5-6-year-olds) and some schools had the prescribed books for both age groups, only one school had enrolled 3-4-year-olds. Failure to enrol the latter was due to limited infrastructure; hence schools had given priority to enrolling 5-6-year-olds to prepare them for first grade. This situation implied that children eligible to enrol at 3-4 years could not enrol but stayed home. Thus, there is no opportunity for children in the 3-4 age group to be exposed to literacy activities in preschool. They wait until they are 5-6 years old. However, at this stage, they would have missed the optimum stage for benefiting from phonological awareness activities such as rhyming.

Even at ages 5-6, the quality of exposure could be better because, at the time of the current study, there were no rhymes available in the language of instruction in these schools. The few rhymes and songs in the prescribed teachers' and pupils' activity books were in English. Considering these factors, children need to have sound sensitivity to words, and exposing them to these without any prior stimulation may have been too complicated for them to grasp. Thus, children must be exposed to rhymes early (Bus & Izjendoorn, 1995). Early exposure will facilitate in children a basic understanding that they can hear letter sounds in words. However, children miss out on this opportunity both at home and in school to benefit from activities or instructions that enhance their sound sensitivity and rhyme skills upon formal school entry. Thus, this is a critical component of emergent literacy that the Zambian child from a low SES background needs to catch up on.

In this study, the digital stories and rhymes did not affect first graders' rhyming skills, probably because rhymes are a lower mental activity, and children were exposed

to rhymes around age six. Research has also shown that the effects of rhymes on rhyming skills disappear with time as children grow older. Nevertheless, the effect of rhymes can be seen in more advanced components of phonological awareness, such as phonemic sensitivity (Bryant et al., 1989; Chard & Dickson, 1999), as well as in vocabulary. Nonetheless, even though the digital stories and rhymes did not significantly impact first graders' rhyming skills, children likely benefitted from the rhymes' vocabulary. They may have also acquired sensitivity to sound patterns. The following section focuses on the effects of the digital literacy programme on more advanced phonological awareness skills, such as initial and end sound discrimination, syllable segmentation, and blending.

Cinyanja is a very syllabic language. In the teaching of reading, these syllables are used to make up words. This makes the current digital literacy programme fit into the reading process in that the stories and rhymes in this digital programme allow children to play with syllables. This is an essential preparation for learning to read among Zambian children, and this aspect makes the current digital literacy programme unique. Most research done in Zambia on literacy among early-grade learners has overlooked the aspect of children playing with language (Chibamba, 2020; Matafwali, 2005, 2010; Mwanza, 2018; Mwanza-Kabaghe, 2015) and how important this is in the trajectory of learning to read. The current study playfully exposed children to the cadence and sounds of Cinyanja, the local language of instruction, using a digital programme.

Nonetheless, this programme is user-friendly for children as it does not require any guidance from adults, and children can independently use it. Thus, the tool is viable for the Zambian child from a low SES background where parents may be preoccupied with income-generating activities and unable to assist their children. Additionally, this

tool does not need the parents to be literate in case they need to be involved as the child interact with the tool. Such an aspect would pose a limitation because some parents from Low SES backgrounds may not be literate. Thus, given this limitation in LSES homes, the digital literacy programme in this current study designed stories and rhymes to help playfully stimulate children's phonological awareness skills without the involvement of adults or guidance from professionals. Other research has designed digital programmes that require parents to be assisted by professionals before they can help their children (e.g. Sa et al., 2022). The current study's digital literacy programme promotes passive rather than active teaching. Perhaps phonological awareness needed to be explicitly taught in a similar manner as done by Egbariah-Ghanamah et al. (2021) and Sa et al. (2022) especially that the children in the current study may have not had any initial stimulation.

Although, results for rhyming and phonological awareness were not statistically significant, rhyming skill positively correlated with grade one letter knowledge, vocabulary and reading. This still makes the digital literacy programme a promising tool for the disadvantaged Zambian child whose HLE lacks the opportunity to interact with stories in their local language, more so rhymes. Likewise, such stimulation seems lacking in the preschool classroom to prepare the children for grade one literacy instruction and acquisition. The inadequate literacy instruction in both preschool and first grade may be attributed to the lack of relevant teaching and learning materials (Mkandawire, 2018, USAID Education Data Activity, 2020) and teachers' inadequate training in literacy instruction (Matafwali, 2010). This scenario may be supplemented by a digital literacy programme that allows children to play with language.

Additionally, Mayer's (2009, 2021) theory used in this study states that people learn better when words are conversational than in a formal style. Thus, the videos in this programme were done conversationally and playfully. Furthermore, the videos in this digital programme show a contrast at all times between words and pictures. For instance, in the *Mkango* (lion) rhyme, there were words such as *zifana* (young), *ziwiri* (two), and *zitatu* (three), and these were contrasted with pictures showing their meaning. This illustrated contrast helps children become aware of syllables in words, an aspect of phonemic awareness. This aspect of PA takes place throughout the entire exposure to stories and rhymes, making children focus on language and sounds. Children also became aware of how small changes (sound/syllable changes) in words also change the meaning. For instance, the *Mkango* rhyme also had rhyming words that differed in one syllable, and this conveyed a different meaning, for example, zi*mu*na (male); zi*fa*na (young). These, too, were contrasted with pictures. Consequently, as children are exposed to more words, their vocabulary increases too. Metsala (1999) postulates that knowing more words is beneficial as it makes children more sensitive to these words and sounds, making them aware of sound differences. The next session considers the aspect of letter-sound correspondence in more detail as it discusses alphabetic knowledge and how this contributes to developing reading skills.

6.1.2 Digital Stories and Rhymes as Predictors of Letter Knowledge in Grade One

It was hypothesised that listening to Cinyanja digital stories and rhymes in the language of instruction in preschool is associated with improved letter knowledge in grade one. To establish this, linear mixed model analyses were conducted to account for school differences. The questions were: Does the intervention programme (Cinyanja digital stories and rhymes) have long-term effects on alphabetic knowledge? Will the

effects of this intervention be evident 15 months later, at the end of grade one? It must be mentioned that alphabetic knowledge was not actively taught to the children, just like the other measures. Alphabetic knowledge was measured using four alphabet subtests of the BASAT and ZAMCAT; letter naming, letter identification, letter-sound knowledge, and letter-sound identification. These variables were factorised/reduced into one variable: alphabet knowledge.

Children need to be familiar with letters and the function of these letters. This familiarity can be acquired through exposure to rhythm and language in rhymes, songs, and stories. These alphabetic knowledge skills are part of the prerequisite skills needed for reading. Letter-sound knowledge is the strongest predictor of later reading abilities in young children (Adams, 1990; Foulin, 2005; Randolph, 2012; Snow et al., 1998). Thus, it was imperative to establish if the intervention would promote letter knowledge beyond preschool. The model showed a significant main effect of the intervention on alphabet knowledge when home possession was controlled, thus supporting the hypothesis that digital stories and rhymes will have a long-term effect on grade one alphabet knowledge. Children from homes with fewer possessions benefited more from the intervention than those with higher home possession scores. This shows that digital stories and rhymes have a long-term effect on alphabet skills for children with lower scores on HP.

The children in this study were from LSES homes. A home possession index as used by Chansa-Kabali (2014) and Mwanza-Kabaghe (2015) in Zambia served as an indicator of SES. The interaction between SES and alphabet knowledge showed that the more HP children had, the lower the score on AK, and the less HP children had, the higher the score on AK. The effect of the intervention in relation to alphabetic knowledge was

substantial among children with fewer home possessions. This shows that within the same SES, class variations can affect how children respond to interventions. To better understand this interaction, the sample was split into two groups by establishing the median. Those with average and below average scores on the HP index were recorded as Low-LSES, while those above the median on the HP index were classified as high-LSES. Results showed that among the Low-LSES sample, children in the intervention group significantly outperformed children in the control group from the same Low-LSES.

In contrast, for the children in the high-LSES group, there was no statistically significant difference in the AK scores between the intervention group and the control group. These results imply that for the Low-LSES sample, children in the intervention benefited the most from the stories and rhymes programme as they significantly outperformed children in the control group from the same Low-LSES. The implications here are twofold, the first being that class variations within the same LSES have a bearing on children's academic performance (Mwanza-Kabaghe, 2015). Children in the Low-LSES lack literacy incentives or what DiMaggio (1982) refers to as cultural capital compared to children from higher fractions within the LSES. Thus, children from high-LSES status backgrounds had more possessions that benefited them regarding their AK acquisition than children from the Low-LSES bracket. For instance, disparities were seen in HP, such as owning a TV, radio, and stove and having access to water and electricity in the home. Owning a TV and radio and having electricity would have exposed children in the high-LSES to more literacy opportunities than children from Low-LSES fraction.

This disparity in AK scores between the intervention group and control group within the Low-LSES group shows that this digital programme familiarised children with

the language of instruction and allowed them to play with the cadence of Cinyanja. By merely listening to and watching the rhymes and stories, the AK skills of children in the intervention group were improved significantly compared to children from the same Low-LSES background that were not exposed to the intervention. These results show that SES predicts AK among Zambian children, and Mwanza-Kabaghe (2015) reported similar results.

A study by Norris et al. (2020) shows that children in USA from an LSES background did not benefit from the highly structured reading intervention, but children from an HSES background did. Norris et al. (2020) compared children from two very distinct classes, LSES and HSES, a sample with highly differentiated strata. In the current study, the sample came from a predominantly LSES background, and the differences within this SES stratum revealed that those from the Low-LSES benefited the most from the intervention. The reading intervention may not have been culturally familiar to the children from an LSES since it was highly structured. Literature has indicated that interventions must be culturally and socially familiar to the children, including experiences, concepts, and characters used (Phillips, 1999).

Nonetheless, Norris et al. (2020) recommend tailoring interventions to children's individual needs. However, this recommendation may not be feasible for struggling Low-income countries where instructional books are lacking, and it may be costly to take up such individualised interventions. Norris et al. (2020) further suggest that such literacy intervention materials are designed to benefit disadvantaged children or children at risk of reading difficulties. The current study found that the intervention was the most helpful for children from poorer families. According to the cultural capital theory guiding this

study, children from better SES-status families would have already accrued the benefits of their SES. DiMaggio (1982) takes note of these differences in the SES stratum that within a single stratum, there are differences and this impact differently on measures/outcomes. Thus children from a low SES will benefit more when presented with cultural capital material (in this case, digital stories and rhymes) than children from a higher class fraction within the same stratum.

However, more is needed in the children's home environment regarding literacy experiences. It seems so hard for Zambian children to learn letters. They know very few letters, yet they are taught these letters in the classroom. Children lack the emergent literacy skills that may be important for benefiting from instruction in grade one. Additionally, there is a lack of written language in these children's homes and immediate environments. Children need to constantly see letters, play with or manipulate them and use them in reading and realise that these letters are the ones that bring about the exciting stories they hear. If children lack such experiences with language, they miss out on the basic understanding of what letters can or can be done with the letters. Even though young children may not be able to read and write, they need to know what letters look like. Zambian children from LSES seem to miss this exposure because their environments need to be filled with letters, so they do not have any attachment to the letters before schooling.

Consequently, when introduced to letters upon school entry, these concepts seem very foreign to them. Zambia does not have a rich reading culture (Luangala, 2017). There is a need for more picture books in the local language and opportunities to playfully be exposed to sound repeatedly to familiarise children with the sounds of words. The shift

from focusing on meaning to sound is fundamental in learning to read. Thus, this digital programme is essential for Zambian children because currently, there is no tradition of rhyming activities in the local language with young children in homes. There is a need for a rich supply of picture books with songs and rhymes in the local language.

6.1.3 Digital Stories and Rhymes as Predictors of Vocabulary

Vocabulary was measured using expressive and receptive tests. The results showed that the digital stories and rhymes had a long-term effect on children's vocabulary skills in grade one. The main effect in the intervention group was statistically significant thus, supporting the hypothesis that digital stories and rhymes will have long-term effects on vocabulary at the end of grade one. Similar results have been reported by Loniza et al. (2018) that listening to digital stories enhances the capacity to learn language. Maya and Halim (2021) found that digital storytelling enhances vocabulary even in second-language learners. The current study exposed children to digital stories and rhymes for 15 minutes four days a week for six weeks, and this exposure time significantly affected their vocabulary skills at the end of first grade. The study by Lawson-Adams et al. (2022) shows that well-designed instructional or intervention materials can significantly affect vocabulary in as short as two weeks. In designing the intervention materials, this study followed Meyer's (2009) principles for designing multimedia materials for optimal learning. For instance, the coherence principle states that presenting children with only relevant materials helps them to hold corresponding relevant words and images simultaneously, thus facilitating meaningful learning. The digital stories and rhymes ensured that pictures and narration were done simultaneously. Lawson-Adams et al. (2022) found that songs provide a practical context for word learning when combined

with picture cards, compared to teaching words using pictures only without song. Thus, integrating pictures and corresponding words is vital in learning vocabulary as children use visual and auditory learning channels.

The current study exposed children to rhymes and stories during preschool and tested their effect on vocabulary at the end of first grade. According to Lawson-Adams et al. (2022), songs provide a quick, practical approach to supporting vocabulary in the preschool classroom. Thus, stories and rhymes introduce children to vocabulary as they have different storylines, plots, settings and climaxes that children find fun and exciting (Sayakhan & Bradley, 2019). In addition, it is important to design literacy intervention materials based on materials that children are familiar with. In designing these intervention materials, it was necessary to factor in the children's cultural context instead of using foreign materials and concepts. Friedlander et al. (2014) had similar findings as Metsala (1999) that children performed better on reading familiar versus non-familiar words.

Rhymes work not only on children's phonemic awareness but also on children's vocabulary. Metsala (1999) postulates that with increased vocabulary, children realise that meaning changes with minor sound changes and become aware of such processes. They become aware that words are made up of sounds that can be heard in letters or symbols. For instance, the word *amai* (mother) is a word most, if not all, children are aware of, and its meaning, however repeatedly listening to this word in stories or rhymes will make children more aware and sensitive to the sounds /a/, /m/, /i/ such that by the time they progress to grade one they will learn the more advanced parts of PA with more ease. They will associate the sound /a/ with its symbol 'a', and whenever or wherever they

see the written symbol 'a', they will associate it with its sound. Thus, exposure to sound sensitivity through rhymes may help children learn letter-sound correspondence (phonemic awareness). This right here is the building block of learning how to read.

Children's literacy development begins with language (Wagner, 2011; Eghbaria-Ghanamah et al., 2020), and children are first exposed to language in their home environment. Thus, children need to start developing vocabulary in their early years, as early vocabulary knowledge is critical for the development of oral language (Coyne et al., 2019; Dickinson et al., 2010; Hart & Risley, 1995), and word learning varies based on children's socioeconomic and linguistic backgrounds (Lawson-Adams et al., 2022). The home literacy environment has a bearing on the vocabulary acquisition of young children. The literature further shows that the SES of families impacts children's vocabulary acquisition and can affect their future literacy attainments. Hart and Risley's (1995) reported a correlation between SES and children's linguistic development. Evidence shows that children from LSES homes lag by 32 million words compared to children from higher SES backgrounds. Thus, children must be exposed to more conversational interactions, and intervention should be done as early as possible for those lacking this exposure.

The digital stories and rhymes being advanced by this study are one such intervention measure that can be used in the classroom setup and the home environment. Additionally, such intervention may help teachers as they do not have to spend much instructional time supporting word learning through songs since children's vocabulary is enhanced by merely listening to nursery rhymes and stories.

6.2 Digital Stories and Rhymes as Predictors of Reading in Grade One

It was hypothesised that listening to animated stories and rhymes in the language of instruction in preschool would improve reading skills (name, word, and sentence reading) in grade one. This hypothesis was supported as results show that digital stories and rhymes significantly affected reading. These effects were seen on both reading tasks, reading own-name, and reading words and sentences. It must be noted that the effect of the intervention on reading was moderated by parental literacy (This is discussed in the next section). Reading is a complex skill supported by several emergent literacy skills, and it does not begin upon entering formal schooling. Thus, for reading to be successful, all the pre-reading and reading prerequisites must be attended to.

Egbariah-Ghanamah et al. (2021) found that a preschool rhyme intervention significantly affected the later reading skills of first graders. This current study did not find any significant effect on the rhyming of later reading skills of first graders. In the study by Egbariah-Ghanamah, the group that recited rhymes was guided on how to recite the rhymes and had the problematic words explained, which had more effect than the group that merely listened to the rhymes. Similarly, Baleghizadeh and Dargahi (2010) reported that reciting nursery rhymes without reading texts promoted word reading among seven-year-olds. However, in the current study, children merely listened without any recitation. They were not guided on how to recite the rhymes. They merely listened, and the effects were recorded. In Egbariah-Ghanamah's study, children were exposed to rhymes at an earlier age, which may explain the disparity in the results. In the current study, the digital stories and rhymes did not affect first-grade rhyming. Perhaps the rhymes needed more (only seven compared to Egbariah-Ghanamah's 28 rhymes). Even though the 28 rhymes only had two rhyming words in each eight-word rhyme, and the

current study had more than one set of rhyming words, perhaps the 28 rhymes had more depth.

Additionally, the length, number of words, and duration of the seven rhymes in the current study were not standard like that of Egbariah-Ghanamah's study. The total intervention time in Egbariah-Ghanamah's study was about 6 hours, while in the current study, it was about 4 hours. While the former study focused mainly on rhymes and reading, the current study focused on a broader range of emergent literacy skills and reading, and rhyming was just one component.

Rhyming has been found to promote reading. However, in this study, the digital stories and rhymes did not affect grade-one rhyming skills. Yeh and Connell (2008) reported that rhyming instruction was less effective than instruction in more advanced PA in promoting phonemic awareness and future reading. Equally, Chard and Dickson (1999) reported that rhyming instruction did not promote future reading. However, most studies in this area have found significant associations between rhyming and reading (Bryant et al., 1989; Egbariah-Ghanamah, 2021; Baleghizadeh & Dargahi, 2010). In contrast, other studies report that rhymes are more effective in promoting phonological awareness (Grofcikova & Macajova, 2020; MacLean et al., 1987) and phonemic sensitivity (Bryant et al., 1989; Chard & Dickson, 1999; Strickland & Schickedanz, 2004), which is a potent predictor of reading (McGuiness, 2005). The basis of phonemic awareness as a potent predictor of later reading success lies in rhymes (Bryant et al., 1997).

A three-year longitudinal study by Bryant et al. (1989) revealed that knowledge of nursery rhymes at an early age was strongly related to reading and spelling success. This study further reported that early informal experiences of playing with language in

rhyme play effectively teach how to read. However, children must be exposed to rhymes at an early age, as early as three years. The current study's programme facilitated playing with language through stories and rhymes. However, this was done in preschool when children were about six. Exposure to rhymes at this age could have affected the rhyming skills among grade one pupils, as the study did not find any significant effects of the intervention on grade one rhyming skills.

Shapiro and Solity (2008) experimented with a preschool where they intensively trained poor readers, developing readers, in PA and phonics to improve the PA of poor readers and benefit typically developing readers. At the end of first grade, they reported significantly improved reading skills for typical readers and children with poor PA. Another experimental study by Cunningham (2010) reported that explicitly using a metalevel approach when teaching phonemic awareness training was causally related to children's reading achievement at the end of grade one. Sa et al. (2022) postulates that PA promotes reading. The intervention significantly outperformed children in both control groups in this current study. This shows that the children in the intervention benefited from the stories and rhymes. PA skills were not taught to children, but children were exposed to stories and rhymes, which facilitated the children's PA skills. The repetition of the words in the stories and the alliteration and rimes in the rhymes could have affected the children's sound sensitivity, thus promoting their PA skills. The current study did not include phonics training and recorded significant effects on PA. This shows that this literacy programme is potent in promoting literacy skills. The two experiments by Shapiro and Solity (2008) and Cunningham (1990) successfully used intensive teaching approaches to promote PA, and this method is efficient. However, this may not

be practical for the population under study, where instructional materials have been reported to be inadequate and teachers not adequately trained to teach literacy (Kombe & Mwanza, 2018; USAID Education Data Activity; 2020) hence the use of digital technologies being advocated by the current study.

Storybook reading was found to promote phonemic awareness in the experimental study by Rababah (2017). Results revealed a statistically significant print and phonemic awareness increase compared to the control group. As much as Rababah's study did not assess reading, it reported significant effects of the stories on phonemic awareness. This skill has been reported to be a potent predictor of later reading skills. Yacizi and Bolay (2017) reported significant gains in reading when children were exposed to story-based activities. This current study assessed PA and reading and found statistically significant results of the digital stories and rhymes on grade one children's PA and reading skills. The current study used digital stories as opposed to traditional storybooks, as these are lacking in the language of instruction. However, there is also a need for shared book reading in most homes of Zambian children from LSES (Chansa-Kabali, 2014). This makes the current programme under study a convenient tool for the Zambian population because it is cheaper to produce compared to traditional storybooks.

Challenges under the PLP contributing to low literacy levels. The current study found low reading levels among grade-one children, and similar results have been reported (Kalindi, 2005; Matafwali & Bus, 2012; Mkandawire, 2018; Mwanza-Kabaghe et al. 2015). It is disheartening that even after spending almost two years in school, almost half of the children in this study could not read their names, and slightly above half could not write their names at the end of grade one (however, writing tasks were not analysed

further due to too many zero scores). Children were in school for two years, and it really should not matter what language the child's name is. A child should be able to recognise and read out their name at least by the end of first grade. Failure for children to recognise and read their names may be an instructional issue on the part of the school system, and inadequate literacy socialisation in the home environment. It is not cultural for families in LSES homes to play with letters, let alone practice name writing. Such incentives are needed to familiarise children with their names within the home environment before school begins. Bohrer (2005) reports that parents and caregivers cannot provide their children with literacy-rich environments and experiences at home to support their child's emerging literacy skills. This may be due to parents being unaware of their role in their child's learning (Chansa-Kabali, 2014), and some parents may not have the literacy skills to support their children (Ngwaru, 2014). Families may not realise this critical role they have and thus leave this for the teachers upon such a time that the child is enrolled in school. Unfortunately, when children are enrolled in preschool, there seems not enough attention is given to instructing them to get familiar with their names.

Additionally, most children could not read words and short sentences. Children in Zambia begin letter knowledge in preschool, and surprisingly, children did not know how to read ten months into grade one. Even three-syllable words were a challenge. The orthography of the Zambian language is transparent, as the letters and sounds are regularly spelt (Kaani, 2014). This makes it different from the English language, which is opaque. The transparency of Cinyanja makes it easier to read, but what could explain these persistent low reading levels? The method of teaching literacy skills at both preschool and grade one is based on phonics (Chibamba, 2020; MESVTEE, 2016), and

this is a good approach, but children cannot read. This may be because children need to prepare to understand sounds in words. They are not sensitive to that. Children would benefit from more exposure to literacy activities before school entry to give them enough time to grasp the idea and awareness that there are sounds in words which alter meaning. Several studies have come up with several reasons explaining these low literacy levels. The study by Mwanza-Kabaghe et al. (2015), found that children attending preschool did not benefit from preschool because the preschools attended were English based. A proposal by Mwanza-Kabaghe was that preschools with instruction in the local language would benefit learners as they transition into grade one, where the instruction is a local language. In this study, children attended public preschools where the language of instruction was the same as in grade one. However, the reading levels are low, and other scholars (Chibamba, 2020; Mkandawire, 2018; Mwanza, 2020) have reported low reading levels under this current PLP curriculum. Could these low reading levels be due to the discrepancy between the local language taught in school and the local spoken language? Tambulukani and Bus (2012) and Matafwali (2010) argue that a mismatch between the language of play and instruction can bring about reading problems. This mismatch was evident during the current study. Thus, allowing children to play with the language of instruction through digital stories and rhymes was essential in bridging such a gap.

Additionally, the rhymes and songs in the approved preschool PLP books are in English as much as the pupils' and teachers' books are in the local language. Teachers are also expected to be resourceful and come up with teaching-learning materials. This situation may be worsened by teachers not being conversant in the local language of

instruction when deployed to schools where the language of instruction is not the teachers' native or familiar language. Matafwali (2010) argues that teachers need explicit instruction in local languages during their teacher training. This study's digital programme allows children to freely play with the language of instruction by listening to the stories and rhymes, thus exposing them to sound sensitivity, the cadence of the language of instruction, and vocabulary.

Furthermore, the current education system is failing children in several ways. This current study found that not all teachers were ECE trained. Even when trained teachers were deployed to these preschools, they were not given the necessary materials to deliver the curriculum effectively (Mwanza et al., 2018). Moreover, only some teachers were trained to use the current PLP. When the PLP programme was implemented, workshops were conducted for some teachers. Thus, it is up to the individual teacher to 'figure it out'. Clay (1972) advances that specially qualified teachers in a wide variety of approaches to reading instruction must be available for intensive and sustained reading instruction, especially for children at risk of reading failure. Additionally, Chibamba (2020) observed that in Finland, children that struggle with Finnish as a second language are assigned a language teacher who gives remedial work until the child catches up with the rest of the class. However, in Zambia, this seldom happens. In the current study, finding grade-one teachers teaching children in preschool classes was commonplace. This was due to a shortage of preschool teachers caused by various reasons, such as recruitment issues, extended leave of absence due to illness or other circumstances. Adequately trained teachers are vital in the delivery of any curriculum.

Another constraint could be attributed to the time allocated to teaching, as children's time in school may be limited. Due to inadequate infrastructure or limited classrooms, pupils must share the same classrooms, so they attend a class for three hours each day. Furthermore, the current study observed that in as much as pupils spent, on average, three hours in class, there was enough time allocated to literacy. However, rhyming was not explicitly done, but rhymes were latently done as part of songs, and these rhymes, as earlier indicated, were in English. This situation already compromises teaching in a local language. This study was conducted when the current PLP was about five years old. The programme was still facing implementation challenges because most, if not all, of the schools, visited did not have the new prescribed books under this programme. Kombe and Mwanza (2019) reveal that five years after implementing the 2013 revised literacy policy, there was a lack of materials to teach literacy, and some schools were using old materials meant for the old curriculum.

The PLP approach caters for children aged three to four. However, due to infrastructure challenges, these could not be accommodated. Thus, only the children aged six were enrolled in preschool, and it is evident that one year in preschool is not adequate to prepare children for first grade. However, both pupils' and teachers' activity books for three and four-year-olds were available in some schools, while the learners were not "eligible" for enrolment. Meanwhile, some schools that enrolled the six-year-olds had no prescribed books. A few schools had these books; unfortunately, they were in the administration office and had not yet been given to teachers to use. So, teachers were left to teach within their resources, Kombe and Mwanza (2019) have reported similar results.

Another factor for the low reading levels could be attributed to the class sizes. The classes have too many children for one teacher to attend to. A study by Mumba and Mkandawire (2020) found a teacher-pupil ratio of 1:80 yet the maximum recommendation is 1:40 (MOGE, 2018). In such a class of 40 pupils, the reading achievement of most children was deemed better than in a class of 80 pupils with one teacher. High teacher-pupil ratios compromise the individualised attention each child may receive during their three hours in class. In addition to this, a class will only have one teacher with no teaching assistant. The teachers also end up being overwhelmed teaching big classes. Some classes had as many as 46 pupils to one teacher. How does a teacher attend to all the academic needs of all these 46 children in three hours? In addition to learners' academic needs, they have social and individual needs. Moreover, within the three hours, there is break time that has to be factored in. Thus, children are in class for 2 hours and 30 minutes at most, and this time must be shared among the different subject areas. Clay (1967:26) argues that "only by sensitive close observation of small classes can the teacher create learning conditions for new entrants that will facilitate early integration of skills and launch children successfully into their school careers".

As a nation, perhaps we were unprepared to handle these public preschools, as evidenced by inadequate infrastructure, untrained teachers and inadequate teachers' prescribed books in schools (Kombe & Mwanza, 2019). The failure of the system to adequately deliver the PLP programme could be summarised as a quality issue. The system prioritised quantity over quality to have as many eligible children accessing ECE at the expense of quality. This scenario is similar when it comes to primary education. The current government pronounced free education to all, which has come with many

challenges that have compromised the quality of education provision. This study observes that public preschools may not positively impact primary education because even when children have a full year in preschool to prepare for instruction in first grade, the children fail to read at the end of grade one.

6.3 Home Literacy Environment and Response to Digital Literacy Interventions

It was hypothesised that children from less stimulating HLEs would benefit more from the intervention than children from more stimulating HLEs. The HLE was measured using five components: parental literacy, parental education, literacy resources (books), literacy activities (reading, storytelling), and frequency of literacy activities. Parental literacy interacted with the intervention, and it moderated the effect of the intervention on reading. That is, the main effect of the intervention on reading was only present when parental literacy was added to the model.

This interaction revealed that children from homes with low parental literacy skills benefited more from the intervention. If parents could not read and write, their children benefited more from the digital stories and rhymes than children from homes where the parents could read and write. This finding supports the cultural mobility model of cultural capital theory (this will be further discussed at the end of this chapter). Shahaeian et al. (2018) argue that an enriched HLE compensates for the relative lack of opportunities afforded by the educational setting of children from low SES. This may explain why children from homes with higher parental literacy in the control group had similar reading mean scores as children from homes with lower parental literacy skills that benefited from the intervention. This may imply that children in the control group from homes with higher parental literacy skills accrued benefits from an enriched HLE through their parents' competent literacy skills.

Additionally, children in the control group from higher parental literacy homes significantly outperformed those in the same control group from homes with low parental literacy skills. The children from low parental literacy homes lacked literacy incentives in the home and the school setup. Chansa-Kabali (2014) reports that shared book reading is uncommon in LSES homes, and low parental literacy levels could exacerbate such a situation. The cultural capital theory postulates that cultural capital acquired in early childhood is a precious educational resource because it significantly affects educational outcomes (Xu & Hampden-Thompson, 2011). Thus, it is only when children are familiarised with reading, linguistic and verbal interactions in the home environment that it helps them perform well in school. Because when they encounter reading at school, such cultural practices do not shock them because they would have already encountered such practices at home. Horbury and Cottrell (1997) postulate that reading does not occur in a cultural vacuum because when readers interact with text, they use their cultural and linguistic experiences. This current study shows that children from low parental literacy homes benefited the most from digital stories and rhymes. This digital programme compensated for the lack of literacy incentives in the home. The digital stories and rhymes allowed this group of children to outperform their counterparts (control group) within the same 'low parental literacy' group.

Results further revealed no interaction between the other four components of HLE (parental education, literacy resources, literacy activities, and frequency of literacy activities) and reading. That is, parental education level, HLE activities, resources, and frequency of these activities did not moderate the effect of the digital stories and rhymes on children's reading outcomes at the end of grade one. This may be because there were

no variations in these aspects of the home literacy environment since children were sampled from a social stratum that was predominantly low. Chansa-Kabali (2014) did not find variations in parental occupation, family size and parental education, as respondents came from very similar SES backgrounds. However, variations in parents' literacy, that is, the ability to read and write, could be expected because one's level of educational attainment may sometimes translate into a different literacy ability. For instance, someone may be a 7th-grader dropout but may have better literacy skills than someone who dropped out in 11th grade. The next session discusses the findings in relation to the theoretical frameworks.

6.4 Discussion of Findings in Relation to the Theoretical Frameworks

Two theoretical frameworks were used in this study, Pierre Bourdieu's Cultural Capital, and Meyer's Multimedia Learning theories. One theory was not sufficient to factor in all variables under study. Bourdieu's theory explains educational success and cultural reproduction. It helps explain why Zambian children start reading instruction poorly prepared. The social mobility model of cultural capital was used to explain the effect of literacy interventions in the form of both objectified cultural capital (digital stories and rhymes), parental literacy (embodied cultural capital), in addition to the effects of SES on the reading trajectory of children. Meyers's theory questions whether people learn better using multimedia (words and pictures) or just using words without pictures (purely verbal learning). This theory was used to explain how best to design multimedia reading interventions (digital stories and rhymes) for the optimal benefit of the learners. In addition, it also postulates that the boundary condition for multimedia design principles benefits low-knowledge learners. The following section discusses the findings in relation to these theories.

An interaction was observed for reading outcomes between the intervention and parental literacy, revealing that children from homes with low parental literacy levels benefited most from the digital stories and rhymes. Both theories under discussion support this finding. Firstly, the social mobility model of the cultural capital theory argues that cultural capital benefits low-achieving children. Hence, it is a form of social mobility. However, children from homes with relatively high parental literacy levels may have experienced a more literate home environment with playful language use than children from less literate families and thus be less in need of this digital programme. This finding is supported by DiMaggio's social mobility model of cultural capital. Children from advantaged backgrounds have already benefitted from their home environment, so they may not benefit as much from the objectified cultural capital (digital stories and rhymes). Secondly, Meyer's theory equally postulates that it is those children who are disadvantaged that benefit the most from multimedia learning. Meyer states that high-knowledge children already have the capacity to process information without further support in the form of digital media. That is, they can create and use images independently. Thus, multimedia learning is more beneficial for low-knowledge learners, who must be presented with visual cues or images in addition to words/narration to integrate words (audio channel) and pictures (visual channel) for optimal learning.

Children from lower socioeconomic backgrounds have inadequate literacy conditions (Chansa-Kabali et al., 2014; Hart & Risley, 1995; Lawson et al., 2022) and are disadvantaged due to low embodied and objectified cultural capital (Bourdieu, 1986; DiMaggio, 1982; Kuppen & Bourke, 2017). Results show that children in the control groups from more advantaged backgrounds (more home possessions and high parental

literacy) had higher alphabet knowledge and reading scores than their counterparts with lower home possessions and parental literacy. This finding is supported by the cultural reproduction model of the cultural capital theory, where Bourdieu advances that cultural capital benefits high-achieving learners. Crook (1997) states that literate parents are more likely to possess more verbal, linguistic and cognitive skills awarded in school to help children cope with academic demands in addition to helping children pass. De Graaf et al. (2002) also argue that children acquire linguistic and cognitive skills at home. Consequently, children with higher cultural capital are neither startled nor experience a hostile school environment by what they learn because they easily communicate with teachers (Farkas, 1996), contributing to academic success.

This model of cultural reproduction supports what is obtained in the Zambian context and explains why children enter school inadequately prepared for reading acquisition. However, when explaining the effects of digital intervention on reading, DiMaggio's cultural mobility theory argues that learners from low-achieving environments have more returns. This is because cultural capital, in this case, the opportunity to play with language, is scarce and gives a more significant impression if possessed. This is well reflected in the results of the current study by the difference in scores between the control and intervention groups with low home possession and parental literacy. High-achieving learners benefit from cultural capital but not as much as low-achieving learners because high-achieving learners have already accrued all the advantages from a more enabling home environment. Thus, resources in the form of embodied and objectified cultural capital will benefit disadvantaged children more than those with advantages.

Since these children are considered a high-risk group in terms of early literacy skills and future academic performance, they are more likely to benefit from targeted literacy interventions (Golova et al., 2016 in Dinler & Cevher-Kalburan, 2021; Kalyuga, 2021; Meyer, 2009). According to Meyer (2009), multimedia materials benefit children with fewer cognitive stimulating experiences. As already alluded to, children with low parental literacy levels were more susceptible to reading difficulties and were more in need of well-designed interventions. The personalisation and voice principle designs allow children to play with the language of instruction through the digital stories and rhymes as children learn at an individual pace in a more fun, playful manner without formal instructions. In designing these stories and rhymes, using human voices instead of computerised ones was essential. One of the voices was a child's cheerful voice, and another was an adult's friendly voice. These principles help provide optimal benefits from digital literacy programmes.

Chapter Summary

The study's results indicate that a 6-week exposure to digital stories and rhymes during preschool significantly improved letter knowledge, vocabulary, and reading skills among first graders15 months later. The effectiveness of the digital intervention varied based on parental literacy and socioeconomic status (SES), with children from homes with lower parental literacy and disadvantaged backgrounds benefiting the most. These findings align with the social mobility model of cultural capital theory and the cognitive theory of multimedia learning. The study suggests that introducing literacy activities like stories and rhymes in the language of instruction during preschool may facilitate reading readiness in first graders. Additionally, the study highlights the long-term impact of SES and parental literacy on alphabet knowledge and reading, emphasizing the importance of

home environments in literacy development. The findings underscore the potential of such programs to address literacy disparities, particularly for children from disadvantaged backgrounds. The next chapter presents the summary, conclusions, and recommendations of the study.

CHAPTER SEVEN: SUMMARY, CONCLUSION AND RECOMMENDATIONS

Overview

This chapter is a summary and conclusion of the study. The recommendations are given at the end of the chapter.

7.1 Summary

This RCT was conducted to determine the long-term effects of a Cinyanja digital stories and rhymes programme exposure on grade-one reading skills. Research has consistently reported the potent effect of digital literacy programmes on emergency literacy skills and reading. Stories and rhymes have been reported to play a vital role in laying the foundation during the preschool years for future reading ability. These stories and rhymes were digitised to offer the optimum benefits.

This study explored how exposure to a Cinyanja digital literacy programme in preschool could enhance reading at the end of grade one among children from low-resourced communities. The study sought to examine the effect of the digital literacy programme on emergent literacy skills, PA (rhyming inclusive), alphabet knowledge, and vocabulary. The study sought to determine if children from less stimulating home literacy environments would be more susceptible to the Cinyanja digital literacy programme. The home literacy environment was characterised by reading resources, literacy activities, frequency of literacy activities, parental literacy, and parental education. This study gives insight into the efficacy of digital literacy materials on children's reading outcomes and further establishes the effectiveness of the digital programme.

7.2 Conclusion

It was hypothesised that children exposed to digital stories and rhymes would have better emergent literacy and reading skills at the end of grade one than children in the control groups. Results show that children exposed to the digital literacy programme outperformed those in the control groups. Thus, this intervention programme had long-term effects on grade-one children's reading outcomes.

Exposure to the Cinyanja Digital Literacy Programme as a Predictor of Phonological Awareness, Letter Knowledge and Vocabulary

This study found a positive effect of the Cinyanja digital stories and rhymes programme on grade-one reading outcomes. The study established that the digital programme had long-term effects on grade-one emergent literacy skills (Letter knowledge, and vocabulary). The digital literacy programme did not affect grade one rhyming and PA.

The digital literacy programme had a main effect on grade one letter knowledge only when home possessions (SES) were controlled for. Results revealed that children from homes with fewer possessions are the ones who benefitted more from the intervention. This shows that SES affects children's literacy outcomes. The digital literacy programme also had long-term effects on children's vocabulary.

Exposure to the Cinyanja Digital Literacy Programme as a Predictor of Reading

The digital programme had a long-term effect on grade-one reading skills (own name, words, and sentences). These results provide evidence of the importance of preschool children listening to a digital animated literacy programme containing stories

and rhymes in the language of instruction, as it benefitted their reading skills. It also offers evidence that such digital tools can effectively augment preschool classroom instruction and serve as a potent tool for enhancing reading instruction in first grade. This shows that it is a practical programme for emergent reading. It helps preschool children carry emergent literacy skills that could be missing in the home and preschool environment into grade one.

Response to Cinyanja digital literacy programme between children from low and high HLE

The effect of the HLE on children's literacy outcomes cannot be overlooked, as studies have shown the HLE's influence on young children's literacy skills. Thus, the study hypothesised that children from less stimulating HLE would benefit more from the intervention than children from more stimulating HLE. Parental literacy interacted with the intervention, showing that children from homes with low parental literacy benefitted more.

7.3 Implications

The digital literacy programme exposed children to the language of instruction while in preschool, making it more viable in settings where there is a mismatch between the language of play, home language and language of instruction. Since it is a readily available programme that can play on a basic smartphone, it can be incorporated into the HLE way before children begin preschool, allowing them to hear and play with the language of instruction.

Additionally, its ease of use implies that it does not need professionals or a high skill to operate; it is as easy as playing any video on a smartphone. Caregivers who do

not have any skill can utilise it. Thus, children can also use the digital literacy programme independent of adult supervision or guidance; it is easy to operate, and videos play automatically. Today's millennial child can efficiently run a smartphone. However, adults should be cautious regarding exposure time, as too much screen time may harm young children. Sa et al. (2022) recommend an exposure time of 11 minutes.

This digital literacy programme is also viable where the caregiver may be unable to participate in shared book reading due to illiteracy and insufficient time. However, this tool is not an ultimate substitute for shared book reading, as shared book reading gives the child more literacy benefits. However, this tool helps cover the gap in the absence of shared book reading. It exposes the child to rhymes and stories that stimulate the child's sensitivity to sound as it allows the child to play with sound and be exposed to sound differences. Interestingly, this study has provided evidence that even in the same SES status, the class fractions of SES have potent effects on the acquisition of literacy skills and alphabet knowledge, to be more specific.

Additionally, as parental occupation and education level did not impact the results, parental literacy levels affected how children responded to the digital literacy programme. This provides evidence that such a programme is more beneficial for the most disadvantaged children. This gives powerful implications for how programmes for literacy intervention ought to be designed and support earlier research that has recommended differentiated literacy instruction in the classroom.

This RCT collected longitudinal data, but very few studies in Zambia have taken this approach. The current research has not only contributed a rich and unique body of knowledge to the early literacy discourse in Zambia but has contributed literacy materials

in the form of rhymes and stories in the language of instruction, Cinyanja. It must be noted that rhymes in the local language are rare in public schools; when this study was being designed, there were no rhymes in the local language. In addition, both the pupils' and teachers' recommended activity books do not have rhymes in the local language; instead, they have a few in English.

This study fills in essential gaps in this discourse as it tested the long-term effects of digital stories and rhymes in the local language on pre-reading and reading skills at the end of grade one. Additionally, there is a knowledge gap on digital stories or rhymes as intervention measures for low reading levels in low-resource communities of Sub-Saharan Africa, specifically Zambia, as much literature on this discourse is in the Western world and partly from the East. In a Western context or environment, children will respond differently to the same variables (HLE and SES) from children in the Sub-Saharan context. Documenting the interplay between digital technologies and literacy from a different perspective is essential to give more insight into the matter. Thus, this study serves as a reference point for future studies.

7.4 Recommendations

Based on the findings of the study, the following recommendations are proposed:

1. Teachers in preschool settings are encouraged to incorporate Cinyanja digital stories and rhymes as supplementary reading materials to enhance literacy skills among young learners.

2. Parents and caregivers, particularly those from backgrounds with lower levels of parental literacy and socioeconomic status, are advised to utilise digital stories and rhymes at home to support their children's literacy development.

3. The Ministry of Education is urged to enrich the curriculum with a wide array of stories and rhymes in the language of instruction, allowing children to engage with the language before entering grade one. This can be achieved through comprehensive teacher training programs focused on story and rhyme creation in local languages, conducted through Continuous Professional Development (CPD) initiatives, teacher training colleges, and universities.

4. Given the significant benefits of rhymes for children aged three to four years, efforts should be made to expand access to early childhood education, especially for this age group, through infrastructure development. This expansion would ensure that all children, including those from disadvantaged backgrounds, have the opportunity to benefit from early literacy interventions.

5. Schools are encouraged to strengthen interactions between the school and home environments to raise awareness among parents and families about the importance of fostering literacy skills in children. This can be achieved through initiatives such as promoting rich conversations and shared book reading activities within families.

7.5 Suggestions for future research

1. This study has shown that Cinyanja digital stories and rhymes have a long-term effect on emergent literacy skills and reading at the end of grade one. There is a need for further research to establish if these skills can facilitate transferring reading skills from Cinyanja to English at the end of fifth grade.

2. Additionally, studies can be conducted to establish the independent effect of stories and rhymes on individual emergent literacy skills and reading.

3. Further research may investigate whether exposing children at an earlier age (3/4) to the digital programme may have long-term effects on rhyming.

4. The study established that children from homes with low parental literacy and fewer home possessions benefitted the most from the intervention. Further research may show if this effect is sustained beyond grade one.

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APPENDICES

Appendix A: FAMILY LITERACY QUESTIONNAIRE

Respond to questions which apply to your situation by ticking or writing in the spaces provided. Understand each item carefully before you respond to it. (*For Parents who cannot read and write, kindly read out the questions and write down their responses*)

1. **How many children of school going age are in your home? …….**
   Of these, how many are in the
   (a) First grade? …….
   (b) Second grade? ……
   (c) Other grades? …….

2. What is your highest level of education? (tick only one)

Never been to school	[ ]
Primary: grade 1 to7	[ ]
Junior secondary: grade 8 to 9	[ ]
Senior secondary: grade10 to 12,	[ ]
Post secondary 2-3 years training	[ ]
Bachelor's degree	[ ]
Masters degree and above	[ ]

3. What do you do mainly to earn your living?

Formal employment	[ ]	specify: …….
Non formal employment	[ ]	specify: …….
Other things	[ ]	specify: ……..
Nothing	[ ]	

4. Are you able to read and write?

Very well [ ] Fairly well [ ] A bit [ ] Not all [ ]

5. **Do you have a general family library in your home? (tick only one)**

Yes [ ] No [ ]

If no, justify your answer:

……
……
……
……

6. Do you have a specific library for young children in your home? (tick only one)

Yes [ ] No [ ]

If no, justify your answer:

……
……

7. If there is a children's library in your home, approximately how many story books for children are there in stock? (tick only one)

Less than 10 [ ]
Between 10 and 20 [ ]
Between 21 and 30 [ ]
More than 31 [ ]

8. If there is a children's library, where do you get the books from?
Schools [ ] Shops [ ] Other library [ ] Any other sources [Specify]
_____

9. If there is a children's library, how are the books selected or chosen? (tick as many as possible)

By myself [ ] By experts e.g. teachers [ ] By children [ ] By other people [ ]
No specific system is followed [ ]

10. If there is a children's library, can you remember some of the book-titles found in this library?
Yes [ ] No [ ] **(tick only one)**

Examples of book-titles remembered:
……
……
……
……

……
……..

11.Do you read to your child/ren in your home? (tick only one)

Usually [ ] Sometimes [ ] Never [ ]

12. If you do read to your child/ren, how many times did you read to him/her/them in the last seven days?
Once [ ] Twice [ ] three times [ ] More than three times [ ]

13. Do you have a schedule/timetable to guide your reading sessions with your child/ren?
Yes [ ] No [ ]

14. **What type of reading activities do you engage your child/ren in? (tick as many as possible)**
letters of the alphabet [ ] syllables [ ] words [ ] sentences [ ] short stories [ ]

15. **Do you experience any challenges when reading to your child/ren? (tick only one)**

Usually [ ] Sometimes [ ] Never [ ]

Give examples of challenges you experience with reading
……
……
……
……
……
…

16. **What type of writing activities do you engage your child/ren in? (tick as many as possible)**
letters of the alphabet [ ] syllables [ ] words [ ] sentences [ ] short stories

17. **Do you experience any challenges as you engage your child in writing activities**?
(tick only one)

Usually [ ] Sometimes [ ] Never [ ]

Give examples of challenges you experience with writing
……
……
……
……
……
……..

18. What type of Maths activities do you engage your child/ren in?

Counting with sticks/stones/etc. [ ] Counting orally [ ] Counting with songs [ ] Writing numbers [ ] Solving sums [ ] Math games [ ] Puzzles [ ]
(tick as many as possible)

19. Do you experience any challenges in Maths with your child/ren?

(tick only one)

Usually [ ] Sometimes [ ] Never [ ]
Give examples of challenges you experience with Maths
……
……
……
……
……
……

20. Who <u>mostly</u> assists the child with school work at home?
Mother [ ] father [ ] siblings [ ] Neighbours [ ] Hired trained teacher [ ] Hired un-trained teacher [ ] No one [ ] **(tick only one)**

21. If the assistance is rendered, where is the child usually assisted/taught from?

Library/study room [ ] Sitting room [ ] Dining room [ ] Bedroom [ ] Kitchen [ ] Outside [ ] School [ ]

22. Do have a chalk board or white board at home for teaching your child/ren? (tick only one)
Yes [ ] No [ ]

23. Do you give academic incentives to your child? (tick only one)

Usually [ ] Sometimes [ ] Never [ ]

24. What sorts of academic incentives are <u>mostly</u> provided to children? (tick only one) (tick only one)
Verbal praises [ ] Tokens [ ] Written comments [ ] Stickers [ ] Family outings [ ] Other [ ]

25. **Do you share your observations regarding your child's performance at home with your child's class teacher**? **(tick only one)**

Usually [ ] Sometimes [ ] Never [ ]

END

Thank you very much for taking your time to answer this questionnaire.

Appendix B: SAMPLE OF RHYMING TESTS

CINYANJA RHYME PRODUCTION TEST

Materials; test template/score sheet and pencil

Say;*Ndidzakamba mau ndipo ndifuna kuti undiuze liu limene lipalana nalo* ***kamvekelo*** *ku last kwake.Tiye tiyeseko.*

Example 1

Basi na Delesi; *Mau aya yapalana* ***kamvekelo*** *kulast kwake. Yonse yali ndi* ***kamvekelo*** *ka '****si****' kulast kwake.*

Ask the Child; *Ndiuze liu lina limeme lipalana* ***kamvekelo*** *kulast kwake ndi* ***Basi****.*

If the child gets example 1 correct say;
eyee ***basi na ……*** *(any word child produces ending in* ***si****)aya mau yapalana* ***kamvekelo****kulast kwake. Yonse yali ndi* ***kamvekelo*** *ka '****si****' kulast kwake.*

If the child fails to produce a rhyming word say;
wayesako liu lina lamene lipalana ***kamvekelo*** *kulast kwake ndi basi ni Sutukesi.Aya mau* ***basi-sutukesi*** *yapalana* ***kamvekelo*** *kulast kwake. Yonse yali ndi* ***kamvekelo*** *ka '****si****' kulast kwake.*

Example 2

Say; *Ndiuze liu lina limeme lipalana* ***kamvekelo*** *kulast kwake ndi* ***nyumba.***

If child fails to produce a rhyming word use ***Nyumba-Nsomba*** to teach them.

Say; *Wayesako. Liu lamene lipalana* ***kamvekelo*** *kulast kwake ndi nyumba,ni nsomba.*

Aya mau ***Nyumba-Nsomba*** *yapalana* ***kamvekelo*** *kulast kwake. Yonse yali ndi* ***kamvekelo*** *ka '****mba****' kulast kwake.*

If child does not produce a rhyming word in both examples, then proceed to the test.

S/N	Words	Child's Response	Correct (√)	Incorrect (√)
1	**Gona**			
2	**Supuni**			
3	**Mbuzi**			
4	**Lima**			
5	**Lemba**			
6	**Zitatu**			
7	**Chimanga**			
8	**Mutolilo**			
9	**Mbululuka**			
10	**Moto**			
11	**Culu**			
12	**Sopo**			
13	**Coko**			
14	**N'gombe**			
15	**Kakowa**			
16	**Sisi**			
17	**Dzinja**			
18	**Kapokola**			
19	**Mbale**			
20	**Windo**			

Appendix C: SAMPLE OF ALPHABET TESTS

LETTER-NAMING TASK

Materials: Sheet with scrambled letters, sheet and numbers for practice. Timer.

Practice: Hold up the number sheet and ask the child to name the numbers by pointing and saying the numbers out loud.
Say*: Ndiza kulangiza ma nambala, ndi zafuna kuti usonte ndi kunena maina ama nambala awa*

If the child cannot do so, teach the child by saying;
Iyi ndi wanu [pointing to the number, 1]. *Sonta pa nambala iyi, ndi kunena kuti wanu.*

Practice as needed with the numbers on the sheet until the child understands how to point and name and is comfortable doing so. Then move on to the task using the scrambled letter sheet.

Say: Lomba, *ndiza kulangiza ma lembo, ndi zafuna kuti usonte ndi unene* ***maina*** *ama lembo awa. Uli na nthawi yayi ng'ono cabe yonena* ***maina*** *ama lembo kulingana namwamene unga kwanisile muthawi iyi ndizakupasa.* (Remember to time the test.)

Scoring Sheet:

	Letters	**Correct (√)**	**Incorrect (√)**
1	A		
2	B		
3	C		
4	D		
5	E		
6	F		
7	G		
8	H		
9	I		
10	J		
11	K		
12	L		
13	M		
14	N		
15	O		
16	P		
17	R		
18	S		
19	T		

20	U		
21	V		
22	W		
23	Y		
24	Z		

LN1	How many ***letters*** did the child say correctly in two minutes?	#_____

Appendix D: SAMPLE OF VOCABULARY TEST
CINYANJA EXPRESSIVE ONE WORD-PICTURE VOCABULARY TEST

Materials: Tablet with animations, pencil and score sheet.

Example 1
Say; *Ndifuna kuti uyangane cithunzi-tunzi niri naco.***(Turn to sample picture 1 -Cule)**

Waciona cithunzi-tunzi ici? **(Point to sample picture 1-Cule)**

Ask the Child: *Ici ndi ciani?*

If the child gives the correct answer say: *Wacita bwino!*
Proceed to Example 2.

If the child gives an incorrect answer correct the child saying:
Wacita bwino kuyesako, koma uyu ndi ***Cule.***
Proceed to Example 2

Example 2
Show the child sample picture 2-**alu phempera**
Point to the Picture and Say: *Kodi alu cita ciani?*

If the child gives the correct answer say: *Wacita bwino!*
Proceed to Sample Picture 3.

If the child gives an incorrect answer correct the child saying:
*Wacita bwino kuyesako, koma uyu alu phempera***.**
Proceed to Sample Picture 3.

Example 3
Show the child sample picture 3-**Nyama**
Point to the Picture and say: *Kodiizi nizi ciani?*

If the child gives the correct answer say: *Wacita bwino!*
Proceed to the test.

If the child gives an incorrect answer correct the child saying:
*Wacita bwino kuyesako, koma izi ninyama***.**
Proceed to the test.

Test Instructions

Say;*Cabwino. Lomba ndidzakuonetsa zithunzi-thunzi zosiyana siyana. Ndifuna uniwuze zili pa zithunzi-thunzi izi.*

Prompts

You may only use the prompt provided in the score sheet, please do not use any other wordings.

Score Sheet

***NR-no response; DK-Do not know**

S/N	Word	Prompts	Correct (√)	Incorrect (√)	NR	DK	Child's Incorrect Response
1.	**Gulugufe**	Ici ndi ciani?					
2.	**Maluwa**	Ici ndi ciani?					
3.	**Piko**	Ici ndi ciani?					
4.	**Sowera**	*alu kucita ciani?*					
5.	C**inkuwala**	Ici ndi ciani?					
6.	**Capa**	*alu kucita ciani?*					
7.	**Cona**	*Ici ndi ciani?*					
8.	**Zinai**	***Yali yangati magalu?***					
9.	**Kugwa**	*alu kucita ciani?*					
10.	**Gwira**	*alu kucita ciani?*					
11.	**Cithunzi tunzi**	*Ici ndi ciani?*					
12.	**Zipatso**	*ndi liu liti limodzi lomwe lingakambe izi zonse?*					
13.	**Fisi**	*Ici ndi ciani?*					
14.	**Kutawa**	*alu kucita ciani?*					
S/N	**Word**	**Prompts**	**Correct (√)**	**Incorrect (√)**	**NR**	**DK**	**Child's Incorrect Response**
15.	**Mkango**	*Ici ciani?*					
16.	**Lalanje**	*Ici ciani?*					
17.	**Onenepa**	***Iluwoneka bwanji***					
18.	**Cidiza**	*Ici ciani?*					
19.	**Kwela**	*alu cita ciani?*					
20.	**Nyundo**	*Ici ndi ciani?*					
21.	**Oyopa**	***Aluwoneka bwanji***					

22.	**Mvuu**	*Ici ndi ciani?*					
23.	**Cothyoka**	*Cili bwanji?*					
24.	**Ukonde**	*Ici ndi ciani?*					
25.	**Mphungu**	*Ici ndi ciani?*					
26.	**Munyansi**	***Galu alikuti?***					
27.	**Nthoci**	*Ici ndi ciani?*					
28.	**Kamunkunkuniza**	*Ici ndi ciani?*					
29.	**Zamamsamba**	*ndi liu liti limodzi lomwe lingakambe izi zonse?*					
30.	**Mbululuka**	*Alu kucita ciani?*					

PEABODY PICTURE VOCABULARY TEST

Practice:
Ndifuna kuti muyangane ma pikicha, kapena zithunzi zimene niri nazo. [Turn to practice item A]
Mwaziona zonse zithunzi-thunzi kapena mapikicha pa page iri pa tsamba iri? [Pointing to each of the four pictures]

Ndidzanena liu limodzi, ndipo ndifuna kuti inu muike cala canu pa cithunzi ico ndidzachula. Tiyeni tiyese. Ikani cala canu pa mwana.

If the subject is correct:
Cabwino! [Turn to practice item B]
Ndionetseni pa alulira.

If the subject again makes the correct response, turn to practice item C, saying:
Cabwino! Ndionetseni _____.

If the subject chooses the wrong illustration at any point, before going on to the next item, point out the correct response while saying:
Munacita bwino kuyesako, koma yankho lake ndi ili.

Test:
Cabwino. Lomba ndidzakuonetsa zithunzi-tunzi zina. Nthawi iri yonse ndidzakamba liu limodzi, ndipo ndifuna kuti iwe usonte pa cithunzi-tunzi ico ndidzakamba.

[begin test items below]

SET 1

Item	Word	Key	Child's Response	Error	Don't know
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		E	
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	

SET 2

Item	Word	Key	Child's Response	Error	Don't Know
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	

Appendix E: BASAT

BASAT

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!

1

The BASAT

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*** ***Example: Say;*** Manje tizapatula mawedi/mau aya kuyaika mwamene yamvekera. Ekizampo mu mau yakuti 'Nyumba' muli mau yabiri 'Nyu' …….'mba' Mu mau ya 'khalidwe' muzamva kamvekedwe katatu, 'Kha…li..dwe'(clap your hands to show syllable segmentation.) Manje muniuze mau yamene ni kamvekedwe yali mu mu mau ya 'Cuma'? Begin test. Score		
CUMA	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*** Say: Mmau 'ena' kamvekedwe koyamba kumveka ni 'e,' ni 'na'. manje kamvekedwe koyamba mu mau yakuti galimoto ni cani? Score		**C3. Discriminates ending sounds in words:** Say: Mu mau ya 'msipu' kamvekedwe kali kothela / ku lasiti ni 'u'. kamvekedwe kali mu mau yakuti mwana ni 'na' Score	
a. **wa**ba		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 **Example: say;** Nizakamba mau ena. Nifuna kuti upange mau ena kucoka mu mau aya . Mwa exampo, m'mau aya / i / - / n / - / a / yapanga 'ina' Manje ungapange mau yambwanji mukamvekedwe aka___ / i / - / f - / e / Proceed to test items. 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 Items D1-D6 Say: Nili ni mau na masentesi/ziganiziro. Nifuna kuona ngati ungawelenge bwino. Mau ena ni yosavuta kuberenga koma yena niyovuta. Unibelengeleko mau ni masentesezi /ziganizo yamene nizakupasa.

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!

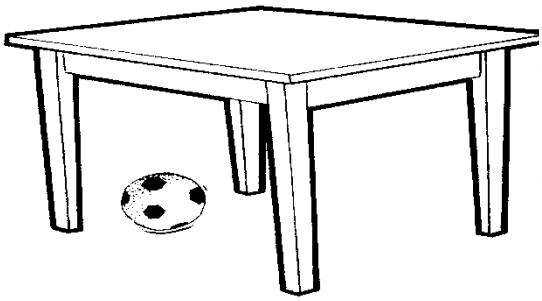
Note: The child reads independently. Do not read anything, just give the child the instruction and present the templates.

	Score		Score
1. Kuwerenga dzina lache (reading own name). Clearly write the child's name and ask the child to read.			
2. Combines two letters/ sounds /both into a syllable or word: ***Kupanga a phatikizi.*** Present the child with the templates, one at a time and place them apart. Ask the child to put them together and read the syllable.		3. Reads 1-syllable words: ***Kuwerenga liu la mphatikizi umodzi.*** Present the child with the templates and ask the child to read the syllables, one at a time.	
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*** Present the child with the templates and ask the child to read the 2-syllables word, one at a time.		5. Reads 3-syllable words: ***Kuwerenga mau muli aphatikizi atatu*** Present the child with the templates and ask the child to read the 3-syllable words, one at a time.	
a.Tate		a. Atate	
b. Mwana		b. Amai	
c. Dzuwa		c. Makolo	
d mai		d. Umwai	
6. Reads sentences: **Kuwerenga ziganizo:** Present the child with the templates and ask the child to read the sentences, one at a time.			
a. Abambo aligone.			
b. Aphunzitsi ali kuwerenga.			

E. Kulemba			
1. Kulemba Dzina lache Say: lemba zina yako (give the child the writing template)			
2. Kulemba Malembo Say: Lemba malembo yakukokhana mu afabeti(use the empty letter template)			
3.**Kulemba aphatikizi ali ndi mau *awiri (writing two-letter syllables)*** Say: Lemba mau aya yamene nizaberenga		4. **Kulemba aphatikizi ali ndi mau atatu (writing three-letter syllables)** Say: Lemba mau aya yamene nizaberenga	
a. ba		a. Nga	
b. pa		b. Kwa	
c. mu		c. Mwa	
d. ku		d. Gwa	
5. **Kulemba aphatikizi ali ndi mau opitirila atatu (writing words with more than three syllables).** **Say:** Lemba mau aya yamene nizaberenga			
a. Wokongola			
b. Amalume			
c. zodabwitsa			
d. Wopatulika			
6. **Kulemba Ziganizo Zapafupi** (writing short sentences) **Say:** Lemba mau aya yamene nizaberenga			
a.Mwana wa topa			
b. Amai ali kuphika			

G. Kuwerenga ndi Kumvetsa (congani mayankho a mwana)
(Reading comprehension)

Say: Ona maganizo ndi mapikicha yali pansi apa. Belenga na kusontapo mau yamene yalongoza zamene ziri kucitika mu cipikica.



(a) Mpira ndi mpando

(b) Mpira ndi motoka

(c) Mpira ndi Tabulo

(a) Alikudya

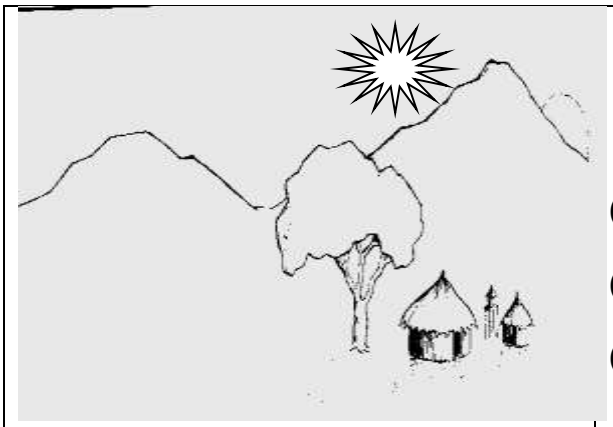
(b) Aligone

(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

E. Kulemba

1.Dzina: _____

2.Zilembo

3. a. _____ b. _____

c. _____ d. _____

4. a. _____ b. _____

c. _____ d. _____

5. a. _____ b. _____

c. _____ d. _____

6. a. _____

b. _____

Appendix F: PERMISSION LETTER

In Reply please quote:

No: PEO/LR/101/28/2

REPUBLIC OF ZAMBIA

MINISTRY OF GENERAL EDUCATION

OFFICE OF THE PROVINCIAL EDUCATION OFFICER
LUSAKA REGIONAL HEADQUARTERS
PRIVATE BG RW 21E
LUSAKA

12th October, 2017

The University of Zambia
School of Education
P.O. Box 32379
LUSAKA

RE: REQUEST TO CONDUCT RESEARCH IN EARLY CHILDHOOD SCHOOLS IN LUSAKA PROVINCE

Reference is made to the above subject matter.

This office is in receipt of your letter dated 8th October, 2017 in which you were seeking permission to conduct a research in Early Child Schools in Lusaka Province.

I write to inform you that permission has been granted for you to carry on the research in Lusaka Province.

Paul. Ngoma
PROVINCIAL EDUCATION OFFICER
LUSAKA PROVINCE
/km

Appendix G: ETHICAL CLEARANCE

THE UNIVERSITY OF ZAMBIA
DIRECTORATE OF RESEARCH AND GRADUATE STUDIES
HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

Telephone: +260-211-290258/293937
Fax: +260-211-290258/293937
Zambia
E-mail drgs@unza.zm

P O Box 32379
Lusaka.

Approval of Study

15th February, 2018

The Principal Investigator

Dear Madam,

RE: "Effects of Stories and Rhymes Presented through electronic media on Language and Literacy Skills among Pre-school and First Grade Learners in Zambia"

Reference is made to your resubmission. The University Of Zambia Humanities And Social Sciences Research Ethics Committee IRB resolved to approve this study and your participation as Principal Investigator for a period of one year.

Review Type	**Expedited Review**	Approval No. **2018-Feb-001**
Approval and Expiry Date	Approval Date: 15th January, 2018	Expiry Date: 14th January, 2019
Protocol Version and Date	Version-Nil	

Information Sheet, Consent Forms and Dates	• English.	To be provided
Consent form ID and Date	Version	To be provided
Recruitment Materials	Nil	Nil

There are specific conditions that will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

Conditions of Approval

- Provide information sheets and consent letters as these were not attached. The information sheets should have had the essential features included. Please use the WHO templates which you could download at www.who.int/rpc/research_ethics/informed_consent/en/). REC would appreciate if the PI could customise the WHO templates and include the domains of what the submitted protocol is positing on tools and the sampling units (people who have been or shall be participating in this study.
- No participant may be involved in any study procedure prior to the study approval or after the expiration date.
- All unanticipated or Serious Adverse Events (SAEs) must be reported to the IRB within 5 days.
- All protocol modifications must be IRB approved by an application for an amendment prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address or methodology and methods. Many modifications entail minimal risk adjustments to a protocol and/or consent form and can be made on an Expedited basis (via the IRB Chair). Some examples are: format changes, correcting spelling errors, adding key personnel, minor changes to questionnaires, recruiting and changes, and so forth. Other, more substantive changes, especially those that may alter the risk-benefit ratio, may require Full Board review and approval. In all cases, except where noted above regarding subject safety, any changes to any protocol document or procedure must first be approved by the IRB before they can be implemented.
- All protocol deviations must be reported to the IRB within 5 working days.
- All recruitment materials must be approved by the IRB prior to being used.

- Principal investigators are responsible for initiating Continuing Review proceedings. Documents must be received by the IRB at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Any documents received less than 30 days before expiry will be labelled "late submissions" and will incur a penalty.
- Every 6 (six) months a progress report form supplied by The University of Zambia Humanities And Social Sciences Research Ethics Committee IRB must be filled in and submitted to us. There is a penalty of K500.00 for failure to submit the report.
- The University Of Zambia Humanities And Social Sciences Research Ethics Committee IRB does not "stamp" approval letters, consent forms or study documents unless requested for in writing. This is because the approval letter clearly indicates the documents approved by the IRB as well as other elements and conditions of approval.

Should you have any questions regarding anything indicated in this letter, please do not hesitate to get in touch with us at the above indicated address.

On behalf of The University of Zambia Humanities and Social Sciences Research Ethics Committee IRB, we would like to wish you all the success as you carry out your study.

Yours faithfully,

Dr. Jason Mwanza
BA, MSoc, Sc., PhD
CHAIRPERSON
The University Of Zambia Humanities and Social Sciences Research Ethics Committee IRB